

[54] ELECTRONIC CARD GAME

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[52] U.S. Cl. .... 273/138 A; 273/1 ES;  
364/900

[58] Field of Search ..... 273/1 E, 138 A, 143 R,  
273/143 C, DIG. 28; 235/92 GA; 340/323 R;  
364/200, 200 MS File, 900, 900 MS File,  
410-412

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Primary Examiner—Vance Y. Hum

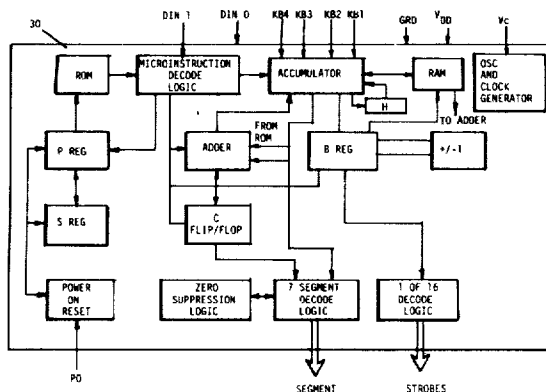
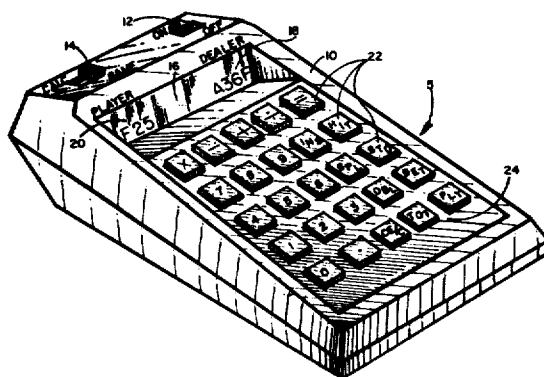
Attorney, Agent, or Firm—H. Fredrick Hamann; Wilfred  
G. Caldwell

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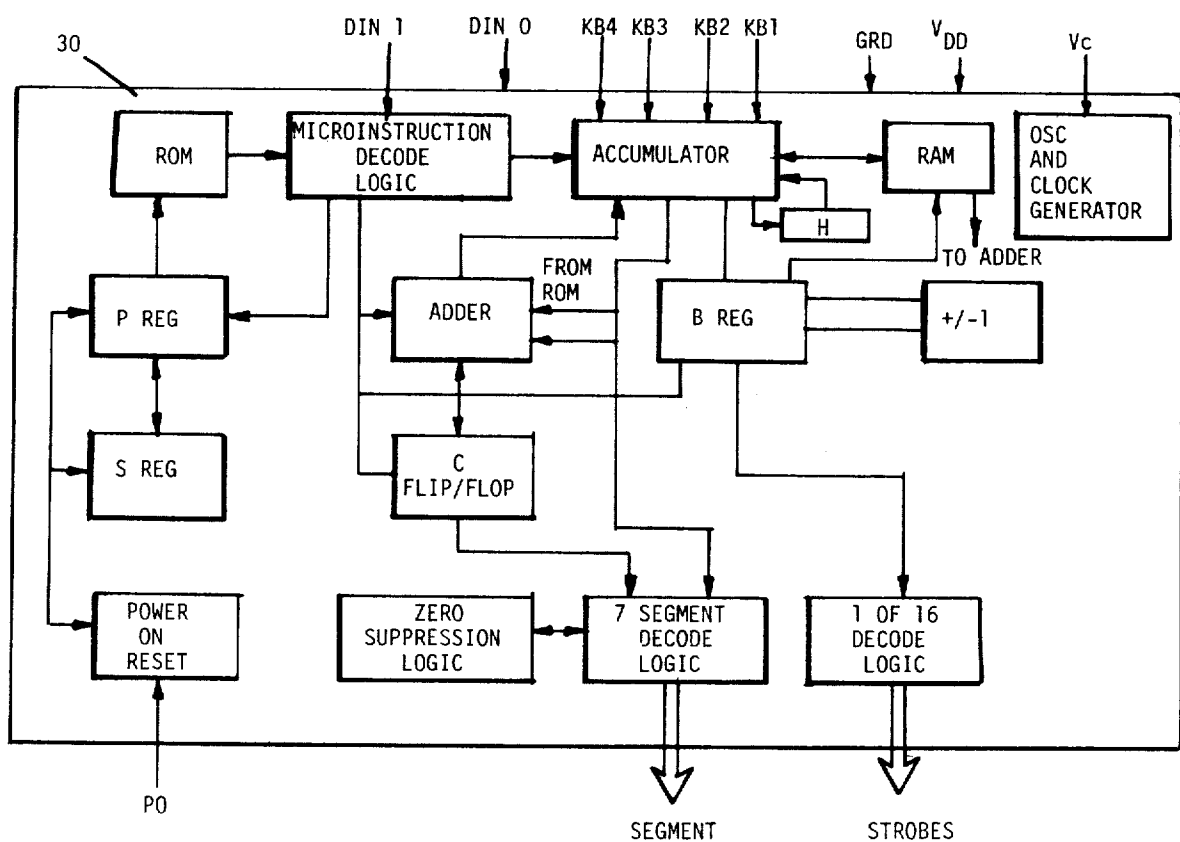
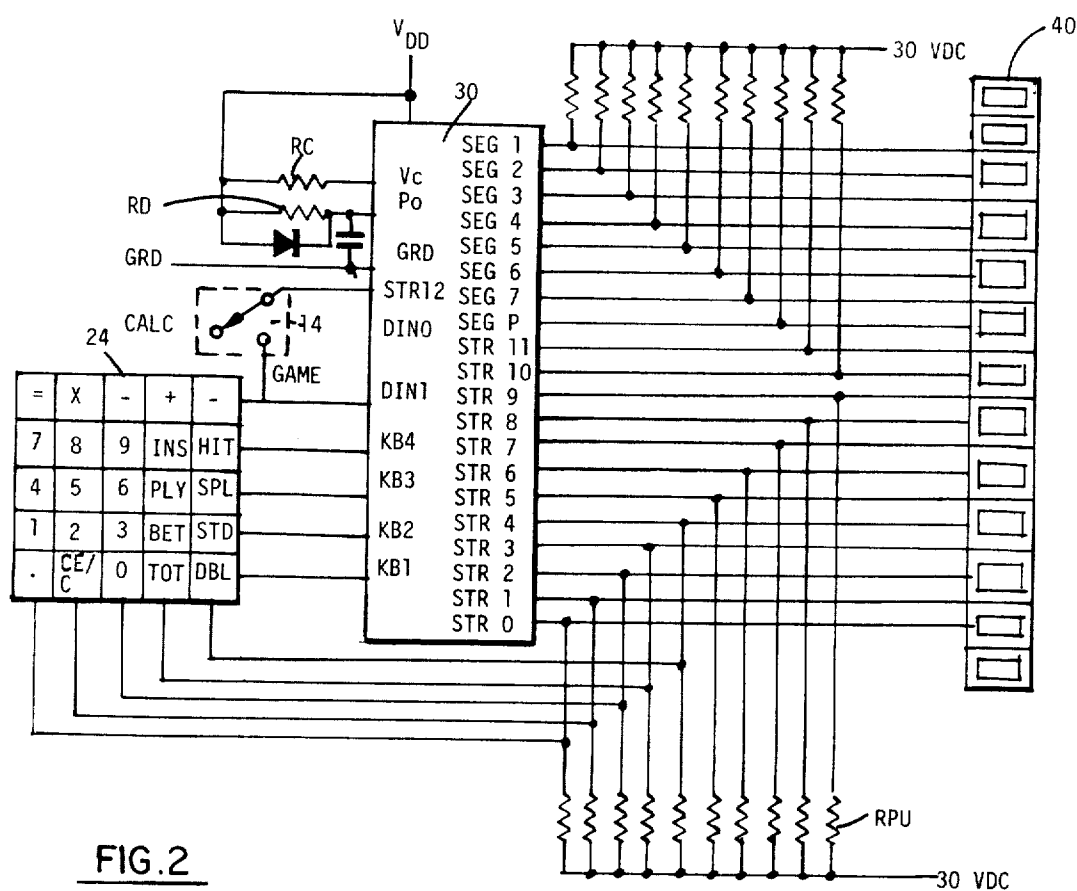
ABSTRACT

An electronic card game simulation apparatus adapted primarily for portable hand-held use by a player. A microprogrammed MOS/LSI device receives selection signals generated by means of a keyboard to which a player has access, and controls the progress of the card game in response thereto and in accordance with established game rules as programmed in a storage device such as a read only memory unit. A display device, such as a plurality of seven-segment fluorescent displays, indicates the identity of simulated playing cards dealt randomly from a full 52-card deck of simulated cards as the game progresses. In a preferred embodiment, the microprogrammed device includes memory capacity, arithmetic capability, and appropriate programming to permit a player to play the well known game of Blackjack against a phantom dealer and to place bets which are automatically added or subtracted from a previously established stake in accordance with the outcome of each hand.

9 Claims, 36 Drawing Figures







0				1				2				3				
0																
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7																
8	K(S)				Z(S)				W(S)				T(S)			
9	K(E)				Z(E)				W(E)				T(E)			
10	VDELAY				DI CF U V				LS				RN CR M			
11	VDELAY				VDELAY				N D R OF				Q MD K PM			
	K <sub>REG</sub>				Z <sub>REG</sub>				W <sub>REG</sub>				T <sub>REG</sub>			

0				1				2				3				
00	10	20	30	DEALER TOT				DEALER'S 1				R0				
01	11	21	31	DB 16		DA		1 2		1 2		R1				
02	12	22	32	PLAYER TOT				3				R2				
03	13	23	33	HIB 16		PA		4		4		R3				
04	14	24	34	SPLIT TOT				5		5		R4				
05	15	25	35	H2C H2B 16		SSA		6		6		R5				
06	16	26	36					6		6		UNITS DIGIT R6				
07	17	27	37	PBJ IN		SDBJ A1		5		5		TENS DIGIT R7				
08	18	28	38	DBJ SP		SPA SPLIT		4		4		PAD				
09	19	29	39	NUMBER OF CARDS				3		3		NEW				
40	50	60	70	80		90		DEALT		2		HS DS3 DS2 DS				
41	51	61	71	81		91		TBJ		PLAYER'S 1		PR HO G				
	C <sub>REG</sub>				S <sub>REG</sub>				H <sub>REG</sub>				R <sub>REG</sub>			

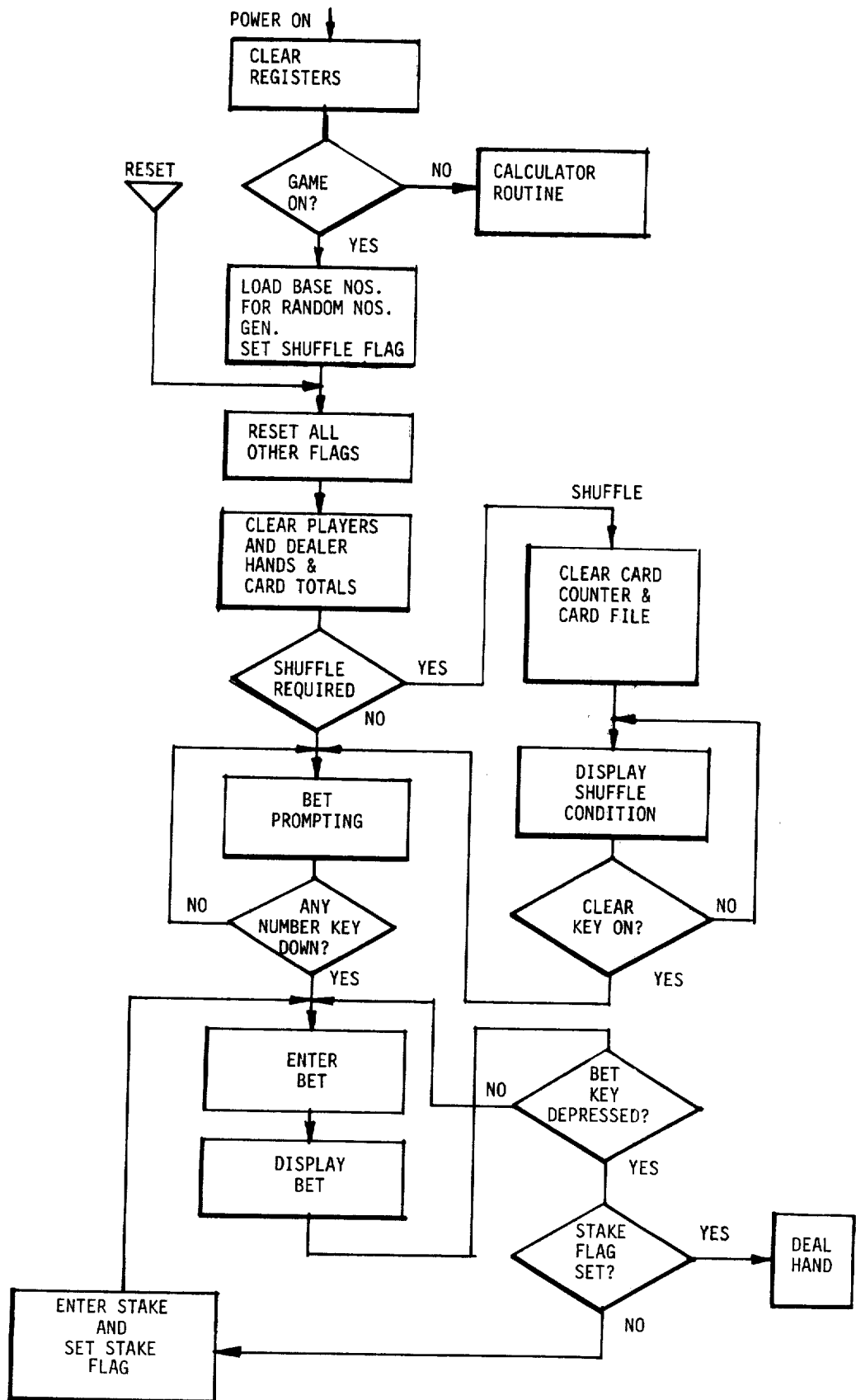


FIG. 5a

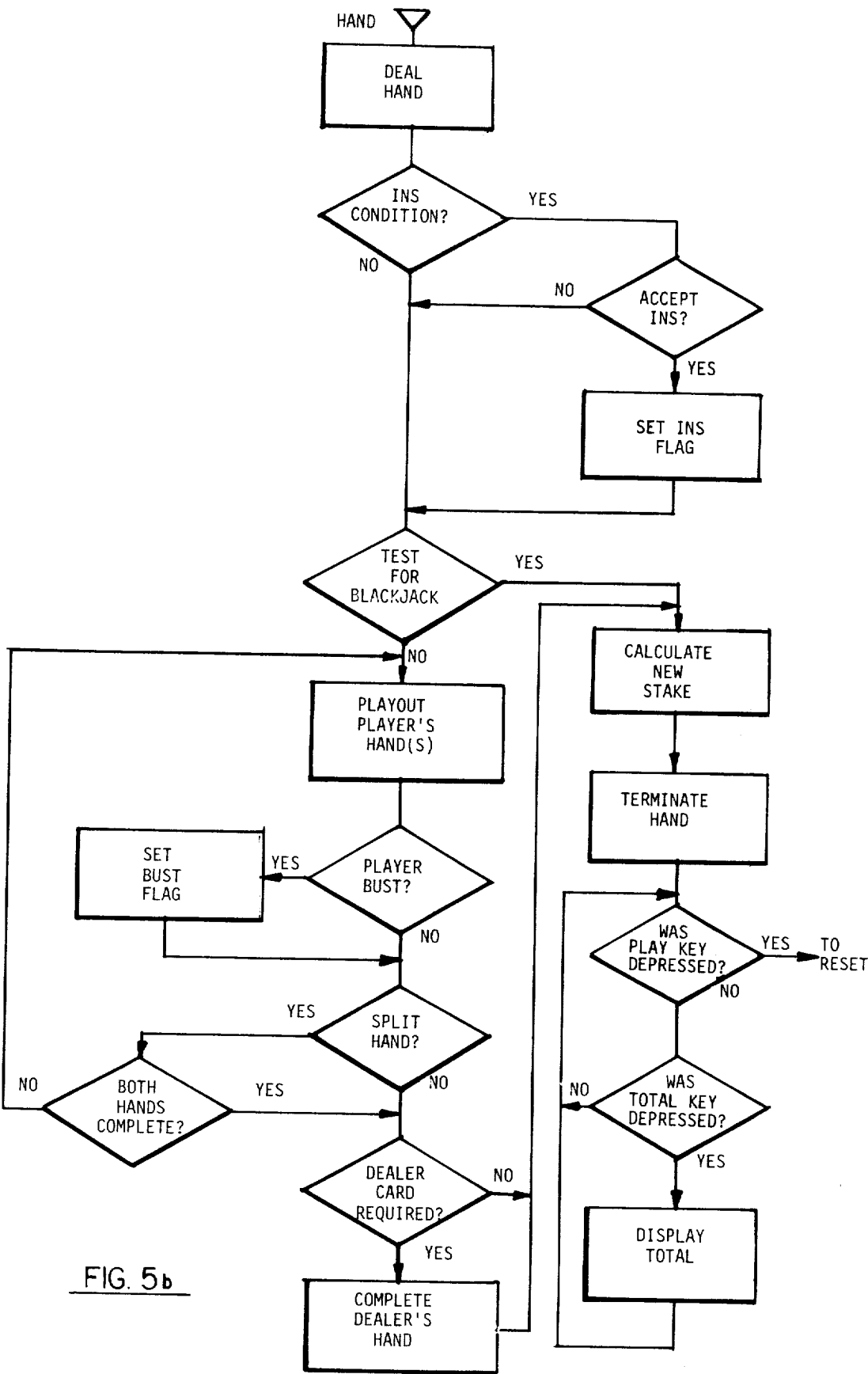


FIG. 5b

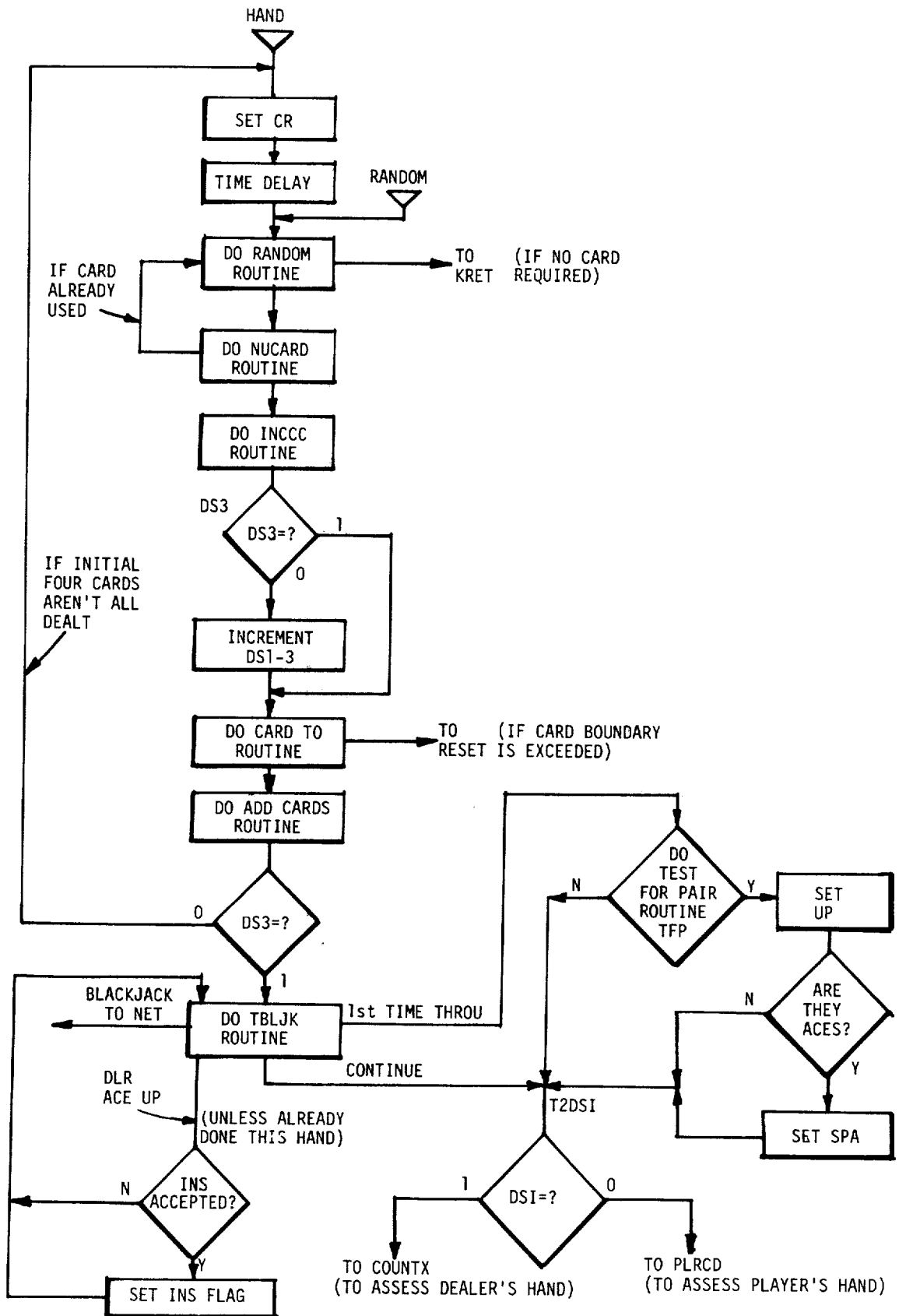
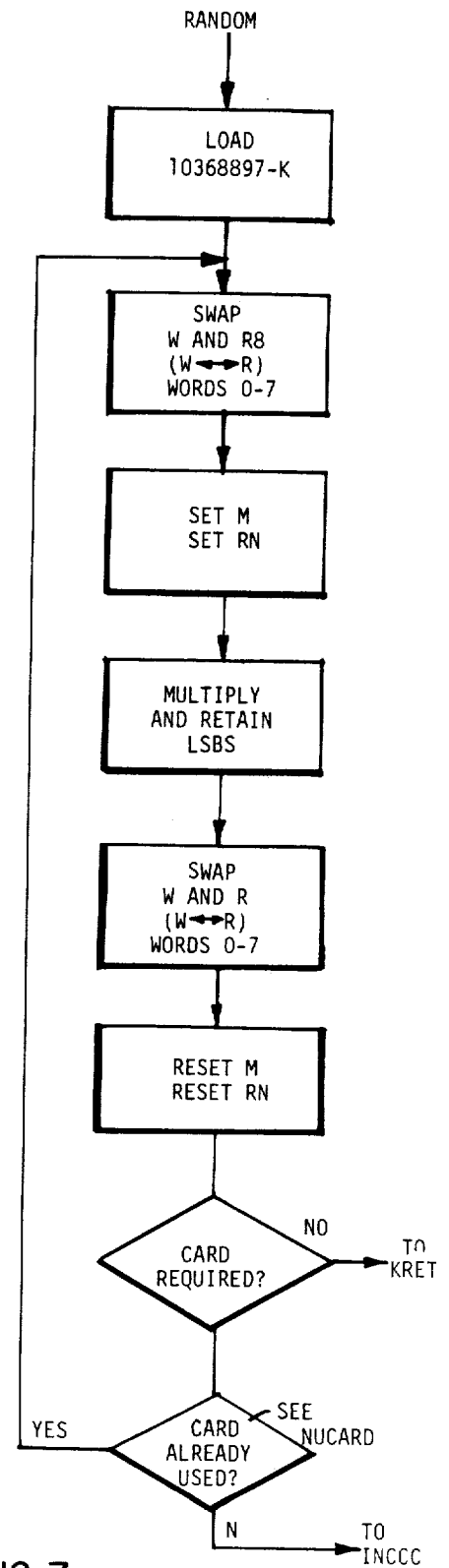
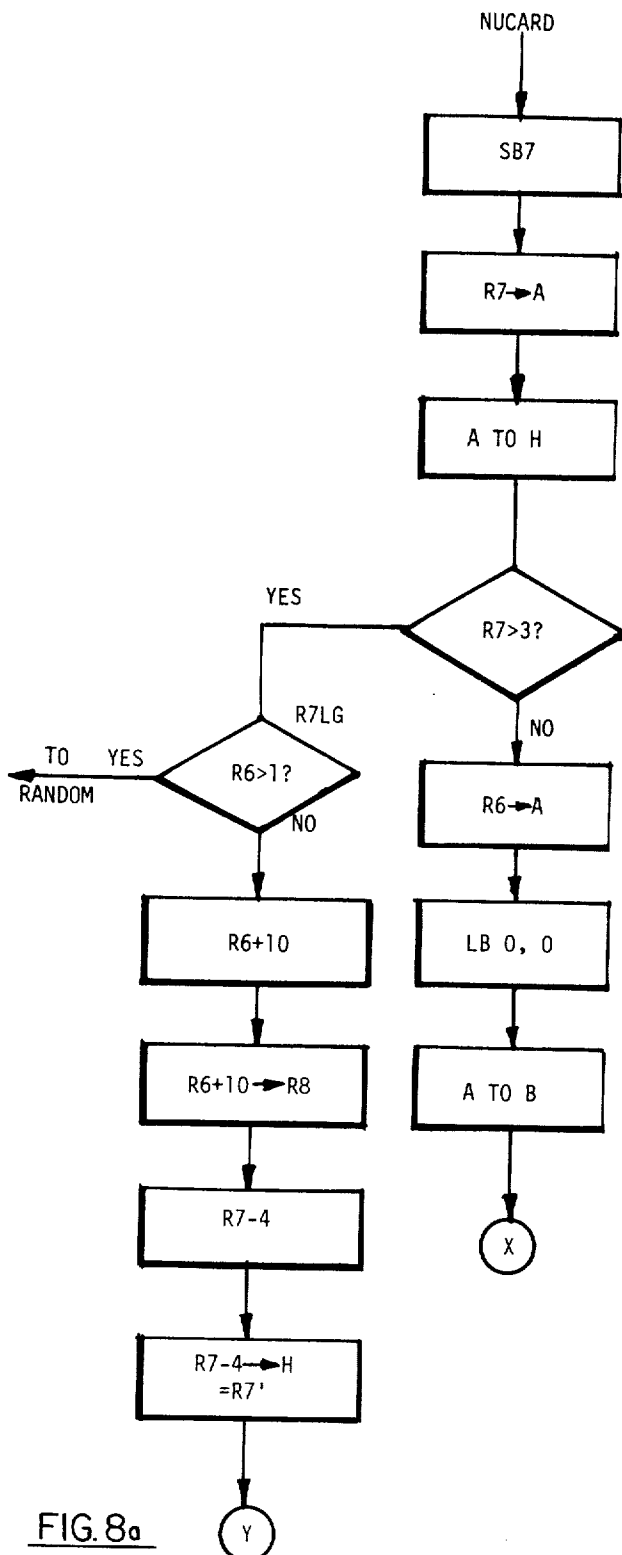


FIG. 6





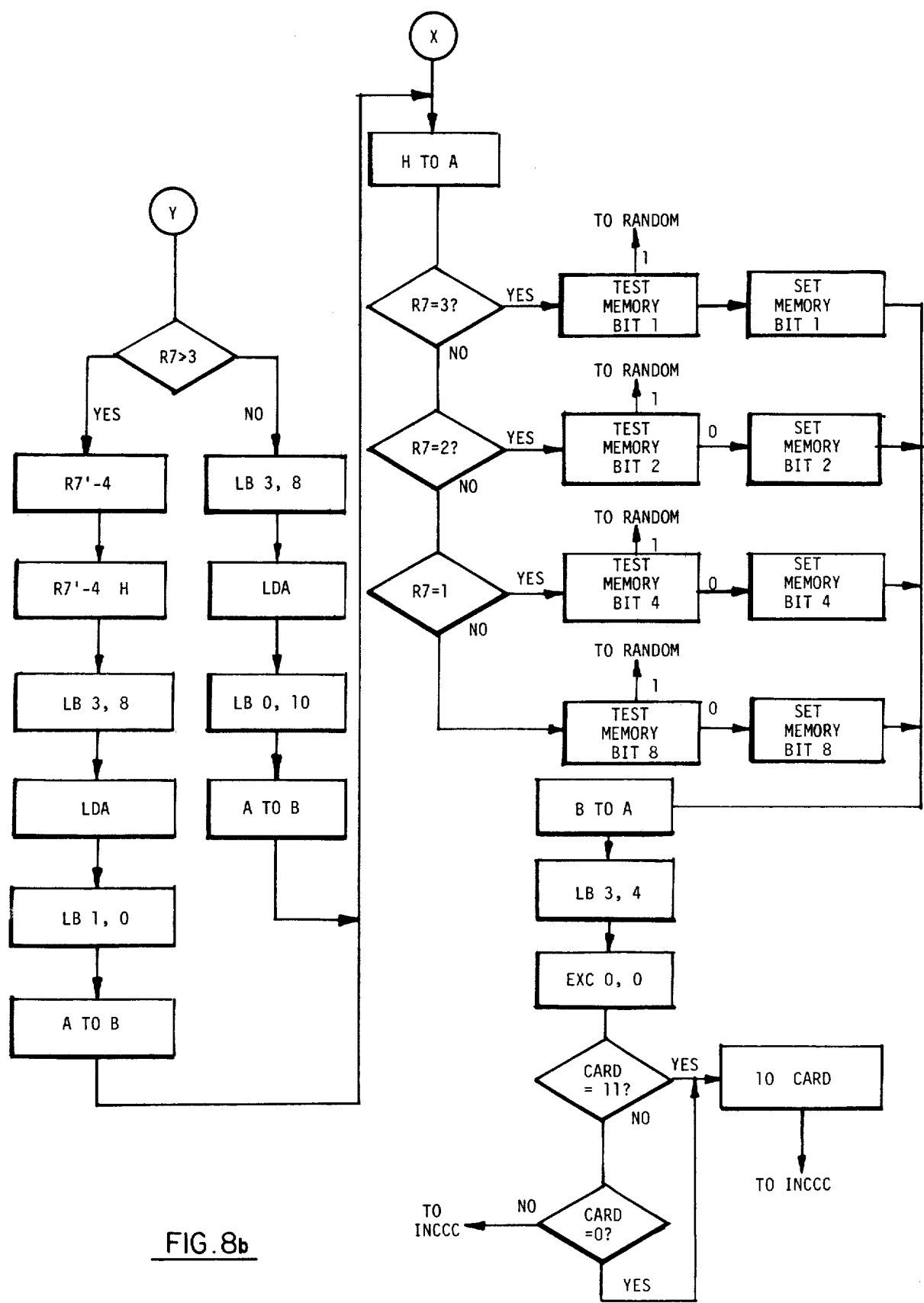


FIG. 8b

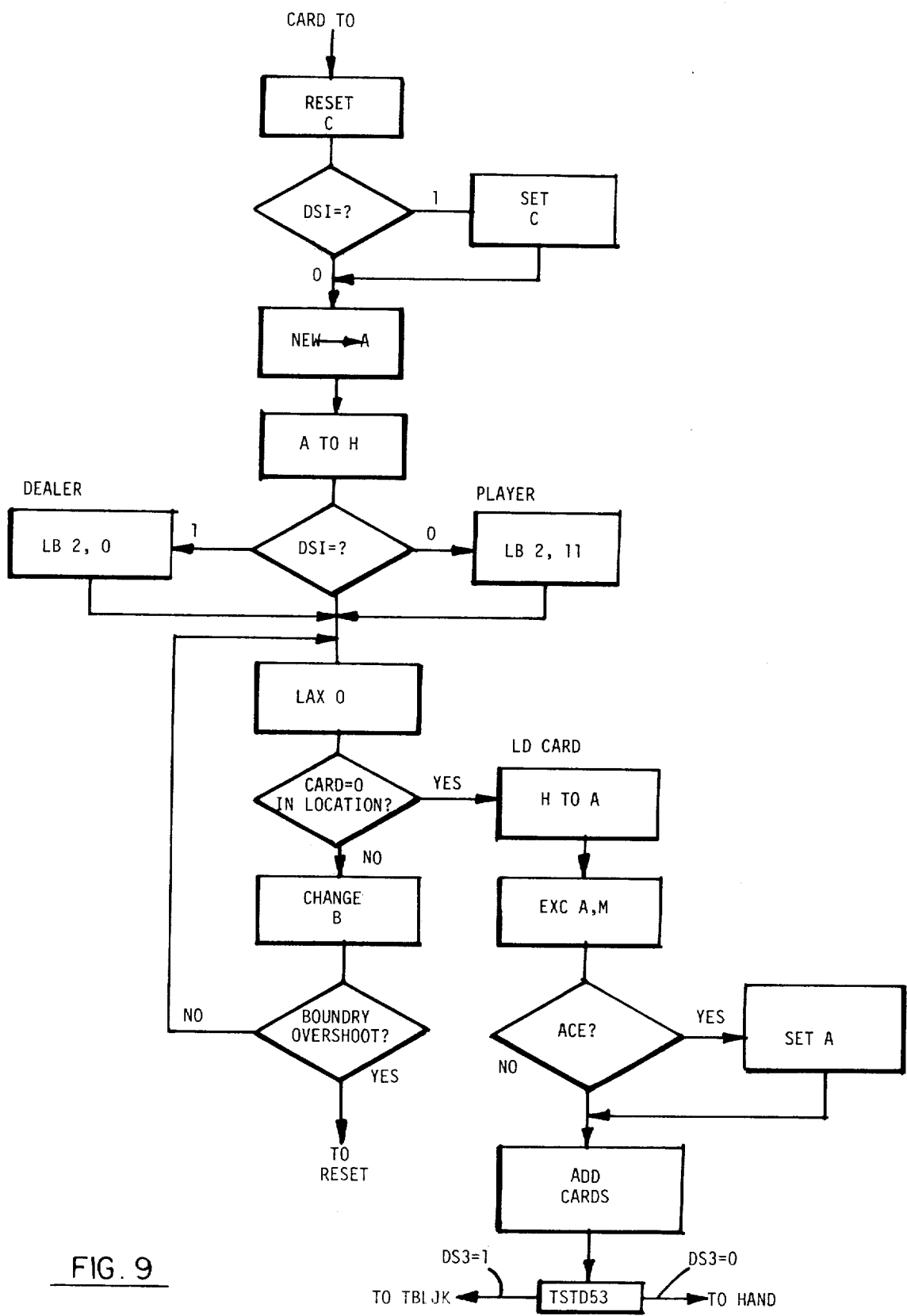
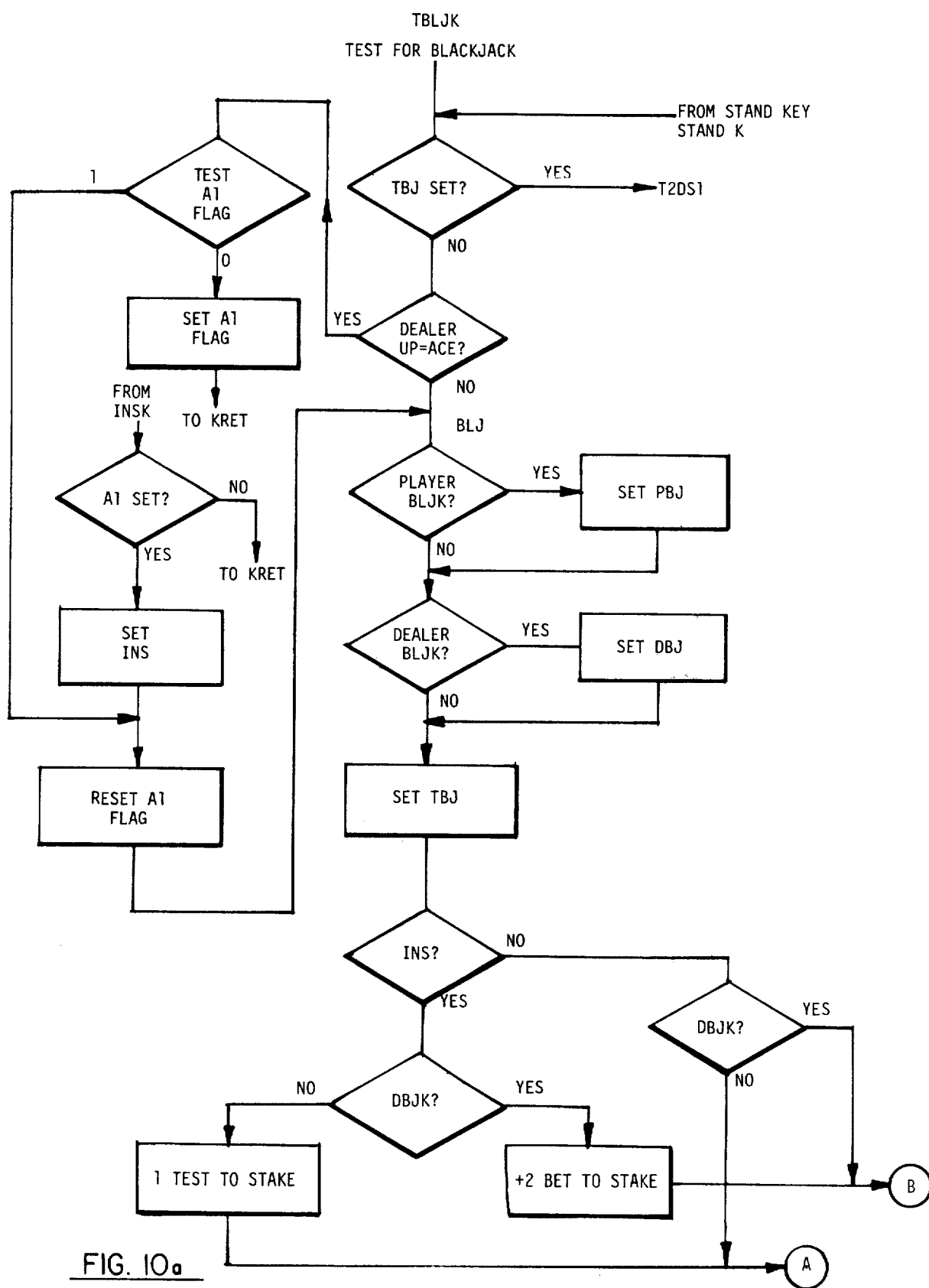
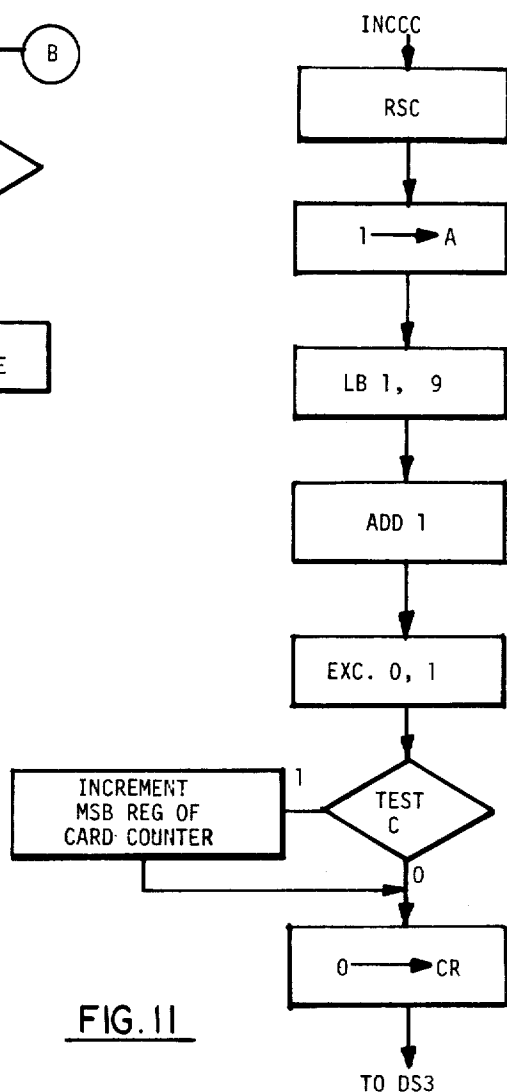
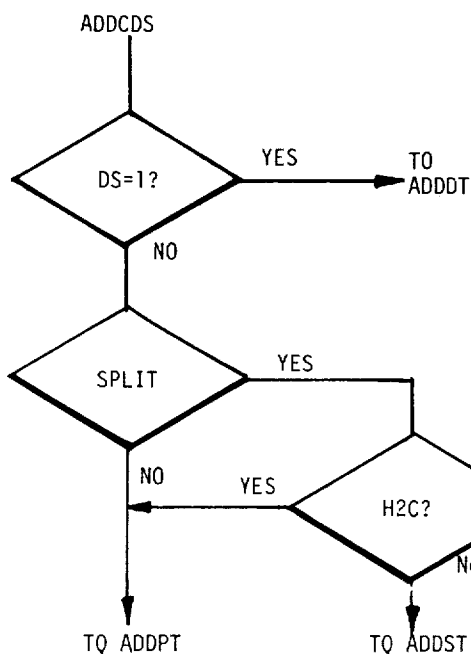
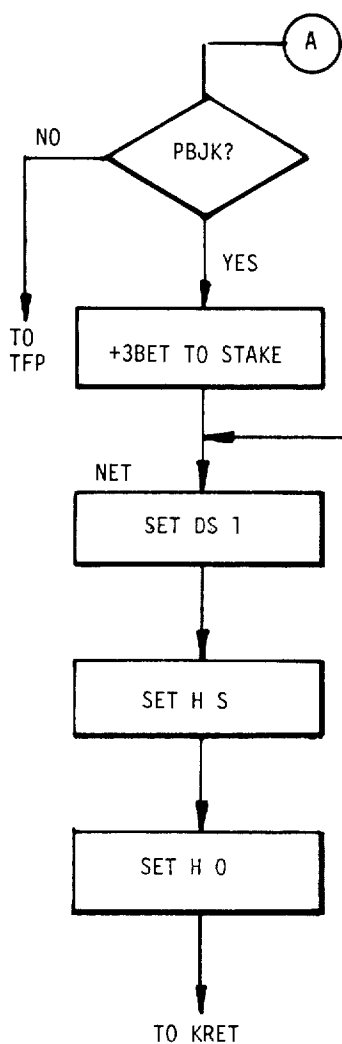
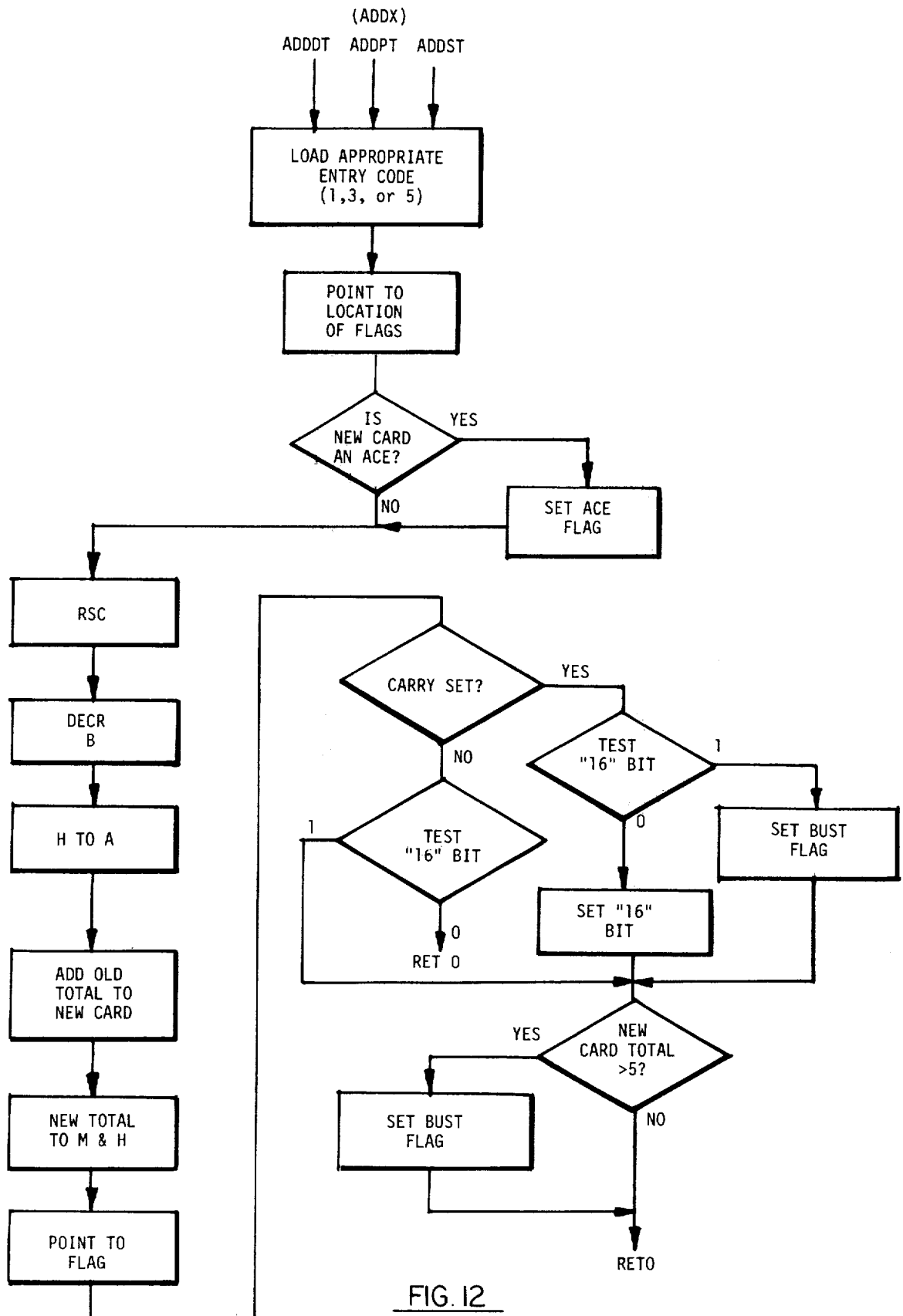


FIG. 9







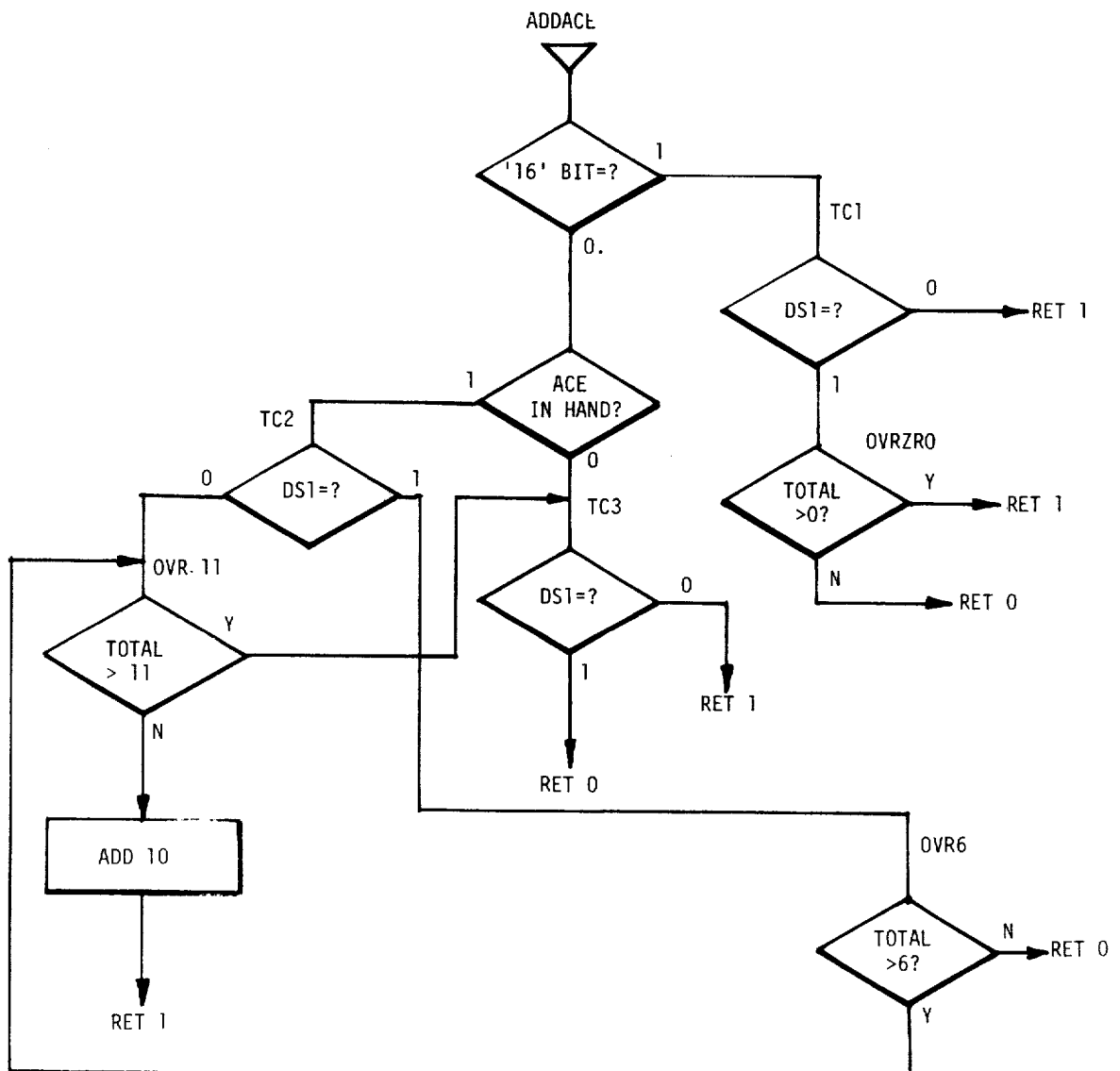
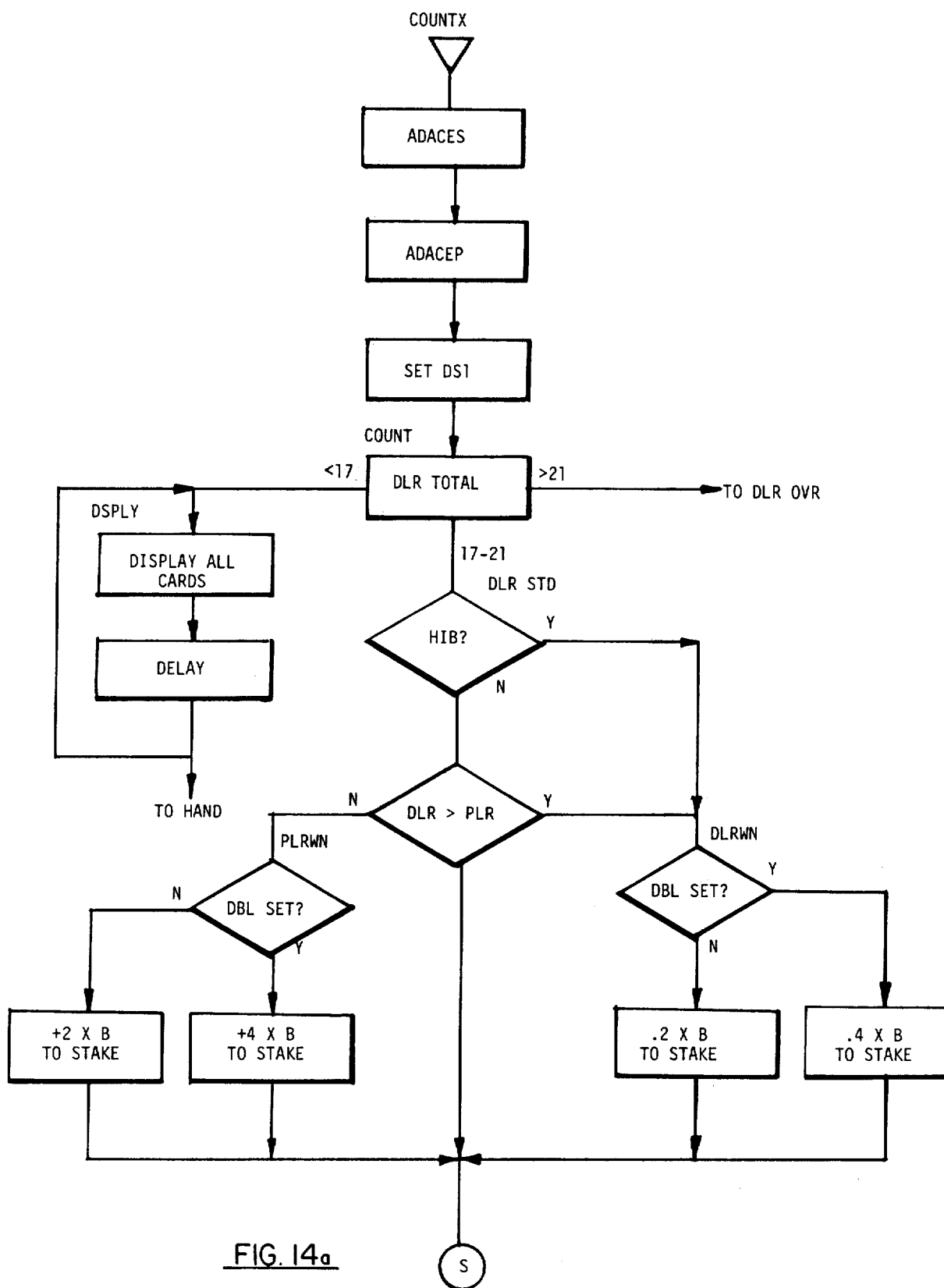
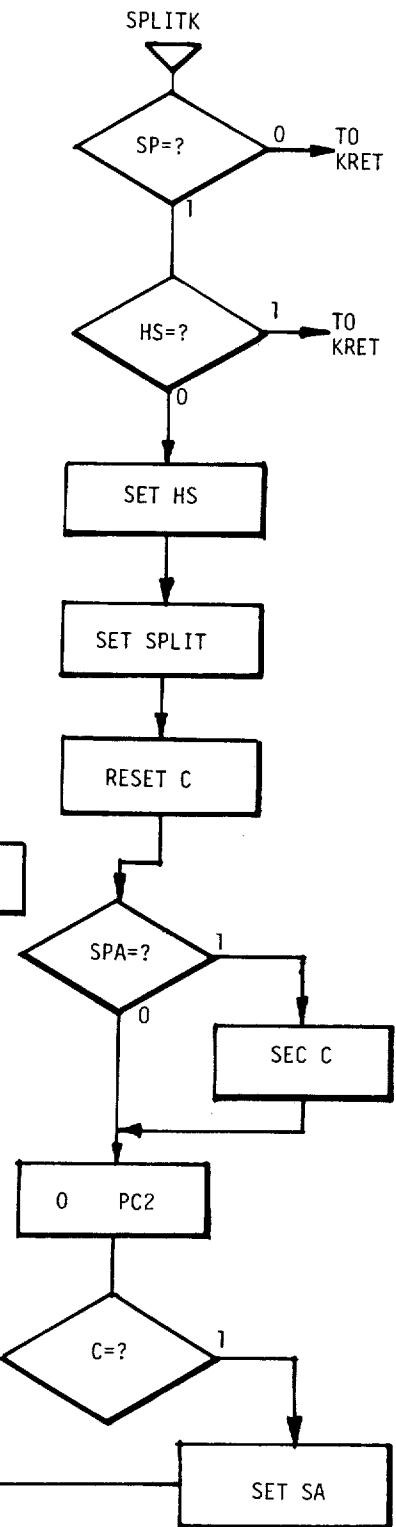
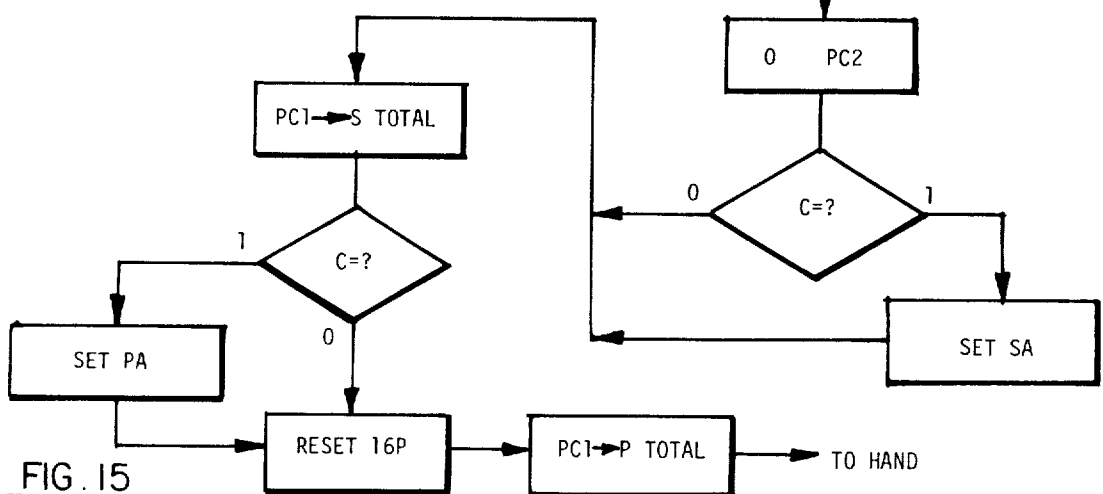
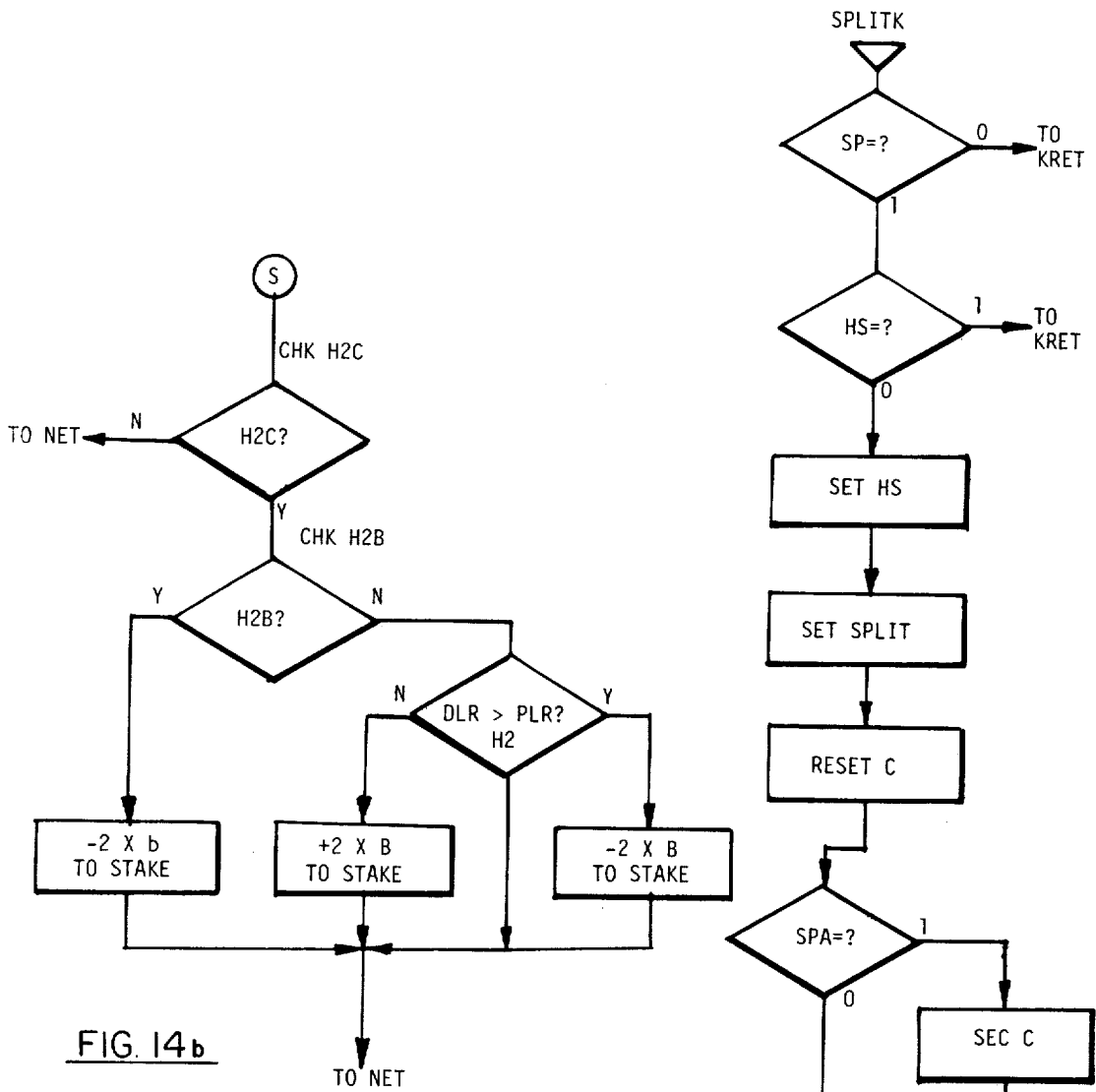
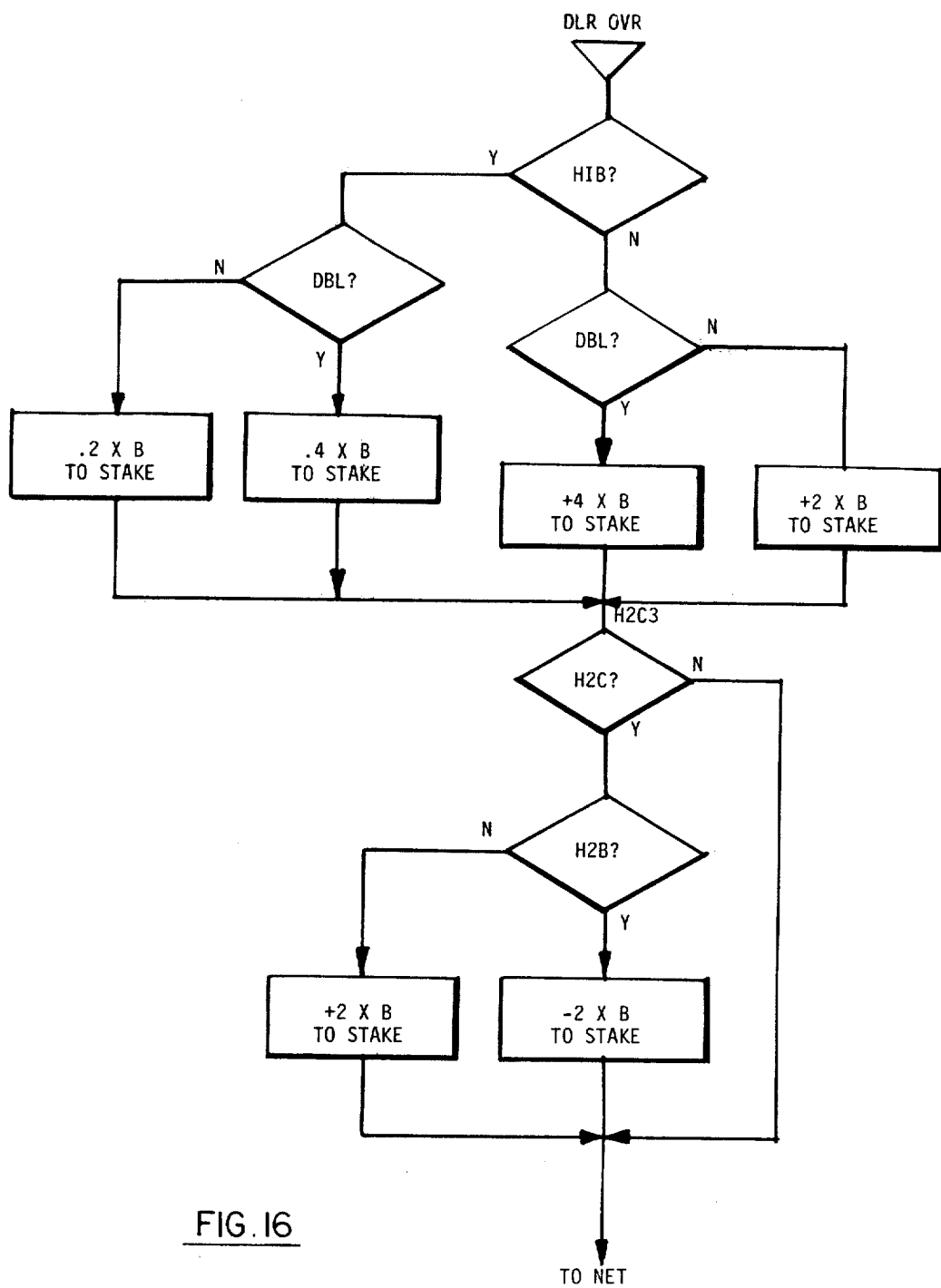


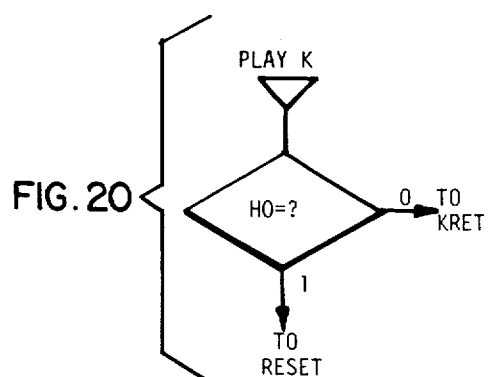
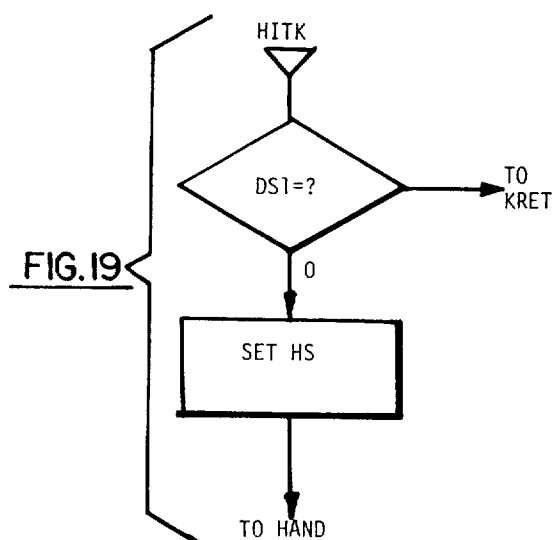
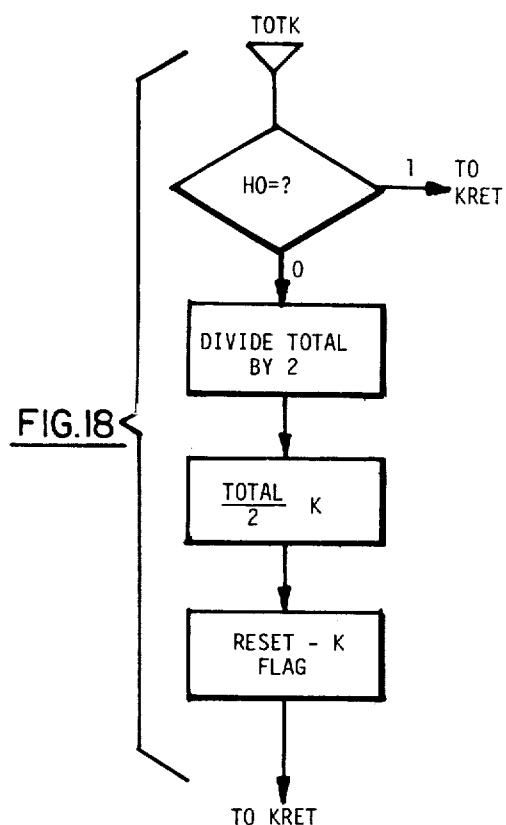
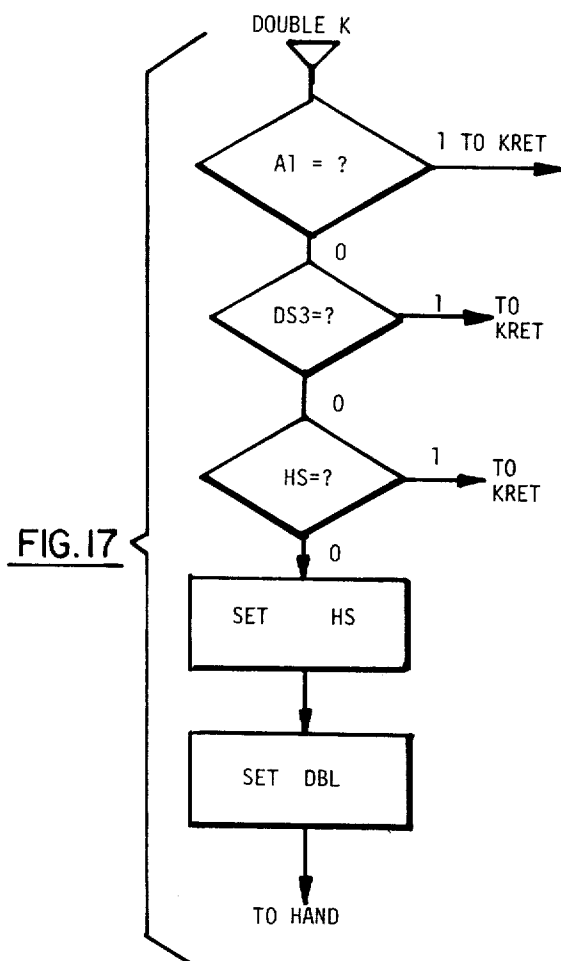
FIG. 13

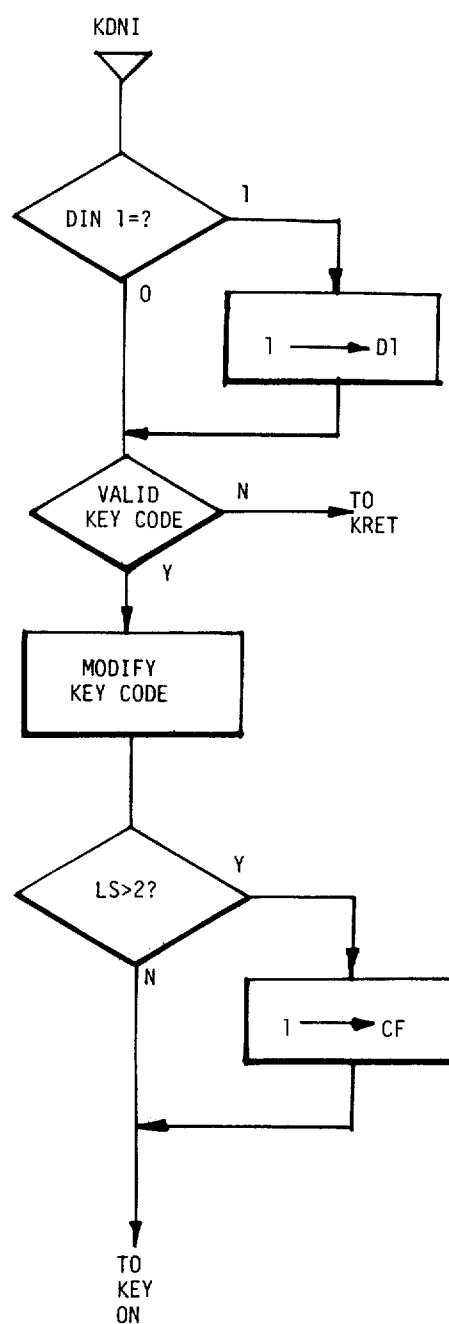
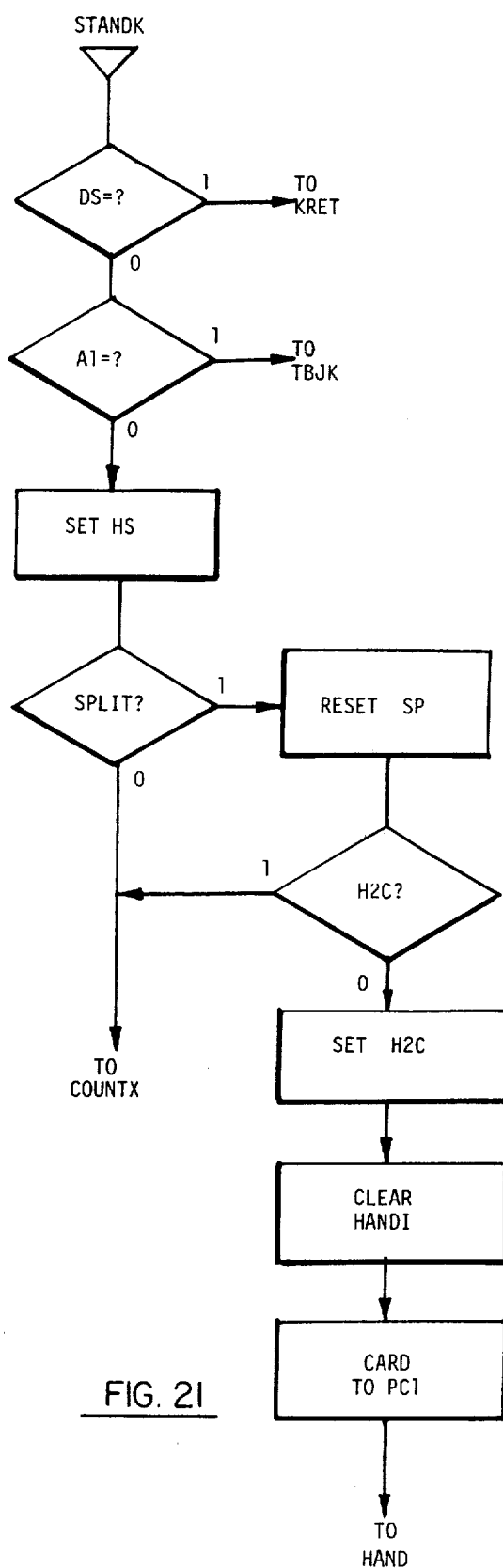


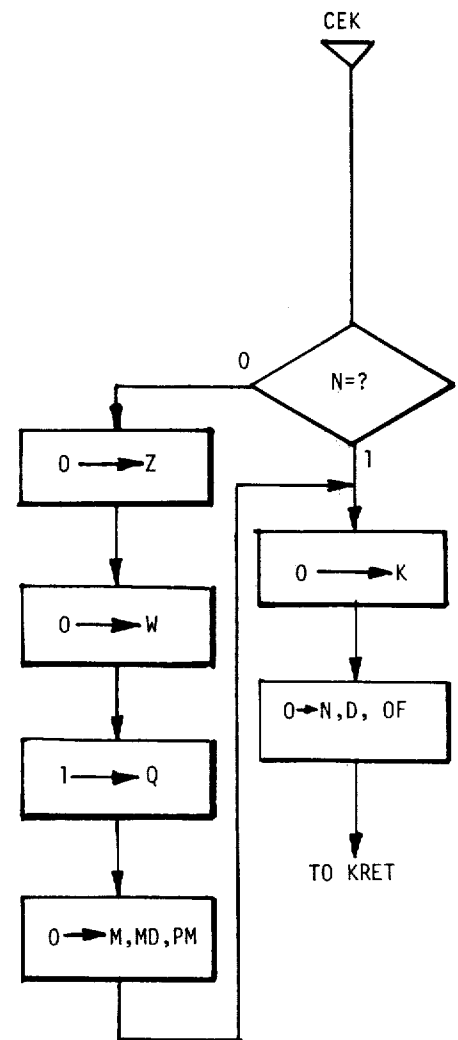
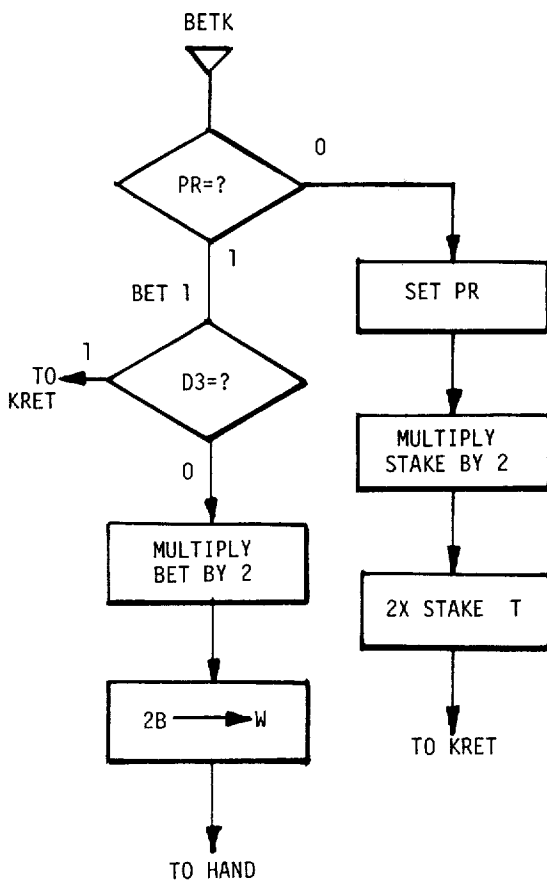












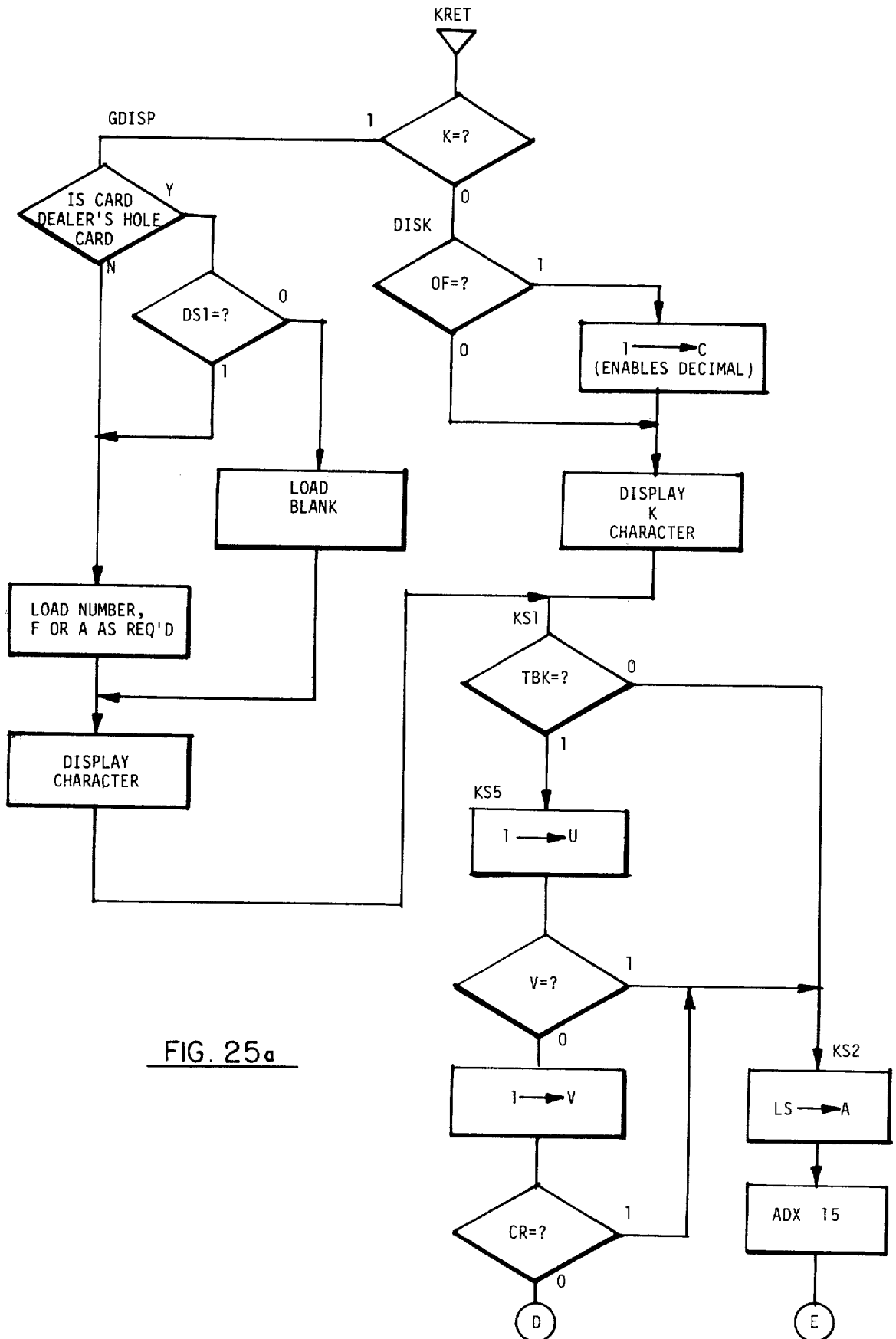


FIG. 25a

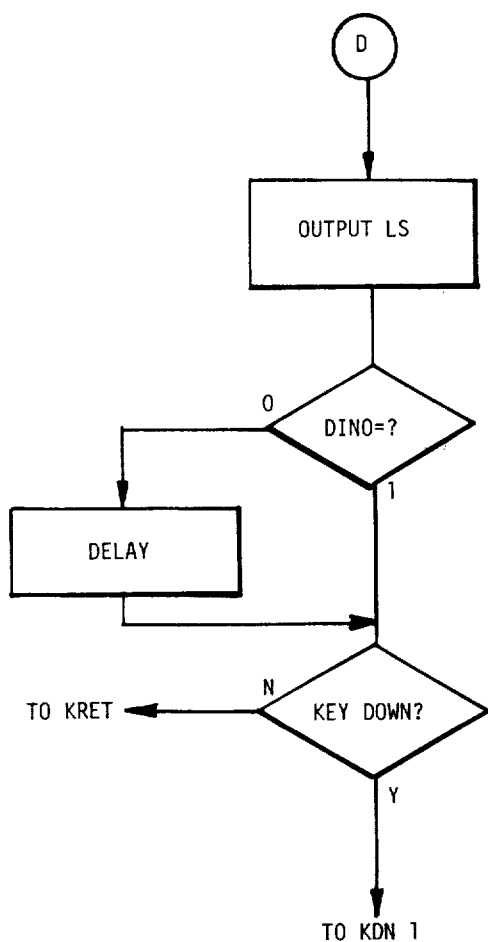
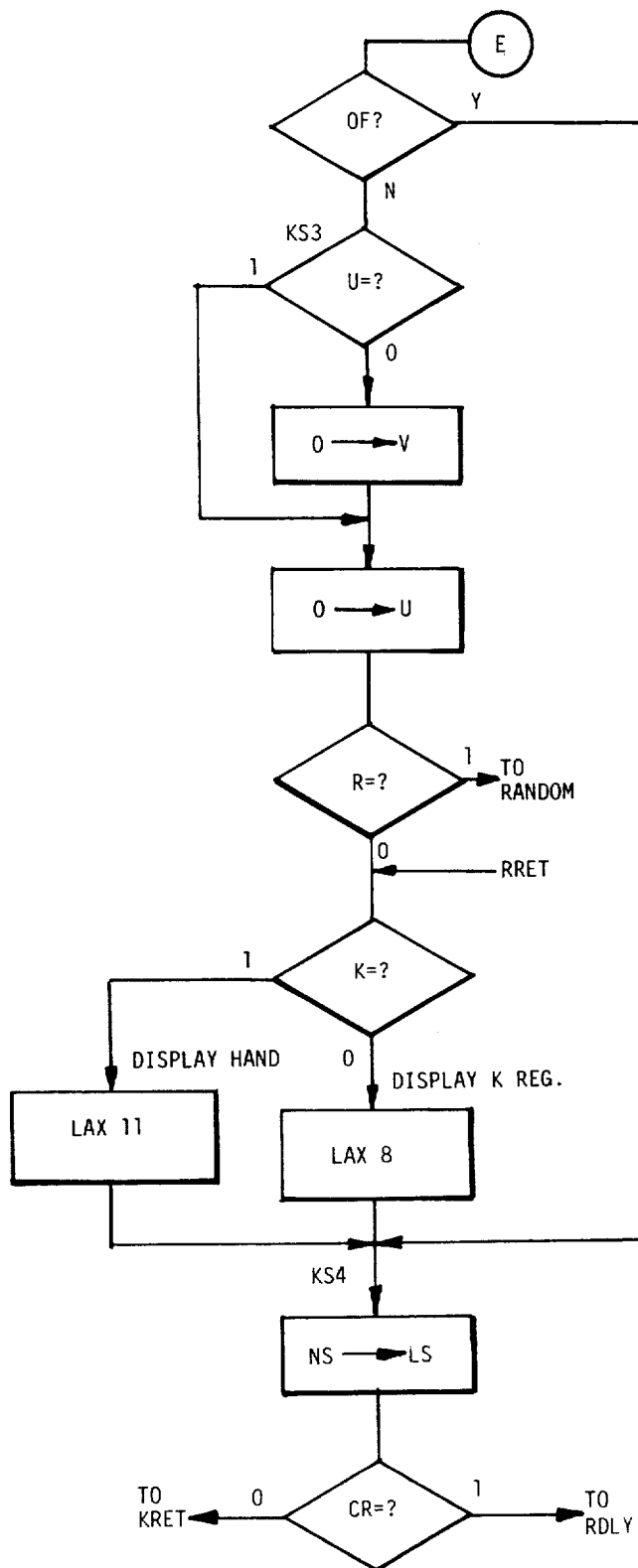


FIG. 25b



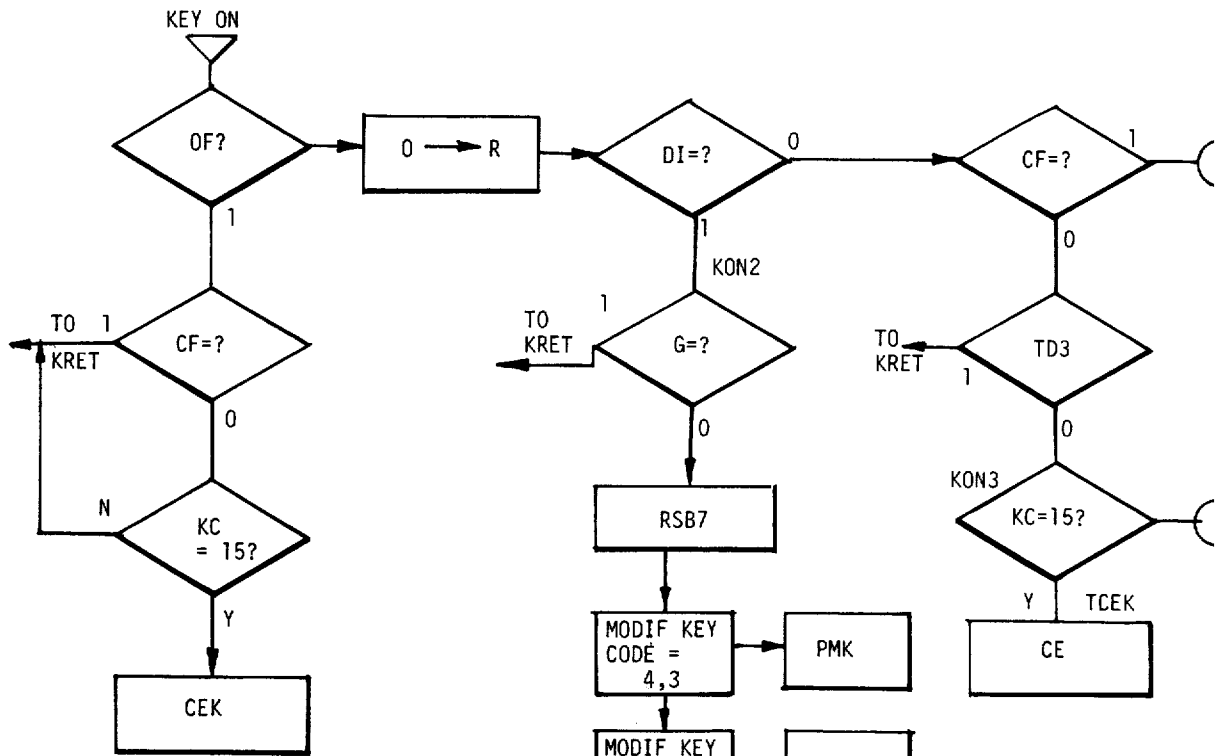


FIG. 26a

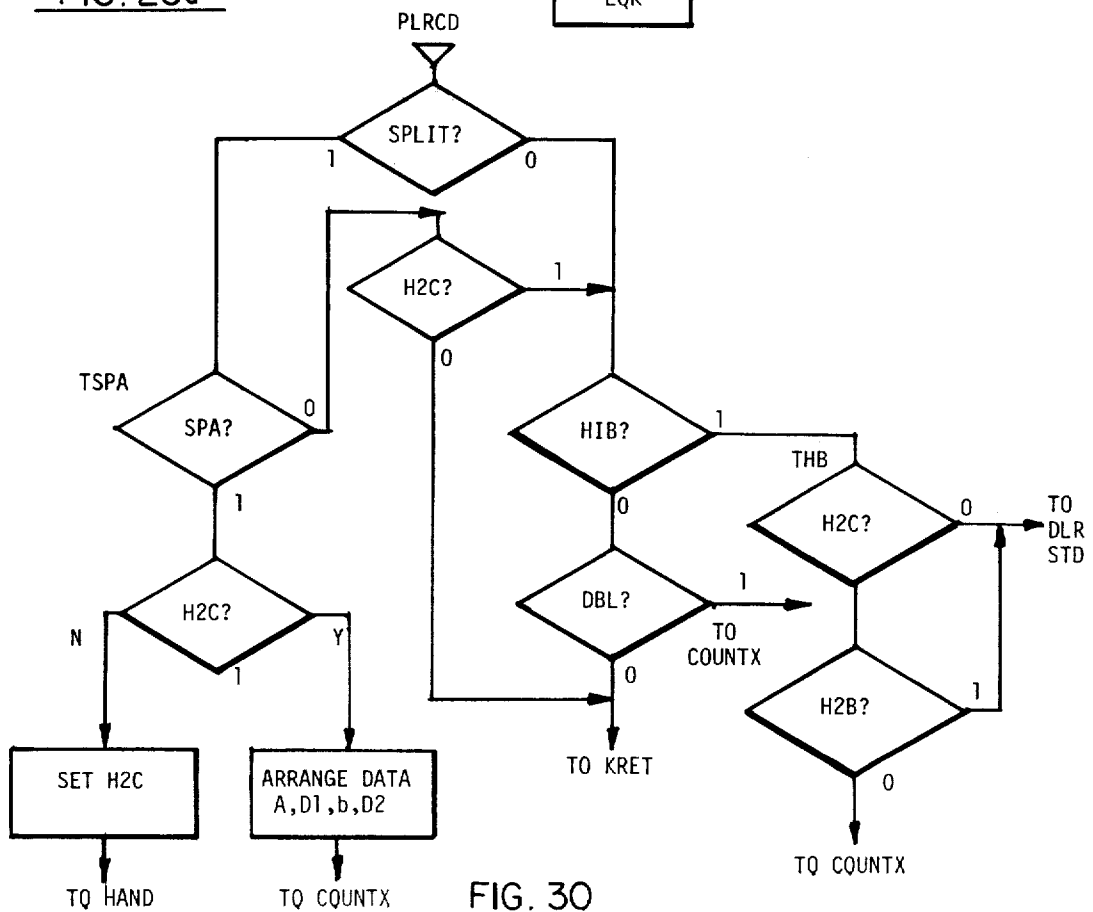
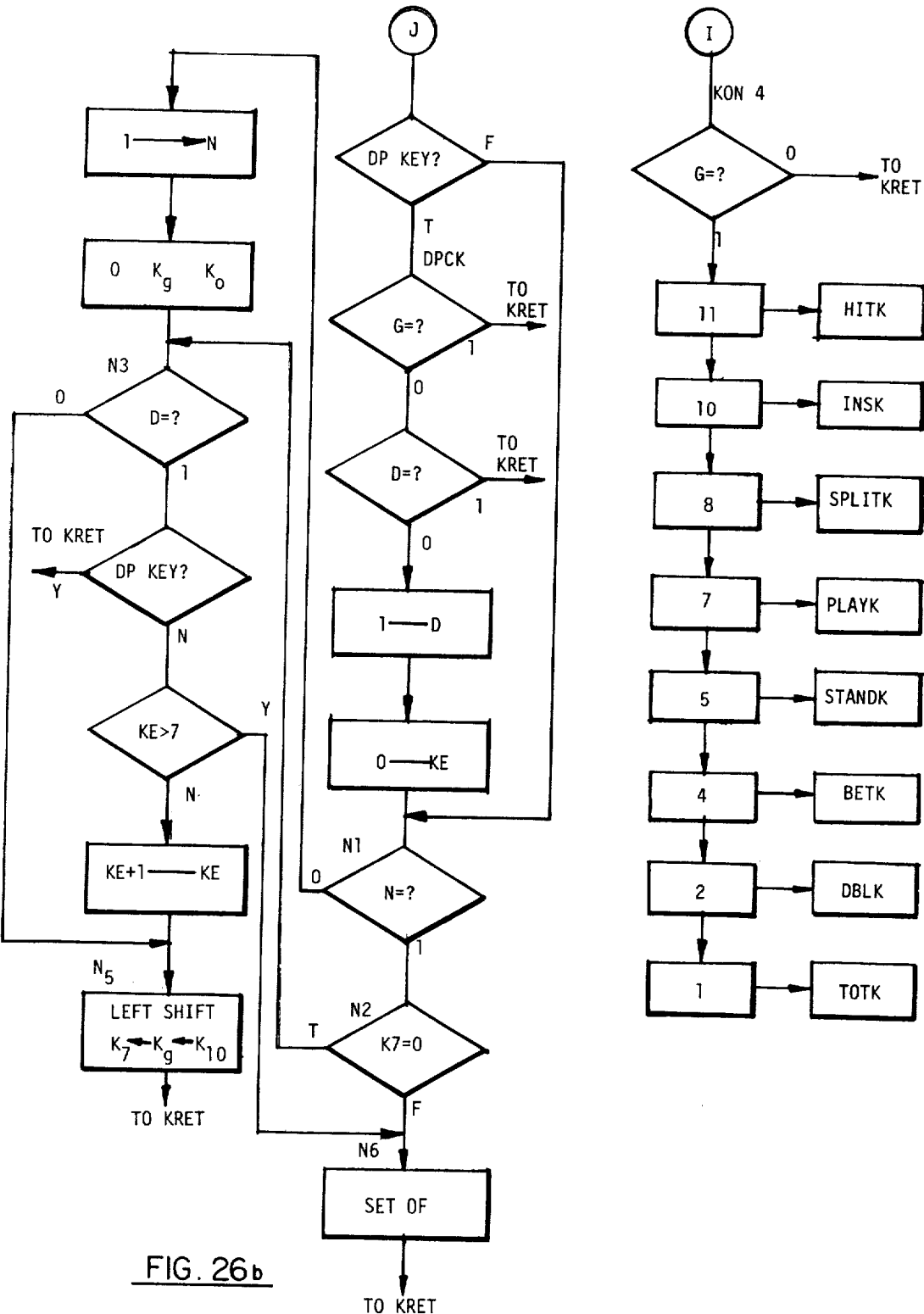


FIG. 30





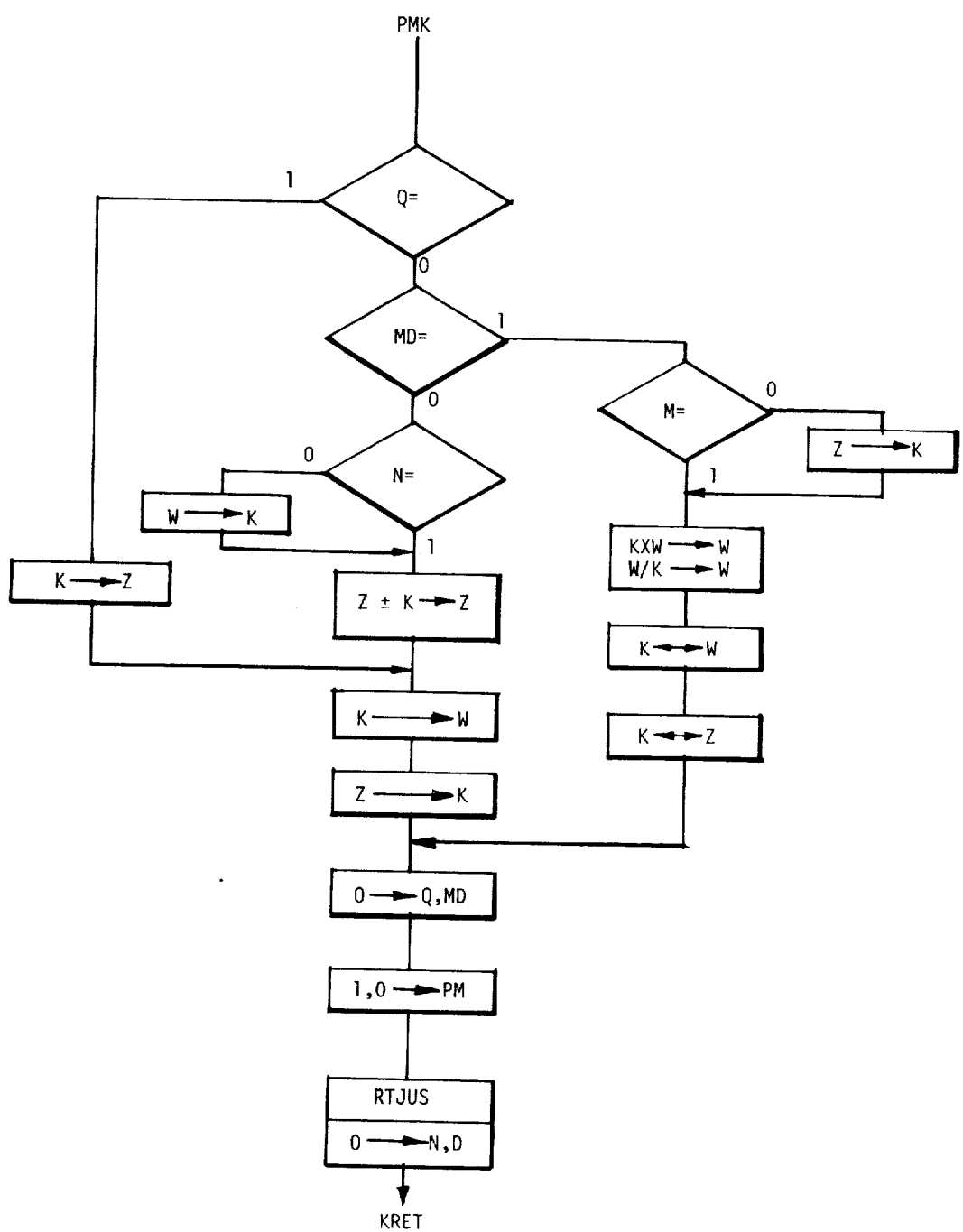


FIG. 27

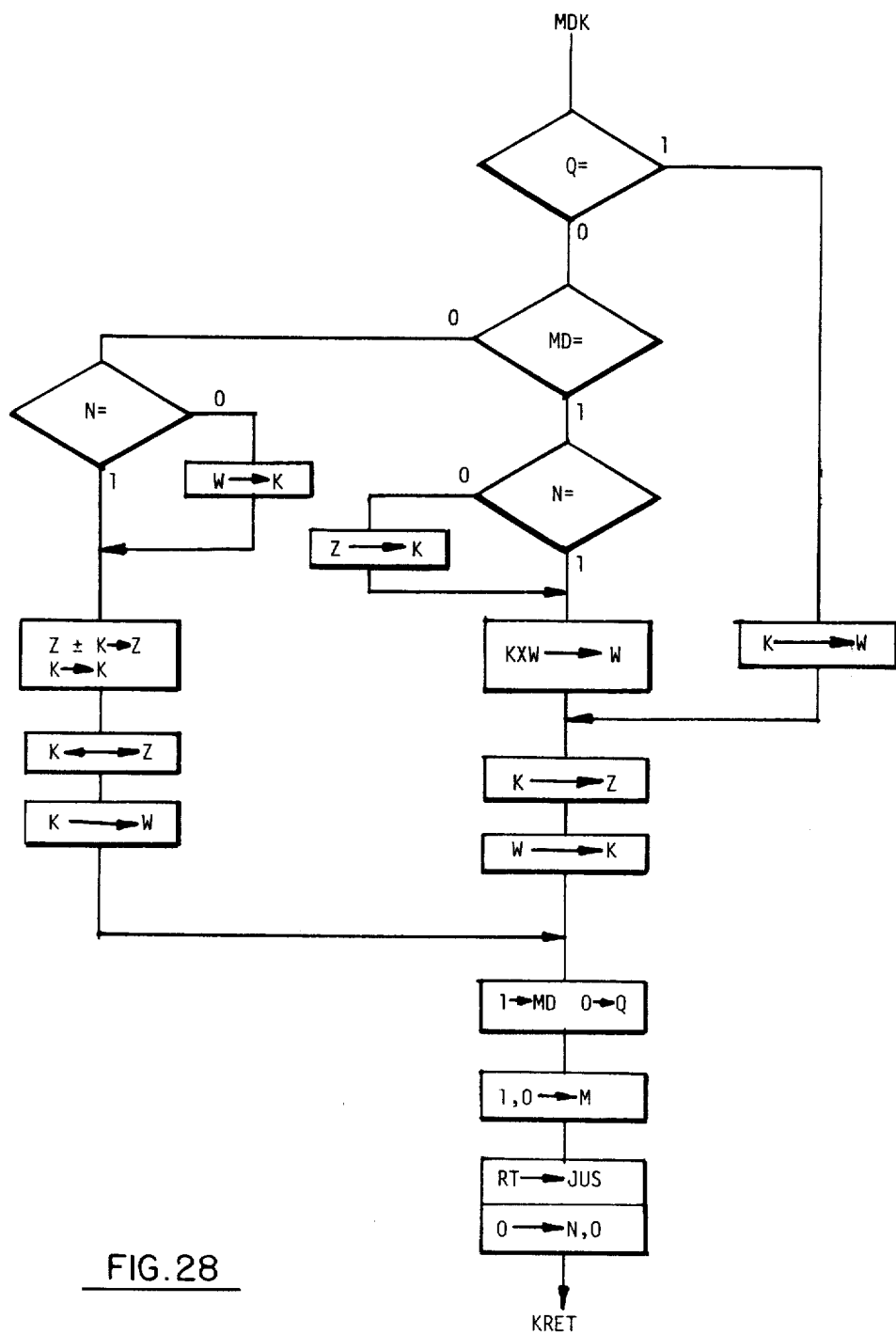
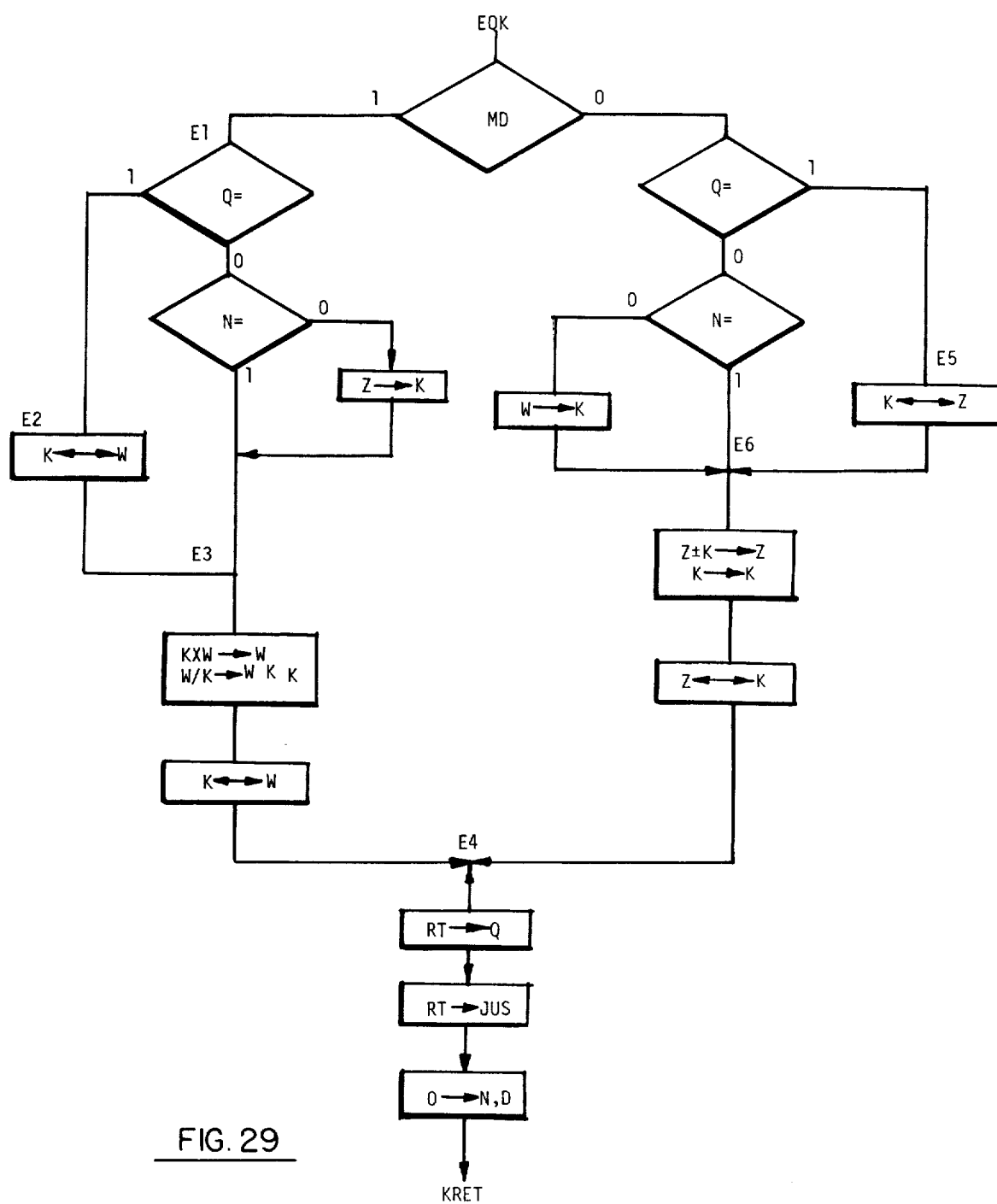


FIG. 28



## ELECTRONIC CARD GAME

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates generally to games of chance and more particularly to an electronically controlled card game apparatus of the type in which a player is dealt and selects a series of simulated playing cards generated in a random fashion from a simulated deck of 52 such cards and displayed whereby the cards dealt and selected may be identified.

#### 2. Description of the Prior Art

Known prior art electrical card game simulation devices permit a player to play such games as blackjack or poker against a simulated dealer represented by the apparatus. It is also known that there are numerous mechanical devices for playing card games such as poker and blackjack, but which permit something less than a realistic simulation of a truly random situation achieved in the actual play of such card games with printed playing cards. Unfortunately, in order to achieve a modicum of realism and an accurate representation of the true probabilities of actual card games the electronic card game simulation devices of the prior art are unduly complex and large and require substantial amounts of electric power which render them impractical for convenient portable hand-held use. Although the mechanical card game simulation devices of the prior art have been manufactured in more convenient sizes for portable hand-held use, they leave much to be desired and fall far short of any realistic simulation of an actual card game.

### SUMMARY OF THE INVENTION

The subject invention overcomes the disadvantages of the known prior art by providing an accurate and realistic simulation of at least one known card game by employing large scale integrated (LSI) circuit devices. Such devices are amenable to low power operation and to extremely small package sizes, thereby providing apparatus that may be powered by small conventional dry cell or rechargeable batteries and housed in electronic calculator type packaging conducive to portability and hand-held operation.

The invention comprises a programmed microprocessor, an electronic keyboard, and a multiple digit display device. The microprocessor in a MOS/LSI device on a single chip that includes fixed and alterable memory devices. Arithmetic and logic devices, also located on said chip, operate to receive selection signals from the keyboard to control the card game in accordance with the selections made thereby and in accordance with the rules of the game as programmed into the fixed memory device of the microprocessor. In addition, signals are generated for displaying on said display device, indications of the simulated cards that comprise the respective card hands of the player and of a simulated dealer.

Large scale integration of the microprocessor circuits permits the inclusion of circuits to provide accurate and realistic simulation of the various nuances of a card game as it might be played using actual playing cards. For example, in a preferred embodiment in which the well known game of blackjack is simulated, the player may choose a stake amount from which he may make bets upon each hand in an effort to increase the value of his stake but at the risk of decreasing the value of the

stake. In the preferred embodiment, after the initial playing cards are dealt the player may choose to stand with the cards already dealt or, in the alternative, he may choose to accept additional cards in an effort to improve his hand but at the risk of going "bust". Furthermore, the player has a number of betting options such as doubling his bet upon the dealing of one additional card, insuring his bet against dealer blackjack when the dealer shows an Ace, and splitting his bet when he receives a pair of equal value cards in the original deal. In addition, the simulated dealer is required to follow the accepted rules of blackjack by dealing additional cards to "his" hand if "he" displays a combination of 16 or less in "his" originally dealt cards. Similarly the dealer must stand with the hand originally dealt if the combined value of those cards is 17 or greater.

The invention also simulates the random selection of cards from a true deck of 52 cards and automatically re-shuffles the entire 52 card deck prior to the beginning of the new hand if, in previous hands of the same game, the total number of cards distributed to the respective players has exceeded 38. Although the particular preferred embodiment disclosed herein is especially adapted for play of the game of blackjack, it will be apparent that with modified circuitry and programming similar to the disclosed circuitry and programming referred to below, the present invention can be utilized to provide electronic simulations of other card games such as, draw poker and gin rummy. The preferred embodiment also provides a standard four-function calculator, the operation of which may be selected as an alternative to the game of blackjack. It will be readily apparent from the discussion below that this is only one combination for which the present invention may be configured and that other combinations such as a plurality of games, may be provided in other embodiments.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a typical hand-held portable blackjack card game apparatus of the invention;

FIG. 2 is a schematic block diagram of the invention indicating the interconnections between three principal elements of the invention;

FIG. 3 is a block diagram representation of the microprocessor portion of the invention;

FIG. 4 is a map of the random access memory device contained within the microprocessor block diagram of FIG. 3; and

FIGS. 5a through 30 are flow chart drawings which illustrate program routines carried out to perform the card playing operations of the invention.

### DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown therein, an assembled electronic portable hand-held blackjack playing card game 5 having a housing 10, an on/off switch 12, a calculator/game selection switch 14, a display 16 having dealer display portion 18 and player display portion 20, and a keyboard 24 having a plurality of depression actuated keys 22.

It will be observed that the electronic blackjack game 5 is similar in appearance to well-known hand-held calculators. In fact, a preferred embodiment includes a calculator/game selection switch 14 which permits the

user to choose between the game playing functions to be described in detail herein below and calculator functions such as, addition, subtraction, multiplication and division which are well-known and need not be described in great detail. The size and shape of the game 5 may be similar to such calculators with differences residing in the specific functions assigned to keys 22 of keyboard 24 which in the described embodiment of the invention, are uniquely associated with the game of blackjack. Another principal difference between the 10 game assembly of the invention and ordinary calculator assemblies, is that the display 20 and the associated driving logic are capable of displaying symbols to identify the various different card values associated with the game of blackjack and are capable of separately displaying the cards attributable to the dealer's hand and the cards attributable to the player's hand so that the two hands can be distinguished by the player.

In order to more fully understand the function of the various keys of the invention that are associated with the game of blackjack, it will be necessary to understand the rules of the game of blackjack, a description of which now follows.

### RULES OF THE GAME

The invention has been designed to permit a player to play Las Vegas Blackjack, that is, a dealer against one player. The player begins each series of hands with a specified amount of money called a stake. Before each hand is dealt, the player may specify the amount he desires to bet on that particular hand. The blackjack game records the player's bet and at the completion of the hand, the player's stake is properly adjusted, either up, down, or unchanged depending on whether respectively, the player won, lost, or tied (pushed). Credit is automatically advanced should the amount lost exceed the player's current stake balance.

Once the bet has been placed, the blackjack game automatically begins to deal, and two cards are displayed on the left for the player while one card is displayed on the right for the dealer. A second card dealt to the dealer is not displayed. The cards are displayed as follows: if the card value is two through nine, the display reveal the corresponding two through nine respectively. All face cards and cards having value 10 are displayed by the symbol F and all Aces are displayed by the symbol A. Aces may be counted as either a 1 or an 11 in card value. Each hand is dealt randomly from a 52 card deck. Shuffling occurs when the blackjack game mode is first turned on and also occurs automatically 40 prior to the beginning of a new hand if the 38th card in the deck was dealt in the preceding hand. The shuffling continues until the CE/C (Clear Entry/Clear) key is depressed to terminate shuffling.

While playing a hand, the player may, depending on the circumstances, accept or decline insurance, split a pair, double down, take a hit or stand. The meanings of these terms of the standard blackjack game are indicated below. If only the player is dealt a card total of 21 (blackjack), a win is recorded which pays one and one-half times the value of the bet to his stake. Once the hand has been completed, the player may review his current stake balance by depressing the Total key. The object of the game is to beat the dealer by achieving a card total less than or equal to 21 and greater than the dealer's card total. Once the player goes bust (exceeds 21) the dealer automatically shows his second card and wins. When the player stands, with 21 or less, the dealer

automatically shows the second card and then continually takes additional cards until the dealer's hand exceeds 16. If the dealer's hand exceeds 21 the dealer busts and the player wins.

To begin the next hand, the player depresses the play key and the display blinks a zero and decimal point until the next bet is entered, unless automatic shuffle is required as previously described. If either the dealer or the player is dealt blackjack, the blackjack game automatically terminates the hand and debits or credits the player's stake in accordance with the outcome, unless the dealer shows an Ace. When both player and dealer are dealt blackjack, the hand is automatically terminated, but the stake remains unchanged.

### BLACKJACK KEYS

The Bet key is a dual function key for entering the player's stake (initial bankroll) and for entering the bet for each hand. The stake is entered as follows:

Step 1—Set the mode switch to: GAME

Step 2—Set the power switch to: ON

Step 3—Depress CE/C to terminate card shuffling.

Step 4—Enter the amount of the stake. If an error is made depress CE/C and re-enter the correct value.

25 Step 5—Depress bet. At this point a single zero is displayed prompting a bet for the first hand. If a different stake was desired begin again with Step 1.

The bet for each hand is entered by indexing the amount and then depressing the Bet key. Card dealing then begins.

The Hit key is depressed when a hit is desired, that is, when a player desires an additional card after the original four cards are dealt, two each to the player and dealer. The player may take a hit as desired until he chooses to stand or until a bust occurs.

The Stand key is a dual function key. Its primary function is to indicate that the player's hand is satisfactory which then initiates dealer action. If the player wins the hand, an amount equal to the bet is automatically added to the value of the stake. On the other hand, if the player loses the hand, the bet is deducted from the stake. A tie results in no change to the stake.

The player also uses the Stand key to decline insurance when the dealer shows an Ace. Normal play then resumes if the dealer did not have blackjack, otherwise the hand is over and the player has lost.

The Insurance key is operable only when the dealer shows an Ace. The player may do one of the following: he may accept insurance equal to one-half of the bet for the hand by depressing the Insurance key. If the dealer has blackjack the insurance bet is paid 2-to-1, which is equal to the total bet of that hand. Consequently, since the original bet is lost as a result of the dealer winning by means of a blackjack hand (unless the player also has a blackjack), the total result is a push, that is, no gain or loss of money from the player's stake. If the player also has a blackjack the resultant gain is the value of the original bet. If the dealer does not have blackjack, then the insurance bet, that is one-half of the hand bet, is automatically deducted from the stake and normal play resumes. The player may also decline insurance by depressing the Stand key. If the dealer has blackjack, the player loses the bet. If the dealer does not have blackjack, then normal play resumes.

The Split key is operable only if the first two cards dealt to the player constitute a pair, that is, two face cards, two Aces or two other cards of equal value. Once

depressed, the Split key initiates the following action: an amount equal to the bet for this hand is secured for the second hand. The card value of the second card dealt is retained in memory but cleared from the first hand, and a third card is automatically dealt, thus displaying two cards for the player's first hand. The player may take additional cards using the HIT key as usual until he depresses the stand key to terminate the first hand. At this point the total count of the first hand is stored in memory. Then the original second card value is displayed and a second card for the second hand is dealt. Like the first hand, the player takes additional cards using the HIT key until he depresses the Stand key or a bust occurs. In either case, dealer action then proceeds. The outcome of each hand is then promptly accounted for and the stake is adjusted as usual. If two Aces are dealt the player in the original deal and the Split key is depressed, the split occurs automatically and one additional card is dealt to each hand of the two split hands. Dealer action then follows.

The player may use the Double key to double his bet in exchange for a one card hit. When the Double key is depressed, the following action takes place: An amount equal to twice the placed bet, is secured as the new bet, the player is automatically dealt one card, and dealer action proceeds as usual.

If the player wins, the new bet is added to the stake. Similarly, the bet is subtracted from the stake if the dealer wins. A tie, that is equal card totals for both the player and the dealer, results in a push, that is, no change to the stake.

After a hand (both hands in the case of a split deal) has been completed, the player may depress the Total key to review the financial progress of the game that is, the new value of the stake. The player may then depress the Play key to begin the next hand.

When the Play key is depressed, one of the following actions takes place: If a zero and decimal blinking action are displayed, that indicates it is time to place the bet for the upcoming hand. If eight zeros and decimals appear blinking on the display, that indicates that shuffling is taking place because in the previous hand the thirty-eighth card of the deck was dealt. The player terminates shuffling by depressing the CE/C key. After this key is depressed, a zero and decimal will be displayed in blinking form to indicate that it is time to place the bet for the next hand.

Table I is an illustrative example of a portion of a game sequence utilizing the preferred embodiment of the present invention. As indicated, Table I includes a column of explanatory comments on the left, a key sequence column which indicates the possible sequence of key depressions for this particular example, and on the right, a column of displayed information indicating the player and dealer cards drawn at random in a plurality of illustrative blackjack hands.

Referring now to FIG. 2 there are shown therein the three major components of a preferred embodiment of the invention, namely, keyboard 24, programmable microprocessor chip 30, and 12-digit display 40. Also shown are various peripheral components employed in the fully assembled blackjack card game version of the invention.

As shown in FIG. 2, the programmable microprocessor chip 30 is connected to the 12-digit display 40 at its segment and strobe terminals SEG 1 through SEG 7, SEGP and STR0 through STR11. Each terminal is also connected to -30 volts DC through a pull-up resistor

RPU which may, for example, have a value of 100,000 OHMS. In addition, microprocessor chip 30 is connected to keyboard 24 by means of four keyboard lines KB1 through KB4 and a discrete input line DIN1. An additional strobe line STR12 is connected to a calculator-game switch 14. Resistor RD, resistor RC and capacitor CF are used to apply the appropriate DC voltages to the programmable microprocessor chip terminals VC and PO respectively.

In one embodiment RC has a value of 56 KOHMS, RD has a value of 180 KOHMS and CF has a value of 0.47 microFarads. Because the manner in which a programmable microprocessor chip, a keyboard and a multi-digit display are interconnected is well known in the art, particularly with respect to calculator type devices, a more detailed description of the interrelationship therebetween is not required. However, a more detailed description of microprocessor chip 30 is desirable and follows in conjunction with the microprocessor chip block diagram of FIG. 3.

Referring now to FIG. 3, there is shown a preferred embodiment of the invention. In this embodiment, the device includes the elements listed herewith. However, this embodiment is not limitative of the invention. Chip 30 is a single MOS/LSI device parallel processing system. In a preferred embodiment, the device contains the following components:

1. A read only memory ROM containing microinstructions arranged as 24 pages of 64 8-bit words.
2. A random access memory RAM for storing information used during the processing of the program contained in the ROM. The RAM is arranged as a group of 8 12-word registers, each word containing 4 bits.
3. A 4-bit parallel binary adder.
4. A 4-bit accumulator.
5. A 4-bit temporary storage register H.
6. A discrete flip-flop C.
7. A 7-bit RAM address register B.
8. An 11-bit ROM address register P with an upper 5-bits designated PU and a lower 6-bits designated PL.
9. Two 10-bit save registers S designated respectively, SA and SB with an upper 4-bits and a lower 6-bits.
10. Up to 16 strobe signals STR0 through STR15 for sampling keyboard entries and for driving display 40.
11. Four keyboard return lines designated KB1-KB4 and lines designated DIN1 and DIN0 for additional inputs.
12. Up to 10 data outputs with options for discrete or seven-segment decoding logic, designated SEG0 through SEG9.
13. An oscillator and clock generator.

#### READ ONLY MEMORY UNIT (ROM)

The ROM is organized into 24 pages of 64 words each. Each word contains 8 bits. Chip 30 is programmed by means of microinstructions coded into the ROM. The ROM is organized in pages which are addressed by the upper 5 bits of the P register. The lower 6 bits, PL, address the specific 8-bit word on each page. The P register can be loaded from the S register. The register is normally incremented each bit time in order to address the next word in the ROM. Return locations, which are used when subroutines are employed, are stored in the save register S.

TABLE I

COMMENT	KEY SEQUENCE		DISPLAY	
	ENTER	DEPRESS	(PLAYER)	(DEALER)
STEP 1	SWITCH TO: "GAME"			
STEP 2	TURN POWER "ON"		(BLINKS)	.0.0.0.0.0.0.0.0.
STEP 3		[CE/C]		(BLINKS) 0.
ENTER STAKE	500	[BET]		0
ENTER BET	50	[BET]	6 7	F
TAKE HIT		[HIT]	6 7 A	F
		[HIT]	6 7 A 6	F
STAY		[STAND]	6 7 A 6	5 F
WON:			6 7 A 6	4 5 F
REVIEW STAKE BALANCE	(OPTIONAL	[TOTAL]		5 5 0.
⋮	⋮			⋮
PLAY NEXT HAND		[PLAY]		(BLINKS) 0.
ENTER BET	100	[BET]	9 9	3
SPLIT		[SPLIT]	9 2	3
PLAY FIRST HAND		[HIT]	9 2 7	3
		[STAND]	9 3	3
PLAY SECOND HAND			9 3	3
PLAYER BUST		[HIT]	9 3 F	3
WON FIRST - LOST SECOND			9 3 F	4 F 3
	(OPTIONAL	[TOTAL]		5 5 0.
PLAY NEXT HAND		[PLAY]	(BLINKS)	.0.0.0.0.0.0.0.0.
SHUFFLE RESET		[CE/C]		(BLINKS) 0.
	100	[BET]	5 6	5
DOUBLE BET ON ONE CARD		[DOUBLE]	5 6 9	F 5
WON-DEALER BUST			5 6 9	8 F 5
	(OPTIONAL	[TOTAL]		7 5 0.
		[PLAY]		(BLINKS) 0.
	200	[BET]	F 9	A
INSURANCE		[INS]	F 9	A
		[STAND]	F 9	9 A
LOST - INSURANCE AND BET	(OPTIONAL	[TOTAL]		4 5 0.

#### RANDOM ACCESS MEMORY ADDRESS REGISTER B

RAM address register B is divided into three parts. The four least significant bits from a digit address register BL. The next two significant bits form a register address register BU. The most significant bit, B7, is used to select between two groups of four registers in the random access memory RAM. (See FIG. 4)

#### RANDOM ACCESS MEMORY (RAM)

The RAM is used for the temporary storage of information in chip 30. The RAM has 4 bit words organized into registers. The most significant bit, B7, of the B register address can be set or reset. The upper two bits

of the B register address can be loaded directly or toggled to change RAM registers. The lower 4 bits address the specific 4-bit word in each RAM register and can be loaded directly, with select values, loaded from the accumulator, incremented or decremented.

#### THE ADDER

The adder is a 4-bit parallel binary adder. The contents of the RAM can be added to the accumulator by means of the adder. The adder can also be employed to add the binary code represented by the 4 keyboard input lines KB1 through KB4 to the contents of the accumulator. There are 16 different instructions which can add different specified numbers directly to the contents of the accumulator.

### THE ACCUMULATOR

The accumulator is a 4-bit register that can be loaded from the RAM, have its contents exchanged with selected contents of the RAM, be loaded directly by 16 different instructions, be loaded from the B register or complemented.

### THE STORAGE REGISTER H

The storage register H is a 4-bit independent register which can be loaded from the accumulator, copied into the accumulator or loaded with the accumulator contents right-shifted 1 bit.

### THE C FLIP-FLOP

The C flip-flop is a discrete flip-flop which can be set, reset, tested, or loaded from the carry output of the adder.

### STROBE OUTPUT SIGNALS (STR0-STR15)

The 16 output strobe signals are generated at the output of a holding flip-flop, in the decode logic shown in the lower right-hand portion of FIG. 3. Each of these holding flip-flops can be loaded from the B register. Only one strobe signal can be enabled at any one time.

### DATA OUTPUTS

The 10 data or segment output signals are generated at the output of a holding flip-flop in the segment decode logic shown in the lower right-hand portion of FIG. 3. The holding flip-flop for segment signals can be loaded through 7 segment display logic driven by the accumulator, or by dedicated bits when special symbols are required. The holding flip-flop for segment signal SEGP is loaded from the C flip-flop.

### POWER ON RESET

The power on reset circuit is connected between the input P0 and ground. The power on reset circuit is used to reset the P and S registers to begin the program at a fixed location after the DC power is applied to the chip.

### OSCILLATOR AND CLOCK GENERATOR

The oscillator and clock generator supply all the required clock signals to programmable chip 30.

### INSTRUCTION SET OF CHIP 30

Table II below provides a complete listing of the instruction set for programmable microprocessor chip 30. The Table includes a brief description of notation used and the flags referred to in the instructions. The Table comprises three columns; a mnemonic column which is used to identify each instruction, an action column that the instruction initiates, and a description column which more fully explains the operation initiated by the instructions.

### DESCRIPTION OF RAM MEMORY ALLOCATION

The RAM map of FIG. 4, including the various flags utilized in the flow charts of FIG'S. 5a through 30, will now be described.

The RAM for the computer of this invention is organized as eight registers containing twelve 4-bit words each. They are denoted, from left to right K, Z, W, T, C, S, H and R, respectively. The addressing distinguishes between the first four registers, (i.e. K, Z, W, T) and the latter four through the use of pointer bit B7 of the addressing scheme. When B7 is set or ONE, the last four registers, registers C, S, H, and R are being addressed and when B7 is ZERO, the first four registers are addressed.



TABLE II

NOTATION

- ( ) DENOTES THE CONTENTS OF A REGISTER, FLIP-FLOP, OR A DEFINED GROUP OF TERMS
- < > DENOTES A GROUP OF ADDRESS TERMS
- > DENOTES THE TRANSFER OF INFORMATION FROM ONE LOCATION TO ANOTHER
- :
- IF THE EXPRESSION TO THE LEFT OF THIS SYMBOL IS TRUE THEN THE OPERATION TO THE RIGHT OF IT WILL BE PERFORMED
- ~ DENOTES THE LOGICAL COMPLEMENT OF A TERM OR REGISTER
- & DENOTES THE LOGICAL AND OPERATION
- | DENOTES THE LOGICAL OR OPERATION
- \* DENOTES THE LOGICAL EXCLUSIVE-OR OPERATION

FLAG DEFINITIONS

- SR SHORT SURROUTINE FLAG
- IGN IGNORE INSTRUCTION FLAG
- IGN2 IGNORE TWO INSTRUCTIONS FLAG
- TLF LONG TRANSFER FLAG
- ATPF ATP INSTRUCTION FLAG
- RLAX LAX INSTRUCTION FLAG
- RLB LB INSTRUCTION FLAG

TABLE II

PNEUMONIC ACTION		DESCRIPTION
SATP	-IGN: 1 --> ATPF	THIS INSTRUCTION PERFORMS NO OPERATION IN ITSELF. IT SETS A FLAG (ATPF) WHICH MODIFIES SEVERAL OTHER INSTRUCTIONS. USEFUL MODIFICATIONS ARE PERFORMED ON SOME INSTRUCTIONS, ON OTHERS THE MODIFICATIONS MERELY ALLOW THESE INSTRUCTIONS TO PERFORM OPERATIONS ALREADY AVAILABLE WITH OTHER INSTRUCTIONS. IN ALL CASES OF INSTRUCTION MODIFICATION REFER TO THE SPECIFIC INSTRUCTION DESCRIPTION FOR AN EXACT EXPLANATION OF THE MODIFICATION.
	IGN: (IGN2) --> IGN	
	0 --> IGN2, RLB, RLAX, TLF	
		NOTE - - - - - CAUTION MUST BE EXERCISED WHEN USING THIS INSTRUCTION BECAUSE THE FLAG IS ONLY ZEROED WHEN AN EXECUTED TRA INSTRUCTION IS ENCOUNTERED.
NOP	(IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	NO OPERATION
RSC	-IGN: 0 --> C IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	RESET C FF
SC	-IGN: 1 --> C 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	SET C FF
YC	-IGN: -(C) --> IGN 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	NEXT INSTRUCTION IS IGNORED IF C IS ZERO
COMP	-IGN: -ATPF: -(A) --> A 0 --> IGN2, RLB, RLAX, TLF ATPF: 15 --> A 0 --> IGN2, RLB, RLAX, TLF	THE ONE'S COMPLEMENT OF THE ACCUMULATOR IS INSERTED INTO THE ACCUMULATOR. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN 15 WILL UNCONDITIONALLY BE LOADED INTO THE ACCUMULATOR.



TABLE II

MNEMONIC	ACTION	DESCRIPTION
LB X,Y	IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLX, TLF	LOADS THE B REGISTER. THE UPPER TWO BITS (BU) WITH X AND THE LOWER FOUR BITS (BL) WITH Y. ONLY THE REFERENCED LB IN A STRING OF CONSECUTIVE LB INSTRUCTIONS WILL BE EXECUTED. THE DESIRED GROUP OF VALID Y VALUES IS SELECTABLE AS A HARDWARE OPTION. IF 6-16 DIGIT REGISTERS ARE USED THEN THE VALID X VALUES ARE: B7=0, X=0,1,2,3; B7=1, X=1,3. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN BL WILL BE LOADED WITH THE RESULT OF A LOGICAL AND OPERATION BETWEEN THE COMPLEMENTED CONTENTS OF THE ACCUMULATOR AND Y. THE STATE OF THE ATP FLAG WILL NOT BE AFFECTED BY THIS INSTRUCTION.
RLB X	IGN: (IGN2) 0 --> (M<BU,RL,X>) 0 --> IGN2, RLB, RLX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLX, TLF	RESETS ONE BIT OF THE CONTENTS OF THE SELECTED MEMORY (M). X=8,4,2,1 CORRESPONDS TO BIT POSITIONS 4,3,2,1.
SM X	IGN: (IGN2) 1 --> (M<BU,RL,X>) 0 --> IGN2, RLB, RLX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLX, TLF	SETS ONE BIT OF THE CONTENTS OF THE SELECTED MEMORY. X=8,4,2,1 CORRESPONDS TO BIT POSITIONS 4,3,2,1.
TM X	IGN: (M<BU,RL,X>) = 0 : 1 --> IGN 0 --> IGN2, RLB, RLX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLX, TLF	TESTS ONE BIT OF THE CONTENTS OF THE SELECTED MEMORY. THE NEXT ROM WORD WILL BE IGNORED IF THE SELECTED BIT=0. X=8,4,2,1 CORRESPONDS TO BIT POSITIONS 4,3,2,1.
TAM	IGN: (A=M) : 1 --> IGN 0 --> IGN2, RLB, RLX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLX, TLF	THE CONTENTS OF THE ACCUMULATOR ARE COMPARED WITH THE CONTENTS OF THE SELECTED MEMORY. THE NEXT ROM WORD WILL BE IGNORED IF THEY ARE EQUAL.
PSB7	IGN: 0 --> R7	THE MSB OF THE RAM ADDRESS REGISTER (R7)

TABLE II

mnemonic	action	description
	0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN	IS RESET TO 0.
	0 --> IGN2, RLB, RLAX, TLF	
S37	-IGN: 1 --> R7 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE MSB OF THE RAM ADDRESS REGISTER (R7) IS SET TO 1.
ADD	-IGN: (A) * (M<BU,RL>) --> A 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	ADDS THE CONTENTS OF THE SELECTED MEMORY TO THE ACCUMULATOR PUTTING THE RESULT INTO (A).
ADD 1	-IGN: (A) * (M<BU,RL>) * (C) --> C,A 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	SAME AS ADD EXCEPT THE C FLIP-FLOP SERVES AS A CARRY-IN AND A CARRY-OUT FOR THE ADC
ADD 1.1	-IGN: (A) * (M<BU,RL>) * (C) --> C,A (C) --> IGN 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	SAME AS ADD 1 EXCEPT THE NEXT ROM WORD WILL BE IGNORED IF A CARRY-OUT IS GENERATED.
ADX X	-IGN: -ATPF: (A) * X --> A WHERE 0 <= X <= 15 0 --> IGN2, RLB, RLAX, TLF -OVERFLOW: 1 --> IGN ATPF: 15 --> A 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE 4 BIT OPERAND (X) IS ADDED TO THE ACCUMULATOR. THE NEXT INSTRUCTION IS EXECUTED IF AN OVERFLOW OCCURS AND IS IGNORED IF A OVERFLOW DOES NOT OCCUR. ADX 6 WILL ALWAYS PRODUCE AN OVERFLOW. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN THE ADX INSTRUCTION WILL UNCONDITIONALLY LOAD 15 INTO THE ACCUMULATOR. THE STATE OF THE ATP FLAG IS NOT AFFECTED BY THIS OPERATION.
LAX X	-IGN: -ATPF: X --> A WHERE 0 <= X <= 15 1 --> RLAX 0 --> IGN2, RLB, TLF ATPF: -A & X --> A	THE FOUR BIT OPERAND (X) IS LOADED INTO THE ACCUMULATOR. ONLY THE REFERENCED LAX IN A STRING OF CONSECUTIVE LAX INSTRUCTIONS WILL BE EXECUTED. IF THE ATP FLAG HAS BEEN

TABLE II

MEMONIC	ACTION	DESCRIPTION
	I --> RLAX 0 --> IGN2, RLB, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	SET (ATPF = 1) THEN THE LAX INSTRUCTION CAUSES THE CONTENTS OF THE ACCUMULATOR TO BE REPLACED WITH THE RESULT OF A LOGICAL AND OPERATION BETWEEN X AND THE COMPLEMENT VALUE OF THE ACCUMULATOR. THE STATE OF THE ATP FLAG IS NOT AFFECTED BY THIS OPERATION.
LDA X	-IGN: -ATPF: (M<RU,HL>) --> (A) BU * X --> BU WHERE X=0,1,2,3 0 --> IGN2, RLB, RLAX, TLF ATPF: (M<RU,HL>) & ~(A) --> A 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	COPIES THE CONTENTS OF THE SELECTED MEMORY INTO THE ACCUMULATOR. THE RESULT OF A LOGIC EXCLUSIVE-OR OF RU AND X REPLACES BU. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THE CONTENTS OF THE ACCUMULATOR WILL BE REPLACED WITH THE RESULT OF A LOGICAL AND OPERATION BETWEEN THE CONTENTS OF THE SELECTED MEMORY AND THE COMPLEMENTED CONTENTS OF THE ACCUMULATOR. THE STATE OF THE ATP FLAG WILL NOT BE AFFECTED BY THIS INSTRUCTION.
ATH	-IGN: -ATPF: (A) --> H 0 --> IGN2, RLB, RLAX, TLF ATPF: 0 --> H 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE CONTENTS OF THE ACCUMULATOR ARE COPIED INTO THE STORAGE REGISTER. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN THE ATH INSTRUCTION WILL UNCONDITIONALLY LOAD 0 INTO THE STORAGE REGISTER. THE STATE OF THE ATP FLAG WILL NOT BE AFFECTED BY THIS INSTRUCTION.
ATHR	-IGN: -ATPF: 0 --> H4 (A4) --> H3 (A3) --> H2 (A2) --> H1 (A1): 1 --> C 0 --> IGN2, RLB, RLAX, TLF ATPF: 0 --> H 0 --> C 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	COPIES THE ACCUMULATOR RIGHT SHIFTED RIGHT 1 BIT INTO THE STORAGE REGISTER. THE MSB OF H IS ZEROED. IF THE LSB OF A IS "0", THE CFF IS SET, BUT IF IT IS "1", THE CFF IS NOT CHANGED. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN THE H REGISTER AND C WILL UNCONDITIONALLY BE SET TO ZERO. THE STATE OF THE ATP FLAG IS NOT AFFECTED BY THIS INSTRUCTION.

TABLE II

MNEUMONIC	ACTION	(H)	DESCRIPTION
HTA	-IGN: -ATPF: 1	0 --> A	THE CONTENTS OF THE STORAGE REGISTER ARE COPIED INTO THE ACCUMULATOR. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN 15 WILL UNCONDITIONALLY BE LOADED INTO THE ACCUMULATOR. THE STATE OF THE ATP FLAG IS NOT AFFECTED BY THE INSTRUCTION.
	ATPF: 15	0 --> A	
	IGN: (IGN2)	0 --> IGN	
	0 --> IGN2, RLB, RLAX, TLF		
TL 7	-IGN: 1	0 --> TLF	TL IMMEDIATELY FOLLOWED BY TRA WILL RESULT IN A TRANSFER TO THE ROM WORD AT PU=7 AND PL=X, Z CAN BE 0 THRU 15. X IS THE ARGUMENT OF THE TRA INSTRUCTION. TL FOLLOWED BY ANY OTHER INSTRUCTION WILL PERFORM NO OPERATION. IF TL IS TO BE IGNORED THE FOLLOWING INSTRUCTION WILL BE IGNORED ALSO.
	Z	0 --> PUD	
	0 --> IGN2, RLB, RLAX		
	IGN: 1	0 --> TGN	
	0 --> IGN2, RLB, RLAX, TLF		
TRA 0.X	-IGN: -ATPF: X	0 --> PL 1 BIT DELAY	THE RETURN ADDRESS IS SAVED BY PUSHING P DOWN INTO THE SA REGISTER WHICH IS PUSHED DOWN INTO THE SR REGISTER. THE SUBROUTINE FLAG IS SET. A TRA 0 NOT PRECEDED BY A TL WILL LOAD PU WITH THE SRO BLOCK ADDRESS. AND PL WITH THE ADDRESS SPECIFIED BY X. TL PRECEDING TRA 0 CAUSES PU TO BE LOADED WITH THE ADDRESS SPECIFIED BY THE TL INSTRUCTION. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN THE ADDRESS TO WHICH THE PROGRAM WILL TRANSFER TO IS MODIFIED BY PERFORMING A LOGICAL OR OF THE LAST 4 BITS OF X WITH THE 4 BITS OF THE ACCUMULATOR. THIS RESULT TOGETHER WITH THE FIRST 2 BITS OF X FORMS THE ADDRESS TO WHICH CONTROL WILL BE TRANSFERRED. THE OCCURRENCE OF AN EXECUTED TRA WILL RESET THE ATP FLAG.
	PL + 1	0 --> SL	
	PU	0 --> SU	
	1 --> SR		
	1 --> IGN		
	0 --> IGN2, RLB, RLAX, TLF		
	-SR: -TLF: SRO	0 --> PU	
	TLF: PUD	0 --> PU	
	SR: -TLF: SRO	0 --> PU	
	TLF: PUD	0 --> PU	
	ATPF: 0	0 --> ATPF	
	X6, X5	0 --> P6, P5	
	(X4 - X1)   (A4 - A1)	0 --> P4 - P1	
	PL + 1	0 --> SL	
	PU	0 --> SU	
	1 --> SR		
	1 --> IGN2		
	0 --> IGN, RLB, RLAX, TLF		
	-SR: -TLF: SRO	0 --> PU	
	TLF: PUD	0 --> PU	
	SR: -TLF: SRO	0 --> PU	
	TLF: PUD	0 --> PU	
	IGN: (IGN2)	0 --> IGN	
	0 --> IGN2, RLB, RLAX, TLF		

TABLE II  
DESCRIPTION

MNEMONIC	ACTION	DESCRIPTION
TRA 1.X	-IGN: -ATPF: X --> PL 1 BIT DELAY 1 --> IGN 0 --> IGN2, RLB, RLAX, TLF -SR: -TLF: PU --> PU TLF: PUD --> PU 0 --> SR SR: -TLF: SR1 --> PU TLF: PUD --> PU 0 --> SR ATPF: 0 --> ATPF X6, X5 --> P6, P5 (X4 - X1)   (A4 - A1) --> P4 - P1 1 --> IGN2 0 --> IGN, RLB, RLAX, TLF -SR: -TLF: PU --> PU TLF: PUD --> PU SR: -TLF: SR1 --> PU TLF: PUD --> PU 0 --> SR IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE ADDRESS SPECIFIED IN X IS LOADED INTO PL. IF IN SR0 PU WILL BE LOADED WITH THE SR1 BLOCK ADDRESS. TRA 1 NOT PRECEDED BY TL WILL LOAD X INTO PL AND PU WILL REMAIN UNCHANGED. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN THE ADDRESS TO WHICH THE PROGRAM WILL TRANSFER TO IS MODIFIED BY PERFORMING A LOGICAL OR OF THE LAST 4 BITS OF X WITH THE 4 BITS OF THE ACCUMULATOR. THIS RESULT TOGETHER WITH THE FIRST 2 BITS OF X FORMS THE ADDRESS TO WHICH CONTROL WILL BE TRANSFERRED. THE OCCURENCE OF AN EXECUTED TRA WILL RESET THE ATP FLAG.
RET X	-IGN: SRL --> SRL --> SAL --> PL SRL --> SRL --> SAU --> PU 1 --> IGN 0 --> IGN2, RLB, RLAX, TLF, SR X: 1 --> IGN2 IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE SUBROUTINE FLAG IS RESET TO 0 AND THE "SR" REGISTER IS PUSHED UP TO THE "SA" REGISTER, WHICH IS PUSHED UP TO THE P REGISTER. IF X=1 THE ROM WORD AT THE RETURN ADDRESS WILL BE IGNORED.
READ 0	-IGN: (KR) --> A 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN 0 --> IGN2, RLB, RLAX, TLF	THE INFORMATION ON THE FOUR KEYBOARD RETURN LINES IS COPIED INTO THE ACCUMULATOR.
TKB	-IGN: (~(KB1 & KB2 & KB3 & KB4)) 1 --> IGN 0 --> IGN2, RLB, RLAX, TLF IGN: (IGN2) --> IGN	THE NEXT INSTRUCTION IS IGNORED IF AT LEAST ONE KEY IS DOWN (AT GROUND). BY OPTION THE STATE OF DIN1 CAN BE INCLUDED IN THE KEY



TABLE II

MEMONIC	ACTION	DESCRIPTION
	0 --> TGN2, RLB, RLAX, TLF	TEST.
BTA	/-TGN: -ATPF: (BL) --> A 0 --> IGN2, RLB, RLAX, TLF ATPF: 15 --> A 15 --> BL 0 --> IGN2, RLB, RLAX, TLF TGN: (IGN2) --> IGN 0 --> TGN2, RLB, RLAX, TLF	COPIES THE 4 LSR OF THE RAM ADDRESS REGISTER INTO THE ACCUMULATOR. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN 15 WILL UNCONDITIONALLY BE LOADED INTO BOTH THE ACCUMULATOR AND BL. THE STATE OF THE ATP FLAG WILL NOT BE AFFECTED BY THIS INSTRUCTION.
TDIN 0	-TGN: (DIN0=VDD): 1 --> IGN 0 --> TGN2, RLB, RLAX, TLF TGN: (IGN2) --> IGN 0 --> TGN2, RLB, RLAX, TLF	THE NEXT ROM WORD WILL BE IGNORED IF DISCRETE INPUT 0 IS AT VDD.
TDIN 1	-TGN: (DIN0=VDD): 1 --> IGN 0 --> TGN2, RLB, RLAX, TLF TGN: (IGN2) --> IGN 0 --> TGN2, RLB, RLAX, TLF	THE NEXT ROM WORD WILL BE IGNORED IF DISCRETE INPUT 1 IS AT VDD.
ATB	-TGN: -ATPF: (A) --> BL 0 --> IGN2, RLB, RLAX, TLF ATPF: 0 --> BL 0 --> IGN2, RLB, RLAX, TLF TGN: (IGN2) --> IGN 0 --> TGN2, RLB, RLAX, TLF	COPIES THE ACCUMULATOR INTO THE 4 LSB OF THE RAM ADDRESS REGISTER. IF THE ATP FLAG HAS BEEN SET (ATPF = 1) THEN ZERO WILL UNCONDITIONALLY BE LOADED INTO BL. THE STATE OF THE ATP FLAG WILL NOT BE AFFECTED BY THIS INSTRUCTION.
BTS	-TGN (RL) --> STROBES 0 --> TGN2, RLB, RLAX, TLF TGN: (IGN2) --> IGN 0 --> TGN2, RLB, RLAX, TLF	THE LOWER FOUR BITS OF THE B REGISTER SELECT THE STROBE TO BE ACTIVATED. BTS IS A THREE HIT TIME OPERATION: 1) THE SEGMENT DRIVERS ARE "ZEROED". 2) THE STROBE DRIVERS ARE "ZEROED". 3) THE STROBE SELECTED BY BL IS LOADED. THE ROM WORD FOLLOWING BTS MUST NOT MODIFY BL. B7 MUST BE 0 DURING THE ENTIRE THREE HIT TIME OPERATION OF BTS.
ATD X	-TGN: (A) --> DISPLAY 0 --> IGN2, RLB, RLAX, TLF	THE ACCUMULATOR AND THE C FLIP-FLOP ARE OUTPUT TO THE DISPLAY DRIVERS.

TABLE II

MNEMONIC	ACTION	DESCRIPTION
IGN: (IGN2)	--> IGN	X=0 OUTPUT SEGMENT DATA SERIAL.
0 --> IGN2, RLB, RLX, TLF		X=1 OUTPUT BINARY DATA SERIAL.
		X=2 OUTPUT SEGMENT DATA PARALLEL.
		X=3 OUTPUT BINARY DATA PARALLEL.

5  
  
10  
  
15  
  
20  
  
25

The program is able to directly address only certain locations in any register. The easily addressable standard locations are, 0, 7, 8, 9, 10 and 11. Any other locations, for example 1 through 6, are addressed by special instructions within the program.

Each individual register and the use or meaning of the contents of that register are now described beginning with register R. Words R0 through R7 represent the results of the random number generation. After each random number multiply process, a new value appears in this register with R7 representing the tens digit and R6 representing the units digit of a possible new card, that is, new random number to be considered as a possible new card. R8, referred to as PAD, represents a scratchpad location used during the determination of the random number. R9, called NEW, is a location of the new or recently generated random number representing a potential card which can be dealt to one of the hands. R10 contains several flags. Bit location 8, (the bits are numbered in binary sequence from the right to left—1, 2, 4 and 8), contains flag HS standing for hand start. The next three bits are the DS counter, DS3, DS2 and DS1. They are used in counting the first four cards dealt, two to a player and two to dealer, and they are set in certain modes after the first four cards are dealt.

DS1 is also used in directing cards during the play of the game, either to dealer's hand or to player's hand. R11 contains additional flags. Flag PR represents pool ready. A ONE here indicates that a stake has been established and entered into the memory. H0 stands for hand over and G when set, represents that the game mode is in operation as opposed to the calculator mode.

Register H contains the cards of both the dealer's hand and the player's hand. The loading of this register is accomplished from opposite ends, depending upon whether the player's hand is being dealt, in which case dealing starts at H11 and goes up, or the dealer's hand is being dealt where dealing starts at H0 and goes down. There is no firm boundary between player's hand and dealer's hand. The only requirement is that the total of

he cards in the two hands not exceed the twelve allowable positions. If this should happen, the routine exits to RESET and the hand is canceled.

Register S contains, in location zero through five, the totals and flags for the three possible hands, the dealer's hand, the player's hand and the split hand. Since the format is the same for all three hands, only one will be discussed.

The first four bits of the total are located in word S0. At S1, bit 1 represents a dealer Ace and if this bit is a ONE, the hand contains an Ace. Bit 2 represents a total value of 16 accumulated in the hand. Bit 4, implies the hand has busted. In the case of the split hand in S5, bit 3 represents the completion of this split hand, and is designated H2C, hand 2 complete. S7 contains flags relating to a blackjack condition. Bit 1 of S7 contains accept insurance. This bit is on when insurance could validly be accepted, or in other words, when the dealer is showing an Ace and no other operation has taken place. Bit 2 is dealer blackjack, implying that after a test was made of the dealer's hand it did indeed produce a blackjack. Bit 4 is INS, for insurance, implying that the player did, in fact, select the insurance option by depressing the insurance key in the proper sequence. Bit 8, PBJ is player blackjack, indicating that examination of the player's hand resulted in the determination of a blackjack condition. S8 contains several more flags. Bit 1 is split, implying that the player has chosen the option of splitting his hand. Bit 2, SPA, is a flag indicating the available option to split Aces, i.e., that there were two cards of the same value dealt to the player and that the cards are both Aces. Bit 4 is SP, standing for split pair, implying that the two first cards dealt to the player were a pair. Bit 8 is double, implying that the player has chosen the option of doubling his hand, that is, doubling his bet and receiving one additional card. The other flag involving the blackjack routine is S11 bit 1. This is TBJ, standing for test blackjack. This bit is involved in the TBLJK routine during the processing of the first four cards dealt, to determine whether any blackjacks exist. Once this flag is set, the test blackjack routine will not be entered again during any subsequent dealing of cards in the same hand. The four bits of word S9 and the two least significant bits of word S10 are used to keep track of the total number of cards that have been dealt. The two most significant bits of register S words 10 and 11, are the locations that are used to represent four of the cards of a deck of 52 cards. All of the remaining card locations are in register C.

Register T is used to keep track of the total of the player's stake. This involves location T0 through T9 where T8 contains the sign of the number, and location T9 contains the exponent or the decimal point setting of the number. T10 contains the following flags: bit 1 contains a flag M indicating multiply or divide, a ONE being used in the multiply routine to signify multiply and a ZERO signifying divide. Bit 4, CR, stands for card required and is used during the random number generation to determine whether cards should be generated or just an updating of the random number. Bit 8 contains flag RN, random number, implying that a processing of the random number is under way. RN is used in the multiply routine to truncate the multiply operation in the proper manner to generate the random number. Word T 11, bit 1 contains the key PM code, plus or minus. PM is used in the calculator mode to determine whether the operation to be performed is add or subtract. Bit 2 is the K flag. If K equals ZERO, the display

routine uses this flag and displays the contents of the K register. K equal to ONE displays the cards involved in the play of the hand. Bit 4 MD, multiply or divide, is used during the multiply routine in the calculator. Bit 8, Q, is a flag used in the calculator routine to set a new constant for use in the four-function mode.

Register W is used in the multiply and the divide routines of the calculator, but in the operation of the game it contains the value of the bet. Words 0 through 7 represent the numerical value. Word 8 is the sign and word 9 is the exponent or the decimal point location. Word 10 contains the last strobe LS and is used during the display and keyboard read routine. Word 11 contains the following flags: bit 1 is overflow, OF, implying that too many numbers have been entered or an overflow condition exists as a result of an operation. Bit 2 is a flag called R, which is used during the random number generation. As long as R is set, after each strobe cycle the random number generation is carried out and a new strobe cycle is started. This results in a flashing of the display representing a shuffle condition. Bit 4, D, stands for decimal which implies that the decimal key has been depressed during this entry and there is a decimal involved in the number. Bit 8 contains N, which implies that the last key entered was a number key and no function keys have been entered in the interim.

In register Z, words 0 through 9, are processing and working registers only. Z10 contains flags used in decoding the keys. Flag V, indicates that this is a first key depression of a strobe cycle. Flag U, in location 2, indicates that a key has been detected down during the present strobe cycle. Flag OF is a key decode flag and is used to separate the various key groupings for later decode. Flag DI indicates that the key was entered through the discrete input DIN1 line used as a keyboard line and is used for decoding the key. Z11 is a scratchpad used to store a delay number in the dealing of the cards to add to the realism of the dealing operation. Register K, words 0 through 9, comprise a keyboard register and are also the registers whose contents are displayed when the K flag equals ZERO. Locations 10 and 11 are used during the multiply and divide operations as scratchpad locations only and are also used during the card dealing time to delay that process.

## GAME OPERATION

An understanding of the way in which the rules of the game of blackjack are accommodated by the invention, will be more clearly understood by examination of FIGS. 5a and 5b which are overview flow charts of the general functions performed in the play of the game of blackjack utilizing the invention. More detailed flow charts of specific program routines are provided in conjunction with descriptions of the program instruction sequence utilized in the game process.

Referring now to FIG. 5a, starting at the top thereof, there is shown the step of applying power to the blackjack game. In response thereto, all of the registers in programmable chip 30 (FIG. 3) are cleared and a decision is made regarding whether or not the game mode is on. If the game mode is not on, the program proceeds to the calculator routines wherein the invention functions as a common 4-function calculator. On the other hand, if the game mode switch 14 is in the game position, the next steps in the process of performing the game functions are the loading of base numbers that are used for the generation of random numbers and the setting of shuffle flag. All other flags in programmable chip 30 are

reset and the player and dealer hands and card totals in registers in the random access memory are cleared.

Following the clearing of registers containing card totals and hands, a decision is made regarding whether or not a shuffle is required. It will be recalled that if in a previous hand, the thirty-eighth card of the deck was used, the blackjack game automatically "reshuffles" the deck. If such shuffling is indicated, the routine proceeds to the operation of clearing the card file, displaying the shuffle condition to the player and awaiting the depression of the CLEAR key to terminate the shuffling condition.

Once the CLEAR key is depressed, the program returns to the bet prompting step. If no shuffling is required, the program proceeds immediately to the bet prompting step. In the bet prompting step, the display flashes a 0 and decimal point indicating to the player that it is the appropriate time for a bet to be placed. The programmable microprocessor chip, in effect, awaits the depression of a number key which can be associated with the amount the player wishes to bet in the upcoming hand. Once the bet is entered, the Bet is displayed and the program proceeds to determine whether or not the bet key was depressed which indicates that the numbers entered constitute the entire bet. If Bet key has still not been depressed, the program returns to the enter bet step to enter additional numbers in the bet. Once the Bet key is depressed, the program then checks for a set stake flag. If the stake flag has not been set, this indicates that it is the player's stake that has been entered and not the bet, because the keys involved in entering the game stake are the same as those involved in entering a bet for each hand. The stake flag is set, the stake is entered and the program returns to the end of bet step so that the bet on that particular hand may be entered. Once this process is complete, and the stake flag is set, the program then exits to the DEAL HAND operation which is represented generally by the flow chart of FIG. 5b.

DEAL HAND represents the computer operation associated with the dealing of the first four cards, two each to the player and the dealer. The numerous program steps associated with this operation are enumerated more specifically in the program listing of Table III and the associated routine flow charts of FIGS. 6 through 30. Once the first four cards of the hand are dealt, the program then tests for an insurance condition which occurs when the dealer's showing card or up card is an Ace. If the insurance condition exists, the next decision to be made is whether or not the player accepts insurance, which he indicates by depression of the INS key (accept) or STAND key (decline). If he accepts insurance, the INS flag is set to allow proper accounting of the stake. After processing of the insurance decision the program then tests for blackjack.

If neither the player nor the dealer has blackjack, that is, an Ace and a 10(F), the player's hand is then played out. In other words, the player may then proceed to have additional cards dealt to his hand in an attempt to come as close as possible to or equal to a card total of 21 without exceeding a card total of 21. Once this is completed, the program tests for a bust condition, that is, for a player card value greater than 21. If the player's hand is in a bust condition, the bust flag is set for later use. In either case, the next step is a test for a split hand condition.

A split hand condition occurs when the player is dealt two cards of equal value in the original deal of the first

four cards and chooses to split the pair and play as if he has two separate hands. Accordingly, if a test for split hand indicates that indeed there is a split hand, the program branches to test whether or not both hands of the split hand have been completed. If both hands have not been completed, the program returns to the payout of the player's hand operation so that the second of the two split hands may also be completed. In either case, the next operation in the program is to determine whether or not any dealer cards are required. It will be recalled that in the usual rules of the game of blackjack, the dealer must stand pat if the value of his card total is 17 or greater, and he must continue to accept additional cards if the value of his cards is less than 17. In either case, after the dealer's hand is completed or if originally the test for blackjack indicated that there was a blackjack condition ending the game, the next step in the game operation is the calculation of the new stake. This calculation will depend upon the outcome of the hand, namely, whether the player or the dealer won the hand and whether or not the betting amount originally entered by the player was altered as a result of a split hand, insurance accepted, or doubling condition, each of which will be discussed in more detail below. Once the calculation of the new stake is completed, the hand is terminated and the program awaits depression of the TOTAL key to display the new stake value, or the PLAY key to initiate a new hand by returning to RESET.

It will be understood that the flow charts in FIGS. 5a and 5b provide a general overview of the game operation. More detailed descriptions of the various routines associated with the play of the game are contained within the program listing of Table III and the flow chart diagrams of FIGS. 6 through 30.

#### DESCRIPTION OF PROGRAM LISTING

The program listing comprising Table III includes all of the instructions and routines used to play the blackjack game in a preferred embodiment of the invention. Together with flow charts of FIG'S. 5a to 30, the RAM map of FIG. 4 and the block diagrams of FIG'S. 2 and 3, the program listing enables one of ordinary skill in the art to make and use the invention.

Page 1 of the program listing relates to the labeling of the RAM addresses. Rather than list the actual RAM locations, for example, 3, 10, a label, such as DS, is assigned to them. The program converts labels such as label DS into the corresponding RAM location (3, 10) for use by the blackjack program. For the programming function, a RAM location is simply referred to by its label which points to the proper RAM location.

Pages 2 through 49 of the program listing are organized in the following manner. RAM addresses corresponding to each instruction are listed in the column at the left. It will be recalled that there are 24 pages of RAM with each page having 64 words of storage. The pages are in sequential order with addresses 0 through 63 located on page 0 and addresses 100 through 163 on page 1 and so on. The programs for all of the 24 pages of RAM are described in the listing.

The next column to the right indicates the assembly language that is used in loading the program into the ROM and is a code representing that operation. The third column from the left is the mnemonic associated with the operation and the following column is also part of the instruction which initiates an operation. For example, the first entry on page 2 of the listing, namely LB

2, 10, is an instruction which loads the B register with address 2, 10.

The statement number is simply a convenience in cross-referencing the program and lists the statements in sequence through the end of the program. The next column provides for labeling routines contained in the program. A label is usually used to refer to a series of instructions comprising a routine if that routine is addressed by another part of the program. The next column is the mnemonic of the function performed by the instruction and in general is identical to the mnemonic mentioned earlier. The next column includes labels and other programming shortcuts for indirect addressing, so that when a program is written the numbers need not be changed every time a location changes. This allows a program to link one of its parts to another by looking for the appropriate label, rather than a program location. The last column consists of notes regarding the program operation and has no function other than to illustrate what is being done in the routine and to explain some of the operations in more easily understood language. The cross-reference table attached to the program listing is used to determine the location of any programming operation that has a name associated with it. For example, looking at page 1 of the cross-reference table, the first of the items called out is the program ADACED or add Ace to dealer's hand. The information given is that ADACED is located at statement 1100 and is called by statement 622. This allows one to examine the manner in which the various routines are used and if a routine is changed it allows the programmer to examine each using routine to determine the effect of that change.

### THE PROGRAM ROUTINES

#### The Hand Routine

The HAND routine of FIG. 6 is used to deal each card of a hand. As shown at the top of FIG. 6 the first step in the HAND routine is to set the card required flag CR. Then a time delay is provided to add realism to the card dealing process. Next the RANDOM routine is performed (see FIG. 7). The RANDOM routine generates a random number which may or may not correspond to an acceptable code number for one of the 52 cards in a standard playing card deck. The RANDOM routine returns to key return KRET if no card is required, indicating entry from a point other than through the HAND routine. However, if a card is required, the random number is assessed by the NU CARD routine (see FIGS. 8a and 8b) to determine whether or not it corresponds to one of the 52 card codes. It also determines whether or not this code (card) has already been use in the play of the game since the last shuffling of the deck. If that card has already been used, the NU CARD routine returns to the RANDOM routine for the generation of a new random number.

TABLE III

3,10	3,9	3,8	3,10	2,11	3,11	3,11	1,8	1,7	2,10	1,11	1,10
DS	NFW	PAD	MC	ND	R	H	SF	RJI	LS	VD	KI

ADDR. CODE STMT.

60

65

TABLE III

ADDR.	CODE	STMT.	NAME PUNCHT ORG	A48(8) 5/16/77 000	B/J GAME
0	1A	LE	LH	LS	
32	41	LAX	LAX	1	
16	7F	TAM	TAM		
8	CF	TRA	TRA	1,GD1	
4	49	TRA	TPA	0,TD51	LS = 1
2	29	TM	TM	2	TDS?
33	FA	TRA	TPA	1,TBLNK	
46	2C	SR7	SR7		
24	0A	LH	LB	2,0	
12	79	HTA	HTA		
6	76	ATB	ATB	8	PT TO CARD
35	48	LAX	LAX		
17	75	ATH	ATH	10	
40	4A	LAX	LAX		
20	7F	TAM	TAM		
10	CE	TRA	TRA	1,GD2	
37	4D	LAX	LAX	13	
50	43	LAX	LAX	8	
57	2D	RSB7	RSB7		
60	07	BTS	BTS		
30	80	TRA	TRA	0,3RD	
47	73	ATD	ATD	3	
23	3E	TL	TL		
11	FF	TRA	TRA	1,KS1	
5	76	ATB	ATB		
34	EC	TRA	TRA	1,BLANK	DSPLY BLANK
49	50	LDA	LDA	0	
56	6E	ADX	ADX	14	
28	02	TRA	TPA	1,GD4	
14	61	ADX	ADX	1	
39	CD	TRA	TRA	1,IS1	
19	4C	LAX	LAX	12	
9	40	LAX	LAX	13	
26	2D	RSB7	RSB7		

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

TABLE III

ADDR.	CODE	STMT.				
18	07	RTS	0, 0			34
41	50	TRA	0, 15			35
52	72	ATD	2, 0		0, 3RD	36
26	ER	TRA	1, 23		2	37
45	50	LDA	0, 0		1, TKS1	38
54	0A	TRA	1, 36		0	39
59	14	LH	0, 9		1, GD5	40
29	7F	TAM	0, 0		0, 9	41
46	24	TRA	1, 27		1, *+2	42
55	06	SC	0, 0			43
27	6A	ADX	8, 0			44
13	FA	TRA	1, 21		T FOR STROBE 8	45
38	61	ADX	1, 0			46
51	02	TRA	1, 61		T FOR STROBE 7	47
25	08	LH	0, 0			48
44	79	HTA	0, 0			49
22	76	ATR	0, 0			50
43	02	TRA	1, 45			51
21	10	LH	0, 8		1, GD4	52
42	2E	TM	8, 0		0, 8	53
53	FA	TRA	1, 9		8	54
5A	EC	TRA	1, 19		1, MIN	55
61	0C	LB	0, 7		1, BLANK	56
62	50	LDA	0, 0		0, 7	57
63	77	COMP	0, 0		0	58
31	61	ADX	1, 0			59
15	02	TC	0, 0		T FOR 0	60
7	D2	TRA	1, 45			61
3	EC	TRA	1, 19		1, GD4	62
					1, BLANK	

TABLE III

ADDR.	CODE	SFMT.	ORG	100	114	115
100	01 TKH	0, 0	TKB	100		
132	F7 TRA	1, 8	TRA	1, KS2		
116	E2 TRA	1, 29	TRA	1, KS5		
108	A1 TRA	0, 30	TRA	0, LLS		
104	6F AUX	15, 0	ADX	15		
102	C6 TRA	1, 57	TRA	1, KS4		
133	19 LB	1, 10	LB	KI		
148	29 TM	2, 0	TM	2		
124	F9 TRA	1, 6	TRA	1, *+2		
112	24 RSM	1, 0	RSM	1		
106	25 RSM	2, 0	RSM	2		
135	1E LB	2, 11	LB	ND		
117	29 TM	2, 0	TM	2		
140	D2 TRA	1, 45	TRA	1, TRAND		
120	1F LB	3, 11	LB	R		
110	29 TM	2, 0	TM	2		
137	4R LAX	11, 0	LAX	11		
150	4R LAX	8, 0	LAX	R		
157	1A LB	2, 10	LB	LS		
160	50 EXC	1, 0	EXC	1, 0		
130	03 TDIN	0, 0	TDIN	0		
147	00 TRA	1, 34	TRA	1, KRET		
123	2A TM	4, 0	TM	4		
111	3D IL	2, 0	IL	1, TRDLY		
105	C2 TRA	1, 61	TRA	1, TRDLY		
134	2D RSH7	0, 0	RSH7	0, LLS		
149	05 RSC	0, 0	RSC	R		
156	A1 TRA	0, 30	TRA	2		
128	75 ATH	0, 0	ATH	1, GOISP		
114	1F LB	3, 11	LB	ND		
139	29 TM	2, 0	TM	1		
119	3F IL	0, 0	IL	1		
100	FF TRA	1, 0	TRA	1, GOISP		
126	1F LB	2, 11	LB	ND		
118	25 TM	1, 0	TM	1		
141	06 SC	0, 0	SC	1		

\*\*\* NO DELAY IF DIN 0 = GRD

T CR

LS TO H

T K

T OF



TABLE III

ADDR.	CODE	STMT.	TL	TRAND	KSS	1.DISPKC	1.RANDOM	1.KS2	0.LLS	OUTPUT LS
152	3F TL	0, 0	136							
153	4C TRA	1, 59	137							
154	00 NOP	0, 0	138							
155	3H TL	4, 0	139							
156	07 TRA	1, 40	140							
157	19 LH	1, 10	141							
158	21 SM	2, 0	142							
159	2H TM	1, 0	143							
160	F7 TRA	1, 8	144							
161	43 LAX	3, 0	145							
162	5E EXC	2, 0	146							
163	2A TM	4, 0	147							
164	F7 TRA	1, 8	148							
165	07 RTS	0, 0	149							
166	A1 TRA	0, 30	150							
167	76 ATB	0, 0	151							
168	07 RTS	0, 0	152							
169	03 TOIN	0, 0	153							
170	C1 TRA	1, 62	154							
171	37 TL	8, 0	155							
172	95 TRA	0, 42	156							
173	19 LB	1, 10	157							
174	01 TKB	0, 0	158							
175	00 TRA	1, 34	159							
176	30 NOP	0, 0	160							
177	3D TL	2, 0	161							
178	FF TRA	1, 0	162							

TABLE III

ADDR.	CODE	STMT.	PLAYK	ORG	200	
200	R5	TRA	0,58	TRA	0,IHO	200
202	E3	TRA	1,28	TRA	1,TKRETS	201
216	1F	LB	3,11	LB	3,11	202
208	26	RSM	4,0	RSM	4	203
204	18	LR	3,10	LR	3,10	204
202	R8	TRA	0,7	TRA	0,ZRO	205
233	1F	LB	2,11	LB	2,11	206
248	9B	TRA	0,4	TRA	0,OTO	207
224	2C	SB7	0,0	SB7	1,11	208
212	1D	LB	1,11	LB	1	209
206	24	RSM	1,0	RSM	0 TRJ	210
235	11	LB	1,8	LB	1,8	211
217	3B	TRA	0,4	TRA	0,OTO	212
240	1E	LB	2,11	LB	NO	213
220	21	SM	2,0	SM	2	214
210	1F	LB	3,11	LB	3,11	215
237	B3	TRA	0,7	TRA	0,ZRO	216
250	2C	SB7	0,0	SB7	1,10	217
257	19	LB	1,10	LB	2	218
260	29	TM	2,0	TM	1,TSHUF	219
230	E9	TRA	1,23	TRA	1,TKRETS	220
247	E3	TRA	1,28	TRA	1,9	221
223	15	LB	1,9	LB	0	222
211	50	LDA	0,0	LDA	0,11	223
205	1C	LB	0,11	LB		224
234	0C	NOP	0,0	NOP		225
249	3E	TL	1,0	TL	1,TSHUF	226
256	CA	TRA	1,53	TRA	1,KRET	227
228	3F	TL	1,0	TL	4	228
214	DD	TPA	1,34	TPA	5	229
239	26	RSM	4,0	RSM	8	230
219	45	LAX	5,0	LAX	1,TOCNTX	231
209	76	ATB	0,0	ATB		232
236	28	TM	8,0	TM		233
218	37	TL	8,0	TL		234
241	EE	TPA	1,17	TPA		235

TABLE III

ADDR.	CODE	SIMF.	B*	0	SM	R	S	H2C	
236	SM	236	B*	0	SM	8			236
237	LAX	237	2*	0	LAX	2			237
238	ATB	238	0*	0	ATB				238
239	LDA	239	3*	0	LDA	3			239
240	ATH	240	0*	0	ATH				240
241	TL	241	4*	0	TL				241
242	TRA	242	0*	31	TRA			0*RLZ	242
243	LB	243	2*	P	LB			2*8	243
244	TL	244	4*	0	TL				244
245	TRA	245	0*	31	TRA			0*RLZ	245
246	LB	246	2*	11	LB			2*11	246
247	HTA	247	0*	0	HTA				247
248	EXC	248	0*	0	EXC			CD TO PCI	248
249	RSR7	249	0*	0	RSB7				249
250	LB	250	3*	10	LB	MC			250
251	SM	251	4*	0	SM	4		S CR	251
252	LB	252	1*	11	LB	VD			252
253	LAX	253	14*	0	LAX	14		VARIABLE DELAY	253
254	EXC	254	1*	0	EXC	1*0			254
255	TRA	255	0*	7	TRA	0*ZRO		0*K11	255
256	NOP	256	0*	0	NOP				256
257	TL	257	4*	0	TL				257
258	TRA	258	1*	0	TRA	1*RDLY			258
259	TRA	259	0*	52	TRA	0*SETM		S DS	259
260	SM	260	6*	0	SM	8		S HS	260
261	LB	261	3*	11	LB	H			261
262	SM	262	4*	0	SM	4			262
263	TRA	263	1*	28	TRA	1*TKRETS			263

TABLE III

ADDR.	CODE	STMT.	DBLK	ORG	300		
300	A5	TRA	0.25	300	TPA	0.1AI	300
332	3E	TL	1.0	301	TL		301
316	DD	TRA	1.34	302	TRA	1.1KRET	302
308	R2	TRA	0.61	303	TRA	0.1D3	303
304	DF	TRA	1.32	304	TRA	1.1KRET	304
302	22	TM	8.0	305	TM	R	305
333	DF	TRA	1.32	306	TRA	1.1KRET	306
344	P3	SM	8.0	307	SM	R	307
324	11	LB	1.8	308	LB	SF	308
312	23	SM	8.0	309	SM	R	309
306	30	TL	2.0	310	TL	S DBL	310
305	D3	TRA	1.44	311	TRA	1.1HAND	311
317	A9	TPA	0.22	312	TRA	0.1DS1	312
340	DF	TRA	1.32	313	TRA	1.1KRET	313
320	A6	TRA	0.25	314	TRA	0.1AI	314
310	DF	TRA	1.32	315	TRA	1.1KRET	315
337	R2	TRA	0.61	316	TRA	0.1D3	316
350	DF	TRA	1.32	317	TRA	1.1KRET	317
357	P3	SM	8.0	318	SM	R	318
360	F9	TRA	1.6	319	TRA	1.1TOHAND	319
330	85	TRA	0.58	320	TRA	0.1HO	320
347	DF	TRA	1.32	321	TRA	1.1KRET	321
323	20	PSR7	0.0	322	RSR7		322
311	32	TL	12.0	323	TL		323
305	A0	TRA	0.31	324	TRA	0.1TOK	324
334	A3	TRA	0.24	325	TRA	0.1SWAPKW	325
349	AF	TRA	0.16	326	TRA	0.1TOK	326
356	0R	LB	0.0	327	LB	0.0	327
328	42	LAX	2.0	328	LAX	2	328
314	5C	EXC	0.0	329	EXC	0.0	329
329	32	TL	13.0	330	TL		330
319	RF	TRA	0.0	331	TRA	0.1MD1	331
309	A3	TRA	0.28	332	TRA	0.1SWAPKW	332
336	1F	LB	3.11	333	LB	3.11	333
318	25	RSM	2.0	334	RSM	2	334
341	DF	TRA	1.32	335	TRA	1.1KRET	335

TABLE III

ADDR.	CODE	STMT.	RET	TM	R	T PR
332	2R	8. 0		TM	1. RETI	T PR
336	CA	1.53		TRA	R	S PR
345	23	R. 0		SM		
354	2D	RSB7		RSB7		
359	1E	2.11		LB	ND	
329	27	RSM		RSM	R	R N
346	0A	2. 0		LH	2.0	
355	42	LAX		LAX	2	
327	5C	FXC		FXC	0.0	
313	89	TRA		TRA	0. SETM	
338	32	TL		TL		
351	HF	TRA		TRA	0. MDI	
325	1R	LB		LB	MC	
344	24	RSM		PSM	1	RESET M
322	AF	TRA		TRA	0. OTOK	
343	16	LB		LH	2.9	
321	93	TRA		TRA	0. SWAPIX	
342	DE	TRA		TPA	1. TKRET	
353	82	TRA		TPA	0. ID3	
354	C1	TRA		TPA	1. *2	
361	DE	TRA		TPA	1. TKRET	
362	2D	RSB7		RSB7	ND	
363	1E	LB		LH	R	R N
331	27	RSM		RSM	R	
315	1F	LH		LB	2	
307	21	SM		SM	0. SWAPKW	
303	A3	TRA		TRA	1. TOHAND	
301	29	TRA		TRA		

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TABLE III

ADDR.	CODE	STMT.	INC	ORG	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	
400	7F	TAM	INCCCX	TAM	0, 0	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435
432	FB	TPA	MSBC	TPA	1, 4	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	
416	19	LB	MSBC	LB	1, 10	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435		
408	9A	TRA	MSBC	TRA	0, 37	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435			
404	1R	LB	MSBC	LB	3, 10	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435				
402	2D	RSH7	MSBC	RSH7	0, 0	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435					
433	26	RSM	MSBC	RSM	4, 0	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435						
448	82	TRA	MSBC	TRA	0, 61	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435							
424	9A	TRA	MSBC	TRA	0, 37	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435								
412	05	RSC	MSBC	RSC	0, 0	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435									
406	A9	TRA	MSBC	TRA	0, 22	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435										
435	06	SC	MSBC	SC	0, 0	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435											
417	17	LB	MSBC	LB	3, 9	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435												
440	50	LDA	MSBC	LDA	0, 0	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435													
420	75	ATH	MSBC	ATH	0, 0	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435														
410	A9	TRA	MSBC	TRA	0, 22	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435															
437	04	LB	MSBC	LB	2, 0	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																
450	1E	LB	MSBC	LB	2, 11	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																	
457	40	LAX	MSBC	LAX	0, 0	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																		
460	7F	TAM	MSBC	TAM	0, 0	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																			
430	E9	TRA	MSBC	TRA	1, 22	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																				
447	79	HTA	MSBC	HTA	0, 0	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435																					
423	5C	FXC	MSBC	FXC	0, 0	422	423	424	425	426	427	428	429	430	431	432	433	434	435																						
411	41	LAX	MSBC	LAX	1, 0	423	424	425	426	427	428	429	430	431	432	433	434	435																							
405	05	RSC	MSBC	RSC	0, 0	424	425	426	427	428	429	430	431	432	433	434	435																								
434	7F	TAM	MSBC	TAM	0, 0	425	426	427	428	429	430	431	432	433	434	435																									
449	E3	TRA	MSBC	TRA	1, 28	426	427	428	429	430	431	432	433	434	435																										
456	06	SC	MSBC	SC	0, 0	427	428	429	430	431	432	433	434	435																											
428	A9	TRA	MSBC	TRA	0, 22	428	429	430	431	432	433	434	435																												
414	CC	TRA	MSBC	TRA	1, 51	429	430	431	432	433	434	435																													
439	RC	TRA	MSBC	TRA	0, 51	430	431	432	433	434	435																														
419	C4	TRA	MSBC	TRA	1, 59	431	432	433	434	435																															
409	35	TL	MSBC	TL	10, 0	432	433	434	435																																
434	82	TRA	MSBC	TRA	0, 61	433	434	435																																	
418	1R	LB	MSBC	LB	3, 10	434	435																																		
441	24	TM	MSBC	TM	4, 0	435																																			



TABLE III

ADDR.	CODE	STMT.										
500	ID	LH	1.11	509	TBLJK	ORG	500				509	
532	28	TM	1.0	501		LH	1.11				501	
516	E4	TRA	1.27	502		TM	1				502	
508	0A	LH	2.0	503		TRA	1.120S1				503	
504	41	LAX	1.0	504		LH	2.0				504	
502	7F	TAM	0.0	505		LAX	1				505	
533	CD	TRA	1.50	506		TAM					506	
548	A6	TRA	0.25	507	SETAI	TRA	1.1RJL				507	
524	DA	TRA	1.37	508		TRA	0.1AI				508	
512	20	SM	1.0	509		TRA	1.1TBJL				509	
506	3E	TL	1.0	510	TKRET7	SM	1				510	
535	DD	TRA	1.34	511		TL					511	
517	A6	TRA	0.25	512	INSK	TRA	1.1KRET				512	
540	F5	TRA	1.10	513		TRA	0.1AI				513	
520	F5	TRA	1.6	514		TRA	1.1**2				514	
510	22	SM	4.0	515		TRA	1.1KRET7				515	
537	24	PSM	1.0	516	TBJL	SM	4				516	
550	1A	L3	2.10	517	RJL	PSM	1				517	
557	36	TL	9.0	518		L3	2.10				518	
560	HF	TRA	0.0	519		TL					519	
530	23	SM	8.0	520		TRA	0.1BJTEST				520	
547	0A	LH	2.0	521		SM	8				521	
523	36	TL	9.0	522		LH	2.0				522	
511	6F	TRA	0.0	523		TL					523	
505	21	SM	2.0	524		TRA	0.1BJTEST				524	
534	10	LP	1.11	525		SM	2				525	
549	20	SM	1.0	526		LH	1.11				526	
554	0C	LP	1.7	527		SM	1				527	
528	2A	TM	4.0	528		L3	RJI				528	
514	E9	TRA	1.22	529		TM	4				529	
529	29	TM	2.0	530		TRA	1.1NSDLR				530	
519	C1	TRA	1.62	531		TM	2				531	
509	2B	TM	8.0	532	TPLRN	TRA	1.1TPLRY				532	
506	D9	TRA	1.38	533		TM	8				533	
518	1E	LH	2.11	534	TFP	TRA	1.13TON				534	
541	50	LDA	0.0	535		LH	2.11				535	
						LDA	0					



TABLE III

ADDR.	CODE	STMT.	LR	2,10	TST FOR PAIR IS PAIR	SET SPA
552	1A LB	2,10	LR			
553	7F TAM	0, 0	TAM			
554	E4 TMA	1,27	TRA	1, T2DS1		
555	11 LB	1, 8	LB	SF		
556	22 SM	4, 0	SM	4		
557	6F ADX	14, 0	ADX	14		
558	E4 TRA	1,27	TRA	1, *+2		
559	21 SM	2, 0	SM	2		
560	37 TL	8, 0	TL			
561	FF TRA	1, 0	TRA	1, T2DS1X		
562	33 TL	12, 0	TL	0, P3TON		
563	AF TRA	0,48	TRA			
564	3D TL	2, 0	TL	1, NFT		
565	E0 TRA	1,31	TRA	2		
566	29 TM	2, 0	TM	1,2TON		
567	C5 TRA	1,58	TRA			
568	33 TL	12, 0	TL	0, M1TON		
569	BF TRA	0, 0	TRA	1, TPLRN		
570	F6 TRA	1, 9	TRA			
571	33 TL	12, 0	TL	0, P2TON		
572	9E TRA	0,33	TRA	8		
573	2R TM	H, 0	TM	1, TONET1		
574	E6 TRA	1,25	TRA			
575	33 TL	12, 0	TL	0, M2TON		
576	9F TRA	0,32	TRA	1, TONET1		
577	E6 TRA	1,25	TRA			

TABLE III

ADDR.	CODE	STMT.	STANDX	ORG	600 DS	S MS	600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
600	LB	3,10	STANDX	ORG	DS		600
601	SM	R, 0		SM	R		601
602	TRA	0,51		TRA	0,TSPLIT		602
603	TL	2, 0		TL			603
604	TRA	1,39		TRA	1,TH2C		604
605	RSC	0, 0	COUNTX	PSC			605
606	TL	11, 0		TL	0,ADACES		606
607	TPA	0,15		TRA	1,*+1		607
608	TRA	1,12		TRA			608
609	RSC	0, 0		RSC			609
610	TL	11, 0		TL	0,ADACEP		610
611	TRA	0,32		TRA	1,*+1		611
612	TRA	1,40		TRA	0,SETM		612
613	TRA	0,52		TRA		S DS1	613
614	SC	0, 0	COUNT	SC	SET CARRY		614
615	LH	1, 0		LH	1,0		615
616	LAX	1, 0		LAX	1		616
617	ATB	0, 0		ATB			617
618	TM	4, 0		TM	4	T DR	618
619	TL	7, 0		TL			619
620	TRA	1, 0		TRA	1,DLROVR		620
621	TL	11, 0		TL			621
622	TRA	0, 0		TRA	0,ADACED		622
623	TL	2, 0		TL			623
624	TRA	1,44		TRA	1,HAND		624
625	LH	1, 0	DLRSTD	LH	1,0		625
626	LDA	0, 0		LDA	0		626
627	ATH	0, 0		ATH		DLR TOT TO H	627
628	TL	12, 0		TL			628
629	TRA	0,36		TRA	0,CMRPP		629
630	TRA	1,61		TRA	1,DLRWN		630
631	IC	0, 0		IC			631
632	TRA	1,54		TRA	1,CHKH2C	TIE	632
633	LH	1, 8	PLRWN	LH	SF		633
634	TM	8, 0		TM	8	TST DBL	634
635	TL	12, 0		TL			635



TABLE III

ADDR.	CODE	STMT.	DLROVR	ORG	700	
700	43	LAX		LAX	3	700
732	76	ATB		ATB		701
716	2A	TM		TM	4	702
708	FR	TRA		TRA	1,TDRL2	703
704	11	LB		LB	SF	704
702	2P	TM		TM	8	705
733	33	TL		TL		706
748	9E	TRA		TRA	0,P2TON	707
724	33	IL		TL		708
712	9E	TRA		TRA	0,P2TON	709
706	45	LAX	H2C3	LAX	5	710
735	76	ATB		ATB		711
717	29	TM		TM	8	712
740	DA	TRA		TRA	1,TH2B3	713
720	3D	TL	TONET	TL		714
710	E0	TRA		TRA	1,NET	715
737	2A	TM		TM	4	716
752	33	TL	TH2B3	TL		717
757	4F	TRA		TRA	0,M4TON	718
760	33	TL	TP2TON	TL		719
730	9E	TRA		TRA	0,P2TON	720
747	EH	TRA		TRA	1,TONET	721
723	11	LB	TDRL2	LB	SF	722
711	29	TM		TM	8	723
705	33	TL		TL		724
734	9F	TRA		TRA	0,M2TON	725
742	33	TL		TL		726
756	9F	TRA		TRA	0,M2TON	727
728	F9	TRA		TRA	1,H2C3	728
714	29	TM	SPLC	TM	2	729
739	06	SC		SC		730
719	40	LAX		LAX	0	731
703	1A	LB		LB	2,10	732
756	5C	EXC		EXC	0,0	733
718	75	ATH		ATH		734
741	09	LB		LB	1,0	735

T SPA  
ACES

0 TO PC2



TABLE III

[illegible]



TABLE III

ADDR.	CODE	SMT.	BJTEST	ORG	900		
900	41	LAX	1.0	LAX	1	900	900
901	7F	TAM	0.0	TAM	1	901	901
902	F9	TRA	1.6	TRA	1.1ST10	902	902
903	54	EXC	0.1	EXC	0.1	903	903
904	4A	LAX	10.0	LAX	10	904	904
905	41	LAX	1.0	LAX	1	905	905
906	7F	TAM	0.0	TAM	1	906	906
907	2E	RET	1.0	RET	1	907	907
908	0C	LH	1.7	LH	1.7	908	908
909	2F	RET	0.0	RET	0	909	909
910	4A	LAX	10.0	LAX	10	910	910
911	7F	TAM	0.0	TAM	1	911	911
912	CF	TRA	1.4H	TRA	1.1RJN	912	912
913	54	EXC	0.1	EXC	0.1	913	913
914	FC	TRA	1.2	TRA	1.1TF01	914	914
915	0A	SC	0.0	SC	11	915	915
916	4R	LAX	11.0	LAX	NEW	916	916
917	17	LH	3.9	LH	0.0	917	917
918	5C	EXC	0.0	EXC	0.0	918	918
919	79	HTA	0.0	HTA	1	919	919
920	7C	ADD	1.0	ADD	H-4 TO H	920	920
921	75	ATH	0.0	ATH	0	921	921
922	05	RSC	0.0	PSC	ND	922	922
923	2F	RET	0.0	RET	8	923	923
924	1E	LH	2.11	LH	T N	924	924
925	2R	TM	8.0	TM	2	925	925
926	CH	TRA	1.52	TRA	1.1C1	926	926
927	29	TM	2.0	TM	1.1ROF	927	927
928	62	TRA	1.29	TRA	0.010Z	928	928
929	87	TRA	0.8	TRA	2.9	929	929
930	16	LH	2.9	LH	0.010	930	930
931	4R	TRA	0.4	TRA	R	931	931
932	1F	LH	3.11	LH	W <--- 0	932	932
933	4R	LAX	8.0	LAX	R	933	933
934	8C	TRA	0.3	TRA	0.1EXCX	934	934
941	8H	TRA	0.7	TRA	0.0ZRO	941	941



TABLE III

ADDR.	CODE	STMT.	CL	TRA	0,0TOK	935
952	AF	0,16	C1	TRA	ND	936
926	1E	2,11		LR	0,0ZRO	937
945	H6	0, 7		TRA		938
954	DE	1, 0	TKRET1	TL		939
959	DN	1,34		TRA	1,0KRET	940
929	2,6	1, 0	ROF	RSM	1	941
946	C9	1,54		TRA	1,0KRET1	942
955	A3	0,28	E2	TRA	0,0SWAPKW	943
927	EA	1,21		TRA	1,0E3	944
913	23	8, 0	E1	TM	8	945
938	C8	1,55		TRA	1,0E2	946
951	23	8, 0		SM	8	947
925	1E	2,11		LR	ND	948
944	2B	8, 0		TM	8	949
922	EA	1,21		TRA	1,0E3	950
943	H6	0, 9		TRA	0,0SWAPKZ	951
921	32	13, 0	E3	TL		952
942	HF	0, 0		TRA	0,0M01	953
953	A3	0,28		TRA	0,0SWAPKW	954
952	3B	7, 0	RND	TL		955
961	95	0,42		TRA	0,0RTJUS	956
962	1E	2,11		LR	ND	957
963	26	4, 0		RSM	4	958
931	27	8, 0		RSM	8	959
915	C9	1,54		TRA	1,0KRET1	960
					R D	
					R N	





ADDR.	CODE	STMT.
0000	0000	0000
0001	0001	0001
0002	0002	0002
0003	0003	0003
0004	0004	0004
0005	0005	0005
0006	0006	0006
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0008	0008	0008
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0010	0010	0010
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0038	0038	0038
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0040	0040	0040
0041	0041	0041
0042	0042	0042
0043	0043	0043
0044	0044	0044
0045	0045	0045
0046	0046	0046
0047	0047	0047
0048	0048	0048
0049	0049	0049
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0070	0070	0070
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0074	0074	0074
0075	0075	0075
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0080	0080	0080
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0082	0082	0082
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0087	0087	0087
0088	0088	0088
0089	0089	0089
0090	0090	0090
0091	0091	0091
0092	0092	0092
0093	0093	0093
0094	0094	0094
0095	0095	0095
0096	0096	0096
0097	0097	0097
0098	0098	0098
0099	0099	0099

1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135		
ADACED	LAX	ADACEP	LAX	ADACES	LR	ATH	TM	TPA	TM	TPA	TC	RET	RET	TC	TPA	RET	LDA	EXC	NOP	LDA	ADP	RET	RET	LDA	EXC	NOP	LDA	TC	TPA	ADP	TPA	LAX	RSC	ADD	EXC	TC	SM
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	15	1	0	0	0	0	0	1	4	1	10	1	0	1	2		
1	3	5	1	0	0	0	1	1	1	1	0	0																									











TABLE III

ADDR.	CODE	SIMT.							
1352	R3	TRA	0,60		TRA	0,L75			1336
1326	67	ADX	7, 0		ADX	7			1337
1345	CC	TRA	1,51		TRA	1,DIV8			1338
1354	RE	TRA	0,10		TRA	0,ZSP1			1339
1359	1C	LB	0,11		LB	0,11			
1329	RA	TRA	0, 7		TRA	0,ZR0			
1346	0A	LB	2, 0		LB	2,0			1343
1355	87	TRA	0,56		TRA	0,LFFTX			1344
1327	HE	TRA	0,49		TRA	0,ZLFFT			1345
1313	R9	TRA	0,54		TRA	0,L0K10			1346
1338	F1	TRA	1,14		TRA	1,DIV4			1347
1351	0E	LB	2, 7		LB	2,7			
1325	RR	TRA	0,55		TRA	0,IS2EHO			
1344	CA	TRA	1,53		TRA	1,DIV10			1349
1322	0D	LB	1, 7		LB	1,7			1350
1343	RR	TRA	0, 4		TRA	0,0T0			1351
1321	31	TL	14, 0		TL				1352
1342	C3	TRA	1,60		TRA	1,DM1			1353
1353	16	LB	2, 9		LB	2,9			1354
1358	9A	TRA	0,37		TRA	0,PLUS1			1355
1361	7F	TAM	0, 0		TAM				1356
1362	C4	TRA	1,59		TRA	1,DIV7			1357
1363	AB	TRA	0,20		TRA	0,ZFP1			1358
1331	C4	TRA	1,59		TRA	1,DIV7			1359
1315	AE	TRA	0,17		TRA	0,MINUS1			1360
1307	1C	LB	0,11		LB	0,11			1361
1303	9A	TRA	0,37		TRA	0,PLUS1			1362
1301	F1	TRA	1,14		TRA	1,DIV4			1363

W7=0

TEST WE =0

TABLE III

ADDR.	CODE	STMT.	ORG		
1400	R5	TRA	TRA	1400	1400
1432	J4	LB	LB	0.10	1401
1416	SC	EXC	EXC	0.0	1402
1408	BA	TRA	TRA	0.0	1403
1404	OE	LB	LB	2.7	1404
1402	9D	TRA	TRA	0.0	1405
1433	R4	TRA	TRA	0.0	1406
1448	R3	TRA	TRA	0.0	1407
1424	68	ADX	ADX	8	1408
1412	E6	TRA	TRA	1.0	1409
1406	91	TRA	TRA	0.0	1410
1435	FF	TRA	TRA	1.0	1411
1417	SC	EXC	EXC	0.0	1412
1440	HF	TRA	TRA	0.0	1413
1420	F2	TRA	TRA	1.0	1414
1410	F9	TRA	TRA	1.0	1415
1437	R2	TRA	TRA	0.0	1416
1450	C3	TRA	TRA	1.0	1417
1457	FA	TRA	TRA	1.0	1418
1460	15	LB	LB	1.0	1419
1430	28	TM	TM	8.0	1420
1447	C9	TRA	TRA	1.0	1421
1423	R1	TRA	TRA	0.0	1422
1411	D8	TRA	TRA	1.0	1423
1405	16	LB	LB	2.0	1424
1434	RA	TRA	TRA	0.0	1425
1449	9C	TRA	TRA	0.0	1426
1456	16	LB	LB	2.0	1427
1426	AE	TRA	TRA	0.0	1428
1414	DF	TRA	TRA	1.0	1429
1439	16	LB	LB	2.0	1430
1419	RP	TRA	TRA	0.0	1431
1409	CR	TRA	TRA	1.0	1432
1436	68	ADX	ADX	9.0	1433
1418	FA	TRA	TRA	1.0	1434
1441	91	TRA	TRA	0.0	1435

ADDR.	CODE	STMT.
1452	FA TRA	1, 5 1436
1453	C8 TRA	1, 55 1437
1445	A3 TRA	0, 28 1438
1454	96 TRA	0, 41 1439
1459	40 LAX	0, 0 1440
1429	16 LH	2, 9 1441
1446	5C EXC	0, 0 1442
1455	B7 TRA	0, 9 1443
1427	2F RET	0, 0 1444
1413	18 LH	0, 10 1445
1438	9A TRA	0, 37 1446
1451	F9 TRA	1, 6 1447
1425	18 LR	3, 10 1448
1444	2B TM	8, 0 1449
1422	C4 TRA	1, 59 1450
1443	LA TRA	1, 37 1451
1421	16 LH	2, 9 1452
1442	14 LB	0, 9 1453
1453	52 LDA	2, 0 1454
1458	5A EXC	2, 2 1455
1461	CA TRA	1, 53 1456
1462	2F RET	0, 0 1457
1463	14 LB	0, 9 1458
1431	15 LH	1, 9 1459
1415	51 LDA	1, 0 1460
1407	59 EXC	1, 2 1461
1403	F0 TRA	1, 15 1462
1401	2F RET	0, 0 1463

TABLE III

ADDR.	CODE	STMT.	PWRON	ORG	1500		
1500	07	BTS		RTS			1500
1532	05	RSC		PSC			1501
1516	1F	LB		LB	3.11		1502
1508	2C	SB7		SB7			1503
1504	HP	TMA		TRA		OR1	1504
1502	2C	SB7		SB7	0.0T0		1505
1533	1E	LB		LB	2.11		1506
1548	HP	TMA		TRA	0.0T0	OW1	1507
1524	2C	SB7		SB7			1508
1512	1D	LB		LB	1.11		1509
1505	HP	TRA		TRA	0.0T0	OZ1	1510
1535	2C	SB7		SB7			1511
1517	1C	LB		LB	0.11		1512
1540	HP	TMA		TRA	0.0T0	OK1	1513
1520	1C	LB		LB	0.11		1514
1510	HP	TRA		TRA	0.0T0	OK	1515
1537	1D	LB		LB	1.11		1516
1550	HP	TRA		TRA	0.0T0	OZ	1517
1557	1E	LB		LB	2.11		1518
1560	HP	TMA		TRA	0.0T0	OW	1519
1530	1F	LB		LB	3.11		1520
1547	HP	TRA		TRA	0.0T0	OR	1521
1523	4C	LAX		LAX	12		1522
1511	75	ATB		ATB			1523
1505	07	BTS		PTS			1524
1534	92	TRA		TRA	0.0T0		1525
1549	04	TDIN		TDIN	0.0T0	0.0T0	1526
1556	0B	TRA		TRA	1		1527
1528	1F	LB		LB	1.0T0	1.0T0	1528
1514	23	SM		SM	B		1529
1539	2D	RSB7		RSB7	8	S O	1530
1519	3E	TL		TL			1531
1509	DE	TRA		TRA	1.0T0	1.0T0	1532
1536	96	TRA		TRA	0.0T0	S OF	1533
1518	2C	SB7		SB7	0.0T0		1534
1541	AD	TRA		TRA	0.0T0	S G	1535

TABLE III

ADDR.	CODE	STMT.	LR	3,7	1536
1552	OF LR	3, 7	LR	3,7	1536
1526	42 LAX	2, 0	LAX	2	1537
1545	58 EXC	0, 2	EXC	0,-1	1538
1554	48 LAX	8, 0	LAX	R	1539
1559	58 EXC	0, 2	EXC	0,-1	1540
1529	42 LAX	2, 0	LAX	2	1541
1546	58 EXC	0, 2	EXC	0,-1	1542
1555	42 LAX	2, 0	LAX	2	1543
1527	58 EXC	0, 2	EXC	0,-1	1544
1513	44 LAX	4, 0	LAX	4	1545
1538	58 EXC	0, 2	EXC	0,-1	1546
1551	47 LAX	7, 0	LAX	7	1547
1525	50 EXC	0, 0	EXC	0,0	1548
1544	30 TL	2, 0	TL		1549
1522	EF TRA	1,16	TRA	1,RFSET	1550
1543	11 LR	1, 8	LR	SF	1551
1521	81 TRA	0,62	TRA	0,ISP	1552
1542	3E TL	1, 0	TL		1553
1553	DD TRA	1,34	TRA		1554
1558	18 LR	3,10	LR	1,KRET	1555
1561	28 TM	8, 0	TM	DS	1556
1562	DS TRA	1,42	TRA	R	1557
1563	23 SM	8, 0	SM	1,TKRET2	1558
1531	11 LR	1, 8	LR	8	1559
1515	20 SM	1, 0	SM	SF	1560
1507	05 RSC	0, 0	RSC	S HS	1561
1503	38 TL	7, 0	TL	S SPLIT	1562
1501	F1 TRA	1,14	TRA	1,SPLC	1563



TABLE III

ADDR.	CODE	STMT.	P2	TL	0•KTOW	0•ZTOK	R	0•ZRO	VD	4	0•SETPM	1•RND	0•KTOZ	1•P2	ND	R	1•P5	0•SWAPKZ	0•MD1	0•SWAPKW	0•KTOZ	1•P6	1•MDK
1652	31	TL	14, 0	1636																			
1653	95	TRA	0•42	1637	TRA																		
1645	31	TL	14, 0	1638	TL																		
1654	A0	TRA	0•31	1639	TRA																		
1659	1F	LB	3•11	1640	LB																		
1629	RR	TPA	0• 7	1641	TRA																		
1646	1D	LR	1•11	1642	LB																		
1655	2A	TM	4• 0	1643	TM																		
1627	AD	TRA	0•18	1644	TRA																		
1613	36	TL	9• 0	1645	TL																		
1638	C5	TRA	1•58	1646	TRA																		
1651	31	TL	14, 0	1647	TL																		
1625	A0	TRA	0•63	1648	TRA																		
1644	CB	TRA	1•52	1649	TRA																		
1622	1E	LB	2•11	1650	LB																		
1643	2B	TM	8• 0	1651	TM																		
1621	CA	TRA	1•53	1652	TRA																		
1642	B6	TRA	0• 9	1653	TRA																		
1653	32	TL	13, 0	1654	TL																		
1658	BF	TRA	0• 0	1655	TRA																		
1661	A3	TRA	0•28	1656	TRA																		
1662	31	TL	14, 0	1657	TL																		
1663	80	TRA	0•63	1658	TRA																		
1631	C4	TRA	1•59	1659	TRA																		
1615	00	NOP	0• 0	1660	NOP																		
1607	3E	TL	1• 0	1661	TL																		
1603	FF	TRA	1• 0	1662	TRA																		

MIN = 0100 PLUS = 0011

T N

TABLE III

ADDR.	CODE	STMT.	MDK	ORG	1700	T O	1700
1700	2B TM	8, 0		TM	R		1700
1732	E8 TRA	1, 23		TRA	1, MK1		1701
1716	2A TM	4, 0		TM	4		1702
1708	F1 TRA	1, 14		TRA	1, MK3		1703
1704	1E LR	2, 11		LR	ND		1704
1702	2R TM	8, 0		TM	R		1705
1733	E7 TRA	1, 24		TRA	1, MK5		1706
1748	A3 TRA	0, 28		TRA	0, SWAPKW		1707
1724	35 TL	10, 0	MK5	TL	0, ADD		1708
1712	BF TRA	0, 9		TRA	0, SWAPKZ		1709
1706	B6 TRA	0, 9		TRA	0, SWAPKZ		1710
1735	31 TL	14, 0		TL	0, KTOW		1711
1717	95 TRA	0, 42		TRA	B		1712
1740	1F LR	3, 11	MK6	LR	4		1713
1720	44 LAX	4, 0		LAX	0, TEXCX		1714
1710	BC TRA	0, 3		TRA	1		1715
1737	24 RSM	1, 0		RSM	VD	R M	1716
1750	1D LR	1, 11		LR	1		1717
1757	2R TM	1, 0		TM	0, SETM	DIV = 0010 MULT = 0001	1718
1760	9H TRA	0, 52		TRA	1, RND		1719
1730	36 TL	9, 0		TL	0, KTOW		1720
1747	C5 TRA	1, 58		TRA	0, KTOZ		1721
1723	31 TL	14, 0	MK1	TL	0, WTOK		1722
1711	95 TRA	0, 42		TRA	1, MK6		1723
1705	31 TL	14, 0	MK2	TL	ND		1724
1734	80 TRA	0, 63		TRA	R		1725
1749	31 TL	14, 0		TL	1, MK4		1726
1756	AA TRA	0, 21		TRA	0, SWAPKZ		1727
1728	07 TRA	1, 40	MK3	TRA	0, MD1		1728
1714	1E LR	2, 11		LR	1, MK2		1729
1739	2B TM	8, 0		TM		T N	1730
1719	0B TRA	1, 36		TRA			1731
1709	b6 TRA	0, 9	MK4	TRA			1732
1736	32 TL	13, 0		TL			1733
1718	BF TRA	0, 0		TRA			1734
1741	FA TRA	1, 5		TRA			1735



TABLE III

ADDR.	CODE	SIMT.	KDN2C	ADP	1	14	1736	1737	1738	1739	1740	1741	1742	1743	1744	1745	1746	1747	1748	1749	1750	1751	1752	1753	1754	1755	1756	1757	1758	1759	1760	1761	1762	1763
1752	61	ADP		ADP	1	0	1736	ADP																										
1726	4E	LAX		LAX	14	0	1737	LAX																										
1745	19	LB		LB	1	10	1738	LB																										
1754	24	TM		TM	8	0	1739	TM																										
1759	40	LAX		LAX	0	0	1740	LAX																										
1729	1A	LB		LB	2	10	1741	LB																										
1746	7E	ADD		ADD	0	0	1742	ADD																										
1755	75	ATH		ATH	0	0	1743	ATH																										
1727	53	LCA		LCA	3	0	1744	LCA																										
1713	60	ADP		ADP	13	0	1745	ADP																										
1738	22	SM		SM	4	0	1746	SM																										
1751	79	HTA		HTA	0	0	1747	HTA																										
1725	10	LB		LB	1	11	1748	LB																										
1744	5C	EXC		EXC	0	0	1749	EXC																										
1722	79	HTA		HTA	0	0	1750	HTA																										
1743	00	NOP		NOP	0	0	1751	NOP																										
1721	3C	TL		TL	3	0	1752	TL																										
1742	FF	TPA		TPA	1	0	1753	TPA																										
1753	6A	ADP		ADP	10	0	1754	ADP																										
1758	C0	TRA		TRA	1	63	1755	TRA																										
1761	3E	TL		TL	1	0	1756	TL																										
1762	DD	TRA		TRA	1	34	1757	TRA																										
1763	BB	TRA		TRA	0	4	1758	TRA																										
1731	2C	SR7		SR7	0	0	1759	SR7																										
1715	10	LB		LB	1	11	1760	LB																										
1707	8B	TRA		TRA	0	4	1761	TRA																										
1703	96	TRA		TRA	0	41	1762	TRA																										
1701	C2	TRA		TRA	1	61	1763	TRA																										

SHUFFLES IF 3A CARDS HAVE BEEN DEALT

0 C

0 S

1,TKRET9



ADDR.	CODE	SIMI.	8. 0	SM	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861
1852	23	SM	8. 0	SM	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861
1826	AF	TRA	0.15	TRA	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861
1845	1E	LH	2.11	LH	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861
1854	2A	TM	4. 0	TM	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861
1859	D1	TRA	1.46	TRA	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861
1829	EA	TRA	1.21	TRA	1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861
1846	1D	LB	1.11	LB	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861
1855	4E	LAX	14. 0	LAX	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861
1827	7F	TAM	0. 0	TAM	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861
1813	CC	TRA	1.51	TRA	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1838	C2	TRA	1.61	TRA	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1851	9D	TRA	0.50	TRA	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1825	69	ADX	9. 0	ADX	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1844	C2	TRA	1.61	TRA	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1822	14	LB	0. 9	LB	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1843	9A	TRA	0.37	TRA	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1821	1D	LB	1.11	LB	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1842	50	LDA	0. 0	LDA	1853	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1853	0H	LB	0. 0	LB	1854	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1858	87	TRA	0.56	TRA	1855	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1861	3E	TL	1. 0	TL	1856	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1862	DD	TRA	1.34	TRA	1857	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1863	OC	LB	0. 7	LB	1858	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1831	88	TRA	0.55	TRA	1859	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1815	D2	TRA	1.45	TRA	1860	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861
1807	C2	TRA	1.61	TRA	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861	1861

TABLE III

ADDR.	CODE	STMT.	ORG	1900	T OF	1900
1900	IE	LB	LR	ND		1900
1932	28	IM	TM	1		1901
1916	E1	TRA	TRA	1.KON1		1902
1908	25	RSM	RSM	2		1903
1904	19	LH	LB	KI		1904
1902	28	TM	TM	8		1905
1933	DD	TRA	TRA	1.TKON2		1906
1948	24	TM	TM	4		1907
1924	E3	TRA	TRA	1.KON4		1908
1912	82	TRA	TRA	0.TD3		1909
1906	EE	TRA	TRA	1.*+2		1910
1935	F4	TRA	TRA	1.TKRET4		1911
1917	2D	RSE7	RSR7	1		1912
1940	61	ADX	ADX	1		1913
1920	DD	TRA	TRA	1.TCEK		1914
1910	61	ADX	ADX	1		1915
1937	CA	TRA	TRA	1.DPCK		1916
1950	0A	NOP	NOP			1917
1957	3D	TL	TL			1918
1940	DE	TRA	TRA	1.N1		1919
1930	61	ADX	ADX	1		1920
1947	36	TL	TL			1921
1923	FA	TRA	TRA	1.CEK		1922
1911	3E	TL	TL			1923
1905	DD	TRA	TRA	1.KRET		1924
1934	00	NOP	NOP			1925
1949	3F	TL	TL			1926
1956	FF	TPA	TRA	1.KON2		1927
1928	93	TRA	TRA	0.TG		1928
1914	EC	TRA	TRA	1.*+2		1929
1939	F4	TPA	TRA	1.TKRET4		1930
1919	65	ADX	ADX	5		1931
1909	3C	TL	TL			1932
1936	EE	TRA	TRA	1.HITK		1933
1918	61	ADX	ADX	1		1934
1941	3A	TL	TL			1935

### TABLE III

ACDR.	CODE	STMT.
1934	TRA	1-17
1936	EE TRA	1-17
1937	ADX	2-0
1938	TL	15-0
1939	TRA	1-43
1940	ADX	1-0
1941	TL	2-0
1942	TRA	1-0
1943	ADX	2-0
1944	TL	8-0
1945	TRA	1-27
1946	ADX	1-0
1947	TL	3-0
1948	TRA	1-52
1949	CB	1948
1950	ADX	2-0
1951	TL	3-0
1952	TRA	1-0
1953	TL	3-0
1954	TRA	1-30
1955	TRA	0-44
1956	PSB7	0-0
1957	LH	2-11
1958	TM	4-0
1959	TRA	1-11
1960	SM	4-0
1961	LB	0-9
1962	TRA	0-7
1963	CD TRA	1-50

TABLE III

ADDR. CODE STMT.

2000	18	LB	0.10	2000	RDLY	ORG	2000	2000
2032	9A	TRA	0.37	2001		LB	0.10	2001
2016	7F	TAM	0.0	2002		TRA	0.0PLUS1	2002
2008	DC	TPA	1.35	2003		TAM		2003
2004	1C	LB	0.11	2004		TPA	1.0TKRETD	2004
2002	9A	TRA	0.37	2005		LB	0.11	2005
2033	7F	TAM	0.0	2006		TRA	0.0PLUS1	2006
2048	DC	TRA	1.35	2007		TAM		2007
2024	1D	LB	1.11	2008		TRA	1.0TKRETD	2008
2012	9A	TRA	0.37	2009		LB	VD	2009
2006	7F	TAM	0.0	2010		TRA	0.0PLUS1	2010
2035	3E	TL	1.0	2011		TAM		2011
2017	DD	TPA	1.34	2012		TRA	1.0KRET	2012
2040	20	RSB7	0.0	2013		TL		2013
2020	08	LB	0.0	2014		RSB7		2014
2010	07	BTS	0.0	2015		LB	0.0	2015
2037	47	LAX	7.0	2016		RIS		2016
2050	54	EXC	0.1	2017		LAX	7	2017
2057	49	LAX	9.0	2018		EXC	0.01	2018
2060	54	EXC	0.1	2019		LAX	9	2019
2030	48	LAX	8.0	2020		EXC	0.01	2020
2047	54	EXC	0.1	2021		LAX	8	2021
2023	48	LAX	8.0	2022		EXC	0.01	2022
2011	54	EXC	0.1	2023		LAX	8	2023
2005	46	LAX	6.0	2024		EXC	0.01	2024
2034	54	EXC	0.1	2025		LAX	6	2025
2049	43	LAX	3.0	2026		EXC	0.01	2026
2056	54	EXC	0.1	2027		LAX	3	2027
2028	40	LAX	0.0	2028		EXC	0.01	2028
2014	54	EXC	0.1	2029		LAX	0	2029
2039	41	LAX	1.0	2030		EXC	0.01	2030
2019	9C	EXC	0.0	2031		LAX	1	2031
2009	98	TRA	0.39	2032		EXC	0.0	2032
2036	8R	TRA	0.52	2033		TRA	0.0SWPWR8	2033
2018	23	SM	8.0	2034		SM	0.0SETM	2034
2041	32	TL	13.0	2035		TL	8	2035

SET RN







TABLE III

ADDR.	CODE	STMT.	LONUCD	RTA	NEW
2152	7A BTA	0 0		LR	NEW
2126	17 LR	3 9		FXC	0 0
2145	5C EXC	0 0		LDA	0
2154	50 LDA	0 0		ADX	5
2159	55 ADX	5 0		TRA	1 0
2129	E4 TPA	1 27		ADX	1 0
2146	6A ADX	10 0		TRA	1 0
2155	09 TRA	1 38		LAX	1 0
2127	4A LAX	10 0	LD10	FXC	0 0
2113	5C EXC	0 0	INCCC	LR	1 9
2138	15 LR	1 9		TRA	0 0
2151	9A TRA	0 37		SH7	0 0
2125	2C SH7	0 0		TL	0 0
2144	39 TL	4 0		TRA	1 0
2122	FF TRA	1 0		TM	1 0
2143	28 TM	1 0	3R7	TRA	1 0
2121	08 TRA	1 36		SM	1 0
2142	20 SM	1 0		TRA	1 0
2153	CR TRA	1 52		TM	2 0
2158	29 TM	2 0	2R7	TRA	2 0
2161	08 TRA	1 36		SM	2 0
2162	21 SM	2 0		TRA	4 0
2163	CB TRA	1 52	1R7	TM	1 0
2131	2A TM	4 0		TRA	1 0
2115	08 TPA	1 36		SM	4 0
2107	22 SM	4 0		TRA	1 0
2103	CB TRA	1 52			

TABLE III

ADDR.	CODE	STMT.
0000	0000	0000
0001	0001	0001
0002	0002	0002
0003	0003	0003
0004	0004	0004
0005	0005	0005
0006	0006	0006
0007	0007	0007
0008	0008	0008
0009	0009	0009
0010	0010	0010
0011	0011	0011
0012	0012	0012
0013	0013	0013
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0015	0015	0015
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0038	0038	0038
0039	0039	0039
0040	0040	0040
0041	0041	0041
0042	0042	0042
0043	0043	0043
0044	0044	0044
0045	0045	0045
0046	0046	0046
0047	0047	0047
0048	0048	0048
0049	0049	0049
0050	0050	0050
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0055	0055	0055
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0067	0067	0067
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0070	0070	0070
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0072	0072	0072
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0075	0075	0075
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0080	0080	0080
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0095	0095	0095
0096	0096	0096
0097	0097	0097
0098	0098	0098
0099	0099	0099

DE	TRA	1.33	2300	ADDZK	OPG
2300	CD TRA	1.50	2301	SURZK	TRA
2316	14 LB	0.9	2302	OTOK	LB
2308	15 LB	1.9	2303	OTOZ	LB
2304	4F LAX	15.0	2304	OTO	LAX
2302	5C EXC	0.0	2305		FXC
2333	40 LAX	0.0	2306		LAX
2348	5C EXC	0.0	2307		EXC
2324	77 COMP	0.0	2308		COMP
2312	EA TRA	1.21	2309		TRA
2306	14 LB	0.9	2310	KEM1	LB
2335	15 LB	1.9	2311	ZEM1	LB
2317	4F LAX	15.0	2312	MINUS1	LAX
2340	C7 TRA	1.56	2313	ANXX	TRA
2320	15 LB	1.9	2314	ZEPI	LB
2310	11 LB	1.8	2315	ZSPI	LB
2337	CE TRA	1.49	2316	PLUS1	TRA
2350	14 LB	0.9	2317	LKE	LB
2357	10 LB	0.8	2318	LKS	LB
2360	11 LB	1.8	2319	LZS	LB
2330	1A LB	2.10	2320	LLS	LB
2347	51 LDA	1.0	2321		LDA
2323	2F RET	0.0	2322		RET
2311	OC LB	0.7	2323	KRIGHT	LB
2305	OD LB	1.7	2324	ZRIGHT	LB
2334	FF TRA	1.0	2325	RIGHTX	TRA
2349	09 LB	1.0	2326	ZLEFT	LB
2356	F7 TRA	1.8	2327	LEFTX	TRA
2328	14 LB	0.9	2328	SWAPKW	LB
2314	F2 TRA	1.13	2329	SWAPZX	TRA
2339	OE LB	2.7	2330	SWPWK8	LB
2319	C1 TRA	1.62	2331		TRA
2309	14 LB	0.9	2332	SWAPKZ	LB
2336	C4 TRA	1.59	2333	SWAPIX	TRA
2318	IF LB	3.11	2334	SETPM	LB
2341	1E LB	2.11	2335	SETOF	LB

TABLE III

ADDR.	CODE	STMT.	SETM	LB	MC
2352	1R	3,10	SETM	LB	1
2352	20	1, 0	SM	SM	1
2326	20	1, 2	DELAY	TRA	1, RETD
2345	FD	0,10	LDK10	LB	0,10
2354	1R	0,11	LDK11	LB	0,11
2359	1C	1,28	LDM	TRA	1, EXCS
2329	E3	2, 0	W01SZ	LB	2, 0
2346	0A	1,52	TS7ERO	TRA	1, ISZ
2355	CH	0, 0	KHFGZ	LB	0, 0
2327	0P	1, 0	7HFGZ	LB	1, 0
2313	0P	1,39	REZ	TRA	1, REZS
2336	0B	1, 8	TSPLIT	LB	SF
2351	11	1, 7	TAJ	LB	RJI
2325	0D	3,11	TG	LB	H
2344	1F	3,10	TDS1	LB	DS
2322	1B	0, 0		SB7	
2343	2C	1, 0		TM	1
2321	2R	0, 0		RET	0
2342	2F	1, 0		RET	1
2353	2E	3,11	THO	LB	H
2358	1F	3,10	TD3	LB	DS
2361	1R	0, 0	TSP	SB7	
2362	2C	4, 0		TM	4
2363	2A	1, 0		RET	1
2331	2E	0, 0	3B0	RET	0
2315	2F	0, 0	ZRO	LAX	0
2307	40	0, 2	TEXCX	EXC	0, -1
2303	58	0, 0		RET	0
2301	2F	0, 0			





TABLE III

## CROSS REFERENCE TABLE

## STMT. NAME USING STATEMENTS

1100	ADACED	622
1101	ADACEP	611
1102	ADACES	607
1000	ADD	1709 1635 1620 1216 1051
2206	ADDB	2300
428	ADDCDS	
1055	ADDDT	448
1056	ADDDT	433
1217	ADDDT	1037
2207	ADDS	
1057	ADDDT	445
2208	ADDS1	2213
2313	ADDX	1305 1025
2300	ADDDK	1413 1335 1011
1142	ADPSX	1063
1004	AI	
1040	AIA	1003
1044	AIB	1042

TABLE III

## CROSS REFERENCE TABLE

## STMT. NAME USING STATEMENTS

1052	A2	1046	
1049	A3	1054	
1014	A4	1012	
1023	A6		
1028	A7	1034	
1021	A9	1010	
336	BETK	1948	
354	PETI	337	
517	BJL	506	
907	RJN	912	
900	BJTEST	523	519
908	BJY		
31	BLANK	62	55 25
409	CARDTO		
924	CEK	1922	
418	CFZ	456	454
450	CHGE	420	
639	CHKH2C	662	632
645	CHKH2B	642	

TABLE III

CROSS REFERENCE TABLE		
STMT.	NAME	USING STATEMENTS
1248	CMP	1245
1233	CMPRP	629
1232	CMPRS	649
614	COUNT	R02
605	COUNTX	R13
936	C1	926
929	C2	
447	DAODDT	429
300	DEBK	1951
233R	DELAY	1525
133	DISK	
40	DISPKC	137
1324	DIV1	
1354	DIV10	1349
1328	DIV2	
1422	DIV3	
1329	DIV4	1363 1366
1335	DIV4X	
1361	DIV5	1330



TABLE III

STMT.	NAME	CROSS REFERENCE	TABLE
1360	DIV5X	USING STATEMENTS	
		1334	
1340	DIV7	1359	1357
1347	DIV4	1338	
1350	DIV6X		
700	DLROVR	620	
625	DLWSTD	842	
656	DLPWN	630	
1419	DM1	1417	1353
1430	DM2	1423	
1954	DPCK	1916	
407	DS3		
404	DS3X	401	
1439	D10F	1421	
1438	D10FX	1323	
1020	END		
1440	ENDGM	1450	
1443	ENIMD	1437	1432
1609	EOK		
2228	EXCS	2341	

TABLE III

CROSS REFERENCE TABLE		USING STATEMENTS	
STMT. NAME	NAME	USING STATEMENTS	
945	E1	1611	
943	E2	946	
952	E3	950 944	
1624	E5	1613	
1619	E6	1625 1617	
1215	FAD	1231	
1533	GAME	1527	
0	GDISP	132	
7	GD1	3	
26	GD2	15	
38	GD4	61 51 28	
32	GD5	39	
1448	GMCHK	1409	
249	HAND	829 752 624 439 311	
312	HITK	1933	
915	HM4	2120 2111	
710	H2C3	728	
2146	INCCC	2143	
400	INCCCX	2150	

TABLE III

### CROSS REFERENCE TABLE

STMT. NO.	NAME	USING STATEMENTS
550	INSDLR	529
512	INSK	1926
2236	ISZ	2343
2343	ISZEPO	1859 1431
17	ISI	30
56	IS7	47
52	ISR	45
1821	KDNX3	1817
1800	KDN1	162
1804	KDN1X	
1824	KDN2	
1736	KDN2C	1832
1823	KDN2X	1819
48	KD2	
2310	KEM1	1047 762
155	KEYDWN	
1900	KEYON	1753
1920	KON1	1902
1600	KON2	1927



TABLE III

## CROSS REFERENCE TABLE

## STMT. NAME USING STATEMENTS

2340 LOK11 1406 1302

2341 LDM

2136 LDNUCD 2162 2158 2154

2144 LO10 2141

2203 LEFT 2327

2327 LEFTX 1855 1343

2317 LKE 1847 1310 1001

2318 LKS 1303 1004

2320 LLS 150 127 103

2319 LZS 1407 1336

1700 MDK 1462

1300 MD1 2036 1734 1655 953 347 331

1310 MD1X

32 MIN 54

2312 MINUS1 1428 1360

1722 MK1 1701

1724 MK2 1735

1729 MK3 1703

1733 MK4 1731

TABLE III

## CROSS REFERENCE TABLE

STMT. NAME USING STATEMENTS

1708 MK5 1706

1713 MK6 1728

830 MOVPC 826

402 MSBC

1326 MULT 1320

1424 MX2 1436 1434 1418

1410 M1 1447 1415 1327

1200 MLTON 553

1445 MIX 1414

1400 M2 1411

1201 M2TON 727 725 661 659 560

1401 M2X 1429

1414 M3 1451

1202 M4TON 718

259 NET 715 644 549

2032 NEWN

2046 NUCARD 2043

1833 N1 1919

1858 N2 1835

## CROSS REFERENCE TABLE

## STMT. NAME USING STATEMENTS

1838 N3 1860

1847 N4 1845

1852 N5 1841

1115 OVRZRO 1113

1128 OVR11 1141

1137 OVR6 1127

1140 OVR6X 1138

200 PLAYK 1942

803 PLACD

633 PLRWN

2316 PLUS1 2147 2009 2005 2001 1851 1446 1362 1355 408 403

1208 PLX 1205

1626 PMK 1606

2227 POMS 2313

2226 POMS1 2316

1500 PWRON

1647 P1 1627

1636 P2 1649

1206 P21ON 720 709 707 638 636 556

TABLE III

## CROSS REFERENCE TABLE

STMT.	NAME	USING STATEMENTS
1650	P3	1629
1207	P3TON	547
1634	P4	1622
1654	P5	1652
1640	P6	1659
163F	P7	
2013	RANDOM	140
2000	POLY	258
202	RESET	1550 458
2205	RET0	2338
2215	RET0	
2216	RET1	
2346	REZ	1325
2230	REZS	2234 2346
2200	RIGHT	2325
2325	RIGHTX	1405
459	RLZ	245 242
955	RND	1721 1646 1623
941	ROF	928



TABLE III

## CROSS REFERENCE TABLE

## USING STATEMENTS

STMT. NAME  
114 RRET 2045

2250 R5B7

2249 R5B7AZ 2263 2256 2244 2229

753 RTJUS 956 763

761 RTJUS1 759

2100 R7LG 2062

507 SETAI

2336 SETM 2033 1719 613 345 259

2335 SETOF 1762 1533 1439 1018

2334 SETPM 1644 1535 1204

1758 SHUFL 1755

729 SPLC 1563

1551 SPLTK 1939

844 STANDK 1945

600 STANDX 852

2217 SURS 2301

2219 SUBS1 2224

2220 SUBS2

2301 SUBZK 1329 1021



CROSS REFERENCE TABLE

STMT. NAME USING STATEMENTS

722 TDHL2 703

1842 TDP 1840

2350 TDS1 844 800 428 415 410 312 4

2356 TD3 1909 846 407 354 316 303

2125 TESTR7 2118 2059

1158 TESTXT 1150

2362 TEXCX 1715 934

1230 TFAD 1220

534 TFP

905 TF01 914

2349 TG 1954 1928 1600 1035

751 THAND

837 TH8 809

2355 TH0 320 200

716 TH2R3 713

230 TH2C 604

440 TH2C1 431

1925 TKON2 1906

301 TKRET 356 353 335 321 317 315 313 306 304

TABLE III

STVT.	NAME	CROSS REFERENCE	TABLE	USING STATEMENTS
2011	TKRET0		2007	2003
939	TKRET1		960	942
1553	TKRET2		1557	
814	TKRET3		847	845 822
1923	TKRET4		1959	1955 1930 1911
228	TKRET5		263	221 201
1601	TKRET6			
510	TKRET7		514	
1856	TKRET8		1861	1849 1846 1822 1820 1814
1756	TKRET9		1763	
22	TKS1		37	
1530	TKS3			
1660	TMDK		1608	
559	TM2TON		651	
643	TNET		653	
1917	TN1		1963	
432	TOADPT		443	
812	TOCNTX		843	836 235
310	TOHAND		363	319

TABLE III

## CROSS REFERENCE TABLE

STMT. NAME  
714 TONET  
721

54R TONET1 561 558

-2133 TORAND --- 2160 2156 2152 2104

320 TOTK 1953

532 TPLRN 554

-557 TPLRY --- 531

719 TP2TON 655

13R TRAND 2134 113

-256 TRDLY --- 124

2060 TR7LG 2051

222 TSHUF 220

-1754 TSHUFL --- 227

805 TSH1R 821

823 TSH2C 817

-2357 TSP --- 1552

816 TSPA 804

2347 TSPLIT 803 602 430

-434 TSD53 --- 449 446

910 TST10 902

TABLE III

05/16/77 11:24 PAGE: 17

## CROSS REFERENCE TABLE

## SYMT. NAME USING STATEMENTS

1154 TS15 1161

1259 TTOK 324

544 T2DS1 538 502

800 T2DS1X 545

455 UP 452

852 VDLY 156

854 VDLY2 862

855 VDLY3

1452 WTOK 1727

1256 W10Z

2342 W01SZ 1435 1410

637 W1NSP

2311 ZEM1 1426 1328 1019

2314 ZEP1 1358 1317 1052

2326 ZLEFT 1344 1053

2345 ZREGRZ 1416

2324 ZRIGHT 1403 1015

2361 ZRO 1962 1641 1341 938 935 831 255 216 205

2315 ZSP1 1400 1339

TABLE III

STMT.	NAME	CROSS REFERENCE	TABLE
1459	Z10K	USING STATEMENTS	1639
1257	710W		
2304	010	2255	1761
		931	212
2302	010K	2038	1837
2303	010Z	1443	1300
2252	0101	2309	
2159	1R7	2131	
2155	2R7	2129	
555	210N	551	
2360	380	35	20
2151	3R7	2127	
546	3TON	533	
2119	89R7	2113	





Subsequent to the completion of the new card routine, (new card found), the increment card count routine INCCC (see FIG. 11) is performed to keep track of the total number of cards dealt. Then the flag DS3 is tested. If it is a ONE, it indicates that prior to the deal of the present card, the first four cards of a hand have already been dealt. If it is a ZERO, it indicates that the first four cards of the hand have still not all been dealt and that this card presently being dealt is one of those four. DS1 through DS3, which are used to keep track of the number of cards dealt in the original four card hand, are then incremented to reflect the true condition regarding the number of cards dealt, (up to four). In either case, the CARDTO routine (see FIG. 9) is then performed to assign the dealt card to the appropriate hand, the dealer's or the player's depending upon whose turn it is to receive a card. If the card currently being dealt by the operation of the HAND routine exceeds the total number of cards for which storage capacity exists in the random access memory (see FIG. 4), the CARDTO routine returns the program to the reset portion of the POWER-ON routine and cancels the hand. Otherwise, the HAND routine continues to the ADD CARDS routine (see FIG. 10c) which adds the value of the newly dealt card to the player's or dealer's hand according to which hand it was dealt.

The hand routine then tests the DS3 flag again to determine whether the card currently being dealt is now the fourth card or not. If it is still not the fourth card being dealt in the original hand, DS3 is zero and the HAND routine returns to the initial step to deal an additional card. If the fourth card has been dealt, the HAND routine then continues to the TEST BLACKJACK routine (see FIGS. 10a and 10b) which determines whether or not there are any blackjack hands in the first four cards. If the TEST BLACKJACK routine has already been accomplished previously in the hand, the next step in the HAND routine is a test of the DS1 flag to determine whose card has just been dealt. If the DS1 flag is ZERO, it indicates that it's the player's card and the HAND routine exits to the PLAYER CARD routine PLRCD (see FIG. 27) to determine the next operation required. On the other hand, if the DS1 flag is a ONE, indicating that the card just dealt was a dealer's card, the HAND routine exits to the COUNT X routine (see FIGS. 14a and 14b) to assess the next action required.

If the TEST BLACKJACK routine has not been accomplished previously, a test is made for an insurance condition, (dealer ACE showing). If such a condition exists the player is allowed to accept or decline insurance. Next, a test for any blackjack is performed and if a blackjack has occurred, the routine exits to the NET routine (see FIG. 10b) which evaluates the effect on the stake in accordance with whose hand had the blackjack. On the other hand, if the TEST BLACKJACK routine determines that neither the player nor the dealer has blackjack, the routine then performs the TEST-FOR-pair decision routine (see FIG. 6) to determine whether or not a split possibility exists. If there is no pair, the DS1 check, as previously described, is then performed. If there is a pair, the split flag SP is set to indicate, for other routines in the program, that a pair has been dealt the player and that a split possibility exists giving the player the option of splitting. After the split flag SP is set, the decision operation "Are they Aces?" is then performed to determine whether or not the pair of cards that may be split is a pair of Aces. If it is a pair of Aces, the SPA flag is set, if they are not Aces, the program exits to the DS1 flag test as previously described.

The various routines of which the hand routine is comprised as well as additional routines incorporated therein and key routines will now be described in conjunction with FIGS. 7 through 30.

#### NUCARD ROUTINE (See FIGS. 8a and 8b)

The RAM indicator being at SB7, forces operations to the right side of the RAM and B is pointed to the seventh word of register R. R7, is the tens digit of the random number that will be considered as a possible card selection. R7 is loaded into the accumulator and transferred into the holding register H since the accumulator contents are destroyed in subsequent processes. The number in the accumulator is tested to ascertain whether or not it is larger than 3. If it is not larger than 3, it is known to represent a set of acceptable random numbers, (0-39).

This routine also determines whether this card has been used before in the play of the hand. The first step in doing this is to examine the units digit which is located in RAM location R6. R6 is entered into the accumulator. The B pointer of the RAM register then points to the R location having the value of R6. For example, if R6 contains the number 5, then the B register points to location 5. Since all of the card values corresponding to numbers 0-39 are located in register C of the RAM, register B should point to RAM register C. This pointing to register C is accomplished by performing an LB00 instruction to change the contents of the B register to point to register 0, (also called register C). Then the contents of the accumulator are transferred to the B register which points to the 4 bits that could contain a card corresponding to R6. For example, if R6 were equal to the number 5, the B register would point to RAM register C, location 5. Then an H to A transfer is performed retrieving the original tens digit which was previously stored in A. The tens digits is used to indicate in which of the four bits the card being searched would be considered to be located. That value will be either three, two, one, or zero, since the earlier test had shown that this value was not greater than three. A routine is then performed to correlate this number to a card storage location. The appropriate bit corresponding to that location is tested for a ONE. If that bit is a ONE, the card is considered to have been previously dealt and the NUCARD routine is exited, through the random number generation routine, to search for a new card. If that location contains a ZERO, the card has not been played and a ONE is loaded into that location to prevent its play again until the deck is reshuffled. The next step is to load the value of the new card into the location in the RAM reserved for that purpose, namely, register R, location 9. The new card is then located in that position by an exchange instruction which takes the accumulator contents and puts them into that location. Since the card value entered into this location could be either zero or eleven, this value is tested for those conditions and if either of them is met, a 10 card value is inserted instead, since a zero and an eleven are considered a ten in the number assignments representing the 52 cards. The NUCARD routine is exited and the increment card counter routine ICCC is entered.

If the R7 term is greater than three, the NUCARD routine performs the steps called R7LG, (R7 large). Numbers larger than 39 can be considered valid cards only if they are the numbers 40, 41, 50, 51, etc. A number like 56 for example, would not be a valid candidate for a new card. Only a number ending in zero or one can produce a valid card. Accordingly, a test is made to determine whether the ending digit is greater than one.

if it is, this loop is exited, and a number generation again performed. If it is less than two, in other words zero or one, then 10 is added to R6 and the result, which will be either 10 or 11, is stored in register R location 8 for future reference. Then the tens digit, that is the R7 digit, is examined and 4 is subtracted from this digit. The sum of R7 minus 4, (called R7'), is put into the H register and the new total is examined to determine whether this number is greater than 3. If it is not greater than 3, it is tested in the same manner as R7 numbers less than 3 for the actual location of the card. The only difference is that the register C address must be either 10 or 11. This is accomplished by loading R6 plus 10, which is in LB3,8, into the accumulator, then performing an LB 0 to point to register C with an A to B transfer which points to either word 10 or word 11, depending upon the value of R6. If the new R7 turned out to be larger than 3, a second subtraction of 4 is required. This second subtraction forces the number to be in the range zero to three inclusive. However, before the R7 loop is entered, it is necessary to point to register S since the only possible card combinations corresponding to these values reside in the four cards stored in the S register.

#### INCCC ROUTINE (See FIG. 11)

The Increment Card Counter routine INCCC begins by re-setting the carry flip-flop. Then a 1 is inserted into the accumulator and the B register is pointed with an LB1,9 to the least significant bits of the card counter. The function add 1 is performed, where the 1 stands for an add with carry, so the contents of the card counter are added to the accumulator. If there is an overflow, the carry flip-flop is set in this operation. The new results of this add operation are then placed into the card counter as an updated card total and the carry flip-flop is examined. If the carry is not set an overflow has not occurred and no further operation is required. If the carry is set, it is necessary to increment the word in location register S10. This is done with an add 1 subroutine. Once this has occurred, the card required flag is reset indicating that the cycle has been completed and the routine progresses to DS3.

#### RANDOM ROUTINE (See FIG. 7)

Random begins by inserting the random generation key number which is 10368897 into the K register. Then a previously chosen seed number, which is located in the R register, is transferred to the W register. These two numbers are then multiplied together. The 8 most significant bits of the result of this multiplication are dropped, and only the least significant bits are used for the random number. This is accomplished by modifying the usual multiply routine, which is classified as MD1, with a flag which is called RN. In the random routine, a 1 is set into RN which indicates that an other than normal multiply operation is to follow. This is the means for discarding the most significant bits. After the multiply operation is accomplished, the W contents are entered again into R and the flag RN is reset. Now the potential random card selection is located in R and the two numbers used are located in R6 and R7, R7 being the most significant or the tens digit and R6 being the units digit. After this process, the card required flag CR, is examined and if no card is required, the RANDOM routine is exited back to the keyboard return routine KRET. If a card is required in the play of a hand, then CR will be set during this time and the RANDOM routine is exited to the new card routine NUCARD. The result of the random routine, other than mere ran-

dom number generation where the routine exits through the key routine, is an exit to INCCC and through DS3. This implies that an unused card has been found which is now available for the play of the hand. Action continues through DS3.

#### THE DS3 ROUTINE (See FIG. 6)

The DS3 routine is contained in the basic hand routine and it consists of two steps. First, the third bit or DS3 of RAM location R10, is examined to determine whether it is a ONE or a ZERO. If it is a ONE, it implies that all of the cards in the initial deal of the hand, that is, the first two cards to the dealer and the first two cards to the player, have been dealt and it is no longer necessary to switch between the dealer and player hands as it is in the beginning of the hand. If DS3 is zero, it implies that the deal of the first four cards is in progress and the steering bit, which is DS1, is incremented to steer the cards either to the dealer hand or to the player hand depending on the card dealing sequence.

#### THE CARDTO ROUTINE (See FIG. 9)

The next routine, called CARDTO, involves the actual distribution of the card to the correct location.

The first step in this routine is to reset the C flip-flop. Then DS1 is tested and C is either set or reset depending upon the state of DS1. If it's a ONE, C is set. Now the new number that was previously stored in location NEW during the NUCARD routine, is loaded into the accumulator and the contents of the accumulator are stored in the H register for future reference. The routine is again called upon to check the state of DS1 and the B pointer is pointed either to B 2,11 if it is a player card to be dealt or to B 2,0 if it's a dealer card to be dealt. Then that location is tested for ZERO. A ZERO implies that no card resides in that location and the NEW card can be loaded there. Thus, if the location is ZERO, the card is retrieved from the H register and an exchange takes place between the accumulator and memory. This new card is now tested for a value of one, which implies it was an Ace. If it was an Ace, the Ace flag is set to be used later in the program for the situation where the Ace can be treated as a value of either 1 or 11 and also in the test for blackjack. Then this part of the routine exits to the add cards routine which is discussed below. Returning now to the situation where the card location examined already contains a card, it is necessary to move the B register pointer up or down to the next possible card location. If it's a player card being dealt, B is changed toward a smaller number or up in the RAM map of FIG. 4. If it's a dealer card, B is changed toward a larger number or down in the RAM map. However, if the boundaries of the RAM chart are overshot, the play discontinues and the routine exits to RESET which causes the total play of this particular hand to be ignored. The stake total is unchanged if this occurs so the effect of the play of the hand is completely negated.

#### THE ADD CARDS ROUTINE (ADDCDS) (See FIG. 10c)

The general purpose of this routine is to determine which has just been dealt; a card for the dealer's hand, a card for the player's hand, or a card for the player's split hand, (one of two hands possible in the split condition). Having dealt a card to one of these hands, the running total kept on these hands is incremented by the

value of the card that was just dealt. The first step in doing this is to determine whether the card was dealt to the dealer or the player by examining bit DS1. If that bit is set, it was the dealer's hand and the routine exits to the subroutine add dealer's total ADDDT. If the DS1 bit is reset, it's the player's hand. The test for a split hand and H2C is then performed to choose to add the card value to the player's normal hand or to his split hand. All three of the routines; add dealer total ADDDT, add player total ADDPT, and add split total ADDST, are called by the ADDCDS routine. They are discussed below as the ADDX routine.

#### ADDX ROUTINE (See FIG. 12)

The function of this routine is to add the total of the new cards to the total of the cards that have previously been dealt to the player, dealer or split hand. This routine can be entered from three different calls, ADD dealer total, ADD player total and ADD split total. The routine is entered through one of these and a flag is loaded with a corresponding entry code number 1, 3, or 5 by means of the LAX instruction. Once the LAX instruction has been executed, additional LAX instructions will not be executed until a different instruction is encountered.

The next operation is to point toward the proper flag location for the player, dealer or split hand as required. The card is then tested to see whether it was an Ace or not. This is accomplished by testing the carry bit which was set by a previous routine if the new card is an Ace. If the card is an Ace, the Ace flag, which is bit 1 of the flag location, is set. The carry flip-flop is then reset to be used in the next routine and the B counter is decremented to point toward the memory location that has the appropriate total from the previous hand. The new card, which has been stored in H, is next put back into the accumulator and the existing total is added to what is in the accumulator and this new total is placed into the memory location. Additionally, this new total is placed into the H storage register. The routine again points to the flag location corresponding to this hand and proceeds to test the carry bit to see whether the new total is larger than 15 and has thus overflowed after the addition of the new card.

If the new total has overflowed, it implies that there is a new total of at least 16 and the routine looks at flag bit 2 ('16' bit which indicates whether total has already reached number greater than 15) of the flag pointers. If bit 2 is set, it implies, a "bust" condition because the total is at least 16 plus another 16, or 32, and therefore, the bust flag is set. If the 16 bit has not been set, it is set at this time. The next step, is testing the new total that is in the total location which has also been stored in the H register, to determine whether it is greater than 5. If it is greater than 5 the hand is busted since the 16 bit, which is the flag bit that has previously been set, and a number greater than 5, would also result in a busted hand. Therefore, if the total is greater than 5, the bust flag is set and the routine exits to return zero. If it is not greater than 5, the routine exits through return zero without setting the bust flag. Return zero is a standard subroutine exit which puts the program back to the next instruction in the sequence from the calling routine. If there had been a return one instruction instead, the program would exit to the location one after the return zero location.

Returning to the test for the new total greater than 15, (test carry), if the new total is not greater than 15,

the routine proceeds to test the flag bit 16 to determine whether it is set or not. If it is not set, it implies that the total for the hand is less than 16 and there has been no bust. The routine is then exited through a return zero. If the 16 flag is set, the routine tests for greater than 5 as discussed previously and exits in the same manner. The return of any of the three add routines is to the next step in the program which is DS3 in the HAND routine.

At the test DS3 instruction, the bit DS3 is examined. If it is a zero, it implies that the program is still in the process of dealing the first four cards. The program returns to the beginning of the hand routine and finds another card and continues to deal. Once the four cards have been dealt, DS3 will be set to one. When this happens, the program goes on to TBLJK, the test black-jack routine.

#### THE TBLJK ROUTINE (See FIGS. 10a and 10b)

In the test blackjack routine the first thing done is monitoring the flag TBJ which indicates whether the program has been through this routine before or not. After the first time through, that is, after the first four cards are dealt, there is no need to repeat this test for every new card. During the first cycle through this routine, TBJ will be zero and the routine proceeds. The routine next tests the dealer's showing card (up card) to determine whether or not it is an Ace in preparation for asking for insurance.

If the dealer's up card is an Ace, the routine tests to see whether the accept insurance (AI) flag is already set. If it is not set, the AI flag is set and the routine exits to the key routine to wait for the player's decision to accept or decline the insurance. If the flag is already set, it implies that the program has been through the routine before and the routine exits to reset the AI flag and continue on. Assuming that the program has not gone through this routine before, the accept insurance flag is set and the program waits for depression of either a stand key, which implies that insurance was not desired, or of an Insurance key, which implies that insurance is desired. If the Insurance key is depressed, the accept insurance flag is retested to see that it is a valid option and that the player may accept insurance. If not, the routine exits to the key routine. If the accept insurance is set, the routine sets a flag called INS, or insurance, and resets the accept insurance flag to prohibit entering this routine again during this hand. The routine then continues with the part of the routine called BLJ.

If the program enters the TBLJK routine through the Stand key, it proceeds down through test blackjack and test up card operations and examines the accept insurance flag. If it is now set, which would normally be true in the insurance case, the routine resets the accept insurance flag denying any further insurance option.

After that decision, the routine commences BJL, where it tests for the actual condition of blackjack. It begins by testing the player's two cards to see if they correspond to blackjack which is represented by a 1 and a 10. If the player has this combination, the routine sets a flag indicating player blackjack (PBJ). If not, that flag is not set. In either case, the routine proceeds to test the dealer's hand for blackjack and if the dealer has a blackjack, the routine sets a flag called dealer blackjack (DBJ). If not, the routine merely proceeds to the next step which is setting the TBJ flag. This allows the program to bypass this routine the next time a card is dealt. Having set this flag, the routine is now prepared to examine the outcome of the hand and if there are any

blackjacks it makes the appropriate payoff. The above portion of this routine can be considered to have occurred in two instances. First, if there was no insurance involved, or INS is zero, the dealer blackjack flag is tested and if the dealer has a blackjack, the player blackjack flag is tested. If he also has a blackjack that represents a tie and the routine exits through NET. This exit will set DS1 to a ONE which is used for display purposes for unveiling the dealer's down-card. If the player did not have a blackjack, then he has lost the hand and two units are deducted from the player's stake.

Returning to the test of the dealer's blackjack, if he did not have blackjack, the routine tests for a player blackjack. If the player also did not have a blackjack the routine exits to test for pair or TFP. If the player did have a blackjack, he wins one and one-half units which represents a 3 in the accounting system and that number of units is added to the stake. The routine then exits through NET. If there was insurance involved, the same routines occur except first the routine considers the insurance payoff. If the dealer did have a blackjack, the player is credited with 2, representing his return on his insurance bet. The routine then transfers to test for player blackjack as before. If the dealer did not have a blackjack, half of the player's bet or one unit is debitted from the pool and the routine proceeds to test for player's blackjack and rewards him accordingly. The NET routine sets three flags. It sets DS1 to reveal the dealer's card, it sets the flag, hand started, (HS) which locks out some of the game keys, and it also sets the flag, hand over HO. All of these flags represent a hand terminated condition which prohibits entry of other game keys at this time. The NET routine is then exited to the keyboard routine, KRET. If the hand is not a blackjack hand, the TBLJK routine exits to the routine called TFP or test for pair which will be discussed next. It should be noted that the accounting system internal to the program is based on doubling all values entered through the keyboard and halving all totals before they are output to the display. This is done to remove the requirement for handling fractional values e.g. 1.5, 0.5 occurring in the blackjack and insurance cases. Therefore, a normal win of bet value 'B' results internally to the program in an increment of 2B units.

#### TEST FOR PAIR ROUTINE TFP (See HAND ROUTINE FIG. 6)

Following the TBLJK routine, (not blackjack condition) a test is made for a pair of player's dealt cards. If the cards are the same, a flag SP is set indicating that it is a pair. A further test is then conducted to determine whether the cards are Aces or not. If they are Aces, a flag called SPA is set. If they are not Aces, the routine continues to T2DS1. It will be recalled that the pertinent card has already been added to the hand total whether it is the dealer's or the player's hand, and determination has been made regarding whether this additional card has caused the hand to bust or not. In the test T2DS1, if the DS1 bit is ZERO, the program proceeds with the routine player card PLRCD.

#### PLAYER CARD ROUTINE (See FIG. 30)

PLRCD involves first testing for the split flag and if it is ZERO the routine proceeds to test for a bust hand. If the hand is bust, the routine exits through THB. If the hand is not bust, a test is performed for a double condition. If a double condition exists, no further cards will be dealt and the loop is exited to the COUNT X routine. If it is not a double condition, the loop is exited back to

the keyboard routine KRET to await further player options. Returning to PLRCD, if the split situation does exist, then the next test performed is test for a split of Aces at the check point TSPA, or test for split Aces. If the pair of cards that was split were Aces, then a check is made to determine whether the second hand is complete, H2C. If the second hand is complete, it implies that both hands have been dealt one card and the loop is exited through COUNT X. If the second hand is not complete, a card is dealt into the second hand, and the set-hand-complete flag is set, indicating that this hand has now received its second card. Then the loop is exited back through the subroutine HAND where a card will be delivered to the other split hand. When the routine is exited from hand 2 complete H2C, the operation arrange data is performed so that the display will show the two hands separated by a blank rather than showing four continuous cards in a row. Returning to the point TSPA, if the split cards are not Aces, a test is made on H2C or hand 2 complete. If hand 2 is not complete, the routine is exited to the key routine to wait to receive further instructions from the player. If hand 2 complete is TRUE, hand 1 is tested for bust condition. If hand 1 is busted, the routine is exited through THB. In the routine THB, or test hand bust, a test is made to determine whether the second hand is complete. If the second hand is complete, a test is made to determine whether the second hand has busted. If it is not complete, it implies there is no valid hand to be processed and the routine is exited to DLR STD. If hand 2 is busted, it implies that both hand 1 and hand 2 are busted and the dealer does not require a draw. The routine is therefore exited to dealer stand DLR STD. If hand 2 is complete and not bust, exit is made through count X.

#### COUNT X ROUTINE (See FIGS. 14a and 14b)

Entry into this routine implies that the player has terminated his portion of the hand and it is now up to the computer to calculate the player's total outcome in one of three fashions. It can determine that he has busted his hand, that he has a soft hand which implies for example, an 8 and a 1 which is converted to a hard hand which totals 19, or it could be just a normal total such as a 9 and an 8 giving him a total of 17.

The basic function of the count X routine is to establish the player's actual valid total. The first entry point for count X involves turning the potential soft hand or the hand containing an Ace into a hard fixed total. This is done with a routine called add Ace. The routine can be either add Ace S which would be add Ace to the split hand, add Ace P (player hand) or add Ace D for adding Ace to the dealer's hand. The add Ace routine is shown in FIG. 13 to which the description will now divert.

#### ADD ACE ROUTINE (See FIG. 13)

The first test that is made is whether or not the hand contains a total of at least 16 by testing the flag '16'. If a total of at least 16 is shown, then a determination is made as to whether the hand being considered is the player's hand or the dealer's hand. This is done by testing DS1. If DS1 is ZERO it implies it was a player's hand and the routine is exited through the Return 1 implying that nothing need be done to the player's hand. If it is a dealer's hand or DS1 is ONE, a further test is conducted to determine whether the contents of the total register are greater than zero. If the register contents are greater than zero, it implies that the dealer has at least 17 and no further cards are required. Therefore, Return 1 is again used to exit the routine implying

that the hand need not receive further cards. If the total in the dealer's register is zero, it implies he has only 16 and requires a hit. This is achieved by exiting the loop through return zero which ultimately will return the routine to the HAND routine for the distribution of another card to the dealer.

If the 16 bit is not set, implying that the hand being considered does not have a total value of at least 16, the next step is to determine whether there is an Ace contained in the hand. If the answer is no, there is nothing more that can be done to the total and a test is made of DS1 to determine where the routine should exit. For the dealer's hand that would imply dealing another card, and for the player's hand that would imply that the hand is terminated.

Returning to the test for Ace, if there is an Ace in the hand, then a determination must be made as to whether it is a dealer's hand or a player's hand. If it is a player's hand, a test is made on the total to determine whether it is more than 11. If it is more than 11, adding 10 to this hand would bust the player and this addition would not be made. The routine is then exited through return 1. If the total is less than 11, a 10 is added to the hand making it a so-called hard hand and the routine is again exited through Return 1. If the hand being considered is the dealer's hand, a test is first made to determine whether the dealer's total is greater than 6. If it is greater than 6, adding 10 to this total will give him at least 17 which is his stand hand. The loop is directed back to the add 10 cycle and finally exited through Return 1. If the dealer's total is less than 6, even the addition of 10 would not give the dealer a pat hand and the routine is exited through a Return 0 which will ultimately result in another card being dealt to the dealer's hand.

#### COUNT X ROUTINE (Continued)

Returning now to the beginning of count X routine, the first two entries were Add Ace to the split hand and then Add Ace to the player's hand, which were discussed above. Following this activity, DS1 is set to ONE, implying that it is now time to process the dealer's hand. The next routine is the COUNT routine. In this routine, the dealer's total value of cards is examined. There are three possible outcomes of this examination. The dealer can have less than 17, which requires that an additional card be dealt to his hand, or he can have 17 through 21, which is a pat hand, or he can have over 21 which implies that he has busted. If the dealer has less than 17, the COUNT enters the display subroutine in which all of the cards, including the hidden card, are displayed with an approximate  $\frac{1}{2}$  second time delay to add realism to the dealing of the dealer's next card. Then the HAND routine is re-entered to deal another card to the dealer's hand. This results in a normal flow through the HAND routine again. However, this time, because DS1 is set, the player card process is bypassed and the program returns directly to count as is shown in the HAND flow chart of FIG. 6.

The second option to examine is the case where the dealer has acquired a card value of more than 21. The dealer's hand is bust and the routine is exited to dealer over DLROVR which will be discussed next.

#### DEAL OVER ROUTINE (See FIG. 16)

If the dealer is over, a determination is made first whether the first player hand is bust. If the player hand is bust, the player will be debited for the hand. The routine next tests to determine whether the hand was a double situation. If it was a double situation, four bet-

ting units are subtracted from the stake since the player lost a double bet. If it was not a doubled hand, two betting units are subtracted from the stake.

If the player's hand is not bust, the player is given credit for winning his first hand and the double test is again made.

If no double was recorded, two betting units are added to the stake. Next, a test is performed to determine whether a second hand was dealt, in other words, whether there had been a split situation. If there was no split situation, the routine is exited to NET. If there was a split situation, the second hand is tested for bust. If the second hand was busted, two units are subtracted from the betting stake. If it was not busted, two units are credited to the betting stake. In either case, the routine is again exited to NET.

#### COUNT X (Continued) (See FIGS. 14a and 14b)

Returning now to the basic routine of count X, the third option for the dealer total is that the dealer total is in the range of 17 to 21 inclusive. This condition is called dealer stand.

Dealer stand begins with a test of hand one bust H1B. If hand 1 is busted, the routine proceeds to dealer win DLRWN. The double is tested to see whether the player's stake is debited four units or two units.

Next the check hand 2 routine, CHKH2C, is entered and hand 2 complete H2C is tested. If hand 2 complete is ZERO, it implies that there was no second hand or no split situation. The routine exits to NET if hand 2 complete is 0. Hand 2 bust H2B is tested to determine whether a comparison of the dealer's and player's hands is required. If hand two bust is TRUE, two units are subtracted from the player's stake. If the hand did not bust, a comparison is made between the dealer's total and the player's total for hand 2. If the dealer's total is greater, two units are subtracted from the player's stake. Of course, if the player's total is greater, two units are added to his stake. If it is a push, or the totals are the same, nothing is done and the routine exits to NET.

Returning to the decision point of the dealer stand routine, if hand one was not busted then a direct comparison is made between the total of hand one and the dealer's total. If the dealer's total is greater, the routine proceeds to dealer win DLRWN and proceeds as previously discussed. If the player's total is greater, player win PLRWN is performed next and once again the double is tested to determine whether four units or two units should be added to the player's stake. If the hands are tied, nothing is done. In all cases the routine proceeds to check hand two complete as described above.

In summary, if the dealer's total is less than 17, the HAND routine is entered to deal other cards until the dealer's total is something greater than 16. Once this is completed, the basic play of this hand is concluded and the remaining steps related to evaluating the outcome of the hand and making the correct pay-off are accomplished. This completes the basic program for the play of one hand.

A discussion of the keys involved in the player interaction of the game now follows.

The first key to be discussed is the Stand key STANDK (see FIG. 21). This key is interlocked by DS1 so that if DS1 is ONE the routine will not accept this entry. This interlock prevents the player from affecting the game once he has previously decided to stand. Assuming that DS1 is ZERO and the player is still in the play of the hand, the first test made is to determine whether accept insurance is set. This would occur with an Ace showing in the Dealer's hand and

would represent the first time the cards had been dealt. If Accept Insurance (AI) is set, the routine transfers to the test blackjack routine which was described above, which interprets this key as Decline Insurance. If Accept Insurance is not set, the Hand Started flag HS is set. This flag is used in rejecting various keys that would be possibly depressed out of sequence for the normal of the game.

Once flag HS is set, the Split Flag is examined. If no split was indicated, this concludes the play of the player's hand and the routine is exited to Count X. If a split is indicated, the flag SP is reset to allow termination of this hand, then hand two is tested for completion. If hand 2 is complete, it implies that both of the split hands have been played and that the stand is the final stand for this hand and the routine exits through Count X. If hand 2 is not complete, it implies that the stand was meant for the first hand only and now it is required to deal the second hand.

The first step in the dealing of the second hand is to set hand 2 complete which prevents entry into this routine again during this hand. Then the cards of hand 1 are cleared away and the first card of the new hand or hand 2 is loaded into position. The routine then exits to the HAND routine for the dealing of the second card for the split hand.

The next key to be discussed is HIT (see FIG. 19). Once again a test is made first on DS1 and if DS1 is ONE, implying that the player's hand has been terminated, the key is rejected. If DS1 is ZERO, the flag HS is set and the routine enters the HAND routine to deal the requested card to the player's hand.

The next key to be discussed is the SPLIT key (see FIG. 15). First, flag SP is tested to ensure that a pair does exist in the player's hand. If it does exist, HS is next tested to ensure that the option of splitting is still available. If so, flags HS and Split are set and the carry bit 'C' is reset. SPA is next tested and if TRUE, C is set for use as a temporary flag. The player's second card is then set to ZERO and the Split 16 flag and the player hand totals are loaded with new totals corresponding to the value of one of the pair dealt, and the SA and PA flags are set if the card is an Ace. Flag 16 P is reset and the routine exits to Hand to obtain another card.

The next key to be discussed is the double key DBLK (see FIG. 17). First a test is made on Accept Insurance. If it is the insurance mode, this key is rejected by existing through Key Return KRET. Next DS3 is tested and an exit is made if DS3=1. In addition, if the HS flag is TRUE, which means the hand has been started, a "double" entry is not valid and the routine is exited through Key Return KRET. If the hand has not previously been started, the flag HS is now set to ONE to prevent further entry through this routine and the double flag is set. The routine then exits to HAND for dealing to the double condition.

The following discussion deals with the operation of the Total Key TOTK (see FIG. 18). Depression of the Total Key results in a test of the Hand Over flag HO. If the hand is not over, or HO equals ZERO, the key is ignored and the routine exits through KRET. If the hand is over and HO is a ONE, the internal machine total is divided by two, because internally for ease of programming, the machine keeps track of a total that is twice the actual value of the stake. This total, divided by two, is inserted into the K register for display. To allow the contents of the K register to be displayed, the flag called K is reset. The K flag is a reset condition for the K register contents to be displayed. This

allows the new total divided by two or the player's actual total, to be displayed on the machine display.

The next key to be discussed is the play PLAYK (see FIG. 20). The only test made is a determination of whether the hand is over. If HO equals ZERO, implying the hand is not over, the routine exits through Key Return KRET. If HO equals ONE, implying the hand is over, the program proceeds to the RESET portion of the POWER ON routine.

The next key to be discussed is the Bet Key BETK (see FIG. 23). The first test performed during the Bet Key routine is testing the Pool Ready flag PR. If the flag is ZERO, it implies the stake has still not been loaded. A ONE is then set in this flag to prevent it from being loaded during any further play of the game. Then two times the keyboard entered value, or two times the stake value, is loaded into the T register. Following this, the routine is exited through K return. If flag PR is equal to ONE, it implies that the stake has previously been entered and that this use of the bet key can be considered to be a betting function and not the entry of the original stake. Next, flag D3 is tested and if equal to ONE, it implies that the game is in the play of a hand and the routine exits through Key Return KRET since betting at this time is not permitted. If flag D3 equals ZERO, the routine continues by multiplying the amount bet by 2 and storing this new value, 2B, in the W register. The routine then exits to the HAND routine in which the player's and dealer's cards are dealt.

The next key is the Clear Entry Key CEK (see FIG. 24). The first test is made on a flag called N to determine whether a number entry was previously made before this key depression. If it was not a number entry, the function is considered to be a clear function and register Z, register W and several flags are preset to initial conditions. Then the K register is cleared and several other flags are cleared including the overflow flag OF and the routine is exited through K return. If the N flag is ONE, the key is considered to be a Clear Entry request and it is only used to clear either the number entry previously made or an overflow condition. Therefore, the K register number entry, the overflow flag and flags N and D are cleared and the routine is exited through K return.

#### KRET ROUTINE (See FIGS. 25a and 25b)

The next routine discussed is the K return routine KRET. The first test made upon entering this routine is a test of the flag labeled K. If flag K is ZERO, the action desired is a display of the contents of the K register. If the K flag is ONE, it implies that the operation is in the game mode and the various cards must be displayed. Examining the situation where K equals ZERO, the routine is called display K or DISK. A test is next made of the overflow flag. If the flag is a ONE, a ONE is set in the carry flip-flop which, in the display routine, turns on the decimal points. This allows an overflow condition to be indicated by all the decimals on the display. If the overflow flag is ZERO, the normal K character is displayed and the routine progresses to the next step called KS1.

Returning to the check of the K flag, if the K flag is ONE, the game display situation exists. A test is first made to determine whether the card to be displayed is the dealer's down card. If it is the dealer's down card, it is necessary to determine whether the entire dealer's hand should be displayed or not. This is done by a test of DS1. If DS1 equals zero, the game is still in progress and a blank is loaded into this character which effectively conceals the dealer's down card. The routine exits through KS1. If DS1 is set, it implies that the



aler is now playing his hand and the player's hand is implete. It is therefore, permissible to display the aler's down card and the routine progresses to loading either the appropriate number corresponding to a card for example, 2 through 9, or the code F if one of the displayed cards is a 10, or an A code if the card to be displayed is an Ace. After these codes are loaded, the coded character is displayed and the routine exits through KS1.

At KS1, the first test, called TKB, determines whether a key is presently depressed. If no key is depressed, the program proceeds to KS2. The strobe count that is presently being used, called LS for last strobe, is loaded into the accumulator and decremented by adding 15 to it. Normally, this will result in an overflow except for the case where the last strobe was zero. When an overflow results, the routine bypasses KS3 and continues to KS4 where this decremented new strobe count is loaded into the last strobe and the flag R, for card required, is tested. If no card is required, the routine exits through K return to repeat the KRET routine. If a card is required, the exit is to RDLY, for random delay. This routine has been discussed earlier. It results in the expansion of the time required to deal a card to allow for a more realistic simulation of an actual game.

Returning to KS2, if the last strobe was ZERO, the addition of 15 will not cause an overflow and the routine enters routine KS3. At this point, the flag U is tested and if it is ZERO it implies that a key was not down during one total strobe sequence. The flags U and V are then reset and operation continues. If U is set, it implies that there was a key down during the process of sequencing through the set of strobe signals. In this case, the flag V is not reset, but the U flag is reset. This allows detection of the situation where a key is constantly held down as distinguished from the first time a key is recognized as being down. This will be discussed further below in conjunction with the KS5 routine.

Having set V and U appropriately, flag R, for random, is tested. If it is set, the routine exits to the RANDOM routine and generates a random number, for continued randomness of the card game. Following the generation of the random number, the random routine returns control to the next step in the routine through random return RRET. If R flag is ZERO, this operation is bypassed. Flag K is then examined to determine whether all 12 digits of the display are required. If K equals ZERO, only 8 digits of the display are required and this results in a display of the contents of the K register. If K equals ONE, this requires a display of the card hand and all 12 positions are displayed. This is accomplished by loading either 11 or 8 into the starting point for the strobes, enabling the strobing of either strobe 8 through strobe 0 or strobe 11 through strobe 0 to provide the appropriate number of strobes. The routine then exits to KS4 where the new strobe is loaded into last strobe location and the sequence begins again with a check of the flag CR.

Returning now to the part of the program labeled KS1, if test keyboard TKB is TRUE, then a ONE is loaded into the flag U. This ONE implies that a key has been detected down during this operation. Next, flag V is tested. If flag V is found to be ONE, it implies that this condition has continued to exist during a full cycle of strobes and does not represent a new key depression but simply a situation where a key is being held down. Therefore, no new processing is performed and

the routine exits to KS2 and continues to strobe in the normal manner. If flag V is ZERO, the condition implied is that it is the first time this key-down condition has existed. Following this discovery, a ONE is set into the V flag and a test of the card required bit, or CR bit, is conducted. If CR is ONE, the game is under way and a card is being dealt. This is not a valid key depression condition and the routine exits to KS2. If CR equals ZERO, no play of a card is under way and a valid key depression is considered to have occurred. The next step is to output the last strobe LS in preparation for determining the identity of the key that is depressed. Following the turning on of strobe LS, a discrete input is monitored to determine the requirement for a delay used in keyboard de-bounce. This function is used in the normal operation of the machine. It is bypassed only during the testing of the chip in manufacture where it may be desirable to reduce the test time required. Following the delay period, a second test is made for a key down. If the key is no longer down it is considered to be an invalid or a bounce situation and return is made through K return. If a key is still down after this delay, the routine exits to determine the key identity and whether it was a valid depression, by performing the routine called KDN1.

#### KDN1 ROUTINE (See FIG. 22)

This routine is a part of the key down routine and it is entered after a determination that a key has been down during the delay time for de-bounce and that the key is not being held down continuously. On entering KDN1, a test is first made of the discrete input line DIN1 and if it is set or on, a 1 is set in a flag bit called DI. Next the routine determines the validity of the key code that has been detected. This will eliminate false readings due to double-key depressions or key bounces that have involved several keys that have escaped detection through the key de-bounce routine. Invalid codes are rejected by an exit to K return. If the key is determined to be a valid code, this code is further modified to generate a usable code in the process of decoding the particular key depressed. One of the uses for this modified key code is to convert this pattern into the actual numbers 1 through 9 so that when a key 4 as an example, is depressed, the resulting key code does indeed produce a 4. In addition, some further modification is accomplished to recognize function keys as opposed to number-entry keys.

The next test is a test of the last strobe, that is, the strobe which was on during the time the key was detected. If this strobe is numbered greater than 2, the CF flag is set. This flag is used in decoding the keys because it has special meaning in the way the keyboard is interconnected. The routine then continues to the routine KEY ON.

#### KEY ON ROUTINE (See FIGS. 26a and 26b)

The purpose of the KEY ON routine is to determine the actual key that has been depressed and to direct the routine to the appropriate subroutine for this key. The first test made is of the overflow flag OF, since if the overflow flag is on, the only valid key to be considered is the clear key. If the overflow flag is 1, a test is made to determine whether flag CF=1. If it is, this situation cannot represent a clear key. Next, the key code is tested for a value of 15. If the key code is 15, that represents the code for clear or clear entry key and the routine exits to the processing of the key CEK. If it is not

15, an exit is made through key return rejecting the key depression. If the overflow flag is ZERO, first a ZERO is set into flag R, which cancels the further periodic generation of random numbers until the next play key depression. Then a test is made on the DI flag, and if it is a ONE, it is assumed that a certain set of keys was depressed. Next a test is made on the flag G, standing for game, since these conditions will not be valid if operation is in game mode. A ONE, implying the game is on, causes an exit to KRET. If game G=0, the key code is tested and decoded as being one of the routines involving the four-function calculator operation and the routine is exited to service one of the appropriate keys depending upon the actual number in the modified key code.

Returning to the test of discrete input, if discrete input DI equals ZERO, the next test conducted is a test of the flag CF. If that is ZERO, it implies a potential number entry or decimal point entry. First, a test is made of D3 to determine the status of the game mode. If D3 equals ONE it implies that the game is in the process of playing a hand or a hand has been completed, but still not reset by a play key and the key depression is rejected and the routine is exited to KRET. If D3 equals ZERO, the routine continues. A test is next made on key code for a value of 15. If the value is 15, this represents a clear entry key and that routine is entered next. If key code is not equal to 15, a test is next performed on the key code to determine whether it is a decimal point key. If it is a decimal point key, the game flag G is checked and if the game flag is TRUE, this is considered an invalid entry and the routine exits through K return. If it is a decimal point key, and game G=0, a test is made to determine whether decimal has been entered previously or flag D is set. If flag D is set, the routine will not accept an additional decimal point. Then the routine is exited to K return. If D is ZERO, it is set and the exponent, which is located in the K register in location KE, is set to ZERO implying the clearing of the decimal point counter.

Returning to the test on the decimal point key, if it was not a decimal key that was depressed, this loop is bypassed ending up at routine called N1. At N1, the flag N is examined. If N equals 1, it implies that a number entry is in progress or that the last key depressed was a number entry. The routine proceeds to N2 at that point and a test is made on register K address 7. If it does not contain a ZERO, it implies that there is no room for an additional number entry and the routine proceeds to N6 setting the overflow flag and exits through K return. At the decision point, N2, if the K7 register is ZERO, the routine is then prepared to process the number entry through routine N3.

Returning now to the beginning of N1, if the number flag is ZERO, implying the last entry was not a number, then a ONE is inserted into the N flag and the K register is zeroed in preparation for entry of the first number. At N3, the D flag is tested and if the D flag is set, it implies that a decimal has been entered previously into the number system. A test is then made on the key code to determine whether it is a decimal key depression. If it is, no entry will be allowed and the routine exits through K return. If it is not a decimal key, it is a number key and the exponent of the number located in position KE is examined. If it is greater than 7, this implies an overflow condition and the routine exits through N6 setting the overflow flag. If KE is not greater than 7, a one is added to that value and routine N5 is entered and shifts

the loaded key code, representing a number, into the K register.

Returning to the top of FIG. 26a, the test on flag CF is made and if it is a ONE, routine proceeds to routine KON4. (see FIG. 26b) A further test is conducted on the game flag and if it is ZERO, the routine exits through K return. If the flag is ONE, one of the game keys is involved and these are decoded depending upon the actual value of the existing key code. The appropriate subroutine for servicing the various keys are called upon depending upon the key code value.

#### CALCULATOR ROUTINES (See FIGS. 27, 28 and 29)

Since four-function calculator routines are generally well known, this will be a general discussion of four-function calculator functions included in the programming.

PMK stands for plus-or-minus key. Generally, this routine services the two keys mentioned, the plus and minus keys, and is capable of handling constants as required in normal four-function operation. The PMK routine contains the proper right justify and sign controls to generate the required four-function operations. Another calculator routine is the MDK routine, which handles multiply and divide functions. MDK includes the appropriate constant handling routines, the multiply and divide subroutines, and appropriate right justify routines, to permit operation in the normal four-function calculator mode. The third routine involving the four-function operation is the EQUAL routine, which is equipped to deal with constant operation in all modes. As in the plus-or-minus and multiply-divide routines, EQUAL contains the required justify routines and the constant handling routines to permit normal four-function operation. FIGS. 27-29 are flow chart illustrations of the above mentioned calculator routines.

#### SUMMARY

It should now be understood that the invention described herein is an electronic card game simulation apparatus primarily for portable hand-held use by a player. A preferred embodiment has been described in which a Las Vegas style blackjack game is combined with a four-function calculator, although other card games and other functional combinations including card games, are intended to be within the scope of the appended claims.

Many details of a type which would be obvious to one skilled in the art have been omitted. For example, detailed aspects regarding timing have been omitted to prevent obfuscation of the more pertinent aspects of the invention. However, such timing aspects, as well as other more commonly occurring considerations, are well known in the art.

Having thus described a preferred embodiment of the invention, what is claimed is:

1. A hand-held portable electronics card game simulation apparatus comprising:

- a hand-held housing constructed and arranged to include;
- a keyboard having keys for entering player selection options, such as, whether to accept a card, whether to place a bet, and what exact amount to bet;
- a display responsive to said keyboard for indicating the cards dealt in accordance with the rules of a card game, for indicating the options selected with said keys, and for indicating the betting status in



accordance with the amount bet and the outcome of the games played;  
 said display comprising:  
 means for displaying at least two distinguishable sets of alphanumeric symbols, one such set indicating only the card values held by a dealer and another such set indicating only the card values held by a player;  
 means operably connected to said keyboard and to said display for simulating the dealing of cards, for ascertaining the outcome of each hand, for calculating the betting status of the player, and for control of a card game in accordance with the rules of play.

2. An electronic card game simulation apparatus as defined in claim 1, said operably connected means further comprising:  
 means for delaying the display of each card added to the respective hands of the player and dealer whereby a more realistic rate of card dealing is provided.

3. An electronic card game simulation apparatus as defined in claim 2, said operably connected means further comprising:  
 means for storing a manifestation of a card being dealt, means to avoid re-dealing a previously dealt card, from a standard deck of 52 cards, and means to automatically re-shuffle the cards prior to the deal of a new hand when a prescribed number of cards approaching 52 likely to leave an insufficient number of cards to play a further hand have been dealt since the immediately previous shuffle.

4. An electronic card game simulation apparatus as defined in claim 3 further comprising:  
 means for signaling the player that a bet is to be entered and for displaying the amount of said bet.

5. The electronic card game apparatus recited in claim 1 wherein said means operably connected to said keyboard and to said display comprises:  
 a single chip monolithic semiconductor chip means having memory means including an array of memory cells, means for sequentially addressing the memory cells, arithmetic means for receiving data from the memory means and executing arithmetic functions on the data and returning it to the memory means, and means for generating timed signals for sequentially scanning the keys of said keyboard and the digits of said keyboard and the digits of said display to check the keys depressed and to display in accordance therewith.

6. An electronic true blackjack card game for hand-held operation by a player comprising:  
 a hand-held housing constructed and arranged to include;  
 keyboard means having keys for selection of player decision operations including the play of the game and the placement of bets in accordance with the complete rules of blackjack;

display means for simultaneous display of card hands held by a player and a dealer, display of player betting and the current stake; and  
 microprocessor means for controlling the game in accordance with the rules of blackjack and for calculating the betting status of the player in accordance with the outcome of the game and displaying player bet and current stake.

7. An electronic blackjack card game as defined in claim 6, said microprocessor means further comprising:  
 means for generating and storing random numbers, each such random number representing a unique card in a single full playing card deck;  
 means for storing a manifestation of a card being dealt;  
 means to avoid re-dealing a previously dealt hand;  
 means to automatically re-shuffle said cards prior to the deal of a new hand when less than a prescribed number of cards have been dealt since the initial shuffle of the deck;  
 means for signaling the player that a bet is to be entered; and for displaying the bet;  
 means for storing manifestations of the cards dealt to the player and to the dealer;  
 means for adding the card values of the respective hands to determine the total hand value;  
 means for adding the card value of each additional card, to the hand value; and  
 means for comparing each said hand value against the other and against a bust value for terminating the hand and determining the outcome of the hand in accordance with the rules of blackjack.

8. An electronic card game simulation apparatus comprising:  
 means for entering player selections in accordance with rules of the game;  
 means for storing a player's stake and for adding to and subtracting from said stake in accordance with the outcome of each hand;  
 means for shuffling and dealing cards in a random sequence and advising a player of the occurrence of shuffling;  
 means for dealing an additional card in accordance with said player selections;  
 means for manifesting the status of each hand as the game progresses; and  
 means for ascertaining the outcome of each hand; and a multi-function calculator apparatus having an alpha-numeric display and means for selectively activating and deactivating said card game simulation apparatus and said calculator apparatus as alternative operating modes.

9. An electronic card game simulation apparatus as defined in claim 8 further comprising:  
 means for generating and storing random numbers, each such random number representing a unique card in a standard playing card deck of 52 cards.

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