Problem Solutions to Problems Marked With a * in

Logic Computer Design Fundamentals, Ed. 2

CHAPTER 9

9-2.

a)
```
LD    R1, A
LD    R2, B
LD    R3, C
LD    R4, D
ADD   R3, R1, R3
ADD   R1, R1, R2
MUL   R2, R2, R4
MUL   R1, R3, R1
SUB   R1, R1, R2
ST    Y, R1
```

b)
```
MOV   T1, A
ADD   T1, C
MOV   T2, B
MUL   T2, D
MOV   T3, A
ADD   T3, B
MUL   T3, T1
SUB   T3, T2
MOV   Y, T3
```

c)
```
LD    A
ADD   C
ST    T1
LD    B
MUL   D
ST    T2
LD    A
ADD   B
MUL   T1
SUB   T2
ST    Y
```

9-3.

A) $(A + B) \times (A + C) - (B \times D) = AB + CA + \times BD \times -$

B,C)

PUSH A	PUSH B	ADD	PUSH A	PUSH C	ADD
A	B	A+B	A	C	A+C
	A		A+B	A	A+B
				A+B	

MUL	PUSH B	PUSH D	MUL	SUB
(A+B)x(A+C)	B	D	BxD	(A+B)x(A+C) - BxD
	(A+B)x(A+C)	B	(A+B)x(A+C)	
		(A+B)x(A+C)		

9-6.

a) X = 200 – 208 – 1 = –9 b) X = 1111 1111 1111 0111

9-9.

address field = 0

9-11.

a) 3 Register Fields x 5 bits/Field = 15 bits. 32 bits - 15 bits = 17 bit. 2^{17} = 131,072

b) 256 = 8 bits. 2 Register Fields x 5 bits/Field = 10 bits. 32 bits - 8 bits - 10 bits = 14 Memory Bits

9-13.

Read and Write of the FIFO work in the following manner:

Write: $M[WC] \leftarrow DATA$
$ASC \leftarrow ASC + 1$
$WC \leftarrow WC + 1$

Read: $DST \leftarrow M[RC]$
$ASC \leftarrow ASC - 1$
$RC \leftarrow RC + 1$

	WC	RC	ASC
WR	1	0	1
WR	2	0	2
RD	2	1	1
RD	2	2	0

9-17.

a)
ADD R0, R4
ADC R1, R5
ADC R2, R6
ADC R3, R7

b)
$R0 \leftarrow 8C + 5C$, R0 = E8, C = 0
$R1 \leftarrow 35 + FE + 0$, R1 = 33, C = 1
$R2 \leftarrow D7 + 68 + 1$, R2 = 40, C = 1
$R3 \leftarrow 2B + 11 + 1$, R3 = 3D, C = 0

9-20.

OPP	Result Register	C
SHR	0101 1101	1
SHL	1011 1010	1
SHRA	1101 1101	1
SHLA	1011 1010	1
ROR	0101 1101	1
ROL	1011 1010	1
RORC	1101 1101	0
ROLC	1011 1010	1

9-22.

$$\text{Smallest Number} = 0.5 \times 2^{-255}$$
$$\text{Largest Number} = (1 - 2^{-26}) \times 2^{+255}$$

9-24.

E	e	$(e)_2$
+8	15	1111
+7	14	1110
+6	13	1101
+5	12	1100
+4	11	1011
+3	10	1010
+2	9	1001
+1	8	1000
0	7	0111
–1	6	0110
–2	5	0101
–3	4	0100
–4	3	0011
–5	2	0010
–6	1	0001
–7	0	0000

9-27.

```
TEST  R, (0001)16      (AND Immediate 1 with Register R)
BNZ   ADRS             (Branch to ADRS if Z = 0)
```

9-29.

```
a)      A =    0011 0101      53
        B =    0011 0100    - 52
    A – B =    0000 0001       1
```

b) C (borrow) = 0, Z = 0

c) BH, BHE, BNE

9-31.

	PC	SP	TOS
a) Initially	2000	2735	3250
b) After Call	2147	2734	2002
c) After Return	2002	2735	3250

9-34.

External Interrupts:
1) Hard Disk
2) Mouse
3) Keyboard
4) Modem
5) Printer

Internal Interrupts:
1) Overflow
2) Divide by zero
3) Invalid opcode
4) Memory stack overflow
5) Protection violation

A software interrupt provides a way to call the interrupt routines normally associated with external or internal interrupts by inserting an instruction into the code. Privileged system calls for example must be executed through interrupts in order to switch from user to system mode. Procedure calls do not allow this change.