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SECTION: 11 __/__/____
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HOMEWORK 6

P1. a. NOT POSSIBLE

b. 11110011_2

c. 10001100

d. 10001101

P2.

```
 101011
+010111
1000010
```

NO OVERFLOW

```
 011101
+010110
 110011
```

OVERFLOW

```
 110001
+110111
1~~0~~01000
```

NO OVERFLOW

```
 101000
-111010
```

101000 → 010111

```
 010111
+     1
 011000
```

```
 011000
+111010
1 010010
```

= NO OVERFLOW

101001
-110101

010110
+ 1
010111

01 0111
+110101
1001100

NO OVERFLOW

110010
-011100

001101
+ 1
001110

000110
+011100
0101010

OVERFLOW

P3. a) -98 = 1 10000101 $\underbrace{10001000\ldots0}_{23 \text{ bits}}$

b) 15.25 = 0 10000010 $\underbrace{11101000\ldots0}_{23 \text{ bits}}$

c) 29 = 0 10000011 $\underbrace{110100\ldots0}_{23 \text{ bits}}$

d) 86.0625 = 0 10000101 $\underbrace{0101100001 00\ldots0}_{23 \text{ bits}}$

e) $-120 = 1\,10000101\,\underbrace{11100\ldots0}_{23\text{ bits}}$

P4. a) $1|10000101|11111000000000000000000_2$

$128+4+1=133$

$(-1)^1 \times 2^{133-127} \times (1 + 2^{-1} + 2^{-2} + 2^{-3} + \ldots 2^{-6})$

$= -127$

b) $0|10000101|10001000100000000000000_2$

$128+4+1=133$

$(-1)^0 \times 2^{133-127} \times (1 + 2^{-1} + 2^{-5} + 2^{-9})$

$= 98.125$

c) $41800000_{16} = 16_{10}$

$2^{131-127} = 2^4 = 16$

d) $C2C44000_{16} = -98.125_{10}$

e) $C2814000_{16} = -64.625_{10}$

P5. a) $10011_2 \cdot 01001_2$

~~10011~~
~~× 01001~~
~~010011~~
~~+ 00000~~
~~001001~~
~~+ 00000~~
~~00100~~

10011
× 01001
11110011
+ 100000
1011001
+ 100000
1001100
+ 110011
1011001
000000
10111001011

b) $01010_2 \cdot 01110_2$

01010
× 01110
0000000
+ 001010
0001010
+ 0010100
0001111
+ 001010
0010001
+ 000000
00100011100

c. $-7_{10} \times 4$

$= 1001_2 \times 4$

$= 100100$

d. 16×32

$= 010000_2 \times 2^5$

$= 01000000000$

P6. $F(a, b, c, d) = \Sigma m(0, 1, 2, 5, 6, 10, 13, 14)$

a.

cd \ ab	00	01	11	10
00	1			
01	1	1	1	
11				
10	1	1	1	1

$= c\bar{d} + \bar{a}\bar{b}\bar{c} + b\bar{c}d$

$F = c\bar{d} + \bar{a}\bar{b}\bar{c} + b\bar{c}d$

Taking c as select

Using Shannons : $\bar{c}(\bar{a}\bar{b} + bd) + c(\bar{d})$

$\Rightarrow \bar{c}(b(d) + \bar{b}(\bar{a})) + c(\bar{d})$

Applying Shannons Theorem Again

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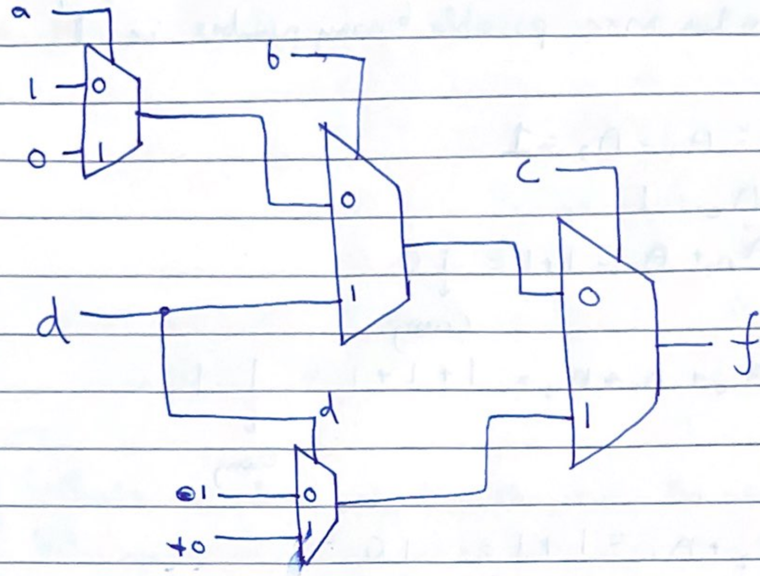
a
1
0
b
c
d
f
d

_/_/___

$$0\,(C_{in}=0)$$

P7 a. Adder P ⇒

$$\begin{array}{cccccccc} & 0 & 1 & 0 & 0 & A_2 & A_1 & A_0 \\ & 0 & 0 & 0 & A_2 & A_1 & A_0 & 0 \\ \hline & 0 & 1 & 0 & A_2 & A_2+A_1 & A_1+A_0 & A_0 \\ & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ W=0 \leftarrow C_{out} & P_6 & P_5 & P_4 & P_3 & P_2 & P_1 & P_0 \end{array}$$

$x = 0$ ↩

Whatever values of A_2, A_1, A_0, the carry out bit $C_{out} = W = 0$ & MSB bit, $P_6 = X = 0$

$\therefore W = 0$ & $X = 0$

b. 7-bit output of Adder 'P' in terms of 'A' is:

$$\begin{array}{ccccccc} P_6 & P_5 & P_4 & P_3 & P_2 & P_1 & P_0 \\ 0 & 1 & 0 & A_2 & A_2+A_1 & A_1+A_0 & A_0 \end{array}$$

c. V = left 7-bit input of Adder 'Q'

$$\begin{array}{cccccccc} V_6 & V_5 & V_4 & V_3 & V_2 & V_1 & V_0 & \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \\ 1 & 0 & A_2 & A_2+A_1 & A_1+A_0 & A_0 & 0 & \\ 1 & 0 & 0 & 0 & A_2 & A_1 & A_0 & C_{in}=0 \end{array}$$

d. Other input to adder Q

$$\begin{array}{cccccccc} 1 & 0 & 0 & A_2 & A_2+A_1 & A_1+A_0+A_2 & A_0+A_1 & A_0 \\ \hline & F_5 & F_4 & F_3 & F_2 & F_1 & F_0 & Y\ Z \end{array}$$

$1 = C_{out}$ ↩

For 1 Bit binary number it can be '0' or '1'

e. Consider max. possible binary number i.e. '1'

$A_0 = A_1 = A_2 = 1$

$Z = A_0 = 1$

$Y = A_0 + A_1 = 1+1 = \underset{\text{Carry}}{1}0$

$F_0 = A_0 + A_1 + A_2 = 1+1+1 = \underset{\text{Carry}}{1}1$

$F_1 = A_2 + A_1 = 1+1 = \underset{\text{Carry}}{1}0$

$F_2 = A_2 = 1$

$F_3 = 0$

$F_4 = 0$

$F_5 = 1$

$\Rightarrow$

F_5	F_4	F_3	F_2	F_1	F_0	Y	Z
1	0	0	1	1+1	1+1+1	1+1	1
		1	10	10	1		
1	0	0	1	1	1	1	1
				1	1	1	
					1		
1	0	1	1	0	0	0	1
F_5	F_4	F_3	F_2	F_1	F_0		

$\Rightarrow (101100)_2 = 44_{10}$

Hence, Proved