Beginner Assignment

Part A

Q1. 255.375 (base 10)

a) into binary

2	255	
2	127	R 1
2	63	R 1
2	31	R 1
2	15	R 1
2	7	R 1
2	3	R 1
2	1	R 1
2	0	R 1

⇒ 11111111 (bottom to top)

decimal part

0.375 × 2 → 0.750 ⇒ 0

0.750 × 2 → 1.500 ⇒ 1 ⇒ 011 (top to bottom)

0.500 × 2 → 1 ⇒ 1

⇒ 11111111.011 (base 2)

b) octal

8	255	
8	31	R 7
8	3	R 7
8	0	R 3

→ 773

0.375 × 8 → 3.0

⇒ 773.3 (base 8)

0, ... 10 (A), ... 15 (F)

c) hexa

16	255	
16	15	R 15
16	0	R 15

$\Rightarrow$ FF

$0.375 \times 16 \rightarrow 6.0$

$\Rightarrow \boxed{FF.6}$ (base 16)

Q2. 110101.101 (binary)

↳ to decimal ?

↳ $2^0 \times 1 + 2^1 \times 0 + 2^2 \times 1 + 2^3 \times 0 + 2^4 \times 1 + 2^5 \times 1$

$\Rightarrow 1 + 0 + 4 + 0 + 16 + 32$

$\Rightarrow 53$

↳ dec. part = .101

$2 \times 2 = 1.25$ ← 0.25 ×2 ← 0.5 ×2

$z = \frac{1.25}{2}$

$= 0.625$

$\Rightarrow \boxed{53.625}$

Q3. if diff. b/w non-zero odd & non-zero even bits is ÷ by 3 $\Rightarrow$ no. div. by 3

$\rightarrow$ for 100111, non-0 odd = 2, non-0 even = 2

diff = 2 − 2 = 0 $\Rightarrow$ div. by 3

Q4. −23 using 2's complement

23 in binary:

2 23	
2 11	R 1
2 5	R 1
2 2	R 1
2 1	R 0
2 0	R 1

$\Rightarrow$ 10111

↓ for 8-bit

00010111

↳ flip 0's & 1's & add 1

$\Rightarrow$ 11101000

$\Rightarrow$ 11101001

$\Rightarrow -23 : \boxed{11101001}$

Q5. $F = (A+B)(A'+C)(B+C')$

↳ multiplying 1st 2 terms,

$(A+B)(A'+C) = AA' + AC + BA' + BC$

now, $\boxed{AA' = 0}$ (and oper^n on A & not A = 0)

so, we get $AC + BC + BA'$

multiplying this with 3rd term,

$(AC + BC + BA')(B+C')$

$\Rightarrow ABC + BBC + BBA' + ACC' + BCC' + BA'C'$

now, $BB = B$ (and oper^n on same object)

& $CC' = 0$ (as shown earlier)

$\Rightarrow ABC + BC + BA' + 0 + 0 + BA'C'$

$\Rightarrow BC(A+1) + BA'(1+C')$

↳ in boolean algebra, $\boxed{(1+\alpha) = 1}$

$\Rightarrow BC + BA'$

$\therefore \boxed{F = BA' + BC = B(A'+C)}$

Karnaugh map

Q6. minimise $F(A,B,C) = \Sigma m(1,3,5,7)$

↳ m stands for minterm, so,
$F(A,B,C) = m_1 + m_3 + m_5 + m_7$

for 3 variables, total $2^3 = 8$ minterms
$(m0, m1 \ldots m7)$

notation	binary	minterm
m1	001	$A'B'C$
m3	011	$A'BC$
m5	101	$AB'C$
m7	111	ABC

↳ it can be seen that in all these 4 minterms, (C) is constant

$\therefore F = A'B'C + A'BC + AB'C + ABC$
$= (A+A')B'C + (A+A')BC$
$= B'C + BC$ $\quad (A+A' = 1$ & $B+B' = 1)$
$= (B+B')C$
$= C$

$\Rightarrow \boxed{F(A,B,C) = C}$