Q1) a) Binary → $255 = 2^8 - 1$ $\Rightarrow (255)_{10} = (11111111)_2$

For fractional part, multiplying decimal part by 2 repeatedly,

$0.375 \times 2 = 0.75 \Rightarrow$ Int. part 0

$0.75 \times 2 = 1.5 \Rightarrow$ ——— 1

$0.5 \times 2 = 1.0 \Rightarrow$ ——— 1

Ans. $(255.375)_{10} = (11111111.011)_2$

b) Octal → $\underline{011}\ \underline{111}\ \underline{111}$ → Base 2 ← $\underline{011}$

$\downarrow\ \downarrow\ \downarrow$ $\downarrow$

3 7 7 → Base 8 ← 3

$(255.375)_{10} = (377.3)_8$

c) Hexadecimal → $\underline{1111}\ \underline{1111}$ ← Base 2 → $\underline{0110}$

$\downarrow\ \downarrow$ $\downarrow$

F F ← Base 16 → 6

$(255.375)_{10} = (FF.6)_{16}$

Q2)

2^5	2^4	2^3	2^2	2^1	2^0		2^{-1}	2^{-2}	2^{-3}
1	1	0	1	0	1	.	1	0	1

Value $= 1\times 2^5 + 1\times 2^4 + \text{- - - -}\ 1\times 2^{-3} = 53.625$

Q3) Alternate sum of bits $= -1+0-0+1-1+1 = 0$

Since $0 \equiv 0 \pmod 3$, $(100111)_2$ is div. by 3.

Explanation: Let a binary no. be

$d_3(2^3) + d_2(2^2) + d_1(2^1) + d_0(2^0)$

Now,

$d_3(2^3) + d_2(2^2) + d_1(2^1) + d_0(2^0) \equiv -d_3+d_2-d_1+d_0 \pmod 3$

So, value $\equiv -d_3+d_2-d_1+d_0 \pmod 3$

Q4) $(-23)_{10}$ in 2's complement.

S1: $(23)_{10} = 16+4+2+1 = (00010111)_2$

S2: 1's complement → $(11101000)_2$

S3: $11101000 + 1 = \underline{\underline{11101001}}$

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

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

$= (AC + A'B + BC)(B+C')$ $[AA' = 0]$

$= (ABC + ACC' + A'BB + A'BC' + BBC + BCC')$

$= (ABC + A'B + A'BC' + BC)$ $[ACC' = BCC' = 0, BBC = BC]$

$= B(AC + A' + A'C' + C)$

$= B(A'(1+C') + C(A+1))$

$= B(A'+C)$

$F = A'B + BC$

Q6) $F(ABC) = \Sigma m(1,3,5,7)$

C \ AB	00	01	11	10
0	0	0	0	0
1	1	1	1	1

⇒ K-map

Analysing, bottom row of 1's,
Independent of A & B, same as C.

∴ $\underline{\underline{F = C}}$