Q1] $F = (P+Q+R)(\bar{P}+Q)(\bar{Q}+R)$

Taking complement of above expr

$\bar{F} = (P+Q+R)(\bar{P}+Q)(\bar{Q}+R)$

Applying De-Morgan's law:

$\bar{F} = \overline{(P+Q+R)} + \overline{(\bar{P}+Q)} + \overline{(\bar{Q}+R)}$

$\bar{F} = \bar{P}\bar{Q}\bar{R} + P\bar{Q} + Q\bar{R}$ → option D

$\bar{F} = \bar{Q}(\bar{P}\bar{R}+P) + Q\bar{R}$

$= \bar{Q}[(\bar{P}+P)(P+\bar{R})] + Q\bar{R}$

$= \bar{Q}[P+\bar{R}] + Q\bar{R}$

$= P\bar{Q} + \bar{Q}\bar{R} + Q\bar{R}$

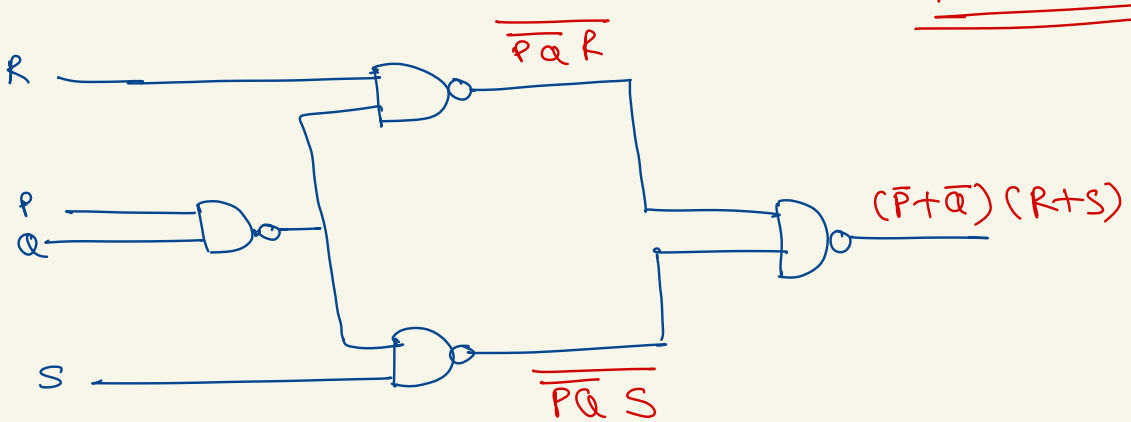
$= P\bar{Q} + (\bar{Q}+Q)\bar{R}$

$= P\bar{Q} + \bar{R}$ —— option B

$= (P+\bar{R})(\bar{Q}+\bar{R})$ —— option C

Q2] $(\bar{P}+\bar{Q})(R+S)$

ANS = 4



Q3] A) ⇒ $\overline{X \oplus Y} = \overline{X\bar{Y}+\bar{X}Y} = (\overline{X\bar{Y}})(\overline{\bar{X}Y}) = XY + \bar{X}\bar{Y} = X \odot Y$

B) ⇒ $\bar{X} \oplus Y = \bar{X}\bar{Y} + XY = X \odot Y$

C) ⇒ $\bar{X} \oplus \bar{Y} = \bar{X}Y + X\bar{Y} = X \oplus Y$

option D

✗ option D

LHS ⇒ $(X \oplus \bar{X}) \oplus Y$

$= 1 \oplus Y$

$= \bar{Y}$

RHS ⇒ $(X \odot \bar{Y}) \odot \bar{Y}$

$= 0 \odot \bar{Y}$

$= Y$

Q4]

1. Overflow Condition

- Arithmetic operations have a potential to run into a condition known as *overflow*.
- Overflow occurs with respect to the **size of the data type** that must accommodate the result.
- Overflow indicates that the result was *too large* or *too small* to fit in the original data type.
- When two signed 2's complement numbers are added, overflow is detected if:
  1. both operands are positive and the result is negative, or
  2. both operands are negative and the result is positive.
- When two unsigned numbers are added, overflow occurs if
  - there is a **carry out** of the leftmost bit.

$x_7\ (1)$, $y_7\ (1)$, $S_7\ (0)$ → $x_7 y_7 \overline{S_7}$ + $x_7\ (0)$, $y_7\ (0)$, $S_7\ (1)$ → $\overline{x_7}\,\overline{y_7} S_7$

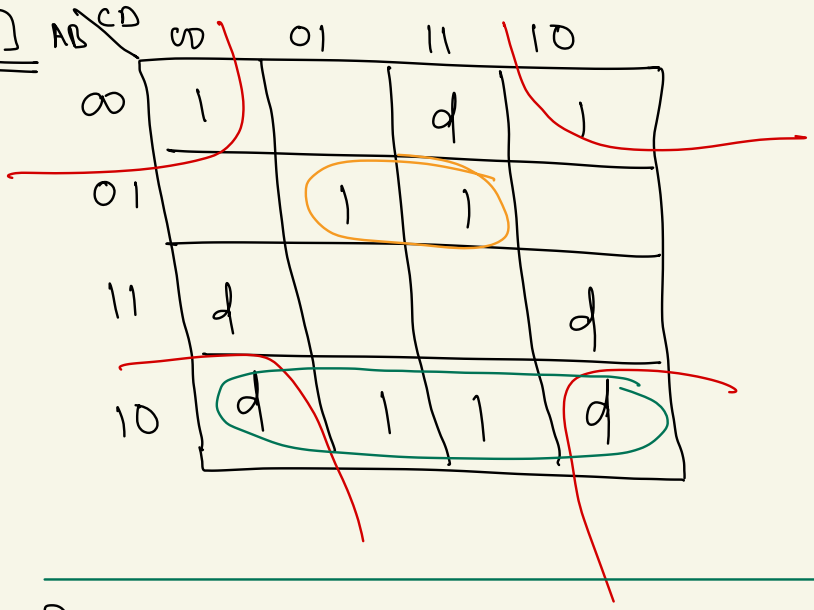
option C is correct

Q5] As per arrangement of MUX, choose BAC, B: MSB, C: LSB

	B	A	C	
x0	0	0	0	1 → Due to A', 1 → Due to A'C'
x1	0	0	1	1 → Due to A'
x2	0	1	0	0
x3	0	1	1	1 → Due to AB'C
x4	1	0	0	1 → Due to A', 1 → Due to A'C'
x5	1	0	1	1 → Due to A'
x6	1	1	0	0
x7	1	1	1	0

x0 x1 x2 x3 x4 x5 x6 x7 = 1 1 0 1 1 1 0 0

Q6]



ANS = 3

Q7) KMAP simplification

$$(C' + A)' = CA'$$

we need only 1 NOR gate as all inputs are given
