Question & Answer based on derivation of SOP and POS Expression

Subject -Computer Science

Class -XII

Q1. A combinational logic circuit with three inputs P, Q, R produces output 1 if and only if an odd number of 0's are inputs.
(i) Draw its truth table.
(ii) Derive a canonical SOP expression for the above truth table.

Ans :-

(i)

P	Q	R	OUTPUT	Min terms
0	0	0	1	P'Q'R'
0	0	1	0	
0	1	0	0	
0	1	1	1	P'QR
1	0	0	0	
1	0	1	1	PQ'R
1	1	0	1	PQR'
1	1	1	0	

(ii)

The **Canonical SOP** expression will be –

P'Q'R' + P'QR + PQ'R + PQR'

Q2. Find the Min term and Max term when:

P = 0, Q=1 , R=1 and S=0

Min term for the given values = **P'. Q . R . S'**

Max term for the given values= **p + Q'+ R' + S'**

Q3. Convert the following boolen expression into its Canonical POS form:

F(A, B, C) = (B + C') .(A' + B)

Ans :-

(B + C') . (A' + B)

=(B + C' + A.A'). (A' + B + C.C')

=(B + C'+ A) (B + C'+A') (A' +B + C)(A'+B+C') [x+yz = (x+y)(x+z) by distributive law]

i.e. (A + B + C') (A' + B +C') (A' + B +C) (A' + B + C')

Q4. A training institute intends to give scholarships to its students as per the criteria given below:

- ❖ The student has excellent academic record but is financially weak.

Or

- ❖ The student doesn't have an excellent academic record and belongs to a backward class.

Or

- ❖ The student doesn't have an excellent academic record and is physically impaired.

The inputs are:

INPUTS

A	Has excellent academic record
F	Financially sound
C	Belongs to backward class
I	Is physically impaired

(in all the above cases 1 indicates yes and 0 indicates no).

Output: X [1 indicates yes, 0 indicates no for all cases]

Draw the truth table for the inputs and outputs given above and write the **SOP** expression for X(A, F,C,I).

Ans:

Truth table for given Function X(A, F, C,I):-

A	F	C	I	X	Min Terms
0	0	0	0	0	
0	0	0	1	1	A'F'C'I
0	0	1	0	1	A'F'CI'
0	0	1	1	1	A'F'CI
0	1	0	0	0	
0	1	0	1	1	A'FC'I
0	1	1	0	1	A'FCI'
0	1	1	1	1	A'FCI
1	0	0	0	1	AF'C'I'
1	0	0	1	1	AF'C'I
1	0	1	0	1	AF'CI'
1	0	1	1	1	AF'CI
1	1	0	0	0	
1	1	0	1	0	
1	1	1	0	0	
1	1	1	1	0	

SOP Expression for X (A, F, C, I) :

A'F'C'I + A'F'CI' + A'F'CI + A'FC'I + A'FCI' + A'FCI +AF'C'I' + AF'C'I +AF'CI' +AF'CI

Q5. A school intends to select candidate for an Inter-School Essay Competition as per the criteria given below:

❖ The student has participated in an earlier competition and is very creative.

Or

❖ The student is very creative and has excellent general awareness, but has not participated in any competition earlier.

Or

❖ The student has excellent general awareness and has won prize in an enter-house competition.

The inputs are:

INPUTS

A	participate in a competition earlier
B	is very creative
C	won prize in an inter-house competition
D	has excellent general awareness

(in all the above cases 1 indicates yes and 0 indicates no).

Output: X [1 indicates yes, 0 indicates no for all cases]

Draw the truth table for the inputs and outputs given above and write the **POS** expression for X(A, B,C,D).

Ans:

Truth table for given input and outputs:-

A	B	C	D	X	MAX TERMS
0	0	0	0	0	A+B+C+D
0	0	0	1	0	A+B+C+D’
0	0	1	0	0	A+B+C’+D
0	0	1	1	1	
0	1	0	0	0	A+B’+C+D
0	1	0	1	1	
0	1	1	0	0	A+B’+C’+D
0	1	1	1	1	
1	0	0	0	0	A’+B+C+D
1	0	0	1	0	A’+B+C+D’
1	0	1	0	0	A’+B+C’+D
1	0	1	1	1	
1	1	0	0	1	
1	1	0	1	1	
1	1	1	0	1	
1	1	1	1	1	

POS Expression for X (A, B, C, D) :

(A+B+C+D) . (A+B+C+D’) . (A+B+C’+D) . (A+B’+C+D) . (A+B’+C’+D) . (A’+B+C+D) . (A’+B+C+D’) . (A’+B+C’+D)