AI1103: Assignment

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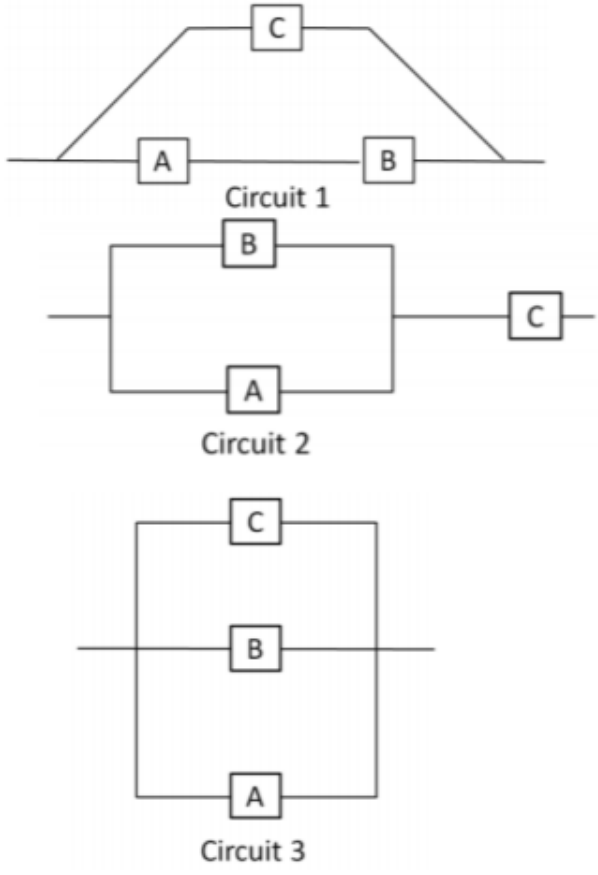
need

PROBLEM CSIR UGC NET EXAM (JUNE 2016), Q.118:

Three types of components are used in electrical circuits 1, 2, 3 as shown below in the figure



Suppose that each of the three components fail with probability p and independently of each other. Let q_i = Pr (Circuit i does not fail); $i = 1, 2, 3$ For $0 < p < 1$, we have

1) $q_3 > q_1$
2) $q_2 = q_1$
3) $q_2 > q_1$
4) $q_2 > q_3$

SOLUTION:

For q_1, the truth table

A	B	C	$(A \wedge B) \vee C$
1	1	0	1
1	1	1	1
0	1	1	1
0	0	1	1
1	0	1	1

TABLE 4: Circuit 1 working

Multiplying and adding probability for each case of $q_1$gives

$$q_1 = p^3 - 2p^2 + 1 \tag{0.0.1}$$

For q_2,

A	B	C	$(A \vee B) \wedge C$
1	1	1	1
1	0	1	1
0	1	1	1

TABLE 4: Circuit 2 working

Multiplying and adding probability for each case of q_2 gives

$$q_2 = p^3 - p^2 - p + 1 \tag{0.0.2}$$

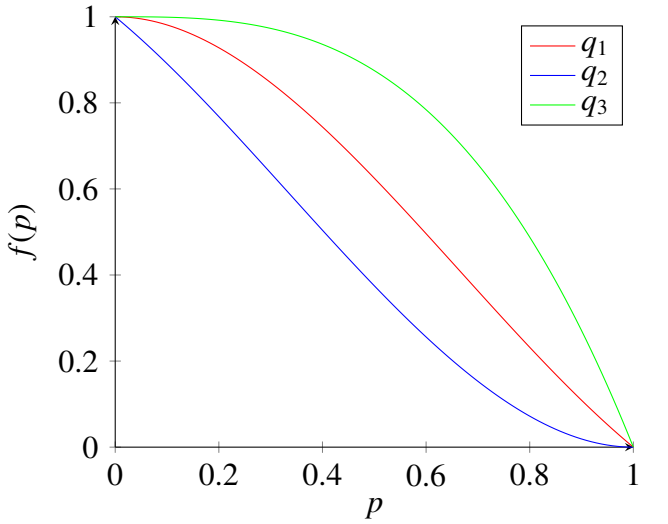
For q_3, the truth table

A	B	C	$A \vee B \vee C$
1	0	0	1
0	1	0	1
0	0	1	1
1	1	0	1
1	0	1	1
0	1	1	1
1	1	1	1

TABLE 4: Circuit 3 working

Multiplying and adding probability for each case of q_3 gives

$$q_3 = 1 - p^3 \tag{0.0.3}$$



$$\therefore q_3 > q_1 > q_2 \tag{0.0.4}$$

Hence **Option 1** is correct