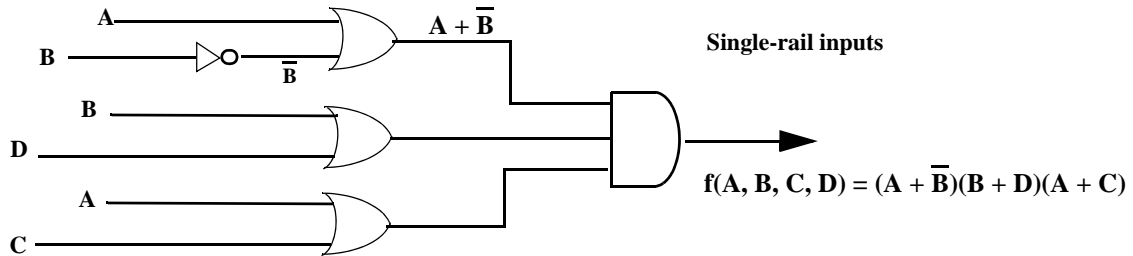


**EXAM I ANSWERS**

1) a) The gate network for the expression in question is as follows :



b) The truth table based on the expression is below. We know that there will be five output columns as there are five gates in the gate network :

	a b c d	$\bar{B}$	$A + \bar{B}$	$B + D$	$A + C$	$f(A, B, C, D)$
0	0000	1	1	0	0	0
1	0001	1	1	1	0	0
2	0010	1	1	0	1	0
3	0011	1	1	1	1	1
4	0100	0	0	1	0	0
5	0101	0	0	1	0	0
6	0110	0	0	1	1	0
7	0111	0	0	1	1	0
8	1000	1	1	0	1	0
9	1001	1	1	1	1	1
10	1010	1	1	0	1	0
11	1011	1	1	1	1	1
12	1100	0	1	1	1	1
13	1101	0	1	1	1	1
14	1110	0	1	1	1	1
15	1111	0	1	1	1	1

Based on the truth table, the maxterm list is as follows :

$$f(A, B, C, D) = \prod M(0, 1, 2, 4, 5, 6, 7, 8, 10)$$

2) a) The algebraic simplification to obtain the minimal SOP expression :

$$\begin{aligned}
 f(a, b, c, d) &= [a + (a d + a)(\bar{a} b + \bar{a})][b + (\bar{b} + \bar{d})] + cd + abcd + \bar{a}bcd + \overline{(b + d)} \\
 &= [a + (a)(\bar{a})][b + (\bar{b} + \bar{d})] + cd + abcd + \bar{a}bcd + \overline{(b + d)} \quad \implies k + km = k \\
 &= [a + (a)(\bar{a})][b + (\bar{b} + \bar{d})] + cd + \overline{(b + d)} \quad \implies k + km = k \\
 &= [a + (a)(\bar{a})][b + (bd)] + cd + \bar{b}\bar{d} \quad \implies (k + m) = \bar{k}\bar{m} \ \& \ \bar{k} = k \\
 &= [a + (a)(\bar{a})][b] + cd + \bar{b}\bar{d} \quad \implies k + km = k \\
 &= ab + cd + \bar{b}\bar{d} \quad \implies k\bar{k} = 0 \ \& \ k + 0 = k
 \end{aligned}$$

