Appendix Solution

Q1. Solution

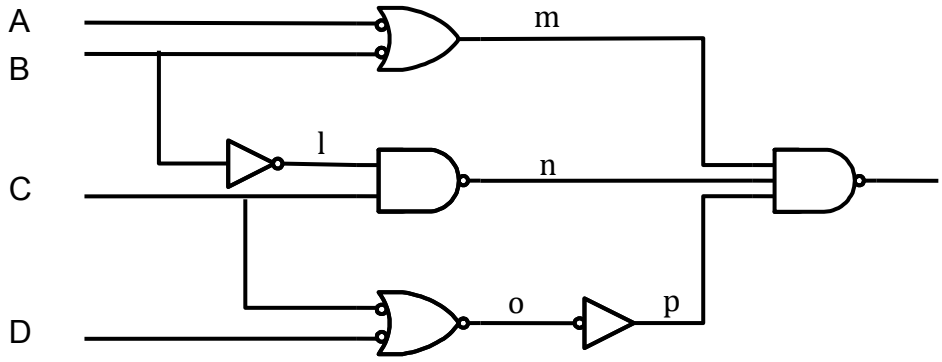
Truth Table

A	*B*	*C*	*D*	*F*
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

$$Z_{SOP} = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + AB\bar{C}\bar{D}$$

$$Z_{POS} = (A + \bar{B} + \bar{C} + \bar{D}).(\bar{A} + B + \bar{C} + D).(\bar{A} + B + \bar{C} + \bar{D}).(\bar{A} + \bar{B} + C + \bar{D}).(\bar{A} + \bar{B} + \bar{C} + D).(\bar{A} + \bar{B} + \bar{C} + \bar{D})$$

Q2. Solution




```
Module Q2 (A,B,C,D,Z);
input A, B, C, D;
output Z;

not (a1, A);
not (b1, B);
and (m, a1,b1);
// above 3 lines can be replaced by   nand (m, A, B);

not (l,B);
nand(n,l,C);

not(c1,C);
not(d1,D);
nor (o,c1,d1);
//above 3 lines can be replaced by and(o,C,D);

not (p,o);
// also can be written as not(o1,o); buf (p,o1);

nand (Z,m,n,o);

endmodule
```

Q3. Solution

$$Z = \overline{A}\,\overline{B}C\overline{D}$$