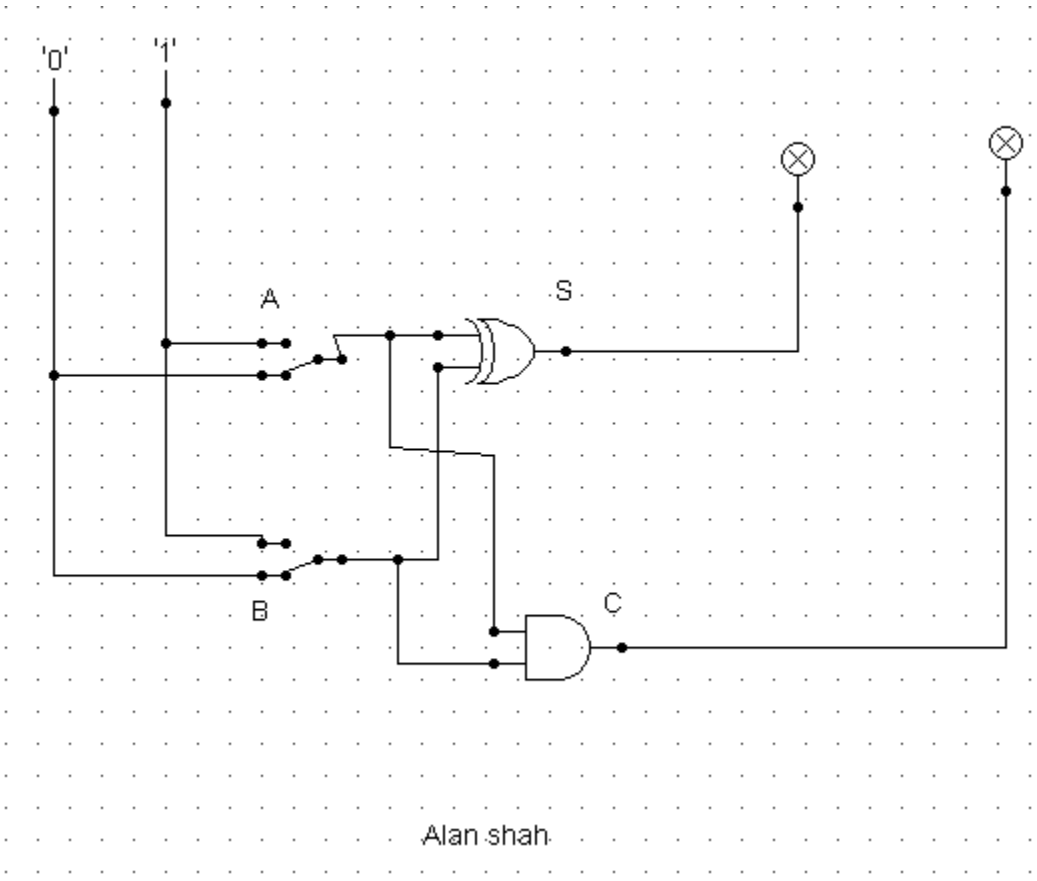
1.

a. Define half adder.
   Ans: A form of combinational logic circuit known as the Half Adder adds two 1-bit binary digits.
b. Draw a truth table for the sum and carry of half adder.

A	B	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

c. Write the sop expression from the truth table.
   Ans: S = x'y + xy', C = xy
d. Draw the circuit using logsim.



2.

a. Draw the truth table for the outputs of the full adder.

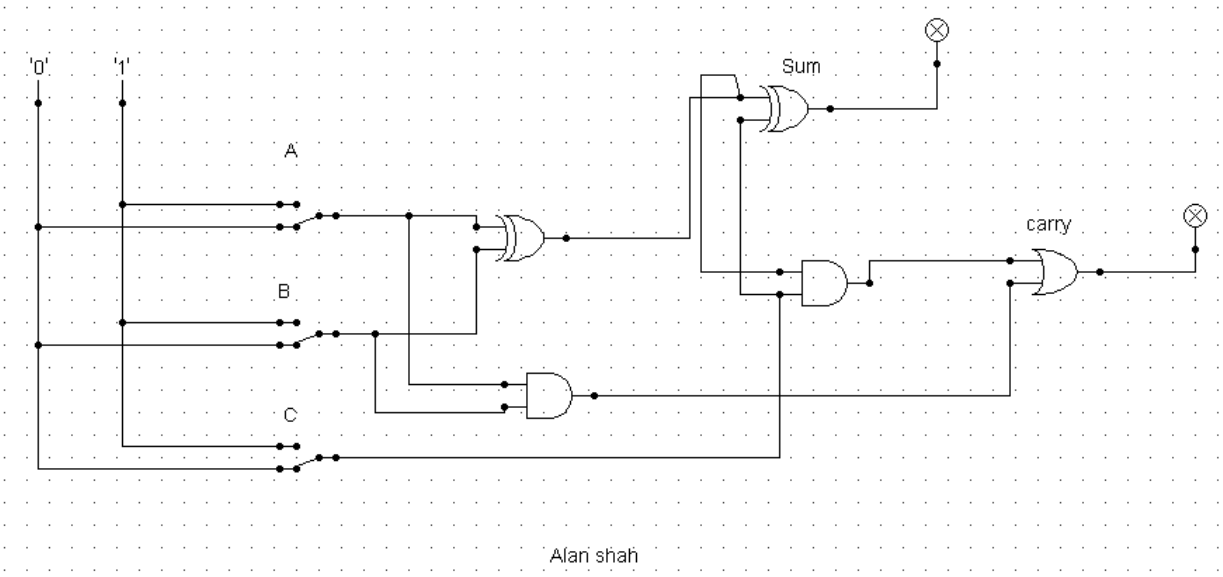
A	B	C-IN	S	C-OUT
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

b. Write the corresponding sop expression for sum and carry of full adder and simplify the expression

Ans: SUM = (A XOR B) XOR Cin = $(A \oplus B) \oplus Cin$

CARRY-OUT = A AND B OR Cin(A XOR B) = $A.B + Cin(A \oplus B)$

c. Draw a full adder using two half adders and an OR gate.



3. Using the three stages of design, construct the circuits for the following input /output values. Here A, B, and C are the inputs whereas D, E, F, G, H

and I are the outputs. *Note: Draw a circuit diagram using logsim corresponding to the simplified expression of outputs D, E, F, G, H, and I.*

A	B	C	D	E	F	G	H	I
0	0	0	1	0	1	0	1	1
0	0	1	1	0	1	1	0	1
0	1	0	1	0	1	1	1	1
1	0	0	1	0	0	1	0	1
1	1	1	1	1	1	1	1	1
1	1	0	1	1	0	1	0	1
1	0	1	1	1	1	1	1	0
0	1	1	0	0	0	1	1	1

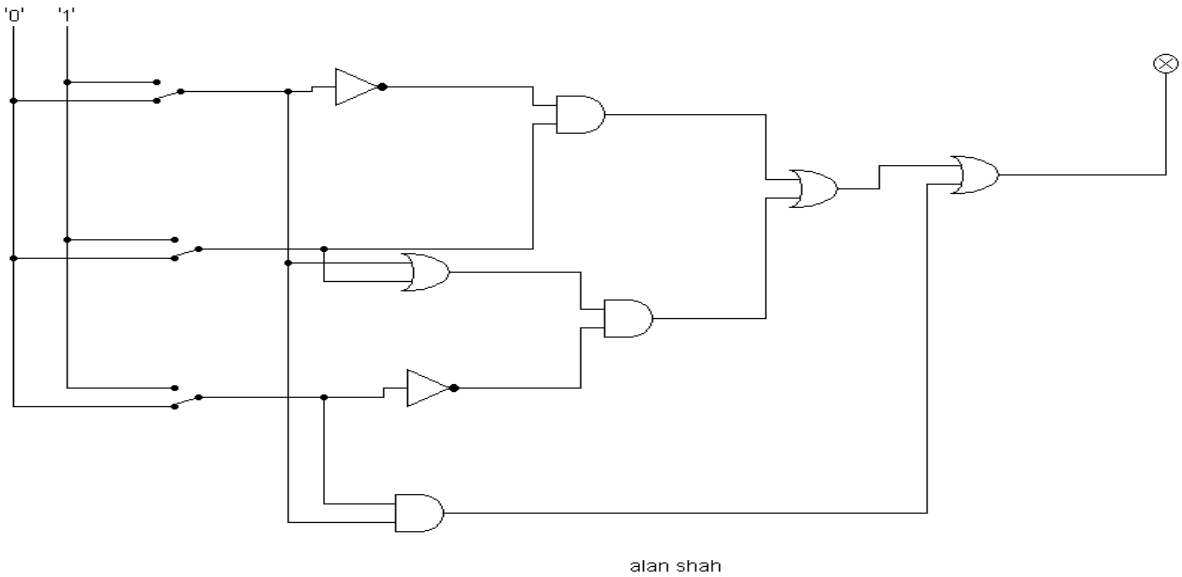
Ans:

D= A'B'C'+A'B'C +A'BC'+AB'C'+ABC+ABC'+AB'C

= A'B'(C'+C) +B(A'C'+AC') +AC(B+B') +AB'C'

=A'B'+BC'(A'+A) +AC+AB'C'

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



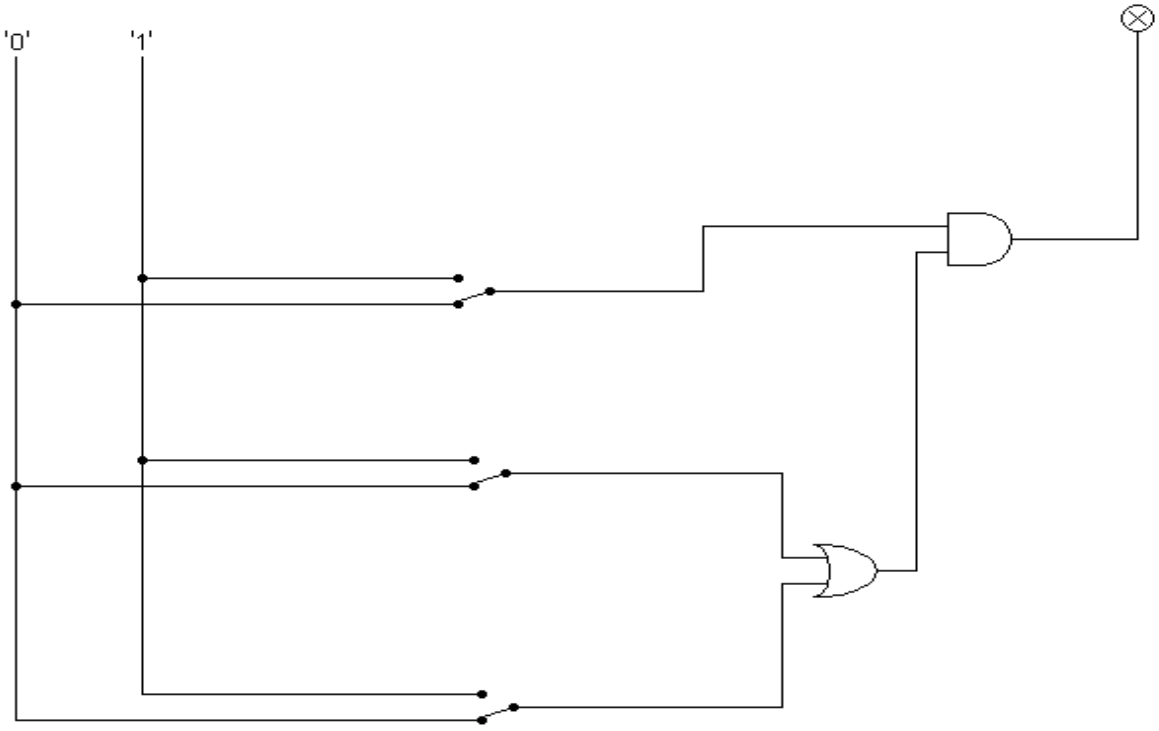
E= ABC+ABC'+AB'C

=AB(C+C') +AB'C

=AB+AB'C

=A(B+B'C)

=A(B+C)



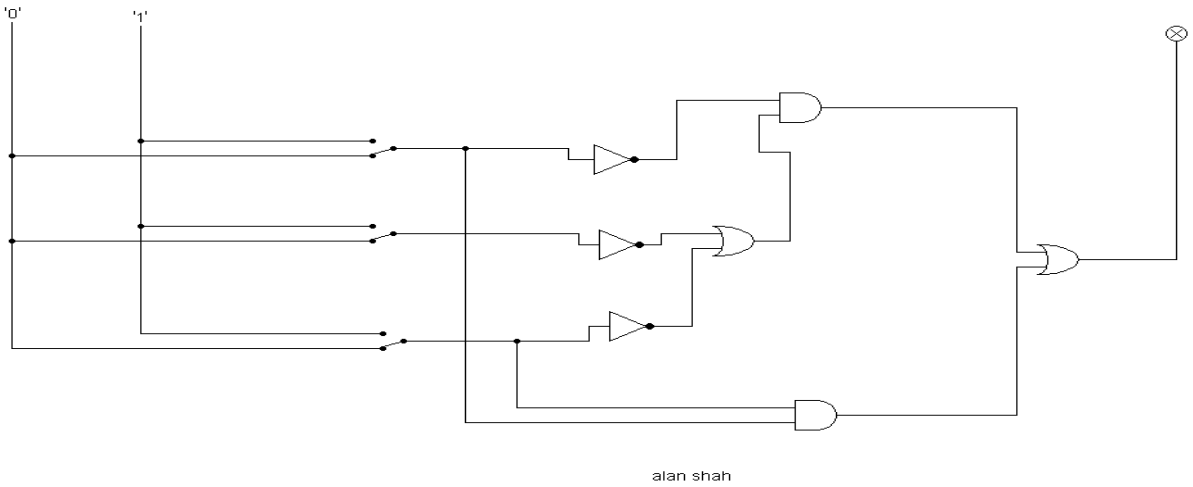
F=A'B'C'+A'B'C+A'BC'+ABC+AB'C

=A'B'(C'+C) +AC(B'+B) +A'BC'

=A'B'+AC+A'BC'

=A'(B'+BC') +AC

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



G=A'B'C+A'BC'+AB'C'+ABC+ABC'+AB'C+A'BC

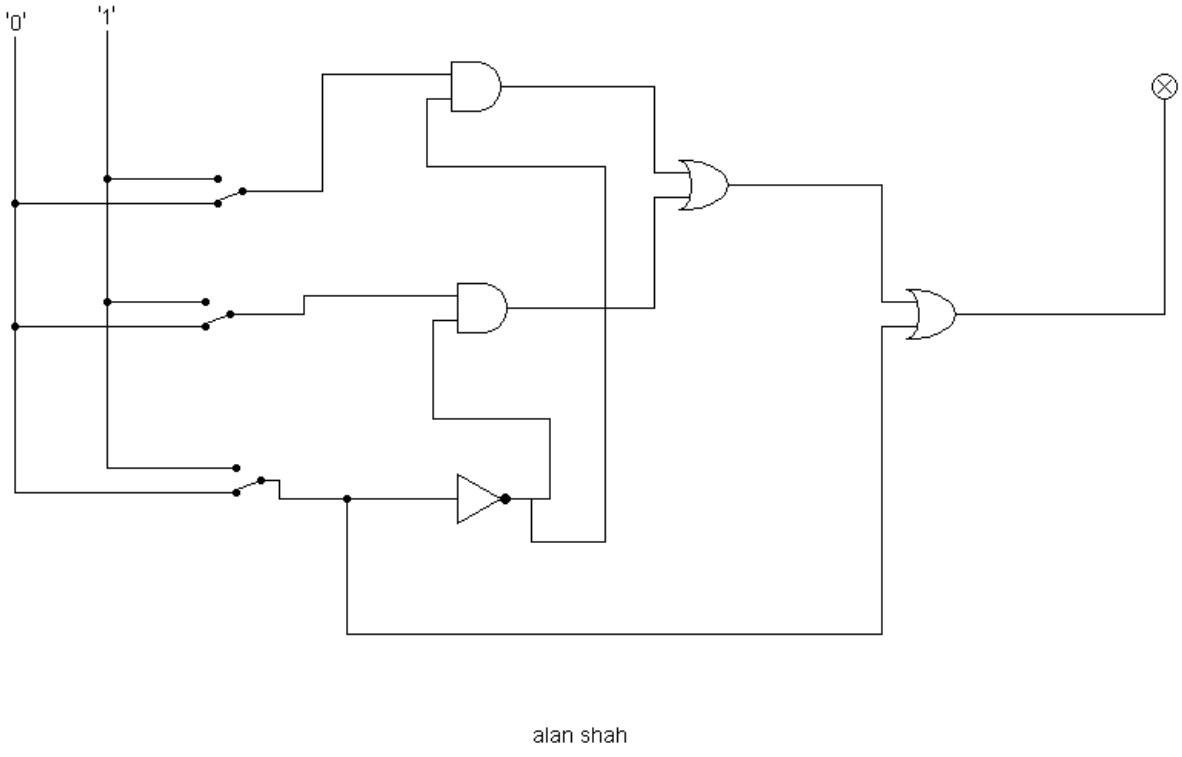
=A'C(B'+B) +BC'(A'+A) +AC(B'+B) +AB'C'

=A'C+BC'+AC+AB'C'

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

=C+C'(B+A)

=C+C'B+AC'



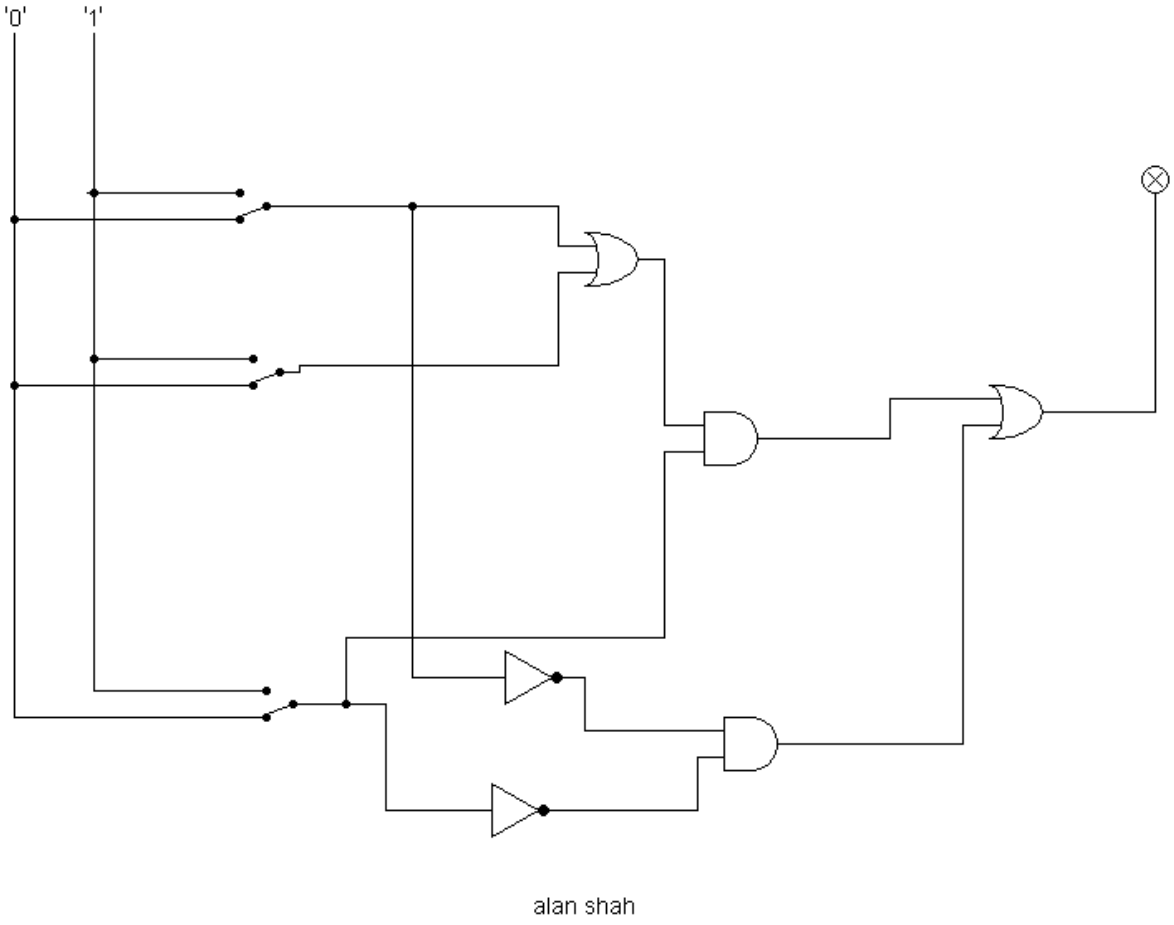
H=A’B’C’+A’BC’+ABC+AB’C+A’BC

=AC(B’+B) +A’C’(B’+B) +A’BC

=AC+A’C’+A’BC

=C(A’B+A) +A’C’

=C(A+B) +A’C’



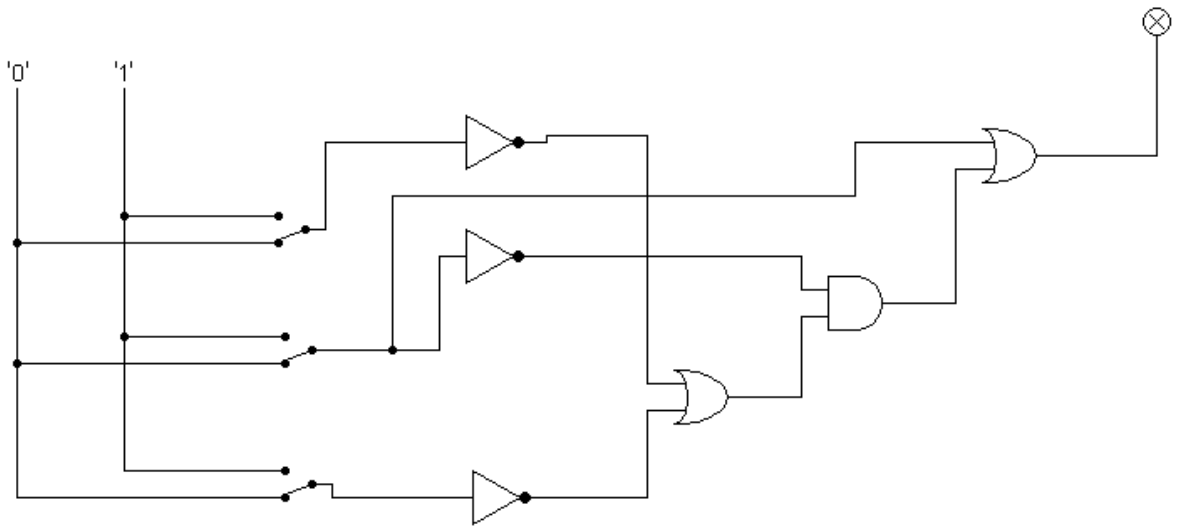
I=A’B’C’+A’B’C+A’BC’+AB’C’+ABC+ABC’+A’BC

=B’C’(A’+A) +AB(C’+C) +A’B(C’+C) +A’B’C

=B’C’+AB+A’B+A’B’C

=B(A+A’) +B’(A’C+C’)

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



alan shah