1. Construct a truth table for each of these compound propositions
   (a) $\sim p \vee q$ (b) $p \wedge q \rightarrow \sim r$
   (c) $p \oplus q \leftrightarrow r$ (d) $\sim(p \wedge \sim q) \rightarrow \sim r$
   (e) $(p \rightarrow \sim r) \wedge (q \rightarrow r)$

2. Using same truth table, show that
   (a) $\sim(p \oplus q) \equiv p \leftrightarrow q$ (d) $(p \rightarrow q) \wedge (p \rightarrow r) \equiv p \rightarrow (q \wedge r)$
   (b) $\sim p \rightarrow (q \rightarrow r) \equiv q \rightarrow (p \vee r)$ (e) $(p \vee q) \wedge (\sim p \vee r) \rightarrow (q \vee r)$ is a tautology
   (c) $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a tautology

3. Let p and q be the propositions
   p : you drive over 65 miles per hour.
   q : you get a speeding ticket.
   Write these propositions using p, q, and logical connectives.
   (a) You do not drive over 65 miles per hour.
   (b) You drive over 65 miles per hour, but you do not get a speeding ticket.
   (c) You will get a speeding ticket if you drive over 65 miles per hour.
   (d) If you do not drive over 65 miles per hour, then you will not get a speeding ticket.
   (e) Driving over 65 miles per hour is sufficient for getting a speeding ticket.
   (f) You get a speeding ticket, but you do not drive over 65 miles per hour.
   (g) Whenever you get a speeding ticket, you are driving over 65 miles per hour.

4. Let p, q and r be the propositions
   p : grizzly bears has been seen in the area.
   q : hiking is safe on the trail.
   r : berries are ripe along the trail.
   Write these propositions using p, q, r and logical connectives.
   (a) Berries are ripe along the trail, but grizzly bears have not been seen in the area.
   (b) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.
   (c) If the berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.
   (d) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.
   (e) Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.

5. Simplify the Boolean functions below by using Algebra laws.
   (a) A. (A' + B) (b) A'B'C + A'BC + AB'
   (c) (A + B). (A' + C). (B + C) (d) [(CD)' + A]' + A + CD + AB
   (e) BC + AC' + AB + BCD (f) $AB'+A(B+C)'+B(B+C)$
   (g) [A. (B'C'+BC)]' (h) C(B + C)(A + B + C)
   (i) ABC + A'B'C + A'BC + A'B'C' + ABC' (j) $\left(A\overline{B}\left(C+BD\right)+\overline{A}\overline{B}\right)C$

6. Given the Boolean function. Obtain the truth table of the function. Find the SOP and POS of each function.
   (a) F = xy' + y'z + xz
   (b) F = x. (y'z' + yz)
   (c) F = xyz + x'yz + x'y'z + x'yz' + x'y'z'
   (d) F = (x' + y). (z' + y)

7. In a singing contest, 3 judges A, B and C can register their votes as '1' or '0' through switches allocated to them. Contestants will be disqualified (X = 0) if two or more judges register '0' votes for them.
   (a) Construct a truth table for the above.
   (b) Obtain a simplified Boolean expression for the outputs 'qualified (X = 1)'.

8. A certain brand of automatic garage door opener utilizes a transmitter control with 3 independent switches, A, B and C, each one set 'on (1)' or 'off (0)'. The garage door will be opened (X = 1) if at least one of the switches are 'on'.
   (a) Construct a truth table for the above information.
   (b) Obtain a Boolean expression for the outputs of 'open the door'.
   (c) Simplify the SOP expression in (b) using K-Map.

9. From the truth table, obtain the minterm expression for X. Use K-map to simplify it.
   (a)

A	B	C	X
1	1	1	1
1	1	0	1
1	0	1	0
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	1
0	0	0	0

   (b)

A	B	C	X
1	1	1	1
1	1	0	1
1	0	1	1
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	0
0	0	0	0

   (c)

A	B	C	X
1	1	1	1
1	1	0	1
1	0	1	0
1	0	0	1
0	1	1	1
0	1	0	1
0	0	1	0
0	0	0	0

   (d)

A	B	C	X
1	1	1	0
1	1	0	0
1	0	1	1
1	0	0	1
0	1	1	1
0	1	0	1
0	0	1	1
0	0	0	1