Oxford College of Engineering and Management
## Assignment - I
Mathematical Foundation of Computer Science
BCA Third Year, Fifth Semester

1. Discuss the various applications of graph theory in computer science with example.
2. "A graph is a bunch of dots and lines where the line connects some pairs of dots", define this statement with degree of graph and types of graph suitable example.
3. What is adjacency matrix? How many paths of length 4 are there from first node to third node in the simple graph represented by the following adjacency matrix?

$$G = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

4. Find the shortest path from V_0 to V_6 in the following graph?
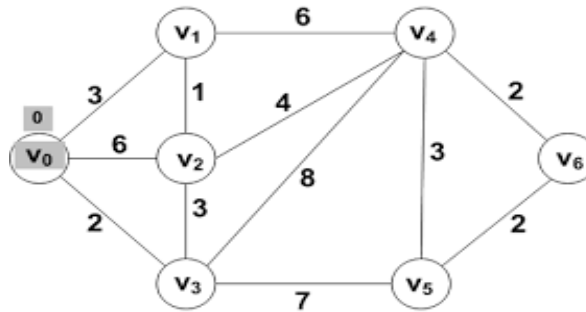
5. Define complete graph, complete bipartite graph, isomorphic graph, planar graph giving example of each.
6. What is strongly connected graph? A connected planar graph has 20 vertices, each of degree 3. How many edges and faces are there?
7. Find the shortest path and its cost from vertices 'a' and 'g' in the following weighted graph (*assume data if any required*).
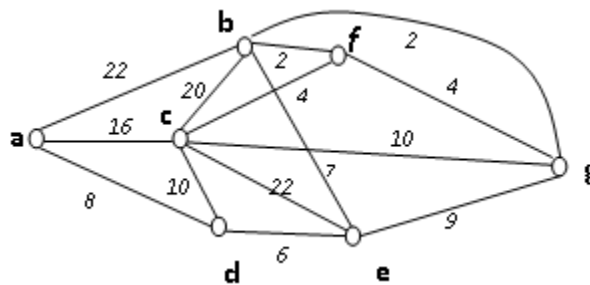
8. Derive the adjacency and incidence matrix representation forms for the following graph.
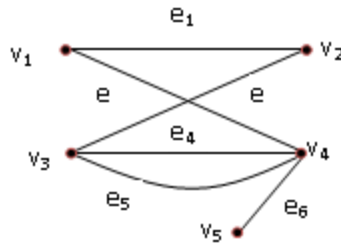
9. Use Dijkstra's algorithm to find the length of a shortest path between the vertices a and z in the weighted graph display in figure:
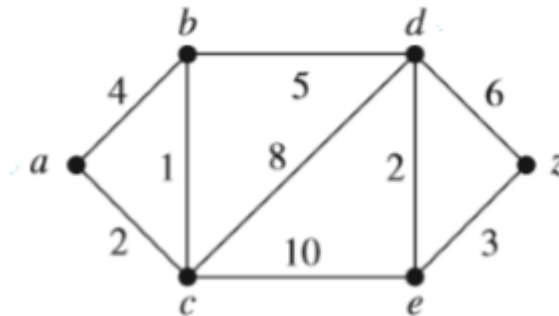
10. Find the contra-positive, converse, inverse and negation of the statement "If it is sunny today, then today is hot."

11. Check the following logical equivalences using truth table
    i. $\neg(p \rightarrow q) \equiv p \wedge \neg q$
    ii. $p \rightarrow q \equiv \neg q \rightarrow \neg p$

12. State the rules of Inference for quantified statements. Give an argument using the rules of inference to determine whether the conclusion follows from the given hypothesis or not.
    To win a gold medal, the athlete must be very fit. If he does not win the gold medal, then either he arrives late for the game or his training was interrupted. If he is not fit for the game, he will blame his coach. If he blames his coach or his training is interrupted, then he will not get into the final. Therefore if he gets into the final, he will not have arrived late.

13. Verity that the following argument is valid by using the rules of inferences:
    If Sanjay does not live in Kathmandu, then he does not speak Newari.
    Sanjay does not drive a Datsun.
    If Sanjay lives in Kathmandu, then he rides a bicycle.
    Either Sanjay speaks Newari, or he drives a Datsun.
    Hence, Sanjay rides a bicycle.

14. Show that $p \leftrightarrow q$ and $(p \rightarrow q) \wedge (q \rightarrow p)$ are logically equivalent.

15. Given an argument using rules of inference to show that the conclusion follows from the hypothesis: "If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on", "If the sailing race is held, then the trophy will be awarded", and "The trophy was not awarded" derive the conclusion "It rained".

Instructions:
- Solve all the questions compulsorily in A4 size paper and make proper binding with cover page.
- Printed and photocopied assignment is not accepted.
- Assignment should be submitted before first term exam.