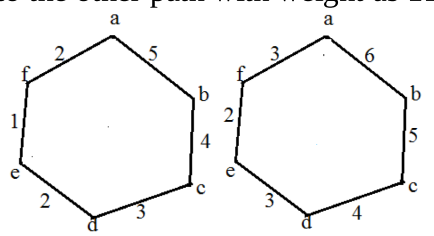
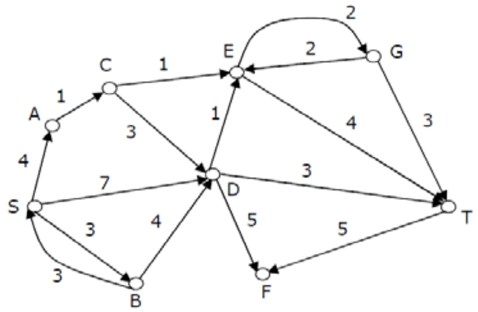
1. **In a weighted graph, assume that the shortest path from a source ‘s’ to a destination ‘t’ is correctly calculated using a shortest path algorithm. Is the following statement true? If we increase weight of every edge by 1, the shortest path always remains same. Justify your answer with proper example.[May 2019- 3 marks]**
   The shortest path may change. The reason is, there may be different number of edges in different paths from s to t. For example, let shortest path between a and c be of weight 8 and has 4 edges. Let there be another path with 2 edges and total weight 9. The weight of the shortest path is increased by 4*1 and becomes 8 + 4=12. Weight of the other path is increased by 2*1 and becomes 9 + 2=11. So the shortest path changes to the other path with weight as 11.



False – 1 Mark, Justification with example – 2 Marks.

2. **.Find the shortest path from s to all other vertices in the following graph using Dijkstra’s Algorithm.[May 2019- 3 marks]**



	A	B	C	D	E	F	G	T
B	4	**3**	∞	7	∞	∞	∞	∞
A	**4**		∞	7	∞	∞	∞	∞
C			**5**	7	∞	∞	∞	∞
E				7	**6**	∞	∞	∞
D				**7**		∞	8	10
G						12	**8**	10
T						12		**10**
F						**12**		

S-B =4, S-A =3, S-C=5, S-E=6, S-D=7, S-G=8, S-T=10, S-F =12

3. Write Dijkstra’s Single Source Shortest path algorithm. Analyse the complexity. (May 2019-4 marks)

```
DIJKSTRA(G, w, s)
INITIALIZE-SINGLE-SOURCE(G, s)
S = ∅
Q = G.V
while Q ≠ ∅
    u = EXTRACT-MIN(Q)
    S = S ∪ {u}
    for each vertex v ∈ G.Adj[u]
        RELAX(u, v, w)
```

```
INITIALIZE-SINGLE-SOURCE(G, s)
for each vertex v ∈ G.V
    v.d = ∞
    v.π = NIL
s.d = 0
```

```
RELAX(u, v, w)
if v.d > u.d + w(u, v)
    v.d = u.d + w(u, v)
    v.π = u
```

- **Time Complexity** of Dijkstra's Algorithm is **O(V^2)** but with min-priority queue it drops down to **O(V+E logV).**