B. E. Sixth Semester (Computer Technology) Examination

Course Code : CT 1314 / CT 314 / CT 609 **Course Name : Design and Analysis of Algorithm**

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry marks as indicated.
(2) Due credit will be given to neatness and adequate dimensions.
(3) Assume suitable data wherever necessary.
(4) Illustrate your answers wherever necessary with the help of neat sketches.

1. Solve any **Two** :—

(A) Write an insertion sort algorithm and derive its worst case time complexity. 3.5

(B) Write a summation that represents the value of the variable sum in terms of the variable n for the following code segment and derive its time complexity

```
int sum = 0 ;
    for (int i = 1 ; i <= n * n ; i + + )
        for (int j = 1 ; j <= 1 ; j + + )
            for (int k = 1 ; k <= 6 ; k + + )
                sum + + ;
```

3.5

(C) Find the Big – oh O – notation for the following functions :—

(i) $f(n) = 5n^2 + n^2 + 6n + 2$

(ii) $f(n) = 4n^3 + 2n + 3$

(iii) $f(n) = 10n^2 + 7$

(iv) $f(n) = 6n^2 + 6n + 2^n$ 3.5

2. Solve any **Two** :—

(A) Solve the given recurrences by making a change of variable.
$T(n) = 2T(\sqrt{n}) + \log n$ 4

(B) Solve the following recurrence
$t_n - 2t_{n-1} = (n + 5)\, 3^n$ for $n \geq 1$ 4

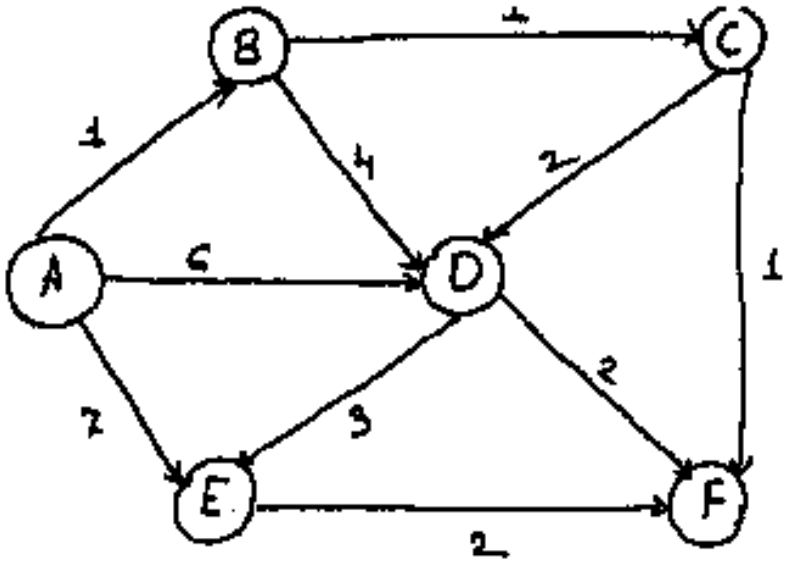
(C) Describe the amortized complexity for 8 bit binary counter from 0 to 16. Write algorithm for binary increment counter. 4

3. Solve any **Two** :—

(A) Find the solution of the knapsack problem for n = 4 , M = 120 ,

(p**1** , p**2** , p**3** , p**4**) = (40 , 20 , 35 , 50) and (w**1** , w**2** , w**3** , w**4**) = (25 , 30 , 40 , 45) Here M is maximum weight carrying capacity of knapsack. Use greedy strategey for this fractional knapsack problem. 3.5

(B) Write greedy based single source shortest path algorithm. Implement it on the following graph and explain execution. (Assume A as source vertex)



3.5

(C) Write Quick – Sort algorithm and Illustrate the operation of partioning on the following array A = { 2 , 8 , 7 , 1 , 3 , 5 , 6 , 4 }. 3.5

4. Solve any **Two** :—

(A) A postman wants to design tour to visit various places in the locality. The distance matrix is as given below. Illustrate with suitable formulation to derive solution with objective of minimizing the travelling distance.

0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

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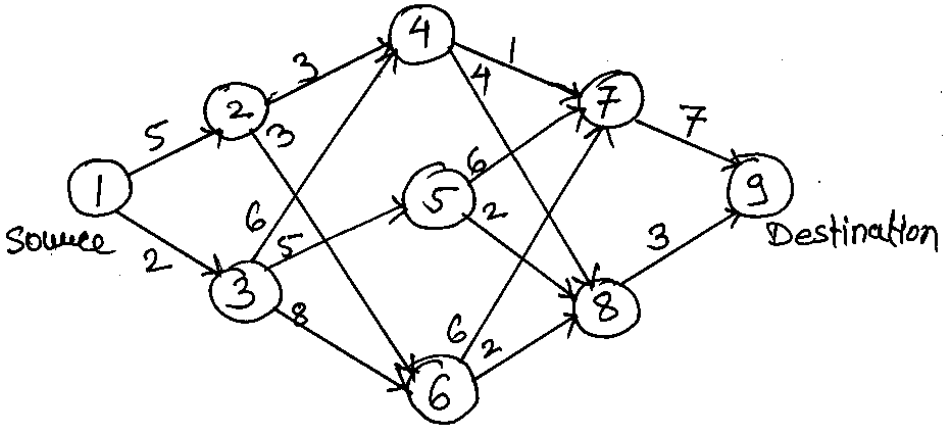
(B) Find the minimum cost path from 1 to 9 from following multistage graph.



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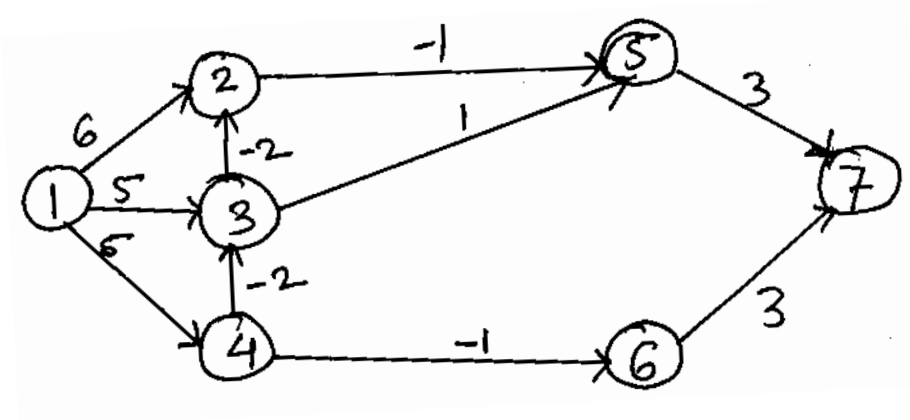
(C) Find the single source shortest path for the following graph using dynamic programming approach (source vertex : 1)



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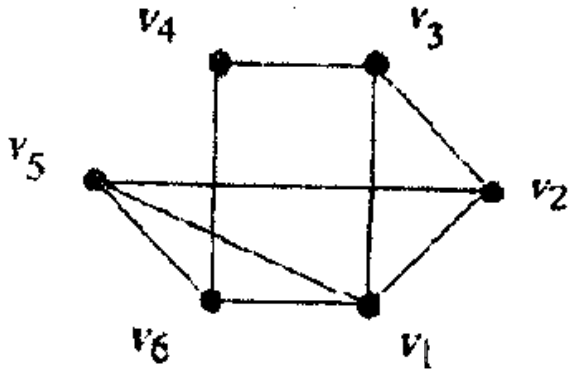
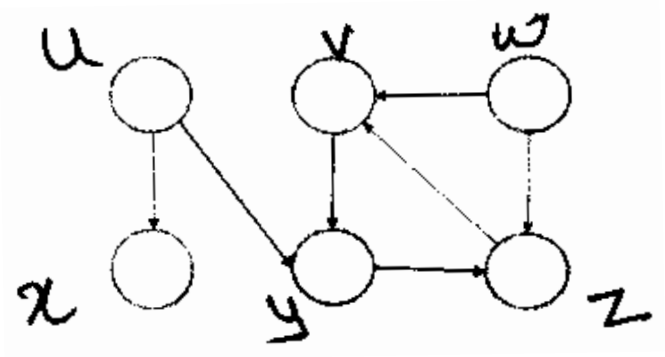
5. Solve any **Three** :—

(A) Write an algorithm to solve "8 queens" problem. Explain the implicit and explicit constraints associated with this problem. Give at least one solution for this problem. 5

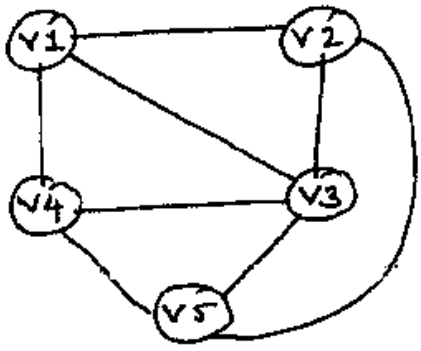
(B) Find a Hamiltonian cycle in the following graph : 5



(C) Design an algorithm for Depth first search. Also illustrate its working on following graph and generate DFS spanning tree. 5



(D) Explain graph coloring algorithm with suitable example. Color the following graph, and find chromatic number for it and draw state space tree. 5



6. Solve any **Three** :—

(A) Explain clearly polynomial reduction and how it can be used to show that a problem is NP – complete. 5

(B) Show that the vertex cover problem is NP – Complete. 5

(C) Explain the following NP Problems

(i) Clique 5

(D) Prove the following theorem : "SAT – 3 CNF is NP – Complete". 5