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National Institute of Technology, Hamirpur
Department of Computer Science & Engineering
End Semester Examination- Nov, 2017

Course: B. Tech **Semester: V^th**
Subject: Analysis and Design of Algorithm **Code: CSD-312**
Time: 03:00 hrs **Max. Marks: 60**
Note: All questions are compulsory

Q 1. (a) Solve the given recurrence relation: $T(n) = 4T(n/2) + n^2\sqrt{n}$ (2)

(b) Is $(n+a)^b = \Theta(n^b)$? (2)

(c) Derive a recurrence relation and calculate the complexity of the following code segment: (2)

```
int IsPrime (n)
{
    int i, n;
    for (i = 2; i ≤ √n; i ++)
        if (n % i = = 0)
        {
            printf ("Not Prime");
            return 0;
        }
    return 1;
}
```

(d) Define Class NP and Non-deterministic algorithms. (2)

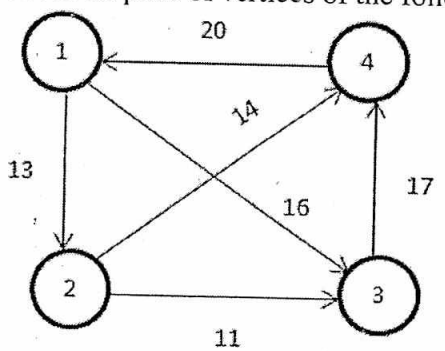
(e) What is N-Queens problem? Give a feasible solution for 4-Queens problem. (2)

Q 2. (a) Illustrate the operation of Heap Sort by sorting the elements of array A [4, 11, 9, 10, 5, 6, 8, 1, 2, 16]. (6)

(b) An undirected graph G (V, E) contains n ($n > 2$) nodes named $v_1, v_2, \ldots, v_n$. Two nodes v_1 and v_2 are connected if and only if $0 < |i - j| \leq 2$. Each edge (v_i, v_j) is assigned a weight $(i + j)$. What is the cost of minimum spanning tree using Kruskals algorithm of such a graph with 8 nodes? (4)

Q 3. (a) A text is made up of 5 characters a, b, c, d, e each occurring with probability 0.11, 0.40, 0.16, 0.09 and 0.24. What is the average length using optimal Huffman coding technique? (4)

(b) Find the shortest path between all pairs of vertices of the following graph. (6)

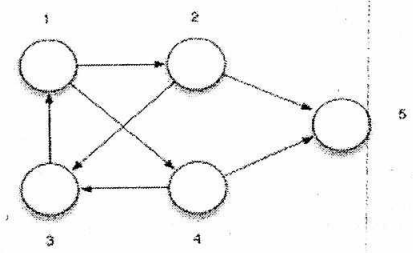


Q 4. (a) Find the maximum profit and a subset of elements that can be included in the given knapsack of weight 9 using dynamic programming for the following instance of items. (5)

Item	Weight	Value
1	2	20
2	5	30
3	7	35
4	3	12
5	1	3

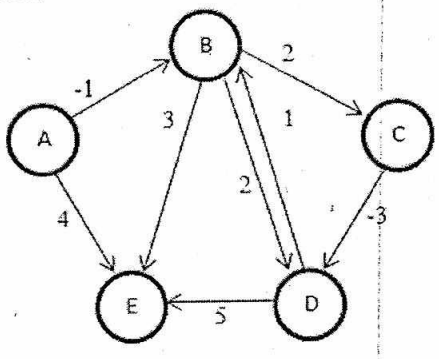
(b) Consider two strings A = "QPQRR" and B = "PQPRQRP". Find the length of the longest common subsequence between A and B. (3)

(c) Apply Depth-first search on the following graph (assuming node labeled as 3 to be the source node). (2)



Q 5. (a) Show that the Clique problem is NP Complete. Take $\Phi = (X_1 \vee \neg X_2 \vee \neg X_3) \wedge (\neg X_1 \vee X_2 \vee X_3) \wedge (X_1 \vee X_2 \vee X_3)$. (5)

(b) Find the shortest path in the following graph using Bellman Ford algorithm. Take **Node B** as the source vertex. (5)



Q 6. Find a tour of minimum cost for a travelling salesman using branch and bound for the given adjacency matrix. (Assume tour starts from **node 1**) (10)

	1	2	3	4	5
1	0	6	6	10	8
2	3	0	12	7	6
3	8	7	0	14	20
4	5	13	9	0	8
5	9	8	10	6	0