

**SANKALCHAND PATEL UNIVERSITY**  
**B.Tech – SEMESTER (5) – EXAMINATION – WINTER 2018**

**Subject Code: 1ET1030502****Date: 23/10 / 2018****Subject Name: Design and Analysis of Algorithm****Time: 3 Hrs.****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q. 1 Answer the following Questions****20****(A) Objective Questions (1 mark each)**

1. Two main measures for the efficiency of an algorithm are  
(a) Processor and memory (b) Complexity and capacity  
(c) Time and space (d) Data and space
2. In quick sort, the number of partitions into which the file of size  $n$  is divided by a selected record is  
(a)  $n$  (b)  $n - 1$  (c) 2 (d) None of the above
3. Number of selections required to sort a file of size  $N$  by straight selection requires  
(a)  $N - 1$  (b)  $\log N$  (c)  $O(N^2)$  (d) None of the above
4. Which of the given options provides the increasing order of asymptotic complexity of functions  $f_1$ ,  $f_2$ ,  $f_3$  and  $f_4$ ?  
 $f_1(n) = 2^n$   $f_2(n) = n^{(3/2)}$   $f_3(n) = n \log n$   $f_4(n) = n^{(\log n)}$   
(a)  $f_3$ ,  $f_2$ ,  $f_4$ ,  $f_1$  (b)  $f_3$ ,  $f_2$ ,  $f_1$ ,  $f_4$  (c)  $f_2$ ,  $f_3$ ,  $f_1$ ,  $f_4$  (d)  $f_2$ ,  $f_3$ ,  $f_4$ ,  $f_1$
5. Which of the following sorting procedures is the slowest?  
(a) Quick sort (b) Heap sort (c) Shell sort (d) Bubble sort
6. The time complexity of binary search is \_\_\_\_\_.  
(a)  $O(1)$  (b)  $O(\log n)$  (c)  $O(n)$  (d)  $O(n \log n)$
7. Which of the following technique is used for solve a 0-1 knapsack problem  
(a) Greedy (b) Dynamic programming  
(c) Divide and Conquer (d) all of the above
8. What is the type of the algorithm used in solving the 8 Queens problem?  
(a) Greedy (b) Dynamic (c) Branch and Bound (d) Backtracking
9. The running time of Strassen's algorithm for matrix multiplication is  
(a)  $\Theta(n)$  (b)  $\Theta(n^3)$  (c)  $\Theta(n^2)$  (d)  $\Theta(n^{2.81})$
10. A characteristic of the data that binary search follow but the linear search ignores, is the  
(a) Order of the list (b) length of the list  
(c) maximum value in the list (d) mean of data values

**(B) Answer the following short questions (2 marks each)**

1. What are the features of dynamic programming?
2. What is minimum spanning tree?
3. Define Big Omega notation.
4. State the Knapsack problem using Greedy approach.
5. Find out Big O notation for following C program code:

```
F()  
{  
    int i;  
    for(i=1 ; i*i<= n ; i++)  
        printf("\nSPU ");  
}
```

14

- (A) Explain master theorem and solve the following recurrence equation with master method
1.  $T(n) = 9T(n/3) + n$                       2.  $T(n) = 3T(n/4) + n \lg n$
- (B) Write the complete Merge Sort procedure. Compute the worst-case computational complexity of the algorithm. Illustrate the operation of merge sort on the array  $A = \{3, 41, 52, 26, 38, 57, 9, 49\}$ .

**OR**

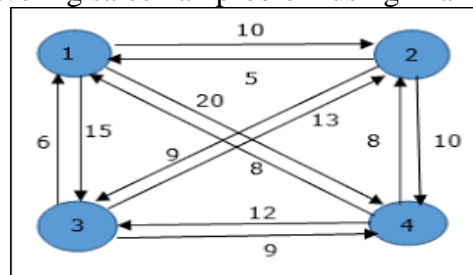
- (A) What is recurrence? Solve recurrence equation  $T(n) = T(n-1) + n$  using forward substitution and backward substitution method.
- (B) Explain Quick sort using divide and conquer method and computer its worst case running time. Trace the same on data set – 4,3,1,9,8,2,4,7

12

- (A) Define asymptotic notations for worst case, best case and average case time Complexities. Give examples.
- (B) Give the properties of Heap Tree. Sort the following data using Heap sort method. 65, 77, 5, 25, 32, 45, 99, 83, 69, 81
- (C) Solve the following 0/1 Knapsack Problem using Dynamic Programming. There are five items whose weights and values are given in following arrays. Weight  $w[] = \{ 1, 2, 5, 6, 7 \}$  Value  $v[] = \{ 1, 6, 18, 22, 28 \}$ . Show your equation and find out the optimal knapsack items for weight capacity of 11 units.
- (D) Using greedy algorithm find an optimal schedule for following jobs with  $n=7$  profits:  $(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (3, 5, 18, 20, 6, 1, 38)$  and deadline :  $(d_1, d_2, d_3, d_4, d_5, d_6, d_7) = (1, 3, 3, 4, 1, 2, 1)$

12

- (A) Solve Making Change problem using Dynamic Programming. Give your answer for making change of Rs. 8. (Denominations: d1=1, d2=4, d3=6).
- (B) Given two sequences of characters, P=<MLNOM> Q=<MNOM> Obtain the longest common subsequence.
- (C) Find out optimal sequence for multiplication:  
A1 [5 × 4], A2 [4 × 6], A3 [6 × 2], and A4 [2 × 7]. Also give the optimal parenthesization of matrices.
- (D) Solve the given Traveling salesman problem using Branch and Bound.



12

- (A) Working modulo  $q = 11$ . How many spurious hits does the Rabin-Karp matcher encounter in the text  $T = 3141592653589793$  when looking for the pattern  $P = 26$ ?
- (B) Define P, NP, NP complete and NP-Hard problems.
- (C) (i) Explain Prim's algorithm to find a minimum spanning tree.  
(ii) Find all possible solution for the 4X4 chessboard, 4 queen's problem Using backtracking.
- (D) Sort the letters of word "DESIGN" in alphabetical order using insertion sort.

\*\*\*\*\*

Seat No.: \_\_\_\_\_

PR No. \_\_\_\_\_

**SANKALCHAND PATEL UNIVERSITY**  
**B. Tech – SEMESTER (5) – EXAMINATION – SUMMER 2019**

**Subject Code: 1ET1030502**

**Date: 18/04 / 2019**

**Subject Name: Design and Analysis of Algorithm**

**Time: 3 Hrs.**

**Total Marks: 70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q. 1 Answer the following questions.**

- |                                                                                    |           |
|------------------------------------------------------------------------------------|-----------|
| 1. Define Algorithm.                                                               | <b>01</b> |
| 2. What is worst case time complexity?                                             | <b>01</b> |
| 3. Define the feasible solution.                                                   | <b>01</b> |
| 4. Define efficiency of algorithm.                                                 | <b>01</b> |
| 5. What is minimum spanning tree.                                                  | <b>01</b> |
| 6. What is principle of optimality?                                                | <b>01</b> |
| 7. What is greedy method?                                                          | <b>01</b> |
| 8. State the 8-queen problem.                                                      | <b>01</b> |
| 9. Write down the best case, worst case and average case complexity for Heap sort. | <b>01</b> |
| 10. List the type of algorithms.                                                   | <b>01</b> |
| 11. _____ is the first step in solving the problem.                                | <b>01</b> |
| a. Understanding the problem                                                       |           |
| b. Identify the problem                                                            |           |
| c. Evaluate the solution                                                           |           |
| d. None to these                                                                   |           |
| 12. Write down the characteristic of greedy algorithm.                             | <b>03</b> |
| 13. Explain the difference between Greedy and Dynamic programming.                 | <b>03</b> |
| 14. Solve the recurrence using master method. $T(n) = T(2T/3) + 1$                 | <b>03</b> |

**Q. 2 Answer the following questions. (Any Two)**

**14**

- A** What is asymptotic notation? Explain in details
- B** Analyze selection sort algorithm in best case and worst case.
- C** What is recurrence equation? Solve the recurrence equation  $T(n) = T(n-1) + n$  using forward and backward substitution.

**Q. 3 Answer the following questions. (Any Two)**

**12**

- A** Explain kruskal's algorithm for minimum spanning tree with example.
- B** Explain chained matrix multiplication with example.
- C** How the multiplication of large integer can be done effectively by using divide and conquer strategy.

**Q. 4 Answer the following questions. (Any Two)**

**12**

- A** Using greedy method find an optimal schedule for following jobs with  $n = 6$ , profits and deadlines are  $(20, 15, 10, 7, 5, 3)$  &  $(3, 1, 1, 3, 1, 3)$  respectively.
- B** Solve the making change problem using dynamic programming. (Denominations:  $d_1=1$ ,  $d_2=4$ ,  $d_3=6$ ). Solve the problem for making change of Rs. 9.
- C** Explain the finite Automata? Explain the use of finite automata for string matching with example.

**Q. 5 Answer the following questions. (Any Two)**

**12**

- A** Explain the concept of P, NP and NP-complete problem.
- B** Explain Floyd's algorithm for finding out shortest path with example.
- C** Give two sequence of characters,  $X = \{G, U, J, A, R, A, T\}$  and  $Y = \{J, R, A, T\}$ , obtain longest common subsequence.

\*\*\*\*\*

**SANKALCHAND PATEL UNIVERSITY**  
**B. Tech – SEMESTER ( 5 ) – EXAMINATION – WINTER 2019**

**Subject Code: 1ET1030502****Date: 09/11/ 2019****Subject Name: Design and Analysis of Algorithm****Time: 3 Hrs.****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q. 1 Answer the following questions.****20**

- 1 Which of the following case does not exist in complexity theory?  
a) Best case   b) Worst case   c) Average case   d) Null case
- 2 The complexity of linear search algorithm is,  
a)  $O(n)$    b)  $O(\log n)$    c)  $O(n^2)$    d)  $O(n \log n)$
- 3 The complexity of Binary search algorithm is,  
a)  $O(n)$    b)  $O(\log n)$    c)  $O(n^2)$    d)  $O(n \log n)$
- 4 The Worst case occur in linear search algorithm when,  
a) Item is somewhere in the middle of the array  
b) Item is not in the array at all  
c) Item is the last element in the array  
d) Item is the last element in the array or is not there at all
- 5 The worst case occur in quick sort when,  
a) Pivot is the median of the array  
b) Pivot is the smallest element  
c) Pivot is the middle element  
d) None of the mentioned
- 6 The worst case complexity of quick sort is  
a)  $O(n)$    b)  $O(\log n)$    c)  $O(n^2)$    d)  $O(n \log n)$
- 7 Sum of two different prime number is a:  
a) Prime number   b) Composite number   c) Either Prime or Composite  
d) None of the mentioned
- 8 Following are called logical operators,  
a) +, -, \*, /   b) <, >, <=, >=   c) AND, OR, NOT   d) \, MOD
- 9 The complexity of merge sort algorithm is  
a)  $O(n)$    b)  $O(\log n)$    c)  $O(n^2)$    d)  $O(n \log n)$
- 10 Two main measures for the efficiency of an algorithm are  
a) Processor and memory   b) Complexity and capacity  
c) Time and space   d) Data and space
- 11 What is an algorithm?
- 12 Define principle of optimality.
- 13 Define backtracking?

- 14 Explain String matching rabin karp Algorithm.
- 15 Define  $\Omega$ -notation?
- 16 What is Feasible solution?
- 17 What is optimal solution?
- 18 Define O-notation?
- 19 What is worst-case efficiency?
- 20 What is pseudocode?

**Q.2 Answer the following questions. (Any Two)**

**14**

- A What is an Algorithm? Also explain its characteristics.
- B Give the general plan for divide-and-conquer algorithms. Also Sort the list "G,U,J,A,R,A,T " in alphabetical order using divide and conquer algorithm strategy.
- C Find the longest common subsequence using Dynamic Programming technique with illustration  $X=\{A,B,C,B,D,A,B\}$   $Y=\{B,D,C,A,B,A\}$

**Q.3 Answer the following questions. (Any Two)**

**12**

- A Solve the following recurrence equation by using Master method
  1.  $T(n)=8T(n/16) + n$
  2.  $T(n)=16T(n/16)+ n^2$
- B Explain 8 queen puzzle problem. How many solutions are there to the 8 queens problem?
- C Write the differences between the Greedy method and Dynamic programming.

**Q.4 Answer the following questions. (Any Two)**

**12**

- A Write a minimum spanning tree of given graph G.

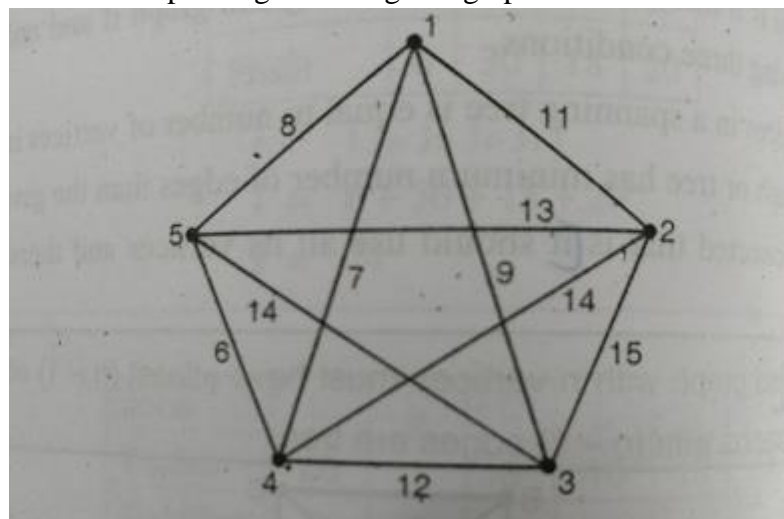


Figure 1:

- B Explain P, NP and NP complete problems.
- C Find out shortest path of spanning tree with vertex node 0 as the source (Dijkstra Algorithm)

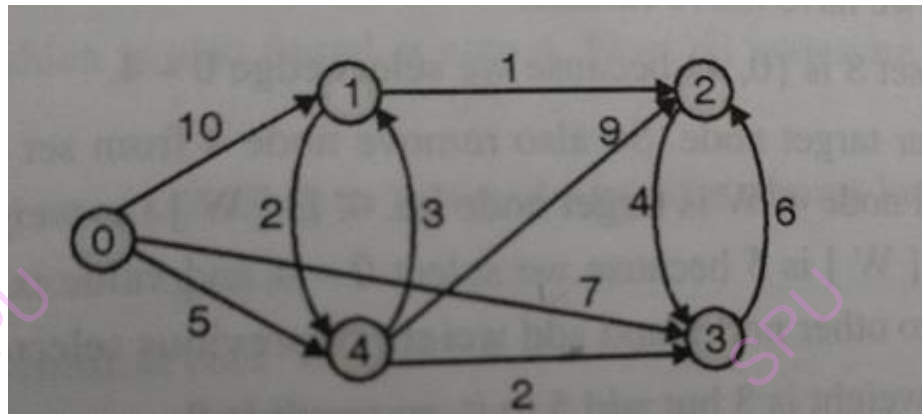


Figure 2:

**Q. 5** Answer the following questions. Any Two

12

**A** Find a minimum cost by using Kruskal's algorithm.

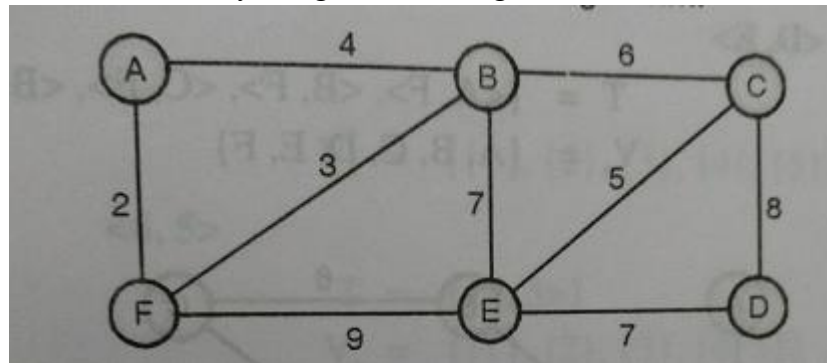


Figure 3:

**B** Explain Naïve string-matching Algorithm with example.

**C** Consider Knapsack capacity  $M=20$ ,  $w = (18, 15, 10)$  and  $p = (25, 24, 15)$  find the maximum profit using Greedy Method.

\*\*\*\*\*

Seat No.: \_\_\_\_\_

PR No. \_\_\_\_\_

**SANKALCHAND PATEL UNIVERSITY**  
**B. Tech. – SEMESTER (5) – EXAMINATION – WINTER 2021**

**Subject Code: 1ET1030502**

**Date: 18 /11 /2021**

**Subject Name: Design and Analysis of Algorithm**

**Time: 3 Hrs.**

**Total Marks: 70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q. 1 Answer the following objective questions.

20

(A) 1 Define space complexity.

2 What is the average case time complexity of bubble sort?

3 What is the worst-case time complexity of Merge sort?

4 State true or false: "Prim's algorithm is based on greedy strategy."

5 Define recurrence.

6 What is the principle of optimality?

7 Solve the following recurrence equation with master method

$$T(n) = 3T(n/4) + n \log n$$

8 Define NP Hard problem.

9 Define Big Omega Notation ( $\Omega$ )

10 Mention the characteristics of Greedy method.

(B) 1 The main measure for efficient algorithm are-

A. Space      B. Time      C. Data and Space      D. Time and space

2 Express the formula  $(n-1)*(n-5)$  in terms of big Oh notation

A.  $O(1)$       B.  $O(\log n)$       C.  $O(n)$       D.  $O(n^2)$

3 The process of processing each element in the list is known as

A. Sorting      B. Merging      C. Traversal      D. Inserting

4 How many passes are required to sort a file of size  $n$  by bubble sort method?

A.  $N^2$       B.  $N$       C.  $N-1$       D.  $N/2$

5 Choose the correct statement from the following.

A) Branch and bound is more efficient than backtracking

B) Branch and bound is not suitable where a greedy algorithm is not applicable

C) Branch and bound divides a problem into at least 2 new restricted sub problems

D) Backtracking divides a problem into at least 2 new restricted sub problems

6 Which of the following problems is NOT solved using dynamic programming?

A) 0/1 knapsack problem

B) Matrix chain multiplication problem

C) Edit distance problem

D) Fractional knapsack problem



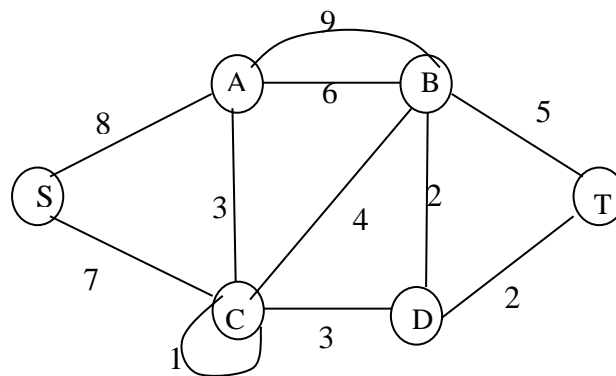
- 7 What is the basic formula applied in Rabin Karp Algorithm to get the computation time as Theta (m)?
  - A) Halving rule
  - B) Horner's rule
  - C) Summation lemma
  - D) Cancellation lemma
- 8 Let  $X$  be a problem that belongs to the class NP. Then which one of the following is TRUE?
  - A) There is no polynomial time algorithm for  $X$ .
  - B) If  $X$  can be solved deterministically in polynomial time, then  $P = NP$ .
  - C) If  $X$  is NP-hard, then it is NP-complete.
  - D)  $X$  may be undecidable.
- 9 Which of the following is true about NP-Complete and NP-Hard problems.
  - A) If we want to prove that a problem  $X$  is NP-Hard, we take a known NP-Hard problem  $Y$  and reduce  $Y$  to  $X$
  - B) The first problem that was proved as NP-complete was the circuit satisfiability problem.
  - C) NP-complete is a subset of NP Hard
  - D) All of the above
  - E) None of the above
- 10 In dynamic programming, the technique of storing the previously calculated values is called \_\_\_\_\_.
  - A) Saving value property
  - B) Storing value property
  - C) Memoization
  - D) Mapping

OR

- A) Derive the worst case time complexity of Quick sort algorithm. 3
- B) Compute the worst-case computational complexity of the Merge sort algorithm. 3
- C) Solve following knapsack problem using greedy strategy with given capacity  $W=5$ , Weight and Value are: (2,12),(1,10),(3,20),(2,15). 3
- D) Explain how multiplication of large integers can be done efficiently by using divide and conquer technique? 3

Q. 4 Answer the following questions. 12

- A) Solve Making Change problem using Dynamic Programming. 6  
(Denominations:  $d_1=1$ ,  $d_2=4$ ,  $d_3=6$ ). Give your answer for making change of Rs. 8.
- B) Consider the following undirected weighted graph. Find minimum spanning tree for the same using Kruskal's algorithm. 6



OR

- A) Explain how to find out Longest Common Subsequence of two strings using Dynamic Programming method. Find any one Longest Common Subsequence of given two strings using Dynamic Programming.  $S_1=abbacdcba$   $S_2=bcdbbcaac$  6
- B) Using greedy algorithm find an optimal schedule for following jobs with  $n=7$  profits:  $(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (3, 5, 18, 20, 6, 1, 38)$  and deadline :  $(d_1, d_2, d_3, d_4, d_5, d_6, d_7) = (1, 3, 3, 4, 1, 2, 1)$  6

Q. 5 Answer the following questions. (Any Three) 12

- A Explain the use of Backtracking method for solving Eight Queens Problem giving its algorithm.
- B Explain Travelling salesman problem with example.
- C Working modulo  $q = 11$ . How many spurious hits does the Rabin-Karp matcher encounter in the text  $T = 3141592653589793$  when looking for the pattern  $P = 26$ ?
- D Compare NP-Hard with NP-Complete problems.
- E Construct an implicit tree for 0-1 Knapsack problem. Give backtracking algorithm to solve it.

\*\*\*\*\*

**SANKALCHAND PATEL UNIVERSITY**  
**B. Tech – SEMESTER 5 – EXAMINATION – SUMMER 2022**

**Subject Code: 1ET1030502****Date: 24/05/2022****Subject Name: Design and Analysis of Algorithm****Time: 3 Hrs.****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q. 1

(A) Answer the following questions:

10

1. What is an algorithm?
2. Define Big Oh and Big Omega notation.
3. Which design strategy does merge sort uses?
4. What is a backtracking algorithm? Provide several examples.
5. What is state space tree?
6. What is minimum spanning tree?
7. Define Directed acyclic graph.
8. Define: Principle of Optimality.

If the array is already sorted, which of these algorithms will exhibit the best performance

9.
  - a. Merge Sort
  - b. Insertion Sort
  - c. Quick Sort
  - d. Heap Sort
10. What is the precondition for Binary Search?

(B) Answer the following questions:

10

1. Write the difference between the Greedy method and Dynamic programming
2. Solve, a recurrence relation  
 $T(n) = T(n-1) + n$   
 With initial condition  $T(0) = 0$
3. Describe the recurrence relation of merge sort?

What is time complexity of fun()?

void fun(int n)

```
{
  int i,j,k;
  for(i=n/2; i<=n; i++)
  {
```

4.
 

```
    for(j=1; j<=n; j=2*j)
    {
        for(k=1; k<=n; k=k*2)
        printf("Hi");
    }
  }
```
5. Explain P, NP problems.

- Q. 2 Answer the following questions.(Any Two) 14
- (A) Explain master theorem and solve the following recurrence equation with master method
    1.  $T(n) = 9T(n/3) + n$
    2.  $T(n) = 3T(n/4) + n \lg n$
  - (B) Design and analyze quick sort algorithm using divide and conquer technique.
  - (C) What is recurrence? Solve recurrence equation  $T(n) = T(n-1) + n$  using forward substitution and backward substitution method.
- Q. 3 Answer the following questions. (Any Two) 12
- (A) Using greedy algorithm find an optimal schedule for following jobs with  $n=6$ .  
 Profits:  $(P_1, P_2, P_3, P_4, P_5, P_6) = (20, 15, 10, 7, 5, 3)$   
 Deadline:  $(d_1, d_2, d_3, d_4, d_5, d_6) = (3, 1, 1, 3, 1, 3)$
  - (B) Differentiate Sequential search with Binary search.
  - (C) Solve making change problem for  $d_1 = 1, d_2 = 4, d_3 = 6, n = 3$ , and  $N = 8$  units.
- Q. 4 Answer the following questions. (Any Two) 12
- (A) Solve the following 0/1 Knapsack Problem using branch and bound.  
 There are four items whose weights and their profits are given in following arrays. Weight  $w[] = \{2, 4, 6, 9\}$  Profit  $p[] = \{10, 10, 12, 18\}$
  - (B) Given two sequences of characters,  $P = \langle X, Y, Z, Y, T, X, Y \rangle$   
 $Q = \langle Y, T, Z, X, Y, X \rangle$ . Obtain the longest common subsequence.
  - (C) Define P, NP, NP complete and NP-Hard problems.
- Q. 5 Answer the following questions. (Any Two) 12
- (A) Using greedy algorithm find an optimal schedule for following jobs with  $n=6$ .  
 Profits:  $(P_1, P_2, P_3, P_4, P_5, P_6) = (20, 15, 10, 7, 5, 3)$   
 Deadline:  $(d_1, d_2, d_3, d_4, d_5, d_6) = (3, 1, 1, 3, 1, 3)$
  - (B) Explain Rabin-Karp string matching algorithm with example.
  - (C) Discuss how 8-queen problem can be solved using backtracking.

\*\*\*\*\*