Roll No: 33231

ASSIGNMENT 2

Problem Statement: Write a program to solve optimal storage on tapes problem using Greedy approach

Theory:

1) Which type of problem can be solved using greedy algorithmic techniques? Write control abstraction of Greedy approach

→ • Suppose that a problem can be solved by a sequence of decisions. The greedy method has that each decision is locally optimal solutions will finally add upto a globally optimal solution

- Only a few optimization problems can be solved by the greedy method.
- Control abstraction for Greedy Approach

```
Algorithm GreedyApproach (a, n) {
  // a is an array of n inputs
  Solution = ∅
  for i:=) 0 to n {
      s :=) select (a);
      if (feasible (solution s)) then
          solution :=) union (solution , s) ;
      reject () ; // if solution not feasible
  } return () ; //solution
}
```

2) Mention applications of MST, shortest path algo. and optimal storage on tapes problem

→ Minimum spanning Tree (MST)

i) Network Design
ii) Approximating NP-Hard Problems
iii) Cluster Analysis
iv) Indirect :
- Max bottleneck paths
- LDPC codes for error correction
- reducing data storage in sequencing amino acids in protein

Shortest Path

i) Digital Mapping Services (Google Maps).
ii) Social Networking Apps
iii) Telephone network
iv) IP routing to find open shortest path first
v) Flighting agenda
vi) Designate file server

3) Explain feasibe solution, optimal solution and objective function with example

→ • A solution for which all constraints in the solver model are satisfied is called a feasible solution

- An optimal solution is feasible solution where the objective function reaches its maximum or minimum value
- The objective fun^n is the weak valued function whose value is to be maximized or minimized relative to a given set of feasible alternatives

4) How Greedy strategy is used to store n programs with positive lengths on m tapes with minimum retrieval time. Explain with example

→ <u>Input</u>: We are given 'n' problems that are to be stored on computer tape of length L and the length of program i is Li

<u>Output</u>: A permutation for all n! for the n programs so that when they are stored on tape in the order of MPT is minimized.

<u>Greedy Solution</u>:

i) Make tapes empty
ii) For i = 1 to n do
iii) Grab the next shortest path
iv) Put it on next tape

Ex: For Tapes. T0, T1, T2. the program lengths are

12, 5, 8, 32, 7, 5, 18, 26, 4, 3, 11, 10 and 6

→ We organize programs in ascending order
3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 26, 32
Tape 0 : 3, 6, 9, 12, 32
Tape 1 : 4, 7, 10, 18
Tape 2 : 5, 8, 11, 26

5) Pseudocode for optimal storage of n programs on m tapes

→
```
Greedy Optimal Storage (n, m) {
    j = 0   // tape number
    for (i = 1 to n) {
        print ("Program ", i, "for tape", j)
        j = (j+1) mod m
    }
```

Time complexity : The first program's length is added n times, second prog 'n-1' times and so on...

$T(1) = n$

$T(2) = n-1$

⋮

$T(n) = 1$

∴ Time complexity $= O(n \log n)$

Conclusion : I successfully understood and implemented optimal storage on tapes problem using Greedy approach.