Quiz-4 (A&B): Design and Analysis of Algorithms (Spring-2024)

SOLUTION

Suppose you have to drive from Islamabad to Lahore on M2 motorway by a car. The gas tank of your car is initially full, and it holds enough gas to travel 'm' miles. You have a direction map with distances between all Gas Stations along the route.

Let $d_1 < d_2 < \ldots < d_n$ be the locations of all Gas Stations along the route, where d_i is the distance from Islamabad to the Gas Station. The distance between neighboring Gas Stations is at most 'm' miles and tank must be filled completely if a car is stopped at any Gas Station.

Design a Greedy Algorithm (pseudocode) to get an optimal solution having minimum number of Stops where car should stop to get refilled with Gas.

Demonstrate, with a simple example of 10 gas stations and m=40, that your solution is optimal.

Pseudocode

d[ ] = 0, 10, 11, 12, 39, 40, 53, 60, 80, 100, 121
m = 40

FOR (i: 1 to d.length-1)   // considering array from 0th index
    diff = d[i] - d[i-1]
    m = m - diff
    diff = d[i+1] - d[i]

    IF (m – diff < 0)
       m = 40
       print d[i]
    END IF
END FOR

Example:
Example: Assume the following distances
$d_1 = 10$
$d_2 = 11$
$d_3 = 12$
$d_4 = 39$
$d_5 = 50$
$d_6 = 53$
$d_7 = 60$
$d_8 = 70$
$d_9 = 80$
$d_{10} = 91$
Greedy Solution= d_4, d_8 = 2 stops
Optimal Solution= 2 stops