Sunday, March 13, 2022

Assignment 5

CSCI 411

1.

a. In order to solve this problem we need a one dimensional array - buffer, which needs to be computed in increasing order. we consider all possible hotels j we can stay at the night before reaching hotel i. For each of these possibilities, the minimum penalty to reach i is the sum of the minimum penalty OPT(j) to reach j and the cost (200–(aj –ai))^2 of a one-day trip from j to i.

b.

```
hotelSequence(A, m):
    for i = 0 till size(hotels):
        buffer.push_back(hotelCell)

    j = 0
    for i = 1 till size(buffer):
        prev = 0
        while (j < i):
            if (cost <= min_penalty):
                min_i = min_j
                prev = j
        buffer_penalty = min_penalty
        buffer_prev = prev
```

```
        trip_cost_penalty = hotel_cell_penalty

        trip_cost_seq(last_index of buffer)


        while buffer value does not exist:

            trip_cost_seq.insert(trip_cost_seq.begin(), holet_cell_prev)

            hotel_cell = buffer(hotel_cell_prev)


        return trip_cost
```

c. Asymptotic run time is O(n^2), where n is the size of hotels vector. We have n subproblems and each subproblems i takes time O(i).

2.

a. A vertex cover of an undirected graph is a subset of its vertices such that for every edge (u, v) of the graph, either ‘u’ or ‘v’ is in vertex cover.

For example, consider the following tree. The smallest vertex cover is {20, 50, 30} and size of the vertex cover is 3.

b.

```
  treeVC( G(V,E) ):

      S = [ ]

      while no edges in G:

          v = one incident edge,  (u, v)

          S = S U [u]

          remove(u)

          remove(incident edges from G to get G’)

          G = G’
```

return S

c. We need to maintain the degrees of vertices in the current graph and vertices with degree 1. Updating the degrees after every iteration will cost time proportional to the degree of the vertex being removed. So, the total time will be proportional to the sum of degrees which in this case would be $O(|V|)$