HOMEWORK 4 – Q3

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3. You are on vacation for N days at a resort that has three possible activities. For each day, for each activity, you've determined how much enjoyment you will get out of that activity. However, you are not allowed to do the same activity two days in a row. What is the maximum total enjoyment possible? (30 pts)

Solution:

Subproblems: For each day $i \leq N$ and each activity a_j out of the three possible activities solve the problem $P(i,j)$ of finding optimal activities up to day i so that on day i you do activity j.

Build-up order:

Solve the subproblems in the order $P(1,j), P(2,j) \dots P(N,j)$

Recursion:

$$P(i,j) = enjoyment(i,j) + \max\{P(i-1,t): t\ is\ compatible\ with\ j\}$$

$enjoyment(i,j)$ is the enjoyment obtained by having activity j on day i.

Base case:

$$P(0,j) = 0$$

At day 0, enjoyment is 0.

Final solution:

$$The\ final\ solution\ is\ given\ by\ \max_{j \in a} P(N,j)$$

Time complexity:

The time complexity is $O(|a| * n)$, $|a|$ is the total amount of activities, in this case $|a| = 3$, so the time complexity is $O(3n) = O(n)$, as the number of days is constant.