Week 4 Answers

Kaung Khant Lin
6540131
542

Version 1

The Number of States

Logic Steps I processed:

1. Look at function comb(i). It is called recursively.
2. To get to index i (let's say i=3), the code had to make decisions for i=0, i=1, and i=2 first.
3. For each previous item, there were exactly 2 choices: x[k] = 0 or x[k] = 1.
4. Therefore, the number of unique ways to reach level i is *2 * 2 * 2 * … (i times).*

Answer: 2^i

Different in Values?

Answer: Yes

Reason:

- The function `comb(i)` relies on a hidden global list `x`.
- Scenario A: You reach item `i` having picked nothing earlier. The bag is empty. The function calculates a valid profit.
- Scenario B: You reach item `i` having picked everything earlier. The bag is full. The function returns `-1` (Overweight).
- Even though the input `i` is the same, the Global State (`x`) is different, so the result changes.

Using Memoization can speed up this?

Answer: No. Memoization requires that a function, given specific inputs, always returns the same output.

Version 3

Question 5

Answer: Yes
The brute-force algorithm repeatedly generates the same state.

Question 6

Answer: Yes

Reason:

- The function maxVal(i, C) depends only on the arguments i and C.
- There is no global list x acting as a "hidden memory."
- The question "What is the max profit starting from Item 5 with 10kg space?" has only one mathematical answer. It does not matter how one arrived at Item 5; it only matters that one is there.
- Because the answer is consistent, we can write it in the memo table.