Week 10: Assignment 1

The due date for submitting this assignment has passed.

Due on 2022-10-12, 23:59 IST.

Assignment submitted on 2022-10-12, 22:53 IST

1) Consider a money system consisting of n coins. Each coin has a positive integer value.

Your task is to calculate the number of distinct ordered ways you can produce a money sum x using the available coins.

For example, if the coins are {2,3,5} and the desired sum is 9, there are 3 ways:

2+2+5
3+3+3
2+2+2+3

Further, if the coins are {2,3,5} and the desired sum is 12, how many ways are there?

5

Yes, the answer is correct.
Score: 1

Accepted Answers:
(Type: Numeric) 5

1 point

2) Continuing the previous question, if the coins are {1,2} and the desired sum is 5, how many ways are there?

3

Yes, the answer is correct.
Score: 1

Targeted Feedback:

We can have 0,1, or 2 "2"'s in the final answer.

Accepted Answers:
(Type: Numeric) 3

1 point

3) Let **dp[w,i]** equal the number of *ordered* ways to choose coins so that they add up to w, but assume that we are only allowed to make use of the first i coins. Which of the following recurrences are valid? ***2 points***

Note: coins[i] denotes the value of the i-th coin.

- (●) dp[w,i] := dp[w,i-1] + dp[w-coins[i],i]
- ( ) dp[w,i] := dp[w,i-1] + dp[w-coins[i],i-1]
- ( ) dp[w,i] := dp[w,i] + dp[w-coins[i],i-1]
- ( ) dp[w,i] := dp[w,i] + dp[w-coins[i],i]

Yes, the answer is correct.
Score: 2

Feedback:

*When calculating dp[w,i], we consider the i'th coin. Either we didn't pick the coin, then there are dp[w,i-1] possibilities. Otherwise, we picked the coin. Since we are allowed to pick it again, there are dp[w-coins[i],i] possibilities (**not** dp[w-coins[i],i-1] possibilities).*

Accepted Answers:
dp[w,i] := dp[w,i-1] + dp[w-coins[i],i]

4) You are given an integer n. On each step, you may subtract one of the digits from the number.

What is the smallest number of steps required to make the number equal 27 to 0?

5

Yes, the answer is correct.
Score: 1

Feedback:

An optimal solution is 27→20→18→10→9→0.

Accepted Answers:
(Type: Numeric) 5

1 point

5) You are given an integer n. On each step, you may subtract one of the digits from the number.

What is the smallest number of steps required to make the number equal 150 to 0?

27

Hint

Yes, the answer is correct.
Score: 2

Feedback:
Here's a 27-step sequence.

5
5
4
6
3
7
2
8
1
9
1
9
9
8
7
6
6
5
9
4
6
3
7
2
8
1
9

Accepted Answers:
(Type: Numeric) 27

2 points

6) Consider the previous question once more. You are given an integer n. On each step, you may subtract one of the digits from the number. ***2 points***

We want to know what is the smallest number of steps that are required to make a given number equal n to 0.

Let dp[n] denote the solution. Which of the following recurrences are valid? Remember the hint from the previous question.

- [x] dp[n] = min$_{d \in digits}$(n) dp[n-d].
- [x] dp[n] = dp[n-d*], where d* is the largest digit in n
- [ ] dp[n] = max$_{d \in digits}$(n) dp[n-d].
- [ ] dp[n] = dp[n-d*], where d* is the smallest digit in n

Yes, the answer is correct.
Score: 2

Accepted Answers:
dp[n] = min$_{d \in digits}$(n) dp[n-d].
dp[n] = dp[n-d], where d* is the largest digit in n*

7) What is the value of dp[n] defined in the previous question if n is a **single digit number?** ***1 point***

- ( ) n
- ( ) 0
- (•) 1
- ( ) n-1

Yes, the answer is correct.
Score: 1

Accepted Answers:
1