Assignment 1 (DP)

Instruction for the following problems

1. Write the solution
2. Explain your solution
3. Show simulation for the sample input(s).

PROBLEM 01. Coin change problem

Consider the problem of making change for **M** cents using the fewest number of coins. There are **d** types of coins **C = {c1, c2, …, cd}**, each coin's value is an integer and there are an infinite number of coins for each coin type. Write a DP algorithm to make change consisting of coins in **C**.

$$\text{minNumCoins}(M) = \textbf{min of} \begin{cases} \text{minNumCoins}(M\text{-}c_1) + 1 \\ \text{minNumCoins}(M\text{-}c_2) + 1 \\ \cdots \\ \text{minNumCoins}(M\text{-}c_d) + 1 \end{cases}$$

Simulate for **M = 206, C={1,2,8,10,50,100}**

PROBLEM 06. Rod cutting

The ***rod-cutting problem*** is the following. Given a rod of length n inches and a table of prices p_i for $i = 1, 2, \ldots, n$, determine the maximum revenue r_n obtainable by cutting up the rod and selling the pieces. Note that if the price p_n for a rod of length n is large enough, an optimal solution may require no cutting at all.

Consider the case when $n = 4$. Figure 15.2 shows all the ways to cut up a rod of 4 inches in length, including the way with no cuts at all. We see that cutting a 4-inch rod into two 2-inch pieces produces revenue $p_2 + p_2 = 5 + 5 = 10$, which is optimal.

We can cut up a rod of length n in 2^{n-1} different ways, since we have an independent option of cutting, or not cutting, at distance i inches from the left end,

length i	1	2	3	4	5	6	7	8	9	10
price p_i	1	5	8	9	10	17	17	20	24	30

Simulate for **n=21** and values in the table above