

Coin Change

I/p: amount = 11

coins = [1, 2, 5]

Initialize:

0	1	2	3	4	5	6	7	8	9	10	11
dp = [0]	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
	1	1	2	2	1						

1. For amount 1 (for loop starting from 1 to amount+1)

Coins: 1 (0) 2 (-ve) 5 (-ve)

$$\min[dp[0], dp[a-c]+1]$$

Coin 1: $a-c \Rightarrow 1-1 \Rightarrow 0=0$ so update $dp[0] \Rightarrow \min(\infty, 1) = 1$

Coin 2: $1-2 = -1$ -ve \Rightarrow no need to update for coin 2 & 5

2. For amount 2

1 (1) 2 (0) 5 (-ve) No update on dp array

Coin 1: $a-c \Rightarrow 2-1 \Rightarrow 1$, so update $dp[2] = \min[dp[2], dp[1]+1] = \min(\infty, 2) = 2$

2 $a-c \Rightarrow 2-2 \Rightarrow 0$, so update $dp[2] = \min[2, dp[0]+1] = \min(2, 1) = 1$

3. For amount 3

1 (2) 2 (1) 5 (-ve) no update on dp required

Coin 1: $a-c \Rightarrow 3-1 \Rightarrow 2$, so update $dp[3] = \min[dp[3], dp[2]+1] = \min(\infty, 3) = 3$

Coin 2: $3-2 \Rightarrow 1$, $dp[3] = \min[3, dp[1]+1] = \min(3, 2) = 2$

4. For amount 4

1 (3) 2 (2) 5 (-1) No update of

Coin 3: $a-c \Rightarrow 4-1 \Rightarrow 3$, $dp[4] = \min(\infty, dp[3]+1) = \min(\infty, 3) = 3$

Coin 2: $4-2 \Rightarrow 2$, $dp[4] = \min(3, dp[2]+1) = \min(3, 2) = 2$

5. For amount 5

1 (4) 2 (3) 5 (0)

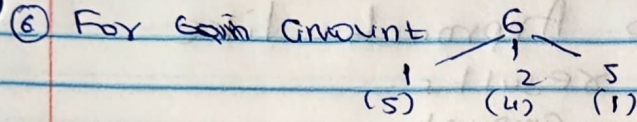
Coin 4: $a-c \Rightarrow 5-1 \Rightarrow 4$, $dp[5] = \min(\infty, dp[4]+1) = \min(\infty, 3) = 3$

Coin 2: $a-c \Rightarrow 5-2 \Rightarrow 3$, $dp[5] = \min(3, dp[3]+1) = \min(3, 3) = 3$

Coin 5: $a-c \Rightarrow 5-5 \Rightarrow 0$, $dp[5] = \min(3, dp[0]+1) = \min(3, 1) = 1$

0	1	2	3	4	5	6	7	8	9	10	11
dp = 0	1	1	2	2	1	∞	∞	∞	∞	∞	∞
						2	2	3	3	2	3

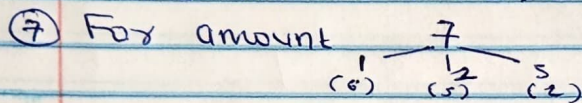
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Coin 1: $a-c \Rightarrow 6-1 \Rightarrow 5$, $dp[6] = \min(\infty, dp[5]+1) = \min(\infty, 2) = 2$

Coin 2: $a-c \Rightarrow 6-2 \Rightarrow 4$, $dp[6] = \min(2, dp[4]+1) = \min(2, 3) = 2$

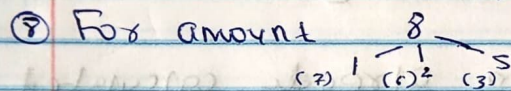
Coin 5: $a-c \Rightarrow 6-5 \Rightarrow 1$, $dp[6] = \min(2, dp[1]+1) = \min(2, 2) = 2$



For coin 1: $a-c \Rightarrow 7-1 = 6$, $dp[7] = \min(\infty, dp[6]+1) = \min(\infty, 3) = 3$

Coin 2: $a-c \Rightarrow 7-2 = 5$, $dp[7] = \min(\infty, dp[5]+1) = \min(3, 2) = 2$

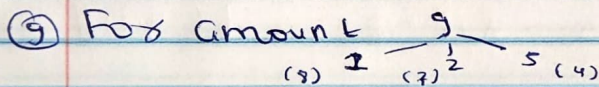
Coin 5: $a-c \Rightarrow 7-5 = 2$, $dp[7] = \min(2, dp[2]+1) = \min(2, 3) = 2$



Coin 1: $a-c \Rightarrow 8-1 = 7$, $dp[8] = \min(\infty, dp[7]+1) = \min(\infty, 3) = 3$

2: $a-c \Rightarrow 8-2 = 6$, $dp[8] = \min(3, dp[6]+1) = \min(3, 3) = 3$

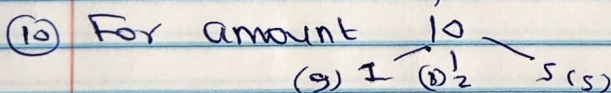
5: $a-c \Rightarrow 8-5 = 3$, $dp[8] = \min(3, dp[3]+1) = \min(3, 2) = 2$



Coin 1: $a-c \Rightarrow 9-1 \Rightarrow 8$, $dp[9] = \min(\infty, dp[8]+1) = \min(\infty, 3+1) = 4$

2: $a-c \Rightarrow 9-2 \Rightarrow 7$, $dp[9] = \min(4, dp[7]+1) = \min(4, 3) = 3$

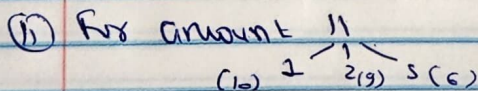
5: $a-c \Rightarrow 9-5 \Rightarrow 4$, $dp[9] = \min(3, dp[4]+1) = \min(3, 3) = 3$



For coin 1: $a-c \Rightarrow 10-1 = 9$, $dp[10] = \min(\infty, dp[9]+1) = \min(\infty, 4) = 4$

2: $a-c \Rightarrow 10-2 = 8$, $dp[10] = \min(4, dp[8]+1) = \min(4, 3+1) = 4$

5: $a-c \Rightarrow 10-5 = 5$, $dp[10] = \min(4, dp[5]+1) = \min(4, 2) = 2$



For coin 1: $a-c \Rightarrow 11-1 = 10$, $dp[11] = \min(\infty, dp[10]+1) = \min(\infty, 3) = 3$

2: $a-c \Rightarrow 11-2 = 9$, $dp[11] = \min(3, dp[9]+1) = \min(3, 4) = 3$

5: $a-c \Rightarrow 11-5 = 6$, $dp[11] = \min(3, dp[6]+1) = \min(3, 3) = 3$

Answer is: $dp[11]$ i.e. 3