CSE221 ALGORITHMS

Assignment 2

Prepared by:
Saad Bin Sohan
BRAC University

Email: sohan.academics@gmail.com
GitHub: https://github.com/saad-bin-sohan

221 Assignment (Greedy + DP)

Question : 1 Mark(10+5)

A team of two infamous thieves, Denver and Nairobi, planned to rob the famous Louvre Museum. Before the scene, they both agreed on the fact that none of them will break any item as all the items in the Louvre are too precious, and taking a fraction of any item won't sell in the black market. If it fits in the bag as a whole, they will take it, otherwise, leave it as it is.

Both of them arrived at the Louvre with an empty knapsack weighing a total of 8 kg. Despite the fact that both thieves are experts in their fields, they take slightly different approaches. Denver believes he will use a Dynamic Programming Approach to rob the items in the most efficient manner possible. Nairobi, on the other hand, believes that if she chooses a Greedy Approach, she will make the most money.

The objects in the Louvre Museum are listed below.

Objects	**Jewelry**	**Sculpture**	**Painting**	**Book**	**Mummy**
Profit ($)	5	9	5	4	6
Weight (Kg)	3	5	4	1	12

i) **Calculate** the maximum profit Denver can make using his strategy. What items did he pick up? **Show** how Denver used the DP table to select these objects. You may use arrows and circles to point to the chosen cells.
ii) Does Nairobi's belief remain valid after the robbery? **Prove** it.

Question : 2 Mark(5+5)

You are given the following table containing symbols and their frequencies:

Symbol	A	B	C	D	#
Frequency	35	15	25	10	20

i) **Build** the Huffman code tree and find the codewords for each character.
ii) **Decode** 100010111001010 using the Huffman code that you generated.

Answer to the question no- 1

1(i)

Denver will use dynamic programming approach in binary knapsack.

Given,

Objects	Jewelry	Sculpture	Painting	Book	Mummy
Profit ($)	5	9	5	4	6
Weight (Kg)	3	5	4	1	12

knapsack = 8 kg

we can build a pseudocode that fills the two condition of this situation:

```
if item_weight > weight_limit:
    copy top [curr take]

else:
    max (top, profit + dp[prev_row]
                [capacity - item_weight])
```

	0	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0	0
Jewelry (3)	0	0	0	5+0=5	5+0=5	5+0=5	5+0=5	5+0=5	5+0=5
Sculpture (5)	0	0	0	5	5	9+0=9	9+0=9	9+0=9	9+5=14
Painting (4)	0	0	0	5	5+0=5	9	9	5+5=10	14
book (1)	0	4+0=4	4+0=4	5	4+5=9	4+5=9	4+9=13	4+9=13	4+10=14
Mummy (12)	0	4	4	5	5	9	13	13	14

so the maximum profit possible is $14 which they will get from

Jewelry (3) + Painting (4) + book (1) = 8kg

5 $ 5 $ 4 $ = 14

1(ii)

Nairobi believed greedy approach in binary knapsack would be efficient.

So if we proceed accordingly,

item	profit	weight	profit per unit weight
jewelry	5	3	1.67
sculpture	9	5	1.8
painting	5	4	1.25
book	4	1	4
Mummy	6	12	0.5

According to value per unit we take,

book (4) + sculpture (1.8)

1 kg + 5 kg

$\Rightarrow$ 4 \$ + 9 \$ = 13 \$

Executing Nairobi's plan will benefit them by 13\$ but dynamic approach gives 14\$. So, Nairobi's plan doesn't give them the maximum profit.

Answer to the question no-2

2(i)

~~A → 35~~

~~B → 15~~

~~C → 25~~

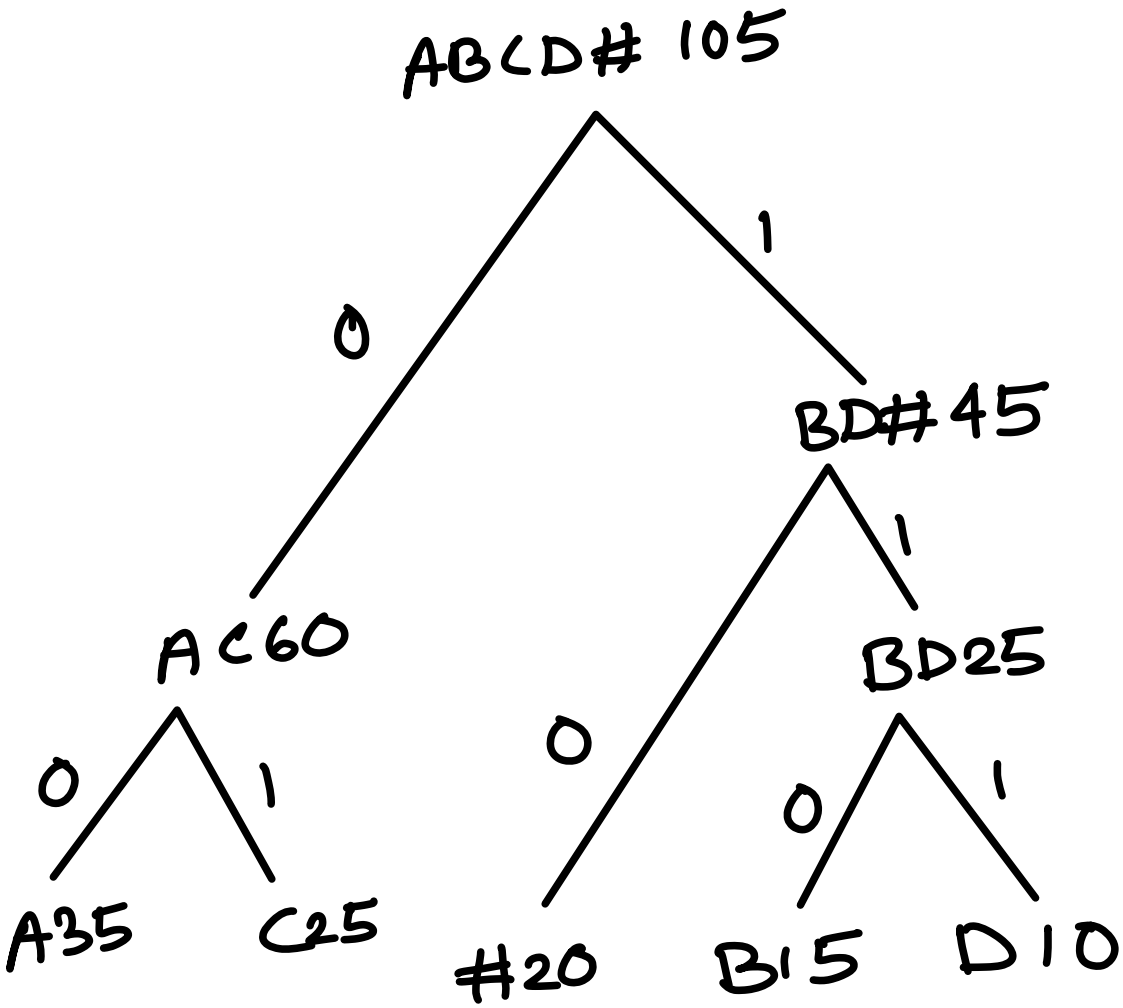
~~D → 10~~

~~# → 20~~

~~BD → 25~~

~~BD# → 45~~

~~AC → 60~~



So the representation for each character becomes:

A → (00)

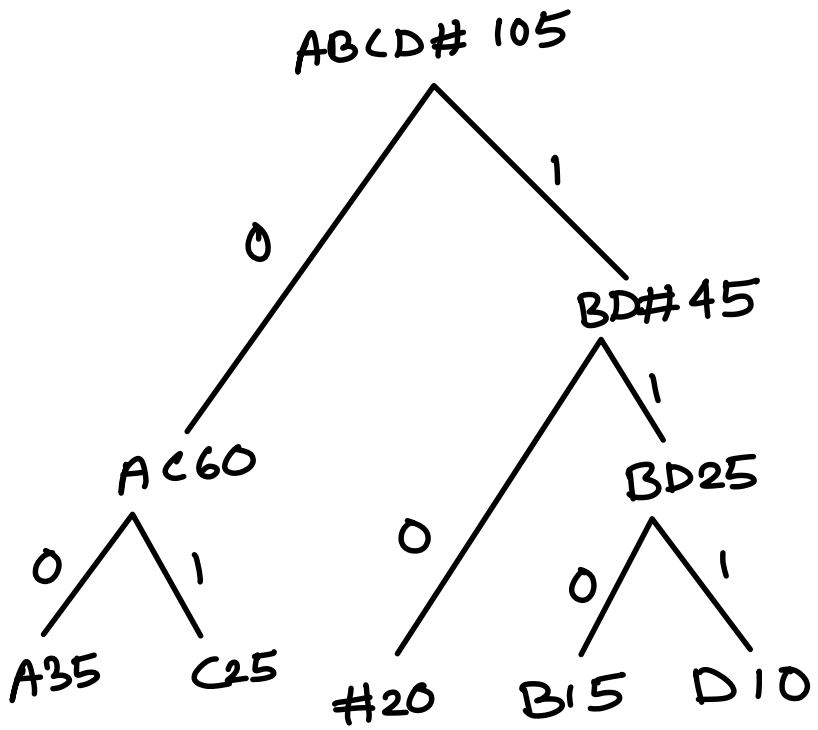
B → (110)

C → (01)

D → (111)

→ (10)

2(ii)



given huffman code.

1 0 0 0 1 0 1 1 1 0 0 1 0 1 0

1	0	0 0	1 0	1 1 1	0 0	1 0 1 0
#		A	#	D	A	# #

decoded huffman message:

#A#DA##