CS575 Homework 4

Due at the Beginning of the Class on May 5

PLEASE PRINT DOUBLE SIDED ONLY

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I promise to follow the academic honesty requirements of the Binghamton University. I agree that I will fill out and sign an official form that I have cheated if I get caught cheating. I understand that this form will be stored by the university. Furthermore, I understand that the minimum penalty for cheating is getting a grade of 0 for this assignment.

Sign: Edavelin Anand

1. [30%] You are given a 0-1 knapsack problem where the capacity ofthe knapsack W=30 and the set of items S ={(i1, 5,$50), (i2,20, $140), (i3,10,$60)} where each element in set S is a tuple of (itemID, weight, profit). Solve the given 0-1 knapsack problem using the dynamic programming method discussed in Chapter 12. Clearly show every step.

A1:

Weight ~~0~~ ... ~~4~~ ~~5~~ ... ~~9~~ ~~10~~ ... ~~14~~ ~~15~~ ... ~~20~~ ~~21~~ ... ~~25~~ ~~26~~ ... ~~30~~

Weight	0...4	5...9	10...14	15...19	20...24	25...29	30
MaxP[ ]	0	0	0	0	0	0	0
MaxP[1,]	0	50	50	50	50	50	50
MaxP[1,2]	0	50	50	50	140	190	190
MaxP[1,2,3]	0	50	60	110	140	190	200

∴ ~~MAX Profit = 200~~

$B[2,20] = \max\{B[1,20], B[1,20-20]+140\}$

$= 140$

$B[2,25] = \max\{B[1,25], B[1,25-20]+140\}$

$= 190$

A1:

$$B[3,10] = \max\{B[2,10] + B[2,10-10] + 60\}$$

$$= 60$$

$$B[3,15] = \max\{B[2,15] + B[2,15-10] + 60\}$$

$$= 110$$

$$B[3,20] = \max\{B[2,20] + B[2,20-10] + 60\}$$

$$= 140$$

$$B[3,25] = \max\{B[2,25], B[2,25-10] + 60\}$$

$$= 190$$

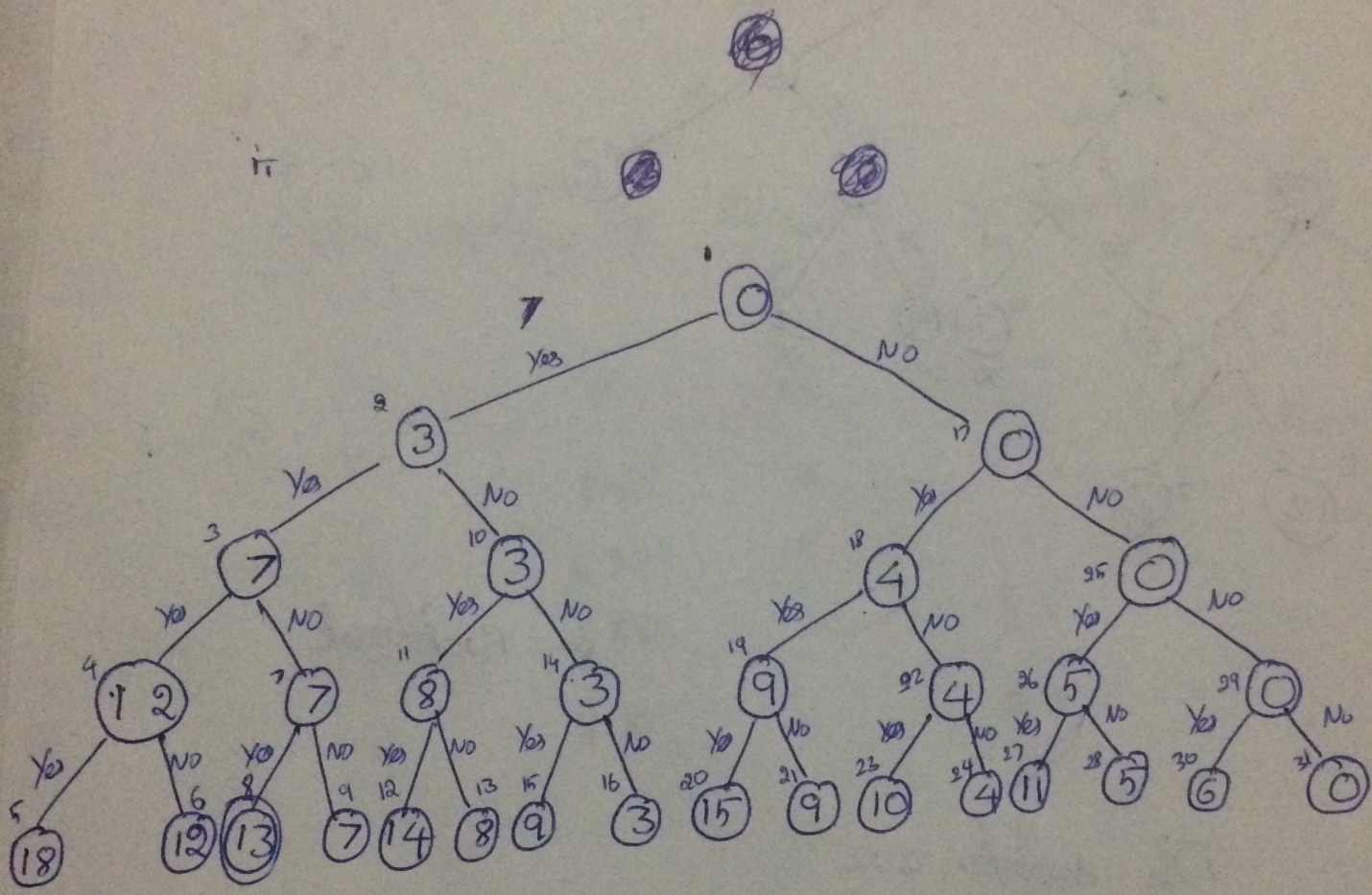
$$B[3,30] = \max\{B[2,30], B[2,30-10] + 60\}$$

$$= 200.$$

$\therefore$ **Max profit = 200**

2. [40%] A set{3,4,5, 6} is given. For the set, findevery subset that sums to S =13.

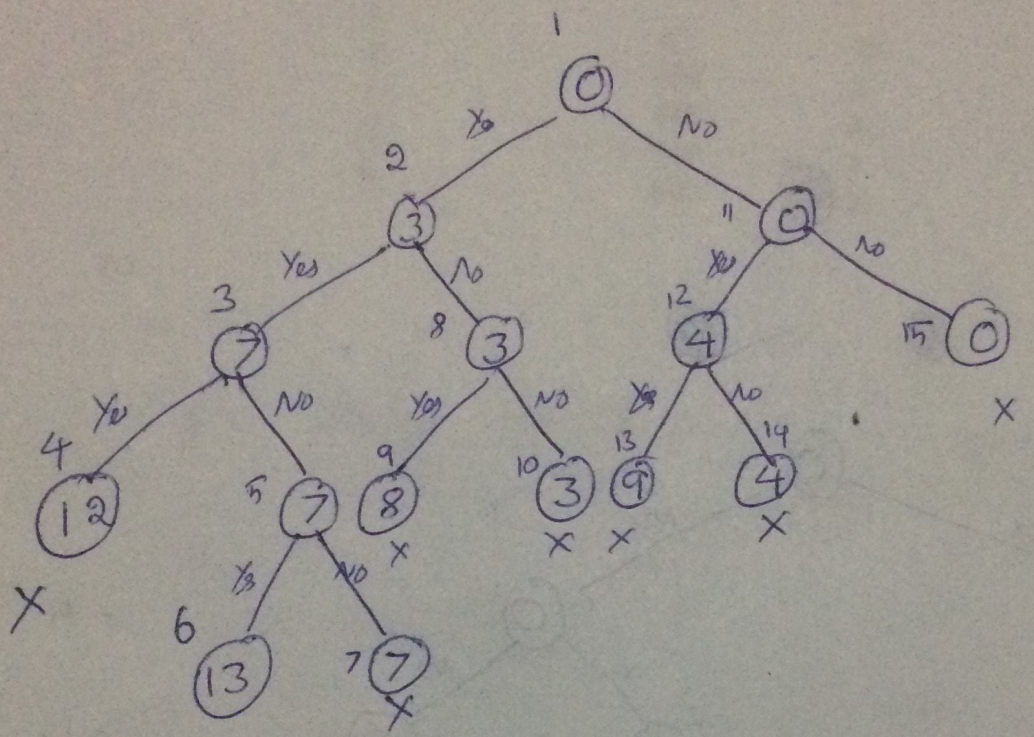
a. [10%] Solve the problem using the depth first method. Draw a state space tree and clearly show every step. Also, number the nodes in the sequence of visiting them.



The Subset that Sums to S=13

$\Rightarrow \{3, 4, 6\}$

b. [30%] Find the subsets via backtracking. Draw a (pruned) state space tree and clearly show every step. Number the nodes in the sequence of visiting them too.



$-i_1 - 3$

$-i_2 - 4$

$-i_3 - 5$

$-i_4 - 6$

X - Backtrack

∴ The subsets are

$\{3, 4, 6\}$

3. [30%] When the capacity of the knapsack is 16, solve the following 0-1knapsack problem using the backtracking algorithm discussed in class that uses the optimal fractional knapsack algorithm to compute the possible upper bound of the profit.

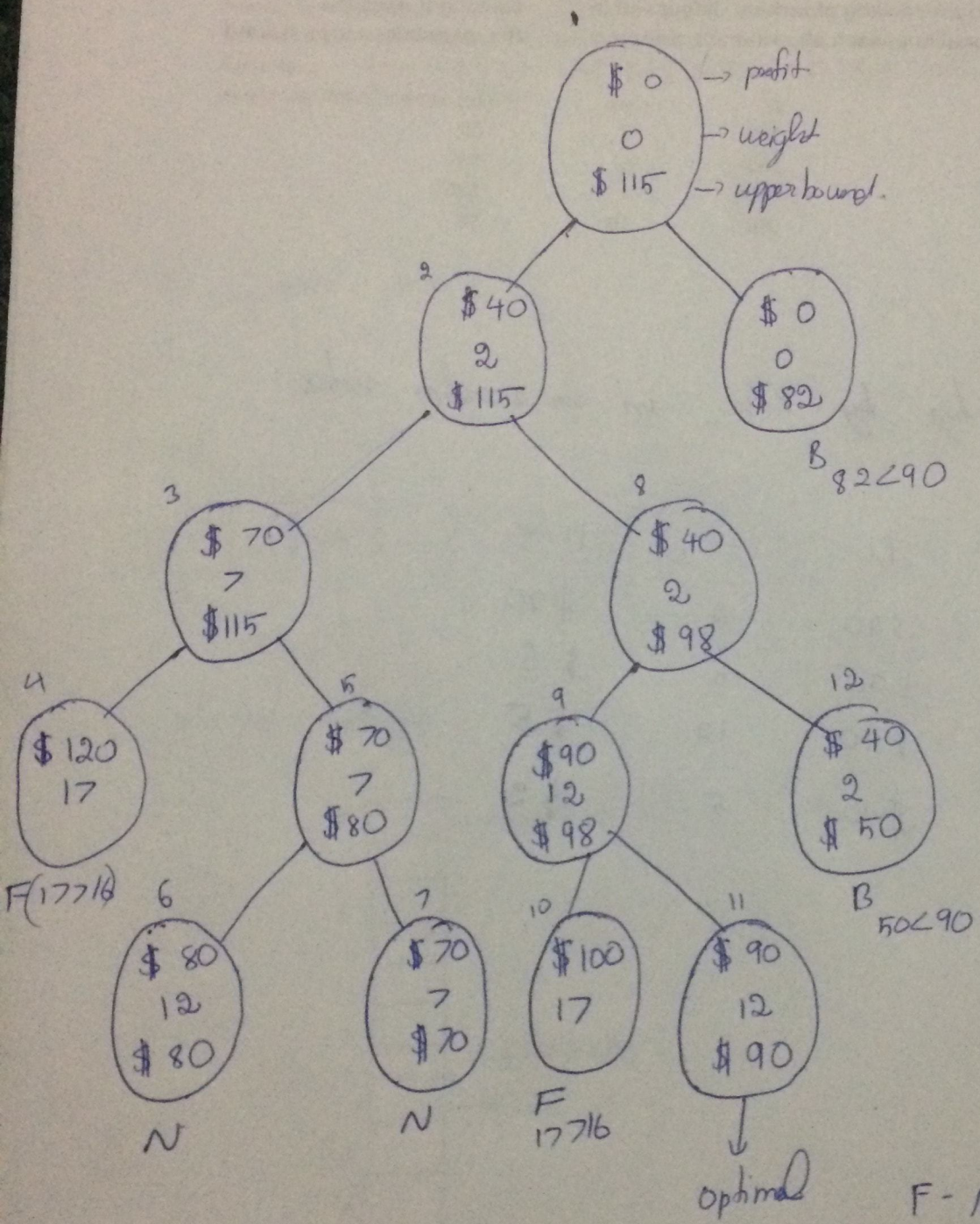
i	p_i	w_i	p_i / w_i
1	\$10	5	\$2
2	\$30	5	\$6
3	\$40	2	\$20
4	\$50	10	\$5

A3

After sorting by p_i/w_i in non-ascending order

i	p_i	w_i	p_i/w_i
1	\$40	2	\$20
2	\$30	5	\$6
3	\$50	10	\$5
4	\$10	5	\$2

A3



Item 1 [$40, 2]

Item 2 [$30, 5]

Item 3 [$50, 10]

Item 4 [$10, 5]

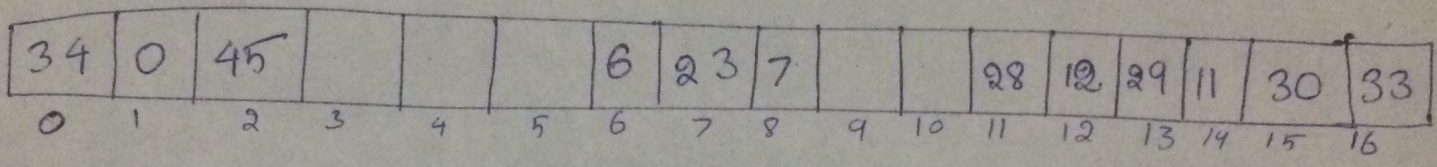
F - Not feasible

N - Not optimal

B - Cannot lead to Best solution

4. [20%] Assume that a hash table has 17 buckets where each buckethas only one slot. A simple hash function: home bucket = key % 17 (where % is a mod function) is used to compute the home bucket based on the key. You are supposed to insert the following keys to the hash table: 6,12,34,29,28,11,23,7,0,33,30,45 using the following overflow handling methods.

a) Linear probing



b) Sorted Chaining