COMBINATORIAL AUCTIONS

- DEFINE THE FORMAL MODEL OF A COMBINATORIAL AUCTION
- DESCRIBE HOW TO FIND THE OPTIMAL ALLOCATION BY MEANS OF BRANCH-AND-BOUND ALGORITHM (WITH PRUNING AND HEURISTICS)
- FIND THE OPTIMAL ALLOCATION IN THE FOLLOWING AUCTION

ITEMS $= \{1, 2, 3, 4\}$

Bids

6	1		
3	2		
12	3	4	
12	1	3	
8	2	4	
16	1	3	4

$\Rightarrow$

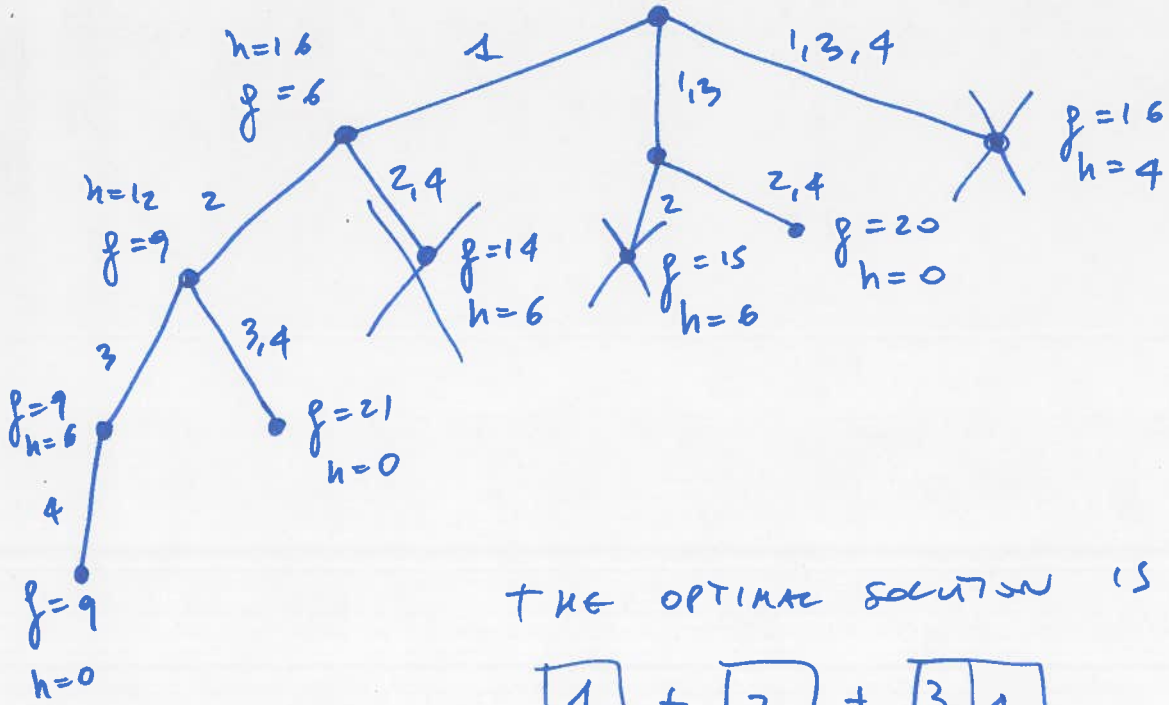
$h_1 = \text{MAX}\{6, 12/2, 16/3\} = 6$

$h_2 = \text{MAX}\{3, 8/2\} = 4$

$h_3 = \text{MAX}\{12/2, 12/2, 16/3\} = 6$

$h_4 = \text{MAX}\{12/2, 8/2, 16/3\} = 6$

THE TREE IS (THE DUMMY BIDS "0" OVER (3) AND (4) MUST BE ADDED)



THE OPTIMAL SOLUTION IS

[1] + [2] + [3 | 4]

- WHAT IS THE COMPLEXITY OF THE BRANCH-AND-BOUND ALGORITHM TO FIND THE OPTIMAL ALLOCATION?
- WHEN BIDDERS ARE SINGLE-MIND?
- WHAT IS THE COMPLEXITY OF SOLVING A COMBINATORIAL AUCTION WITH SINGLE-MIND BIDDERS?
- SOLVE APPROXIMATELY (IN POLYNOMIAL TIME) THE FOLLOWING PROBLEM

$b_1 = \{ \boxed{1},\ v_1 = 6 \}$

$b_2 = \{ \boxed{2},\ v_2 = 3 \}$

$b_3 = \{ \boxed{3}\boxed{4},\ v_3 = 12 \}$

$b_4 = \{ \boxed{1}\boxed{3},\ v_4 = 12 \}$

$b_5 = \{ \boxed{2}\boxed{4},\ v_5 = 8 \}$

$b_6 = \{ \boxed{1}\boxed{3}\boxed{4},\ v_6 = 16 \}$

① COMPUTE $\frac{v_i}{\sqrt{|S_i|}}$

$\frac{v_1}{\sqrt{|S_1|}} = 6$, $\frac{v_2}{\sqrt{|S_2|}} = 3$

$\frac{v_3}{\sqrt{|S_3|}} = 8.48$ $\frac{v_4}{\sqrt{|S_4|}} = 8.48$

$\frac{v_5}{\sqrt{|S_5|}} = 5.65$ $\frac{v_6}{\sqrt{|S_6|}} = 9,23$

② $b_6 > b_3 \geq b_4 > b_1 > b_5 > b_2$

③

b_6 IS ACCEPTED $\boxed{1}\boxed{3}\boxed{4}$

b_3 IS REJECTED

b_4 IS REJECTED

b_1 IS REJECTED

b_5 IS REJECTED

b_2 IS ACCEPTED $\boxed{2}$

THE VALUE IS 19, WHILE THE OPTIMAL VALUE IS 21

④ PAYMENTS:

$$p_3 = p_4 = p_1 = p_5 = 0$$

$$p_6 = v_3 \sqrt{\frac{|S_6|}{|S_3|}} = 14.69$$

$$p_2 = 0$$

- WHAT IS THE APPROXIMATION RATIO FOR THE BEST APPROXIMATION OF COMBINATORIAL AUCTIONS WITH SINGLE-MIND BIDDERS?