



## Hw3 - Homework for cs404

Artificial Intelligence (Sabanci Üniversitesi)



Scan to open on Studocu

NAME:

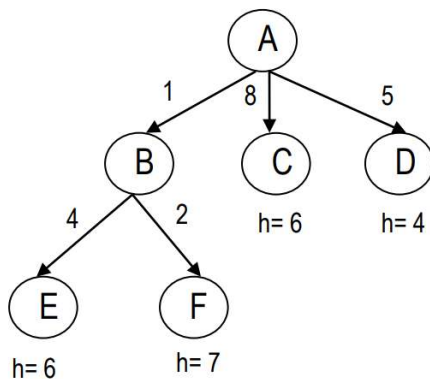
## CS 404 – Artificial Intelligence Spring 2019

### HW3–Local Search – Adversarial Search 75pts

- 1) **5pts** – Give the name of the algorithm that results when you do a local beam search with  $k = 1$ .

**Answer: Hill Climbing Search**

- 2) **30pts** - Consider the following **partial** search tree (we are in the middle of the search), where each edge is labeled with the cost of the corresponding operator and the leaves (fringe nodes) are labeled with the value of a heuristic function,  $h$ , estimating the remaining cost to the goal. Which node will be expanded next by each of the following search methods? Give a very small explanation or show your work.



1. Uniform-Cost Search: **F** (Only looks at the edge costs and advances with the cheapest one)
2. Greedy Best-First Search: **D** (Only looks at the heuristic function and advances with the optimum one)
3. A\* Search: **D** (A\* looks at the sum of heuristic function and the edge cost, then advances with the smallest one)

NAME:

- 3) **10pts** A heuristic results in exploring  $N=180$  nodes and finds the solution at depth  $d=2$ . What is its effective branching factor? Give an **approximate** answer, but you must show your work.

**Hint:**

$9^3 \sim 720$   
 $10^3 = 1000$   
 $11^3 \sim 1300$   
 $12^3 \sim 1800$   
 $13^3 \sim 2200$   
 $14^3 \sim 2750$

$N$  is the number of nodes traversed,  $d$  is the solution's depth and  $b$  is the effective branching factor.

$$N = 1 + b + b^2 + \dots + b^d = (b^{d+1} - 1) / (b - 1)$$

$$180 = (b^3 - 1) / (b - 1)$$

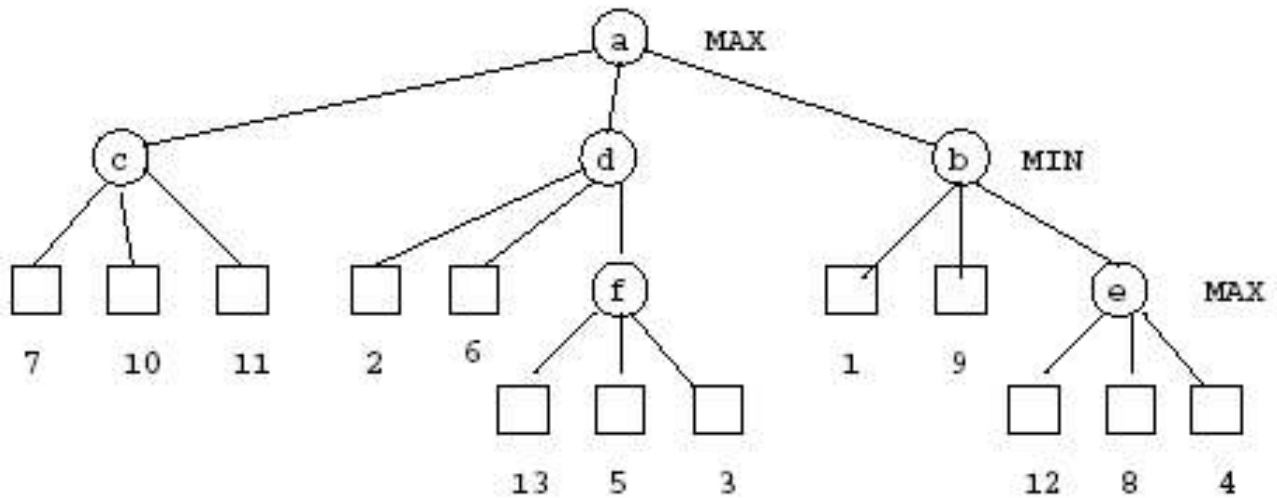
$$180b - b^3 = 181$$

$$b^* = 12.8 \approx 13$$

NAME:

#### 4) 30pts - Game Playing

Using the following Minimax tree, answer the following questions:



a) 5pt - What score is guaranteed for MAX?

**Answer: 7**

b) 15pt - Indicate **all the nodes** that are pruned using alpha-beta pruning? You can use the node name or values to indicate.

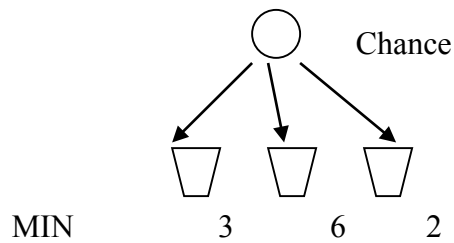
**Answer: 6, f, e, 9**

c) 5 - True or False: If Max uses alpha-beta pruning in Minimax, can s/he miss the chance of a better play (if s/he didn't prune)? Assume a perfect opponent.

**Answer: False**

NAME:

d) 5pt - What is the expectimax value for the following chance node (circle)? Assume equal probability for each of the chance outcome and the given expectimax values for the MIN node.



$$\text{Chance} = \frac{1}{3} * 3 + \frac{1}{3} * 6 + \frac{1}{3} * 2 = 3,66$$

\*) For those who have requested extra study questions, other good questions to work on (from the topics we covered) are: AIMA 3rd ed: 4.9 (topic not covered, but in the slides) 5.12, 5.15, 5.18, 5.19, 5.21,