

# CSE 5525 Artificial Intelligence II

## Quiz #1: A\* Search and Minimax

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### 1 Pancake Heuristics

The pancake problem is a well-known optimization problem that is described as follows: a chef has a stack of pancakes, all of which have different sizes. The chef can flip the top  $k$  pancakes, reversing their order. The cost of flipping  $k$  pancakes is  $k$ . The chef's goal is to order the pancakes from the smallest on the top to the largest at the bottom with the minimal cost. More formally, the search states are all permutations  $\sigma$  of  $(1, 2, 3, \dots, n)$ , and the goal state is  $(1, 2, 3, \dots, n)$ .

Here are two heuristics for the pancake problem:

$H_a$  - the largest pancake that is out of the place (largest  $i$  such at  $i \neq \sigma_i$ )

$H_c$  - the number of pancakes out of position (count of all  $i$  such at  $i \neq \sigma_i$ )

#### Questions:

1) Is  $H_a$  admissible? Why?

$H_a$  is admissible because putting pancake  $i$  into place will cost at least  $i$ .

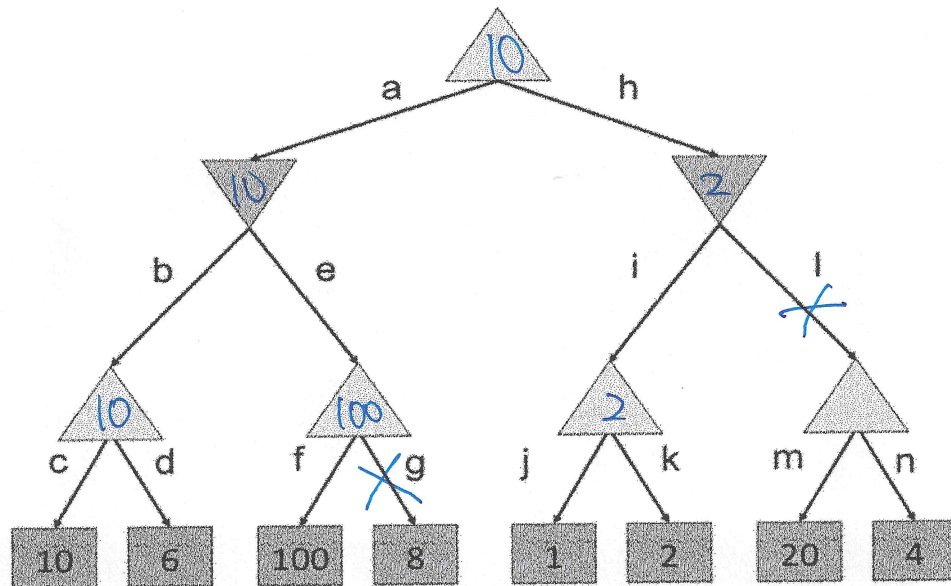
2) Is  $H_c$  admissible? Why?

$H_c$  is admissible because putting  $k$  pancake into position will require

2) Does  $H_a$  dominates  $H_c$ ? Why? a flip or flips of cost  $\geq k$

Yes,  $H_a$  dominates  $H_c$ . If  $k$  pancakes are not in position, then one of them (or <sup>1</sup>more) is of size  $k$  or bigger.

## 2 Alpha-Beta Pruning



**Questions:** Triangles with the point up are *MAX* and Triangles with point down are *MIN*. Given the game tree above, which branches of  $a, b, c, \dots, n$  will be pruned based on the Alpha-Beta algorithm?

*g and l*