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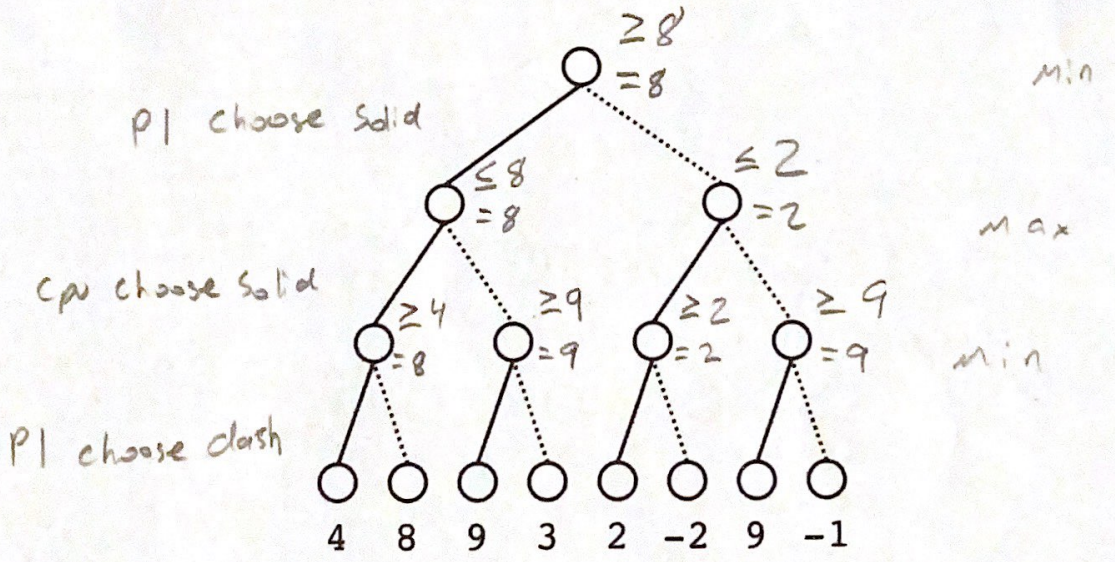
CMSC 471
Artificial Intelligence
Summer 2021
Quiz 2
Due: As long as it is 27-JUL-2021 anywhere on Earth (AOE)
https://time.is/Anywhere_on_Earth
20 points
6 questions
4 pages

1. MINIMAX-$\alpha\beta$ selects a move that yields a higher evaluation than MINIMAX. [T or (F)] 0.5

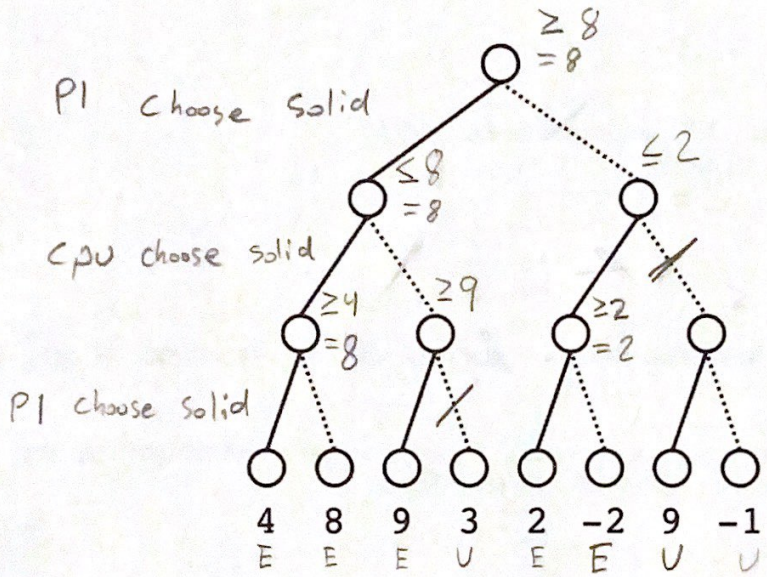
2. In a tree with branching factor b and depth d, if moves are ordered the right way, the number of nodes examined by MINIMAX-$\alpha\beta$ is (circle one): 0.5
   a. O(b)
   b. O(b^d)
   (c.) O($b^{d/2}$)

3. For all parts of this question, start from the left-most leaf node and show all your work for full credit, including the =, ≤, and ≥ symbols when propagating node values.

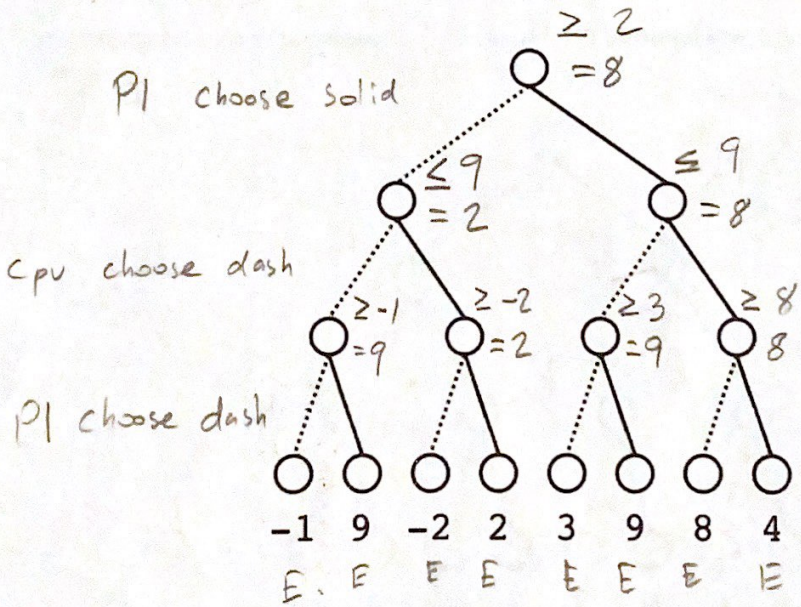
   a) Use MINIMAX to indicate whether P1 (maximizer) chooses action DASH or SOLID. 2



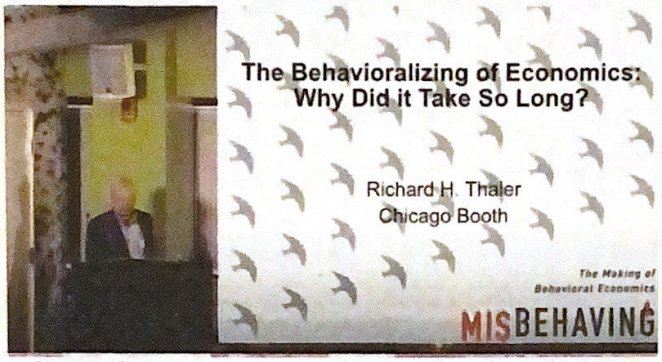
b) Use MINIMAX-$\alpha\beta$ to indicate whether P1 (maximizer) chooses action DASH or SOLID. Cross out the static evaluations that are not used. 3



c) Use MINIMAX-$\alpha\beta$ to indicate whether P1 (maximizer) chooses action DASH or SOLID. Cross out the static evaluations that are not used. 3



5. Watch this video on *Behavioral Economics* and answer the following questions:



https://www.youtube.com/watch?v=D9Uk-YsjQsI

a) *Richard Thaler* refers to optimizing agents as logical (Econs?), as opposed to humans. 0.5

b) Caring about your raw score on an exam (as opposed to the percentage) is an example of a Supposedly Irrelevant factor, which classical economics tends to ignore. 1

c) Humans *optimize*, but only when stakes are high (buying a house vs milk). [T or F] 0.5

6. This question requires you to investigate pruning techniques beyond MINIMAX-$\alpha\beta$. You may use the book or other resources, but don't forget to cite your sources.

a) `ProbCut` is a pruning method. Briefly describe it in your own words. 2

ProbCut enhances minimax-ab by calculating probabilities of sub-trees having the chance of a max-win selection. This allows for a faster calculation, at the expense of a 100% correct choice. Allows substituting correctness for speed.

b) What is the main difference between MINIMAX-$\alpha\beta$ and `ProbCut`? 2

Minimax-ab always makes the correct choice in $O(b^{d/2})$. Probcut can run faster, but has a probability of correctness proportional to run time.

c) `ProbCut` is a type of *forward pruning*. Describe another *forward pruning* approach. 1

Null move pruning: no selection is made for alpha, if subtree is still large enough for a beta cutoff then cutoff performed END without needing to check subtree further.

4

4. The top node at a certain stage of a tic-tac-toe game is shown below. What move will an AI agent running MINIMAX make next? Start from the left-most leaf node and show all your work for full credit, including the =, ≤, and ≥ symbols when propagating node values. 4

AI: X
Human: O

- *Hint:* AI is P1 (maximizer).

1 = win move
0 = lose move