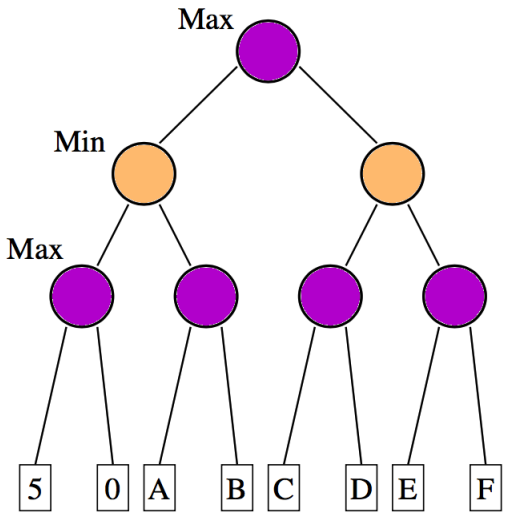
COMS 4701 Artificial Intelligence

Homework 3 Conceptual – Due date: Friday March 10th, 2021

Justify all your work to receive full credit

1. **Alpha-Beta Pruning**

   Consider the following game tree. Let A through F be real numbers. We explore the nodes with minimax and α-β pruning.



   (a) Give a domain for A, so B is pruned.

   (b) Let $A = B = 5$. Suggest values for C and D such as the subtree with children E and F is pruned.

2. **Iterative Deepening in Adversarial Search**

   Provide at least two reasons why Iterative Depth Search (also called Depth First Iterative Deepening DFID) is useful in solving adversarial two-player games like chess.

   Suggested reading: Section 7 of Depth-First Iterative Deepening, Korf 1985:

   `https://courseworks2.columbia.edu/courses/124199/files/folder/READING?preview=9877550`

3. **Machine Learning Evaluation Measures**

   Consider a dataset with 90 negative examples and 10 positive examples.

   (a) Suppose a model built using this data predicts 30 of the examples as positive (only 10 of them are actually positive) and 70 as negative. What are the numbers of True Positives (TP), False Positives (FP), True Negatives (TN), and False Negatives (FN).

   (b) What measure derived from these numbers can help detect the poor prediction ability of the model? Consider the measures of accuracy, precision, recall, specificity defined below. Justify your choice.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad Precision = \frac{TP}{TP + FP}$$

$$Recall(sensitivity) = \frac{TP}{TP + FN} \quad Specificity = \frac{TN}{TN + FP}$$

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