

CS-171, Intro to A.I., SS-1, 2018 — Quiz # 3 — 20 minutes

NAME: _____

YOUR ID: _____ ID TO YOUR RIGHT: _____ ROW NO.: _____ SEAT NO.: _____

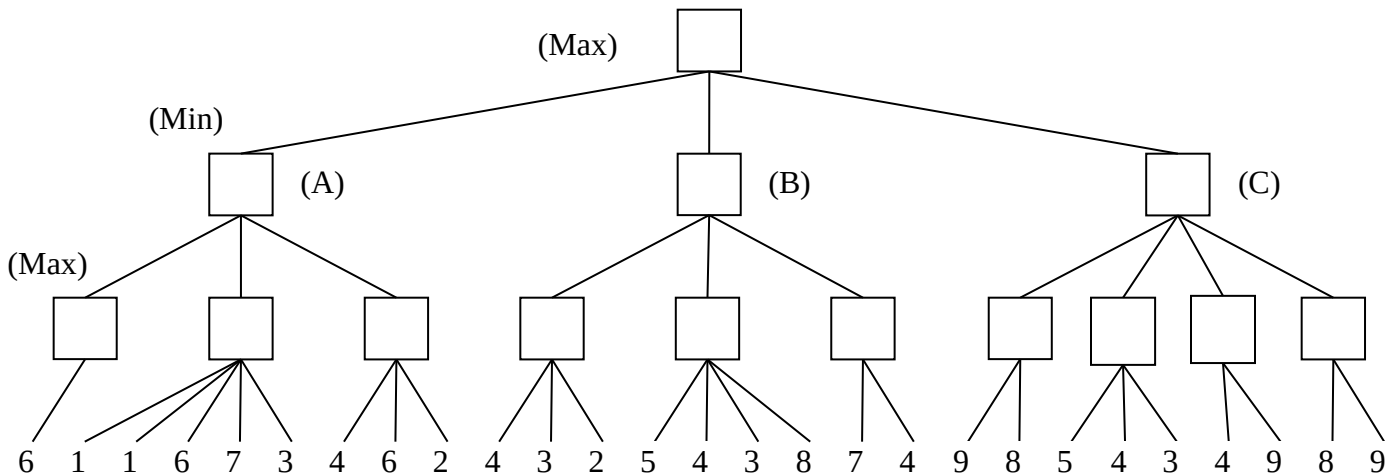
1. (15 pts total, -5 pts for each error, but not negative) MINI-MAX SEARCH IN GAME TREES.

The game tree below illustrates a position reached in the game. Process the tree left-to-right. It is **Max**'s turn to move. At each leaf node (number at bottom) is the estimated score returned by the heuristic static evaluator.

1.a. Fill in each blank square with the proper mini-max search value.

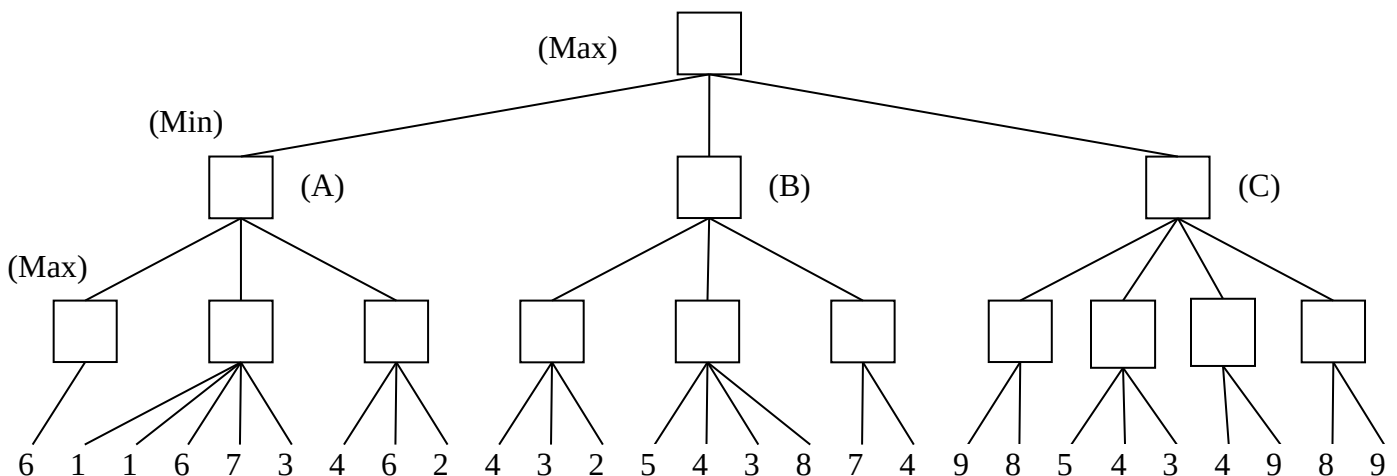
1.b. What is the best move for Max? (write A, B, or C) _____

1.c. What score does Max expect to achieve? _____



2. (35 pts total, -5 for each error, but not negative) ALPHA-BETA PRUNING. Process the tree left-to-right. This is the same tree as above (1.a). You do not need to indicate the branch node values again.

Draw X over each leaf node (number at bottom) that will be pruned by Alpha-Beta Pruning.



**** TURN PAGE OVER AND CONTINUE ON THE OTHER SIDE ****

3. (25 pts total, 5 pts each) Unifiers and Unification.

Write the **most general unifier** (or MGU) of the two terms given, or "None" if no unification is possible. Write your answer in the form of a substitution as given in your book, e.g., the substitution $\{x / John, y / Mary, z / Bill\}$ means substitute x by *John*, substitute y by *Mary*, and substitute z by *Bill*.

The first one is done for you as an example.

3.a. (example) UNIFY(*Knows(John, x)*, *Knows(John, Jane)*) $\{x / Jane\}$

3.b. (5 pts) UNIFY(*Knows(John, x)*, *Knows(y, Jane)*) _____

3.c. (5 pts) UNIFY(*Knows(John, x)*, *Knows(y, Father (y))*) _____

3.d. (5 pts) UNIFY(*Knows(John, F(x))*, *Knows(y, F(F(z)))*) _____

3.e. (5 pts) UNIFY(*Knows(John, F(x))*, *Knows(y, G(z))*) _____

3.f. (5 pts) UNIFY(*Knows(John, F(x))*, *Knows(y, F(G(y)))*) _____

4. (25 pts total, 5 pts each) Quantifiers.

In this problem, Likes(A, B) means A likes B, and Sister(A, B) means A is a sister of B. Single-argument predicates have their intended meaning; e.g., Cat(A) means A is a cat, etc. Fill in each blank below with Y (= Yes) or N (= No) depending on whether the first order logic sentence correctly expresses the English sentence.

The first one is done for you as an example.

4.a. (example) N "All cats are mammals."

$\forall x \text{ Cat}(x) \wedge \text{Mammal}(x)$

4.b. (5 pts) _____ "Spot has a sister who is a cat."

$\exists x \text{ Sister}(x, \text{Spot}) \wedge \text{Cat}(x)$

4.c. (5 pts) _____ "Every person has someone that they like."

$\exists x \text{ Person}(x) \wedge (\forall y \text{ Person}(y) \Rightarrow \text{Likes}(x, y))$

4.d. (5 pts) _____ "There is someone who likes everyone."

$\forall x \text{ Person}(x) \Rightarrow (\exists y \text{ Person}(y) \wedge \text{Likes}(x, y))$

4.e. (5 pts) _____ "Everyone likes ice cream."

$\forall x (\text{Person}(x) \Rightarrow \text{Likes}(x, \text{IceCream})) \equiv \neg \exists x \neg (\text{Person}(x) \Rightarrow \text{Likes}(x, \text{IceCream}))$

4.f. (5 pts) _____ "All men are mortal."

$\forall x \text{ Man}(x) \Rightarrow \text{Mortal}(x)$

Scratch Paper (1) Please Do Not Detach From Test

Scratch Paper (2) Please Do Not Detach From Test