

CS-171, Intro to A.I. — Quiz#2 — Winter Quarter, 2014 — 20 minutes

YOUR NAME AND EMAIL ADDRESS: _____

YOUR ID: _____ ID TO RIGHT: _____ ROW: _____ SEAT: _____

1. (15 pts total, -5 pts each error, but not negative) **Search Properties.** Fill in the values of the four evaluation criteria for each search strategy shown. Assume a tree search where b is the finite branching factor and d is the depth of the shallowest goal node; m is the maximum depth of the search tree; ϵ is the maximum error allowed and equal to some positive ϵ ; in bidirectional search both directions use b .

Your answer will be considered correct if it differs from that shown below by no more than ± 1 , e.g., $O(b^d)$ vs. $O(b^{d+1})$.

Note: These assumptions are the same as in Figure 3.21 of the textbook.

	Complete?	Time complexity	Space complexity	Optimal?
Depth-First	No	$O(b^m)$	$O(bm)$	No
Breadth-First	Yes	$O(b^d)$	$O(b^d)$	Yes
Uniform-Cost	Yes	$O(b^{(1+\text{floor}(C^*/\epsilon))})$ $O(b^{(d+1)})$ also OK	$O(b^{(1+\text{floor}(C^*/\epsilon))})$ $O(b^{(d+1)})$ also OK	Yes
Depth-Limited	No	$O(b^l)$	$O(bl)$	No
Iterative Deepening	Yes	$O(b^d)$	$O(bd)$	Yes
Bidirectional (if applicable)	Yes	$O(b^{(d/2)})$	$O(b^{(d/2)})$	Yes

2. (35 pts total, -5 pts for each error, but not negative) 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 is the estimated score returned by the heuristic static evaluator.

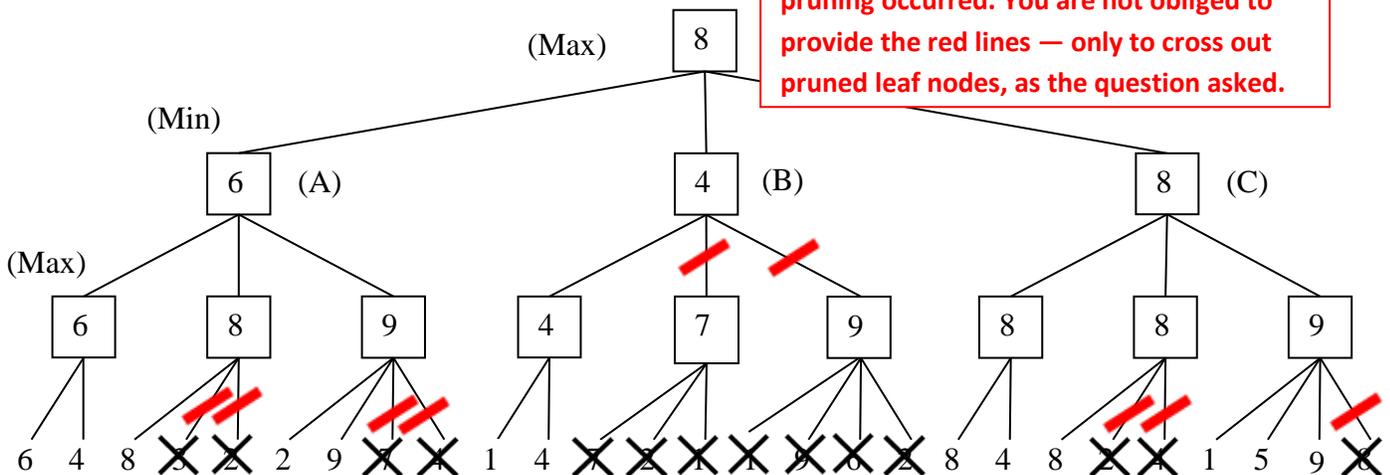
2.a. Fill in each blank square with the proper mini-max search value.

2.b. Cross out each leaf node that will be pruned by Alpha-Beta Pruning.

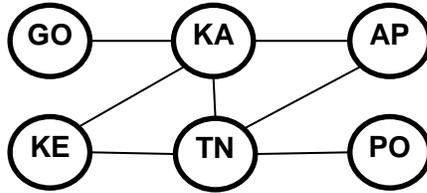
See Sections 5.2 and 5.3.

2.c. What is the best move for Max? (write A, B, or C) C

Red lines indicate where in the tree pruning occurred. You are not obliged to provide the red lines — only to cross out pruned leaf nodes, as the question asked.



3. (50 points each, 10 pts each) Constraint Satisfaction Problems



GO = Goa
 KA = Karnataka
 AP = Andhra Pradesh
 KE = Kerala
 TN = Tamil Nadu
 PO = Pondicherry

You are a map-coloring robot assigned to color this Southern India map. Adjacent regions must be colored a different color (R=Red, B=Blue, G=Green). The constraint graph is shown.

3a. (10 pts total, -5 each wrong answer, but not negative) FORWARD CHECKING. Cross out all values that would be eliminated by Forward Checking, after variable KA has just been assigned value R as shown:

GO	KA	AP	KE	TN	PO
X G B	R	X G B	X G B	X G B	R G B

See Section 6.3.2.

3b. (10 pts total, -5 each wrong answer, but not negative) ARC CONSISTENCY. GO and AP have been assigned values, but no constraint propagation has been done. Cross out all values that would be eliminated by Arc Consistency (AC-3 in your book).

GO	KA	AP	KE	TN	PO
B	X G X	R	R XX	XX R B	R G X

See Section 6.3.2.

3c. (10 pts total, -5 each wrong answer, but not negative) MINIMUM-REMAINING-VALUES HEURISTIC. Consider the assignment below. KA is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Minimum-Remaining-Values (MRV) Heuristic: GO, AP, KE, TN.

GO	KA	AP	KE	TN	PO
R B	G	R B	R B	R B	R G B

See Section 6.3.1.

3d. (10 pts total, -5 each wrong answer, but not negative) DEGREE HEURISTIC. Consider the assignment below. (It is the same assignment as in problem 3c above.) KA is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Degree Heuristic: TN.

GO	KA	AP	KE	TN	PO
R B	G	R B	R B	R B	R G B

See Section 6.3.1.

3e. (10 pts total) MIN-CONFLICTS HEURISTIC. Consider the assignment below. TN has been selected to be assigned a new value. What new value would be chosen below for TN by the Min-Conflicts Heuristic? R.

GO	KA	AP	KE	TN	PO
B	G	B	G	?	B

See Section 6.4.