CS-171, Intro to A.I., Fall Quarter, 2018—Quiz # 4—20 minutes

NAME: _____ UCI NetID: _____

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

See Section 18.3.

1. (50 pts total) Decision Tree Classifier Learning. You are a robot in a lumber yard, and must learn to discriminate Oak wood from Pine wood. You choose to learn a Decision Tree classifier. You are given the following examples:

Example	Density	Grain	Hardness	Cla
Example #1	Heavy	Small	Hard	Oa
Example #2	Heavy	Large	Hard	Oa
Example #3	Heavy	Small	Hard	Oa
Example #4	Light	Large	Soft	Oa
Example #5	Light	Large	Hard	Pin
Example #6	Heavy	Small	Soft	Pin
Example #7	Heavy	Large	Soft	Pin
Example #8	Heavy	Small	Soft	Pin

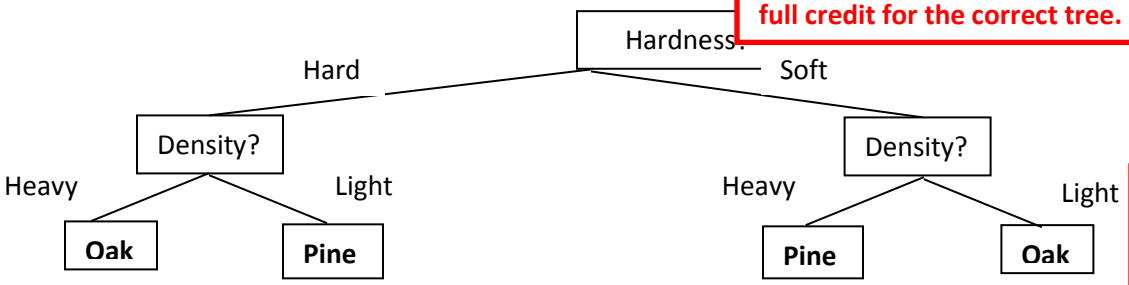
If root is Density:
Heavy = OOOPPP, Light = OP
If root is Grain:
Small = OOPP, Large = OOPP
If root is Hardness:
Hard = OOOP, Soft = OPPP
(O = Oak, P = Pine)

1a. (10 pts) Which attribute would information gain choose as the root of the tree?

Hardness .

1b. (20 pts) Draw the decision tree that would be constructed by recursively applying information gain to select roots of sub-trees, as in the Decision-Tree-Le

Half credit for the correct root; half credit for wrong root but correct classification; full credit for the correct tree.



Full credit if your answers are right for the tree you drew, even if the tree itself is wrong.

Classify these new examples as Oak or Pine using your decision tree above.

1c. (10 pts) What class is [Density=Light, Grain=Small, Hardness=Hard]? Pine

1d. (10 pts) What class is [Density=Light, Grain=Small, Hardness=Soft]? Oak

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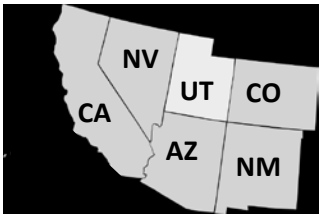
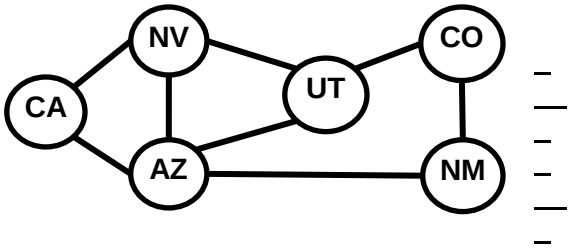
2. (50 points total, 10 pts each) Constraint Satisfaction Problems. See Chapter 6.





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

2.a. (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 AZ has just been assigned value R as shown:

CA	NV	AZ	UT	CO	NM
~~R~~ G B	~~R~~ G B	R	~~R~~ G B	R G B	~~R~~ G B

2.b. (10 pts total, -5 each wrong answer, but not negative) ARC CONSISTENCY.
CA and AZ 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).

CA	NV	AZ	UT	CO	NM
B	~~R~~ G ~~B~~	R	~~R~~ ~~G~~ B	R G ~~B~~	~~R~~ G B

2.c. (10 pts total, -5 each wrong answer, but not negative) MINIMUM-REMAINING-VALUES HEURISTIC. Consider the assignment below. NV is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Minimum-Remaining-Values (MRV) Heuristic: **CA, AZ, UT** .

CA	NV	AZ	UT	CO	NM
R B	G	R B	R B	R G B	R G B

2.d. (10 pts total, -5 each wrong answer, but not negative) DEGREE HEURISTIC. Consider the assignment below. (It is the same assignment as in problem 2.c above.) NV is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Degree Heuristic (note: ignore MRV for this problem): **AZ** .

CA	NV	AZ	UT	CO	NM
R B	G	R B	R B	R G B	R G B

2.e. (10 pts total) MIN-CONFLICTS HEURISTIC. Consider the complete but inconsistent assignment below. AZ has just been selected to be assigned a new value during local search for a complete and consistent assignment. What new value would be chosen below for AZ by the Min-Conflicts Heuristic?. **R** .

CA	NV	AZ	UT	CO	NM
B	G	**?**	G	G	B