CS 171, Intro to A.I., Winter Quarter, 2020 — Take-Home Quiz # 4

NAME:_____ UCINetID _____

1. (25 pts total) Machine Learning.

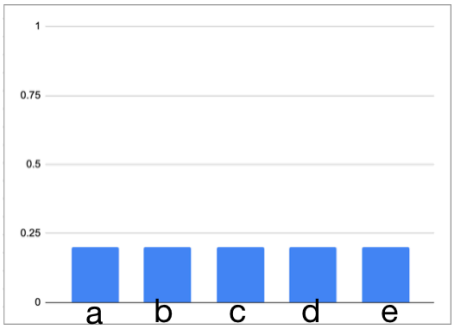
1.a. (15 pts) The probability distribution of random variables X, Y, and Z is shown in the graphs bellow. Each of these random variables can get 5 different values of a, b, c, d and e and the probability of each value is shown in the graphs.

P(X=a) = P(X=b) = P(X=c) = P(X=d) = P(X=e) = 0.2

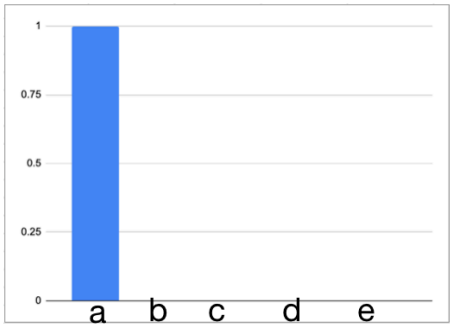
P(Y=a) = 1, P(Y=b) = P(Y=c) = P(Y=d) = P(Y=e) = 0

P(Z=a) = 0.6, P(Z=b) = P(Z=c) = P(Z=d) = P(Z=e) = 0.1

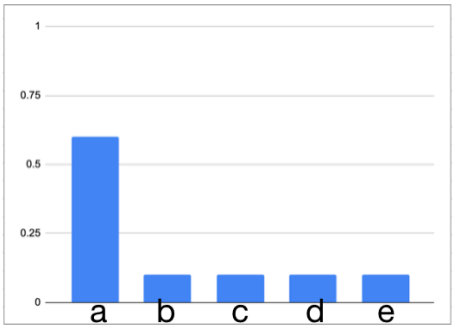
P(X)



P(Y)



P(Z)



1.a.i (5 pts) Which variable has the highest entropy H? (Write one of X, Y, or Z) _____

1.a.ii (5 pts) Which variable has the lowest entropy H? (Write one of X, Y, or Z) _____

1.a.iii (5 pts) Which variable has an intermediate entropy H? (Write one of X, Y, or Z) _____

1.b (10 pts) Assume we have a coin that can get the values of heads(H) and tails(T) after tossing. We do not know the probability of heads or tails for this coin (this may be a biased coin).

P(H) = 1-P(T) = ?

Circle the values below that can be the value of entropy (H) for the output of this coin as a random variable?

a) 1 **b) 0.34** **c) -0.5** **d) 2.5**

2. (25 pts total, 5 pts each) Machine Learning. Label the following statements T (true) or F (false).

2a. _____ The information gain from an attribute A is how much classifier accuracy improves when attribute A is added to the example feature vectors in the training set.

2b. _____ Overfitting is a general phenomenon that occurs with most or all types of learners.

2c. _____ When we are using labeled (with output) examples like (x_1, y_1), (x_2, y_2) … (x_n, y_n) for our learning algorithm we call it unsupervised learning.

2d. _____ An agent is learning if it improves its performance on future tasks after making observations about the world.

2e. _____ For a given dataset there always will be a single unique decision tree with the accuracy of 100%.

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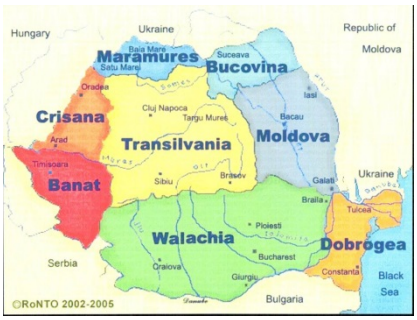
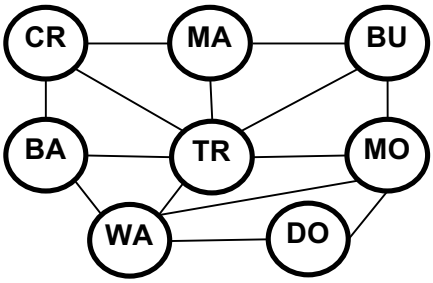
3. (50 points each, 10 pts each) Constraint Satisfaction Problems





BA = Banat
BU = Bucovina
CR = Crisana
DO = Dobrogea
MA = Maramures
MO = Moldova
TR = Transilvania
WA = Walachia

You are a map-coloring robot assigned to color this map of Romania regions. 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. TR has been assigned value R, as shown. Cross out all values that would be eliminated by Forward Checking:

BA	BU	CR	DO	MA	MO	TR	WA
R G B	R G B	R G B	R G B	R G B	R G B	R	R G B

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

BA	BU	CR	DO	MA	MO	TR	WA
R	R G B	R G B	R G B	R G B	R G B	B	R G B

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

BA	BU	CR	DO	MA	MO	TR	WA
R G	R G B	R G B	R G	R G B	R G	R G	B

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.) WA has been assigned B and constraint propagation has been done, as shown. List all unassigned variables that might be selected by the Degree Heuristic:._____.

BA	BU	CR	DO	MA	MO	TR	WA
R G	R G B	R G B	R G	R G B	R G	R G	B

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

BA	BU	CR	DO	MA	MO	TR	WA
R	G	R	R	G	G	**?**	B