

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

NAME: _____ UCINetID _____

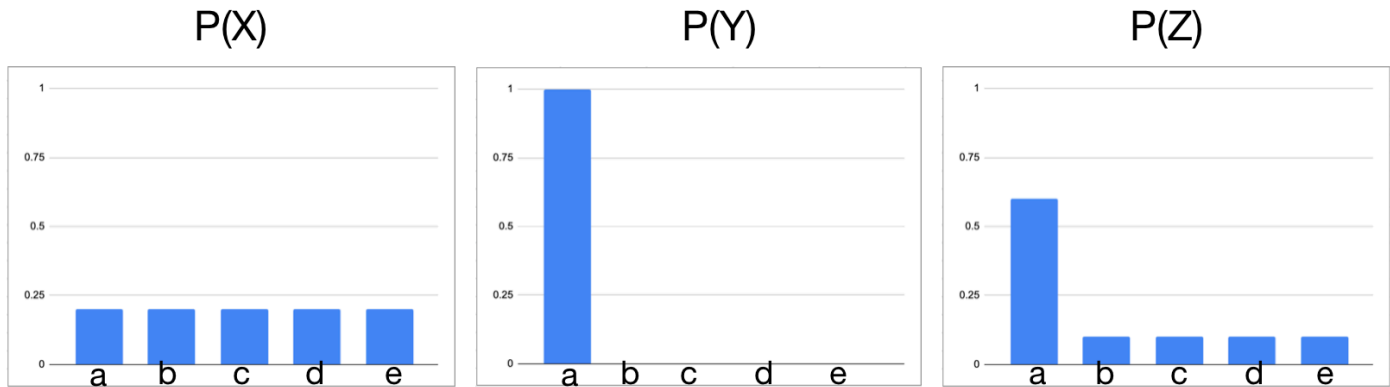
1. (25 pts total) Machine Learning.

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.

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

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

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



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

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

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

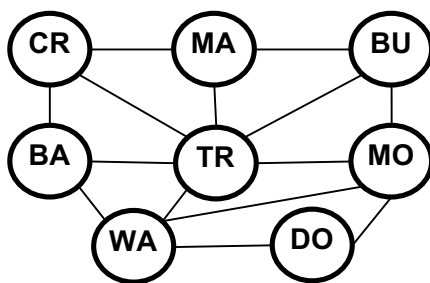
2a. F The information gain from an attribute A is how much classifier accuracy improves when attribute A is added to the example feature vectors in the training set.

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

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

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

2e. F For a given dataset there would be a single unique decision tree with the accuracy of 100%.

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
X G B	X G B	X G B	R G B	X G B	X G B	R	X 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 has been done. Cross out all values that would be eliminated by Arc Consistency (AC-3 in your book).

See Section 6.3.2.

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

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

See Section 6.3.1.

Remaining-Values (MRV) Heuristic: BA, DO, MO, TR.

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: TR.

See Section 6.3.1.

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? B.

See Section 6.4.