Games and Computation Homework #11: k-Means Clustering and Basic Strategic Games

Answer these questions within the HW #11 Moodle quiz:

Machine Learning Types

Match the following types of learning with their most accurate descriptions.

Types (alphabetical ordering):

- Classification
- Clustering
- Regression
- Reinforcement Learning
- Supervised Learning
- Unsupervised Learning

Descriptions (alphabetical ordering):

- Given a training set of inputs, learn the structure of the input data.
- Given a training set of (input, output) pairs, learn a function from any input to a predicted output.
- Given a training set of (state, action, reward) triples, learn an action policy that maximizes expected future rewards.
- Supervised learning with a continuous output
- Supervised learning with a discrete output
- Unsupervised learning that partitions the data into sets such that each set member is more similar to others of its set that it is to other sets.

Machine Learning Problems and Problem Types

Match the following problems to their problem types.

Problems:

- Given data of gambling game states, actions, and changes to the gambler's bankroll, learn the best way to play the gambling game.
- Given data on observable mushroom physical characteristics (e.g. height, cap diameter, color, smell), and toxicity level, learn simple rules that are predictive of edibility/inedibility of mushrooms.
- Given IMDB.com data on movie directors and actors and the assumption that directors and actors tend to work within a genre, discover finer movie genre distinctions than those normally used.
- Given purchase/non-purchase decisions of an online item with variable pricing, learn to predict the purchase rate for any given price.

Problem types:

- Supervised Learning: Classification
- Supervised Learning: Regression
- Reinforcement Learning
- Unsupervised Learning: Clustering

k-Means Clustering 1

Given six 2-dimensional data points {(0.00, -0.60), (1.20, 2.40), (2.40, 2.40), (-1.20, 1.80), (0.00, 0.00), (-2.40, -2.40)} and k=3 Forgy-initialized centroids {(0.00, 0.00), (2.40, 2.40), (-2.40, -2.40)}, perform the k-Means Clustering algorithm and select the correct final Within-Clusters Sum-of-Squares result below:

- ☐ 4.46
- ☐ 4.80
- ☐ 7.14
- ☐ 7.68
- ☐ 11.94
- ☐ 12.96

k-Means Clustering 2

Given six 2-dimensional data points {(-3.00, -1.20), (-2.40, 0.00), (-0.60, -3.00), (-1.20, -1.80) (-1.80, 0.60), (2.40, -1.80)} and k=3 Forgy-initialized centroids {(-3.00, -1.20), (-1.80, 0.60), (-2.40, 0.00)}, perform the k-Means Clustering algorithm and select the correct final Within-Clusters Sum-of-Squares result below:

- ☐ 1.24
- ☐ 2.66
- ☐ 3.30
- ☐ 5.16
- ☐ 7.38
- ☐ 8.76

Iterated Elimination of Strictly Dominated Strategies

P1 \ P2	L	C	R
U	-3, 1	-1, 4	-2, 0
M	2, 3	-1, 0	2, 5
D	0, 4	4,-1	0, 2

For the first given game payoff matrix (with player 1 actions {U,M,D} and player 2 actions {L,C,R}), perform the Iterated Elimination of Strictly Dominated Strategies (IESDS) algorithm and list the eliminated row/column action letters in the order of their elimination and without spaces: _____

Best Responses

P1 \ P2	V	W	X	Y	Z
A	-2, -3	-2, -1	0, 1	0, -3	4, -3
B	1, -2	-3, 0	0, 1	-1, -2	5, 1
C	3, -3	-2, -1	-1, -3	0, -3	5, -4
D	2, -7	-1, -5	1, -6	6, -6	6, -6
E	-1, -1	-2, 0	3, -1	5, -2	4, -2

A payoff that includes a best response action for both players is a Nash equilibrium. For the second given game payoff matrix (with player 1 actions {A-E} and player 2 actions {V-Z}), mark all best responses for each player and enter the Nash equilibrium action of player 1 followed by the Nash equilibrium action of player 2 without any spaces: _____

Mixed Strategy Computation

P1 \ P2	L	R
U	0, 0	-2, 2
D	-4, 4	1, -1

Mixed Strategy Computation 1

For the third given game payoff matrix (with player 1 actions {U,D} and player 2 actions {L,R}), compute and write the probability fraction with which player 1 will choose action U, i.e. sigma_U. Do not include any spaces in your fraction:

_____

Mixed Strategy Computation 2

For the third given game payoff matrix (with player 1 actions {U,D} and player 2 actions {L,R}), compute and write the probability fraction with which player 2 will choose action L, i.e. sigma_L. Do not include any spaces in your fraction:

_____

Mixed Strategy Computation 3

For the third given game payoff matrix (with player 1 actions {U,D} and player 2 actions {L,R}), compute and write the fraction expressing player 1's expected utility (i.e. average payoff) with the optimal mixed strategies. Do not include any spaces in your fraction: _____

Mixed Strategy Computation 4

For the third given game payoff matrix (with player 1 actions {U,D} and player 2 actions {L,R}), compute and write the fraction expressing player 2's expected utility (i.e. average payoff) with the optimal mixed strategies. Do not include any spaces in your fraction: _____