

Question 1:

(i):

This example is NOT LEARNING, because we aren't utilizing data collected from various coins to "learn" a pattern, we are simply memorizing by matching input specifications with those specs given for various coins from the mint.

(ii)

This example is supervised learning. It is learning because the computer is using an algorithm to make sense of data from various real world coins and making predictions using the patterns "learned". It is supervised because the data is labeled with the actual coin value and the algorithm can make use of that data in order to detect the patterns.

(iii)

This is reinforcement learning. We can tell because the algorithm consistent of producing game play data and penalizing moves that lead to bad results. This is the main characteristic of reinforcement learning.

The answer is therefore **D**.

Question 2:

(i)

This is a pattern that can be pinned down explicitly and therefore doesn't lend itself to learning.

(ii)

This is a good place to apply learning. As far as data, one would need a dataset pertaining to past incidents of credit card fraud. Given data, it is reasonable to believe that incidents of credit card fraud follow loosely a pattern that can be learned to a degree. It is also unrealistic that this target function could be pinned down mathematically as there are an unbelievably amount of variables that make it impossible to predict explicitly. Thus, this problem is well suited for learning.

(iii)

We can derive this directly from the equations of Newtonian physics and therefore do not need to "learn" it.

(iv)

This would be a good place to apply learning. It is reasonable to believe that one could obtain a wealth of data from the use of street cameras, navigation apps, in accordance with a known light schedule. It is also clear that there is some pattern to be learned as we know that cars traveling on public roads is a fairly predictable occurrence and follows patterns as far as rush hours and especially busy road etc. It also seems difficult to pin something like this down mathematically (although probably easier than example ii). Theoretically one could make rough

estimates applying equations from fluid dynamics however that is already an approximate at best and it would probably be more effective to apply learning.

Thus the answer is **A**

Question 3:

We know that we first picked a black ball. Since 2 of the 3 black balls are in the “two black balls” bag, we know that there is a $2/3$ chance that we picked into the “two black balls” bag and a $1/3$ chance we picked into the “one black one white” bag. We remove the black ball we pick, so there is a $2/3$ chance that we picked out of the “two black balls” bag, meaning that we will necessarily pick another black ball, and a $1/3$ chance that we picked out of the “one black one white” bag and will necessarily pick a white ball.

So the chances of picking two black given the first choice is black are $2/3$ which is **D**

Question 4:

We know that $\mu = 0.55$, thus the odds of picking a green marble are $1 - \mu = 0.45$. We know we must draw 10 greens consecutively to have a sample with $v = 0$. We assume that either we put the marbles back after each draw or that the bin is so large that the removal of a marble doesn't change μ .

Thus $P[10 \text{ greens}] = 0.45^{10} \approx 0.00034050$ which indicates **B**

Question 5:

We know $P[10 \text{ greens}] = 0.45^{10}$ from question 4. Thus, the probability of picking at least 1 red is $1 - P[10 \text{ greens}] = 1 - 0.45^{10}$. Thus, the probability of picking at least 1 red in 1000 samples is:

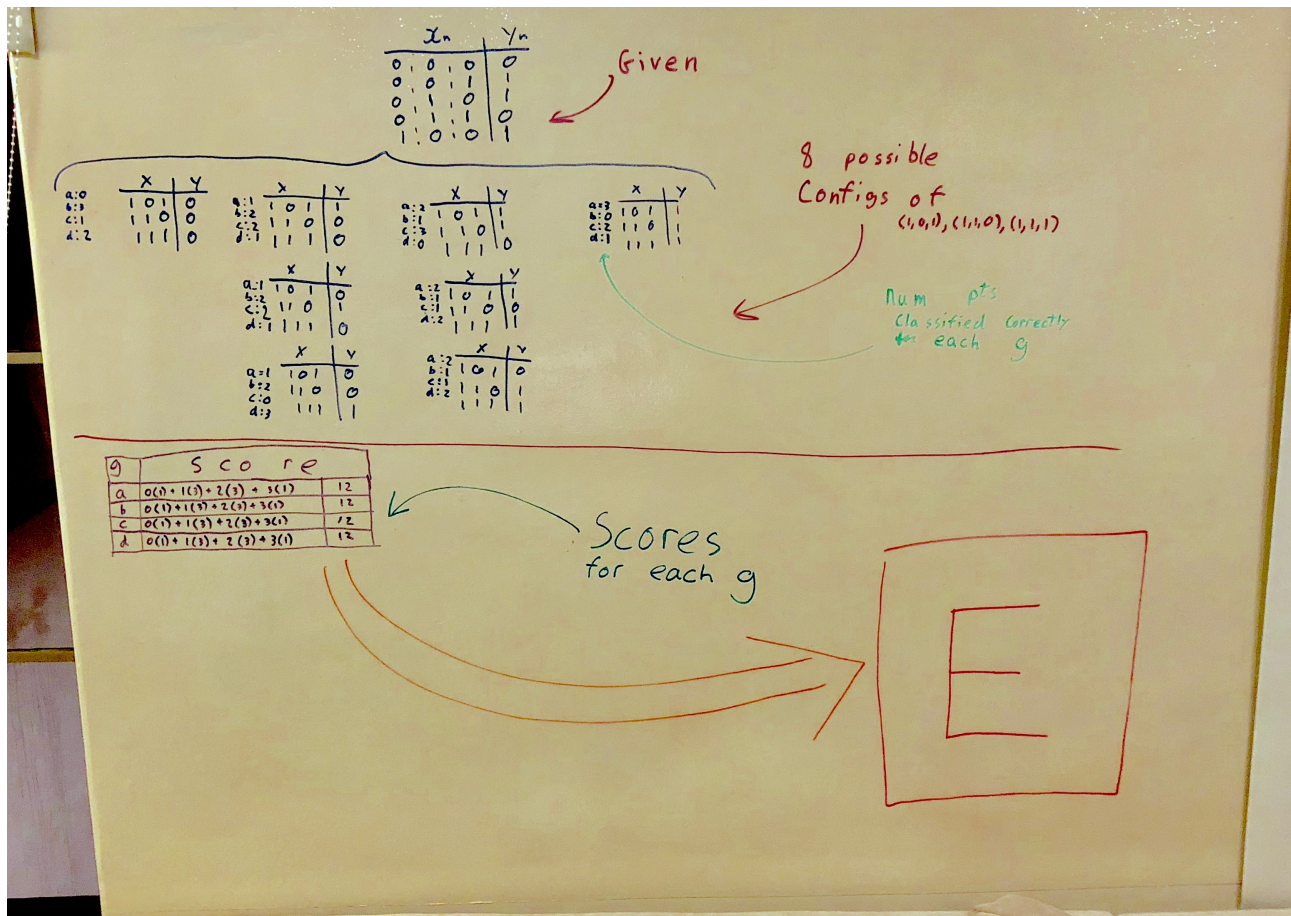
$$(1 - P[10 \text{ greens}])^{1000} = (1 - 0.45^{10})^{1000} \approx 0.71136$$

Thus, the probability of picking 0 reds at least one time in the 1000 samples is:

$$1 - (1 - P[10 \text{ greens}])^{1000} \approx 1 - 0.71136 = 0.289 \text{ which indicates } \mathbf{C}$$

Question 6:

One could simplify the below process by observing the symmetric nature of (a) relative to (b) and (c) relative to (d) however below is a full tabulation of the scores for all 4 g 's and the scores are, as can be seen below, the same \Rightarrow the answer is **E**



Questions 7-10 are in the jupyter notebook printout