Review Test Submission: M1

User	Akhila Juturu
Course	-CSE 544.01 Probability and Statistics for Data Scientists - Spring 2022
Test	M1
Started	3/9/22 8:15 PM
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Status	Completed
Attempt Score	170 out of 200 points
Time Elapsed	1 hour, 0 minute out of 1 hour
Results Displayed	All Answers, Submitted Answers, Correct Answers

Question 1

10 out of 10 points

Refer to the {C, S, R} problem on Slide 3 of Lecture 8 with the transition probabilities: P(C → R) = 0.4, P(C → C) = 0.6, P(R → S) = 0.3, P(R → R) = 0.7, P(S → C) = 0.5, P(S → R) = 0.5. What is the long-term probability of being in state S?

Report your answer with exactly one digit before the decimal and rounded to three digits after the decimal. For example, report 0.0042 as 0.004, report 0.32 as 0.320, report 0.1067 as 0.107.

Selected Answer: 0.179

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.179	

Question 2

10 out of 10 points

Consider the set of data points { 0.32, 0.20, 0.16, 0.04, 0.20 }. Find eCDF at X = 0.14

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 0.20

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity

Exact Match	0.20

Question 3

10 out of 10 points

Consider a standard deck of 52 cards with 13 numbered cards (from one/Ace to thirteen/Kings) each of Hearts, Clubs, Spades, and Diamonds. In other words, the 52 cards are divided into 4 suits (Hearts, Clubs, Spades, Diamonds) of 13 cards each, and each of these 13 cards is numbered from 1 (also called Ace) to thirteen (represented as Kings).

The face cards(Kings,Queens,Jacks) of all 4 suits have been removed. From the remaining 40 cards, two cards are drawn in succession without replacement. What is the probability that the first card is not a 6 given that the second card is a 4 ?

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 0.90

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.90	

Question 4

10 out of 10 points

Let X and Y be two independent random variables such that X ~ Uniform(0,4) and Y ~ Uniform(0, 2). Calculate E[min(X,Y)]

Which of the following best represents the answer when rounded to two digits after the decimal

Selected Answer: 0.83

Answers:
- 0.43
- 0.83
- 0.47
- 0.63
- 0.33

Question 5

10 out of 10 points

To estimate the fraction of adults who prefer beer over wine, we randomly sample 1000 people and poll their preference. 750 of these report that they indeed prefer beer over wine. If we use sample mean as an estimator of the true fraction of adults who prefer beer over wine, find the standard error of this estimator.

Report your answer rounded to three digits after the decimal. For example, report 3.3334 as 3.333, report 1.1064 as 1.106, and report 2.7067 as 2.707.

Selected Answer: 0.014

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.014	

Question 6

10 out of 10 points

Refer to the daily weather tracking problem on Slide 2 of Lecture 8. But assume that P(C → C) = 0.6, P(C → S) = 0.4, P(S → S) = 0.2 and P(S → C) = 0.8. What is the probability of two clear days in succession? That is, what is the value of π_{CC}?

Report your answer with exactly one digit before the decimal and rounded to three digits after the decimal. For example, report 0.0042 as 0.004, report 0.32 as 0.320, report 0.1067 as 0.107.

Selected Answer: 0.400

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.400	

Question 7

10 out of 10 points

Let X and Y be independent random variables that are normally distributed. X ~ N(1,4) and Y ~ N(3,16). Let Z = 2X + Y + 1, a = E[Z], b = Var(Z) then a + b equals

Report your answer rounded to closest integer without decimals. eg: report 66.0 as 66, report 66.3 as 66 and report 2.7 as 3

Selected Answer: 38

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	38	

Question 8

10 out of 10 points

Let X and Y be two independent RVs, and let a > 0 and b > 0 be some constants. Which of the following is NOT true ?

Selected Answer: Var(aX + bY) = aVar(X) + bVar(Y)

Answers:

E[a + b] = a + b

E[aX + bY] = aE[X] + bE[Y]

Var(aX + bY) = aVar(X) + bVar(Y)

Var(X - Y) = Var(X) + Var(Y)

Question 9

10 out of 10 points

Let $X_1, \ldots, X_n$ be i.i.d. random variables with finite non-zero mean m and non-zero variance s^2. Consider an estimator for m, $\hat{m} = 0.5\ X_1$. Which of the following is true.

Selected Answer: se($\hat{m}$) is non-zero

Answers:

bias($\hat{m}$) is zero

se($\hat{m}$) is non-zero

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None of the listed

$\hat{m}$ is consistent

MSE($\hat{m}$) = 0

Question 10

10 out of 10 points

For a random variable X, we define epsilon as $E[(X+E[X])^2]$. Find the plug-in estimator for epsilon given sample data D = {4,3,2,1}.

Report your answer rounded to two digits after the decimal. For example, report 11.056 as 11.06, report 33.333 as 33.33, report 14.106 as 14.11, and report 27.704 as 27.70.

Selected Answer: 26.25

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	26.25	

Question 11

10 out of 10 points

Three independent and fair coins are tossed simultaneously. Let $X_i = 1$ if the i^{th} coin shows heads and $X_i = -1$ if the i^{th} coin shows tails. Let A = $(X_1 + X_2 + X_3)$ and let B = $(X_1 * X_2 * X_3)$.

What is E[A/B=-1]? That is, what is expectation of A, given that B = -1? Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report -3 as -3.00, report 1.106 as 1.11, and report -2.704 as -2.70.

Selected Answer: 0.00

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.00	
Exact Match	0	

Question 12

0 out of 10 points

Let A and B be i.i.d RVs with mean m and variance v. Let C = A be another RV. Which of the following is NOT true

Selected Answer: $E[3A^2 + AC + C^2] = 5v + 5m^2$

Answers:

$E[A^2 + 3AC + 2C^2] = 6v + 6m^2$

$E[3A^2 + AC + C^2] = 5v + 5m^2$

$E[A^2 + 3AB + 2C^2] = 3v + 6m^2$

All are correct

Question 13

10 out of 10 points

Given p = 0.4, find $E[X^2]$ where X is a distribution such that

$$X \sim \begin{cases} 1 & w.p.\ p \\ 2 & w.p.\ 2p \\ 3 & w.p.\ (1-3p) \end{cases}$$

Report your answer rounded to two digits after the decimal. For example, report 11.056 as 11.06, report 33.0 as 33.00, report 1.106 as 1.11, and report 27.704 as 27.70.

Selected Answer: 1.80

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	1.80	

Question 14

10 out of 10 points

Given that X and Y are i.i.d random variables with mean 2 and variance 1. Calculate $E[Z^2]$ where Z = X + 2Y

Report your answer rounded to closest integer without decimals. eg: report 66.0 as 66, report 66.3 as 66 and report 2.7 as 3

Selected Answer: 41

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	41	

Question 15

10 out of 10 points

Which of the following is NOT true about consistent estimators

Selected Answer: None of the listed

Answers:

$$\lim_{n \to \infty} P\{|\widehat{\theta} - \theta| > \epsilon\} = 0, \forall\ \epsilon > 0$$

$$\lim_{n \to \infty} |bias(\widehat{\theta}) - se(\widehat{\theta})| = 0$$

$$\lim_{n \to \infty} E(|\widehat{\theta}|) = \theta$$

None of the listed

Question 16

0 out of 10 points

You are given two 4-sided dice and three 6-sided dice. If a dice is picked randomly, what is the probability of rolling exactly a 5 ?

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 0.20

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.10	

Question 17

10 out of 10 points

Refer to the 10 students example from lec 2 (slide 11). Let {A, B, C} be the equally likely grades being assigned to 10 students independently in the class. What is the probability that at most 2 students get an A.

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 0.30

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.30	

Question 18

10 out of 10 points

Let X ~ Uniform(-1, 1). Then 9X + 10 ~ Uniform(a, b). Report the value of a + b.

Report your answer rounded to two digits after the decimal. For example, report 11.056 as 11.06, report 33.333 as 33.33, report 14.106 as 14.11, and report 27.704 as 27.70.

Selected Answer: 20

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	20.00	

Question 19

10 out of 10 points

Let X and Y be two continuous random variables with joint density function f(X,Y) = X + Y for X,Y defined on [0,1] and is 0 otherwise. Find E[X].

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 0.58

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.58	

Question 20

0 out of 10 points

Given the set of data points { 2.0, 3.0, 4.0, 5.0, 5.0, 6.0, 6.0, 6.0, 9.0, 10.0 }. Calculate the width of a 95% normal based CI for the empirical pmf at X = 6.0 . Assume $z_{0.025}$ = 1.96

Report your answer with exactly one digit before the decimal and rounded to two digits after the decimal. For example, report 0.004 as 0.00, report 3.333 as 3.33, report 1.106 as 1.11, and report 2.704 as 2.70.

Selected Answer: 2.89

Correct Answer:

Evaluation Method	Correct Answer	Case Sensitivity
Exact Match	0.57	

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