Homework 3

Back to Week 3

10/10 points earned
(100%)

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1 / 1
points

1.
"Sixty percent of the time, it works every time" - Brian Fantana, Anchorman

In this week's material, we cover the basics of probability including trials, outcomes, and events. We also consider some simple applications of Monte Carlo simulation. This week's homework will focus on these topics.

Basic probability

What is the sum of the probabilities associated with the all possible outcomes of a single trial? Enter the number in the box below.

1

Correct Response
The sum of the probabilities associated with all possible outcomes is 1.

1 / 1
points

2.

Single trials

You are dealt a single card from a standard deck of 52 playings cards (4 suits with 13 cards in each suit). What is the probability that the card will be of a specific suit? Enter the probability as a decimal number below.

0.25

Correct Response

Correct. There are 13 outcomes corresponding to the event. Each outcome has probability $\frac{1}{52}$ so the probability of the event is $\frac{13}{52}$ which is 0.25.

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1 / 1 points

3.

Consider a trial with 36 possible outcomes where each outcome has equal probability. How many outcomes correspond to an event that has probability $\frac{1}{9}$? Enter the number of outcomes below.

4

Correct Response

Correct. Four outcomes, each of probability $\frac{1}{36}$, yields an event with probability $\frac{4}{36} = \frac{1}{9}$.

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1 / 1 points

4.

Which Python expressions below simulate a single trial corresponding to the roll of a fair six-sided die whose faces are numbered 1 to 6?

- [x] `random.randrange(1, 6)`

Correct Response

- [x] `random.randrange(6) + 1`

Correct Response

- [x] `random.randrange(6)`

Correct Response

- [x] `random.randrange(1, 7)`

Correct Response

✔ 1 / 1 points

5.

Given a standard deck of 52 cards, what is the probability that two cards drawn at random will have the same rank? Note that first card drawn is **not** added back into the deck when the second card is drawn.

- ○ $\frac{1}{13}$
- ○ $\frac{1}{52}$
- ● $\frac{1}{17}$

Correct Response

There are 3 cards among the 51 cards remaining in the deck that match the rank of the first card.

- ○ $\frac{4}{51}$

✔ 1 / 1 points

6.

Expected value

What is the mean GPA of class where 30% of the students have 4.0 GPA, 40% of the students have a 3.0 GPA and 20% of the students have 2.0 GPA, and 10% of the student have a 1.0 GPA?

Review this week's math notes on expected value if necessary.

2.9

Correct Response

Good job.

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1 / 1 points

7.

Consider a dice game in which you roll two dice. If the sum of the dice is odd, you win $1. If the sum of the dice is even, you lose $1. What is the expected value (in terms of your winnings) of a single roll in this game?

- The expected value is positive. If I play this game a lot, I expect to win money.
- The expected value is negative. If I play this game a lot, I expect to lose money.
- The expected value is zero. If I play this game a lot, I expect to break even.

Correct Response

The expected value is zero since the probability of rolling an even sum equals the probability of rolling an odd sum.

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1 / 1 points

8.

What is the expected value of `trial(n)` as a function of n? (Here, assume that n is a positive integer.) Enter the answer below as a math expression in n.

```
1  def trial(n):
2      val = random.randrange(n)
3      return val
```

As a hint, note that the arithmetic sum $0 + 1 + 2 + . . + k$ has the value $\frac{1}{2}\, k(k+1)$.

- n/2
- (n+1)/2
- (n-1)/2

(n-1)/2

Correct Response

Correct. The possible outcomes are $\{0, \ldots, n-1\}$.

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1 / 1 points

9.

Monte Carlo simulations

In all of the previous problems, the sample space (space of possible outcomes) had a finite number of outcomes. However, conducting trials where the outcome lies in a continuous space is perfectly reasonable.

Consider that following mystery program. This program uses `random.random()` to generates a random set of points that are uniformly distributed over the square with corners at $(1, 1)$, $(-1, 1)$, $(1, -1)$, and $(-1, -1)$. (Here, being uniformly distribution means that each point in the square has an equal chance of being generated.) The method then tests whether these points lie inside a unit circle.

As one increases the number of trials, the value returned by `estimate_mystery` tends towards a specific value that has a simple expression involving a well-known constant.

Enter this value as a math expression below. (Do not enter a floating point number.) You can consult this page if you would like to see a list of math constants that Coursera's quiz system recognizes.

Preview

$\frac{1}{4}\,\pi$

pi/4

Correct Response

Correct. The function returns the ratio of the number of points inside the circle divided by the total number of points. This value corresponds to the ratio of the area of the circle to the area of the square which is $\frac{\pi}{4}$.

Your answer, pi/4, is equivalent to the instructor's answer pi/4.

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1 / 1

points

10.

For the final question of each of the remaining homeworks in PoC1, your task will be to create a list of test cases for a function that you have implemented in IIPP or PoC. Our purpose in these problems is to focus your attention on the process of creating test cases on your own and not relying entirely on OwlTest. To assess the quality of your test cases, we have created a series of OwlTests that automatically assesses how well your test cases detect erroneous programs written by your peers.

For this question, your task is to create a collection of test cases for the function `format()` that you implemented for the Stopwatch mini-project in IIIPP1. To refresh your memory, the function `format(tenths)` takes an integer `tenths` corresponding to the number of tenths of second elapsed and returns a string of the form: `A:BC.D` where `A`, `C` and `D` are digits in the range 0-9 and `B` is in the range 0-5. This string is the readout of a digital stopwatch after `tenths` tenths of seconds have elapsed. Note that the string returned by `format` should always correctly include leading zeros. Here are several example inputs and outputs for `format()`:

- `format(0)` = `0:00.0`
- `format(11)` = `0:01.1`
- `format(321)` = `0:32.1`
- `format(613)` = `1:01.3`

To complete this problem, visit this OwlTest page and follow the directions for creating and submitting a list of test cases. Once OwlTest has successfully assessed your test cases, you will see the message `TEST CASES successfully assessed.`. Following this message is a seven-digit number that you should enter in the form below. For this task, **please ignore the fact that this message appears under the red Unit Test Failures tab**. This program is an example of input to OwlTest that incorporates the four test cases given above.

This OwlTest automatically assesses how effective your list of test cases is in detecting erroneous programs from a suite of implementations of `format()` compiled from IIPP. If you do not catch all of the erroneous programs, OwlTest outputs an example of one erroneous program that passes all of your submitted test cases. You must catch all of the erroneous programs to get this question correct. The homework feedback will tell you what percent of erroneous programs you were able to catch.

Note that trying to debug this program to create new test cases may be difficult and you may wish to consider other methods for creating test cases.

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Correct Response

Congratulations! Your tests did a great job of catching all incorrect

programs.