Started on	Thursday, 21 April 2022, 11:31 AM
State	Finished
Completed on	Thursday, 21 April 2022, 11:34 AM
Time taken	2 mins 53 secs

Question **1**

Correct

Marked out of 1.00

Let X be the max(a,b) of the roll of two fair six-sided dice, where a is the number in the first die and b the number in the second. For example, (3,4) means that the first die was a 3 and the second a 4.

If you remember the distribution of the max of the roll of two fair six-sided die, a pmf, then you can put together the pmf of X^2. The X^2 is a random variable and its probability will depend on that of X. Here we just ask for a probability, but looking at the learning glass lectures on LOTUS could you find a way to calculate the $E(X^2)$ knowing what you know about the distribution of X? Of course, you can always find $E(X^2)$ using the pmf that you are going to put together to calculate

$$P(X^2 \leq 16),$$

which equals

Select one:

a. 0.06481481

b. 0.44444 ✔

c. 0.25

d. 0.1

Question **2**

Correct

Marked out of 1.00

The number of alpha particles per square centimeter emitted by a radioactive substance is Poisson with expected value equal to 12. Knowing that information, you can calculate the probability of the event A that a square centimeter has 4 alpha particles. Do that. Write it down.

Now imagine an urn with 100 square centimeters. How many of them would have 4 alpha particles, if all we had was 100 square centimeters? Write it down.

Now suppose you sample 3 square centimeters from your urn. Go back to the lectures on Sampling in Week 2 and answer the following question.

What is the probability that 2 out of 3 square centimeters had 4 alpha particles?

Select one:

a. approximately 0 ✔

b. 0.5

c. 0.31

d. approximately 1

Question **3**

Correct

Marked out of 1.00

20% of the workers in a factory work in plant A and 80% work in plant B.

The number workers calling in sick per week follow a Poisson probability mass function with parameter

$$\lambda = 3$$

for plant A, and

$$\lambda = 5$$

for plant B.

What is the probability that next week there will be 2 workers calling in sick?

Hint: Does this problem ring the bell? Does it look like one of the exercises done in lecture 14? Think law of total probability.

$P(D) = P(D \mid T)P(T) + P(D \mid T^c)P(T^c)$

D is the event that 2 workers call sick. T is the event that the number of workers calling sick per week follows the poisson model for factory A.

Select one:

- a. 0.42
- b. 0.31
- c. 0.1121878 ✔
- d. 0.891

Question **4**

Correct

Marked out of 1.00

The number of accidents that a person has in a given year is a Poisson random variable with expected value equal to

$$\lambda$$

. However, suppose that the value of

$$\lambda$$

changes from person to person, being equal to 2 for 60 percent of the population and 3 for the other 40 percent. If a person is chosen at random, what is the probability that this person will have 3 accidents in a year?

Hint: Can you see the similarities between this problem, the one in question 3 and the typist example in the lecture notes? You could even think of one of your own.

Select one:

- a. 0.00161
- b. 0.3518
- c. 0.001011
- d. 0.5
- e. 0.1978 ✔

Question **5**

Correct

Marked out of 1.00

The number of people arriving to a bicycle store can be modeled by a Poisson process with a rate parameter

$$\lambda$$

of five per hour. How many people do you expect to arrive during a 45 minute period?

Hint: think of Poisson extended period, seen at the end of Lecture 14th

Select one:

a. 45

b. 3.75 ✔

c. 5

d. 0.75

e. 0.1

Question **6**

Correct

Marked out of 1.00

The number of car accidents per day in a certain suburbian road has a Poisson distribution with parameter

$$\lambda = 4$$

. The local firefighter facilities can respond to this road accidents 3 times per day, otherwise the firefighters from the neighboring district are called out. On any given day, what is the probability of having to call the neighboring firefighters ?

Hint: Have you seen this problem in any of the lectures?

Select one:

a. 0.219118

b. 0.1953667

c. 0.43347

d. 0.56653 ✔

Question **7**

Correct

Marked out of 1.00

The number of surgery room electric generators malfunctions per day in a certain hospital follows a Poisson distribution with parameter 4. Present maintenance facilities can repair 3 generators per day, otherwise a contractor is called out. On any given day, what is the probability of having electric generators repaired by a contractor?

Select one:

- a. 0.43
- b. 0.57
- c. 0.1
- d. 0.96
- e. 0.37

Question **8**

Correct

Marked out of 1.00

By definition, if

$$X$$

is a random variable,

$$Var(X) = E(X - E(X))^2 = \sum_x (X - E(X))^2 P(X)$$

Five students gave alternative expressions for the variance. Their responses are given below

$$\text{(a)} \quad \sum_x (X^2 + (E(X))^2 - 2XE(X))P(X)$$

$$\text{(b)} \quad \sum_x X^2 P(X) + \sum_x (E(X))^2 P(X) - \sum_x 2XE(X)P(X)$$

$$\text{(c)} \quad \sum_x X^2 P(X) + \sum_x \mu^2 P(X) - \mu \sum_x 2XP(X)$$

$$\text{(d)} \quad E(\mu^2) + (E(X))^2 - 2(E(X))^2$$

$$\text{(e)} \quad E(X^2) - \mu^2$$

Which one does NOT equal the variance of X?

Hint: you could review one of the learning glass lectures. In which lectures was LOTUS applied to the variance of a random variable?

Select one:

- a. (a) does not equal the variance of X
- b. (b) does not equal the variance of X
- c. (c) does not equal the variance of X
- d. (d) does not equal the variance of X
- e. (e) does not equal the variance of X

Question **9**

Correct

Marked out of 1.00

The gamma density function for a random variable Y is

$$f(y) = \begin{cases} \frac{\lambda e^{-\lambda y}(\lambda y)^{\alpha-1}}{\Gamma(\alpha)}, & y \geq 0, \alpha > 0, \lambda > 0 \\ 0, & \texttt{otherwise} \end{cases}$$

The montly salary of women that are in the labor force in a large town,

$$Y$$

, follows a gamma distribution with

$$\alpha = 2000$$

and

$$\lambda = 4$$

. The city is planning to obtain a random sample of 100 women to obtain some information. The city is planning to ask the 100 women about their salary.
Let

$$y_1, y_2, \dots, y_{100}$$

represent the salary of these women. Consider the random variable

$$W = 4\left(\frac{\sum_{i=1}^{100} y_i}{100}\right).$$

The expected value of W is

Hint: Use LOTUS, as learned in the Learning glass lecture 13 to answer this question.

Select one:

- a. 500
- b. 5000
- c. 1000
- d. 2000 ✔
- e. 3000

Question **10**

Partially correct

Marked out of 1.00

In the water heater salesperson example, the following is true when we apply LOTUS to the random variable sales (X) and week 3 lecture.

E(100+2X)= 1450 ✔

Var(100+2X) 309375 ✖

Question **11**

Correct

Marked out of 1.00

According to the LOTUS results seen this week, the expected value of g(X) = 100+2X equals (select what it equals) for X in the following families

X Poisson with parameter λ equal 5	110 ✔
X exponential with parameter λ equal 5	100.4 ✔
X lognormal, as in Lecture 12, with parameters $\mu = 10$ and $\sigma = 2$	325609.6 ✔

Question **12**

Correct

Marked out of 1.00

According to the lognormal model fitted to radon data from Minnesota, the probability that a randomly chosen household has radon level larger than 4 is estimated as

- a. 0.426 ✔
- b. 0.574
- c. 0.41006
- d. approximately 0

Question **13**

Correct

Marked out of 1.00

In fitting the Poisson model to the baby birth's data we first had to manage the data provided in a way that we could create a random variable that we recognize as one of the models we studied and that is appropriate for what we are trying to measure.

How many births were recorded in the fifteenth hour of the day?

- a. 4 ✔
- b. 1
- c. 2
- d. 0

Question **14**

Correct

Marked out of 1.00

With the Poisson model that was fit to the baby birth data, that is, using that model as if it was the true model, what was the probability that there would be 2 births pr hour?

- [ ] a. 0.7226
- [ ] b. 0.16
- [x] c. 0.277 ✔
- [ ] d. 0.891

Question **15**

Correct

Marked out of 1.00

That they found that the counts of deaths by horse kick per cavalry unit followed a Poisson probability model means that

- [x] a. That a death by horse kick is a Poisson process ✔
- [x] b. That death by horse kick is something that happens by chance (aka as luck, fate) ✔
- [ ] c. That death by horse kick can be perfectly predictable, no chance involved
- [ ] d. that death by horse kick always happens when the horse rider is not careful