Feedback — Unit 2 Quiz - Probability and Distributions

Help Center

You submitted this quiz on **Fri 13 Mar 2015 8:35 PM EET**. You got a score of **12.00** out of **12.00**.

Question 1

Which of the following explains the phenomenon that while in 10 flips of a fair coin it may not be very surprising to get 8 Heads, it would be very surprising to get 8,000 Heads in 10,000 flips of the coin.

Your Answer		Score	Explanation
Law of averages			
Bayes' theorem			
Law of large numbers	✔	1.00	
General addition rule			
Total		1.00 / 1.00	

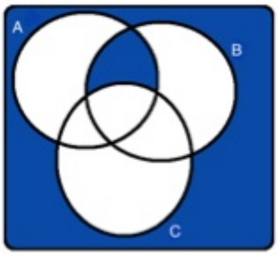
Question Explanation

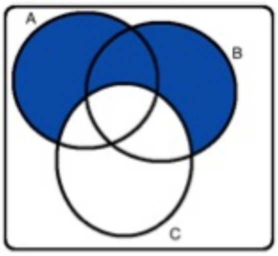
This question refers to the following learning objective: Explain why the long-run relative frequency of repeated independent events settles down to the true probability as the number of trials increases, i.e. why the law of large numbers holds.

Question 2

Shown below are four Venn diagrams. In which of the diagrams does the shaded area represent A or B but not C?

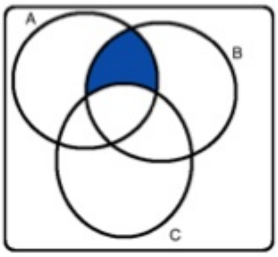
Your Answer	Score	Explanation

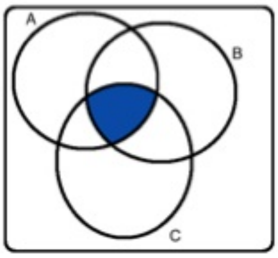




✔ 1.00

We need the area covered by events A or B to be entirely shaded, except any portions covered by event C: “A or B but not C”.





Total 1.00 / 1.00

Question Explanation

This question refers to the following learning objective: Draw Venn diagrams representing events and their probabilities.

Question 3

Which of the following is **false** about probability distributions?

Your Answer	Score	Explanation

Each probability should be less than or equal to 1.			
The outcomes listed must be independent.	✔	1.00	There is no such restriction that we must only list independent outcomes.
Each probability should be greater than or equal to 0.			
The probabilities must total 1.			
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Define a probability distribution as a list of the possible outcomes with corresponding probabilities that satisfies three rules:
- The outcomes listed must be disjoint.
- Each probability must be between 0 and 1.
- The probabilities must total 1.

Question 4

Last semester, out of 170 students taking a particular statistics class, 71 students were "majoring" in social sciences and 53 students were majoring in pre-medical studies. There were 6 students who were majoring in both pre-medical studies and social sciences. What is the probability that a randomly chosen student is majoring in social sciences, given that s/he is majoring in pre-medical studies?

Your Answer		Score	Explanation
6/170			
(71+53–6)/170			
6/71			
6/53	✔	1.00	If M is the event a student is majoring in pre-medical studies and S is the event s/he is majoring in social sciences, then calculate $P(S\vert M) = \frac{P(S\&M)}{P(M)} = \frac{6}{53}$.
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Distinguish marginal and conditional probabilities.

Question 5

Which of the following statements is **false**?

Your Answer		Score	Explanation
Two complementary outcomes (of the same event) cannot occur at the same time.			
Two mutually exclusive outcomes (of the same event) cannot occur at the same time.			
Two independent events cannot occur at the same time.	✔	1.00	Independent events are not necessarily mutually exclusive.
Two disjoint outcomes (of the same event) cannot occur at the same time.			
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective:
• Define disjoint (mutually exclusive) events as events that cannot both happen at the same time: If A and B are disjoint, P(A and B) = 0.
• Distinguish between disjoint and independent events.
- If A and B are independent, then having information on A does not tell us anything about B (and vice versa).
- If A and B are disjoint, then knowing that A occurs tells us that B cannot occur (and vice versa).
- Disjoint (mutually exclusive) events are always dependent since if one event occurs we know the other one cannot.

Question 6

Suppose that scores on a national entrance exam are normally distributed with mean 1000 and standard deviation 100. Which of the following is **false**?

Your Answer	Score	Explanation

Roughly 68% of people have scores between 900 and 1100.			
A score greater than 1300 is more unusual than a score less than 800.			
A normal probability plot of national entrance exam scores of a random sample of 1,000 people should show a straight line.			
We would expect the number of people scoring above 1200 to be more than the number of people scoring below 900.	✔	1.00	1200 is 2 SD above the mean, 900 is only 1 SD below the mean. Fewer people will be more than 2SD away than just 1 SD away.
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Use the Z score
- if the distribution is normal: to determine the percentile score of a data point (using technology or normal probability tables)
- regardless of the shape of the distribution: to assess whether or not the particular observation is considered to be unusual (more than 2 standard deviations away from the mean)

Question 7

A 2005 survey found that 7% of teenagers (ages 13 to 17) suffer from an extreme fear of spiders (arachnophobia). At a summer camp there are 10 teenagers sleeping in each tent. Assume that these 10 teenagers are independent of each other. What is the probability that at least one of them suffers from arachnophobia?

Your Answer		Score	Explanation
52%	✔	1.00	We are asked for $P(k \geq 1 \mid n = 10, p = 0.07)$. Notice this is equal to $1 - P(k = 0 \mid n = 10, p = 0.07)$. The latter is easier to calculate since it only requires one calculation using the binomial distribution. So, we use the binomial distribution with $n = 10$, $k = 0$, and $p = 0.07$ and calculate $P(k \geq 1 \mid n = 10, p = 0.07) = 1 - P(k = 0 \mid n = 10, p = 0.07) = 1$

$- \binom{10}{0} 0.07^0 \, 0.93^{10} = 1 - 0.4840 = 0.516.0$

82%		
72%		
42%		
62%		
Total	1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Calculate the probability of a given number of successes in a given number of trials using the binomial distribution.

Question 8

You are about to take a multi-day tour through a national park which is famous for its wildlife. The tour guide tells you that on any given day there's a 61% chance that a visitor will see at least one "big game" animal, and a 39% chance they'll see no big game animals; when the tour guide says "big game", he refers to either a moose or a bear. The guide assures you that big game sightings on a single day are independent of any other day's sightings. Given the information from the tour guide, which of the following calculations cannot be performed using a binomial distribution?

Your Answer		Score	Explanation
Calculate the probability that over a 5-day trip, you see big game on the first day and on every day after.			
Calculate the probability that you see big game on at least 8 days of a 10-day trip.			
Calculate the probability that	✔	1.00	You cannot calculate the probability of seeing at least 4 big game animals on a particular day because not enough

you see at least 4 big game animals on the first day of a 5-day trip.		information was given in the problem. In other words, the problem gave information on the probability of a success and failure where “success” means seeing any (i.e. at least 1) big game animals on a particular day - we have no information on the exact number of big game animals seen on a particular day.
Calculate the probability that you see big game exactly 0 days of an 8-day trip.		
Total	1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Determine if a random variable is binomial using the four conditions.

- The trials are independent.
- The number of trials, n, is fixed.
- Each trial outcome can be classified as a success or failure.
- The probability of a success, p, is the same for each trial.

Question 9

Suppose you observe a data point x = 12 and it is known that this data point came from a normal distribution with mean 5 and standard deviation 2. Which of the following statements is **true** regarding the observation of x = 12?

Your Answer	Score	Explanation
The observation would not be considered unusual because it is only about three standard deviations from the mean.		
The observation would not be considered unusual, because it comes from a normal distribution.		

The observation would be considered unusual because it is farther than three standard deviations from the mean.	✓	1.00	The observation x = 12 is more than three standard deviations from the mean (mean+3×SD = 5+3×2 = 11; we observed 12). Recall that 99.7% of data following a normal distribution are within 3 standard deviations of the mean of that distribution.
The observation would not be considered unusual, because we know exactly which normal distribution it comes from.			
The observation would be considered unusual because x = 12 is over twice as large as the mean of the distribution.			
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Assess whether or not a distribution is nearly normal using the 68-95-99.7% rule or graphical methods such as a normal probability plot.

Question 10

Which of the following is **true**? Hint: It might be useful to sketch the distributions.

Your Answer	Score	Explanation
The Z score for the mean is undefined if the distribution is bimodal and skewed.		
The Z score for the median is undefined if the distribution is bimodal.		

◉ The Z score for the median is approximately 0 if the distribution is bimodal and symmetric.	✔	1.00	Note the Z score is always defined, regardless of the shape and skew of a distribution. In a symmetric bimodal distribution, the median will roughly equal the mean and so the Z score for the median will be approximately 0.
○ The Z score for the median will usually be 0 if the distribution is unimodal and right-skewed.			
Total		1.00 / 1.00	

Question Explanation

This question refers to the following learning objective: Depending on the shape of the distribution determine whether the median would have a negative, positive, or 0 Z score keeping in mind that the mean always has a Z score of 0.

Question 11

More than three-quarters of the nation's colleges and universities now offer online classes, and about 23% of college graduates have taken a course online. 39% of those who have taken a course online believe that online courses provide the same educational value as one taken in person, a view shared by only 27% of those who have not taken an online course. At a coffee shop you overhear a recent college graduate discussing that she doesn't believe that online courses provide the same educational value as one taken in person. What's the probability that she has taken an online course before?

Your Answer		Score	Explanation
◉ 0.1997	✔	1.00	Let T be the event one has taken an online class before (with $\overline{T}$ having not taken one), and let S be the event that one believes the experience provides the same educational value as in-person courses (with $\overline{S}$ being the complement). One way to solve this problem is first write down the known information: $P(T) = 0.23$, $P(S\|T) = 0.39$, $P(S\|\overline{T}) = 0.27$. Then $P(\overline{S}\|T) = 1 - 0.39 = 0.61$. Now we want to calculate $P(T\|\overline{S})$, which we write using Bayes' Theorem as $P(T\|\overline{S}) = \frac{P(\overline{S}\|T) \cdot P(T)}{P(\overline{S})}$. The terms in the numerator have already $P(\overline{S})$ been calculated. We need the denominator which we can write as $P(\overline{S}) = 1 - P(S)$ where by the law of total probability $P(S) = P(S\|T)P(T) + P(S\|\overline{T})P(\overline{T})$. This gives P

($\bar{S}$) ≈ 0.7051, so finally the quantity we wanted was P (T |$\bar{S}$) ≈ $\frac{.61 \cdot .23}{.7051}$ ≈ 0.1997. Your answer may vary slightly due to rounding.

0.1403

0.2079

0.3014

Total	1.00 / 1.00

Question Explanation

This question refers to the following learning objective: Distinguish between marginal and conditional probabilities. Construct tree diagrams to calculate conditional probabilities and probabilities of intersection of non-independent events using Bayes' theorem: P(A|B) = $^{P(A \text{ and } B)}/_{P(B)}$

Question 12

Your boss is a biologist who needs wood samples from long-leaf pine trees with a fungal disease which is only visible under a microscope, and she sends you on an assignment to collect the samples. She wants at least 50 different diseased samples. She tells you that approximately 28% of long-leaf pine trees currently have the fungal disease. If you sample 160 long-leaf pine trees at random, what is the probability you'll have at least 50 diseased samples to return to your boss? (Use the normal approximation to calculate this probability.)

Your Answer		Score	Explanation
13%			
18%	✔	1.00	This calculation would involve the sum of many binomial probabilities, so after checking conditions for the normal approximation to the binomial ($\mu = np$ = 160 × 0.28 = 44.8 > 10 and n(1−p) = 115.2 > 10) and calculating $\sigma = \sqrt{np(1-p)}$ = 5.68, we let T denote the number of tree samples containing the disease. Then calculate $P(T > 50) = P((T - 44.8)/5.68)$ $= P((50 - 44.8)/5.68)$ $\approx P(Z > .92)$

≈ 0.18

- 28%
- 82%
- 92%

Total	1.00 / 1.00

Question Explanation

This question refers to the following learning objective: When number of trials is sufficiently large, use normal approximation to calculate binomial probabilities, and explain why this approach works.

This calculation would involve the sum of many binomial probabilities, so after checking conditions for the normal approximation to the binomial ($\mu = np = 160 \times 0.28 = 44.8 > 10$ and $n(1-p) = 115.2 > 10$) and calculating $\sigma = \sqrt{np(1-p)} = 5.68$, we let T denote the number of tree samples containing the disease. Then calculate

$$P\ (T > 50) = P\ ((T - 44.8)/5.68)$$
$$= P\ ((50 - 44.8)/5.68)$$
$$\approx P(Z > .92)$$
$$\approx 0.18$$