

Exam2 for STA291, Fall 2009 Section 13, 14, and 15.

NAME Solution

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Multiple Choice

Identify the choice that best completes the statement or answers the question.

- b 1. The collection of all possible events is called
- an outcome
 - a sample space
 - an event
 - None of these choices.
- d 2. If two events are independent, what is the probability that they both occur?
- 0
 - 0.50
 - 1.00
 - Cannot be determined from the information given
- c 3. A and B are disjoint events, with $P(A) = 0.20$ and $P(B) = 0.30$. Then $P(A \text{ and } B)$ is:
- 0.50
 - 0.10
 - 0.00
 - 0.06

Pets

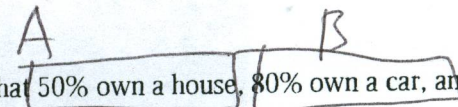
Suppose X = the number of pets owned by a family in the U.S. The probability distribution of X is shown in the table below.

X	0	1	2	3
Probability	0.56	0.23	0.12	0.09

- d 4. {Pets Narrative} Suppose you choose two families at random. What is the chance that they each own one pet? (That means family A owns one pet and family B owns one pet.)
- 0.23
 - $0.23 + 0.23 = 0.46$
 - $0.23 + 0.23 - (0.23)(0.23) = .4071$
 - $(0.23)(0.23) = 0.0529$
- c 5. If $n = 10$ and $p = 0.60$, then the mean of the binomial distribution is
- 0.06
 - 2.65
 - 6.00
 - 5.76
- b 6. Given that Z is a standard normal random variable, the area to the left of a value z is expressed as
- $P(Z \geq z)$
 - $P(Z \leq z)$
 - $P(0 \leq Z \leq z)$
 - None of those choices

- c 7. The sample variance s^2 is an unbiased estimator of the population variance σ^2 when the denominator of s^2 is
- $n + 1$
 - n
 - $n - 1$
 - $\sqrt{n - 1}$
- d 8. Which of the following is not a part of the formula for constructing a confidence interval estimate of the population mean?
- A point estimate of the population mean.
 - The standard error of the sampling distribution of the sample mean.
 - The confidence level.
 - The value of the population mean.
- a 9. Suppose a 95% confidence interval for μ turns out to be (1000, 2100). What does it mean to be 95% confident?
- In repeated sampling, the population parameter would fall in the resulting interval 95% of the time.
 - 95% of the observations in the entire population fall in the given interval.
 - 95% of the observations in the sample fall in the given interval.
 - None of these choices.
- a 10. When determining the sample size necessary for estimating the true population mean, which factor is not of our concern when sampling with replacement?
- The population size.
 - The population standard deviation.
 - The level of confidence desired in the estimate.
 - The allowable or tolerable sampling error.

Short Answer

11. A survey of a magazine's subscribers indicates that 50% own a house, 80% own a car, and 90% of the homeowners also own a car. What proportion of subscribers:
- A B P(B|A)
- 
- if 0.9, then 1 pts cond prob 2pts*
- own both a car and a house?

$$P(AB) = P(B|A)P(A) = 0.9 \times 0.5 = 0.45$$

\Rightarrow 45%

- own a car or a house, or both?

$$P(A \cup B) = P(A) + P(B) - P(AB) = 0.5 + 0.8 - 0.45$$

$$= 0.85 \Rightarrow$$

85%

- own neither a car nor a house?

$$P((A \cup B)^c) = 1 - P(A \cup B)$$

$$= 1 - 0.85 = 0.15$$

\Rightarrow 15%

12. In the following question, indicate how to use the web applet provided in the last page (i.e., show which one we should click among Left tail, Right tail, Middle or Two-tail, and then what value you have to fill in (z-value or probability box), and then which arrow you should click).

A new car that is a gas and electric powered hybrid has recently hit the market. The distance traveled on 1 gallon of fuel is normally distributed with a mean of 65 miles and a standard deviation of 4 miles. Find the probability of the following events

- (a) The car travels more than 70 miles per gallon.

$$z = \frac{70 - 65}{4} = \frac{5}{4} = 1.25$$

click ~~Left~~ ^{Right} tail

fill in 1.25 in the z-value box

click ~~Left~~ arrow
→

Answer is in the probability box

- (b) The car travels less than 60 miles per gallon.

$$z = \frac{60 - 65}{4} = \frac{-5}{4} = -1.25$$

click Left tail

fill in ~~1.25~~ -1.25 in the z-value box

click → arrow

Answer is in the probability box

- (c) The car travels between 55 and 70 miles per gallon.

$$z_1 = \frac{70 - 65}{4} = \frac{5}{4} = 1.25$$

$$z_2 = \frac{55 - 65}{4} = \frac{-10}{4} = -2.5$$

• click Left tail

• fill in 1.25 in the z-value box

• click → arrow

• Record the answer in the probability box, say X

• click Left tail

• fill in -2.5 in the z-value box

• click → arrow

• Record the answer in the probability box, say Y.

then we take X - Y

Bookstore Visits

Let X represent the number of times a student visits a bookstore in a one month period. Assume that the probability distribution of X is as follows:

x	0	1	2	3
$p(x)$	0.05	0.25	0.50	0.20

13. {Bookstore Visits Narrative} Calculate the variance and standard deviation of X directly from the probability distribution of X .

$$\begin{aligned}\mu &= 0 \cdot (0.05) + 1 \cdot (0.25) + 2 \cdot (0.50) + 3 \cdot (0.20) \\ &= 0.25 + 1.00 + 0.60 = 1.85\end{aligned}$$

$$\begin{aligned}V(X) &= (0 - 1.85)^2 (0.05) + (1 - 1.85)^2 (0.25) \\ &\quad + (2 - 1.85)^2 (0.50) + (3 - 1.85)^2 (0.20) \\ &= 0.6275\end{aligned}$$

$$\sigma = 0.79215$$

Investment Bankers

An official from the securities commission estimates that 75% of all investment bankers have profited from the use of insider information. Assume that 15 investment bankers are selected at random from the commission's registry.

14. {Investment Bankers Narrative} What is the expected number of investment bankers who have profited from the use of insider information?

$$15 \cdot 0.75 = \boxed{11.25}$$

15. We conduct an experiment in which we toss a coin four times.

(a) List all outcomes in the sample space.

HHHH, HHHT, HHT~~H~~H, HHTT
HTHH, HTHT, HTTH, HTTT
T~~H~~HH, THHT, THTH, THTT
TT~~H~~H, TTHT, TTTH, TTTT

(b) Compute the probability that we have at least three tails given that we have tails for the first and second tosses.

$$\boxed{\frac{3}{4}}$$