

Practice Problems for Exam 2

Chapter 6

1. The costs of medical care in North America are increasing faster than inflation, and with the baby boom generation soon to need health care, it becomes imperative that countries find ways to reduce both costs and demand. The following table lists the joint probabilities associated with smoking and lung disease among 60- to 65-year-old men.

	He is a Smoker	He is a Nonsmoker
He has lung disease	.12	.03
He does not have lung disease	.19	.66

One 60- to 65-year-old man is selected at random. What is the probability of the following events?

- a. He is a smoker.
- b. He does not have lung disease.
- c. He has lung disease, given that he is a smoker.
- d. He has lung disease, given that he does not smoke.

Answers a. 0.31 b. 0.85 c. 0.387 d. 0.043

2. A firm has classified its customers in two ways: (1) according to whether the account is overdue and (2) whether the account is new (less than 12 months) or old. An analysis of the firm's records provided the input for the following table of joint probabilities.

Account	Overdue	Not Overdue
New	.06	.13
Old	.52	.29

One account is randomly selected.

- a. Given that the account is overdue, what is the probability that it is new?
- b. Given that the account is new, what is the probability that it is overdue?

Answers

- a. 0.103 0.316

3. You are given the following table of joint probabilities.

	A_1	A_2
B_1	.4	.3
B_2	.2	.1

Compute the following.

- a. $P(A_1 \text{ or } B_1)$ b. $P(A_1 \text{ or } B_2)$ **Answers:** a. 0.9 b. 0.7

4. Suppose there are 100 students in your accounting class, 10 of whom are left-handed. Two students are selected at random.

- a. Draw a probability tree and insert the probabilities for each branch.

What is the probability of the following events?

- b. Both are right-handed.
c. Both are left-handed.
d. One is right-handed and the other is left-handed.
e. At least one is right-handed.

Answers:

- a. You can draw, and then you can solve for the rest.
b. $P(RR) = .81$
c. $P(LL) = .01$
d. $P(RL) + P(LR) = .0909 + .0909 = .18$
e. $P(RL) + P(LR) + P(RR) = .09 + .09 + .81 = .99$

5. For examples of Baye's Law Problems, refer to the handout found on Canvas and the website titled [Bayes' Problems](#),

Chapter 7

1. The random variable X has the following probability distribution.

X	-3	2	6	8
$P(x)$	.2	.3	.4	.1

Find the following probabilities.

- a. $P(X > 0)$ b. $P(X \geq 1)$ c. $P(X \geq 2)$ d. $P(2 \leq X \leq 5)$

Answers:

- a. .8 b. .8 c. = .8 d. = .3

2. Draw a probability tree to describe the flipping of three fair coins.

Find the following probabilities.

- a. Two heads b. One head c. At least one head d. At least two heads

Answers:

- a. $P(2 \text{ heads}) = .375$ b. $P(1 \text{ heads}) = .375$
 c. $P(\text{at least 1 head}) = .875$ d. $P(\text{at least 2 heads}) = .500$

3. The number of pizzas delivered to university students each month is a random variable with the following probability distribution.

x	0	1	2	3
$P(x)$	.1	.3	.4	.2

- a. Find the probability that a student has received delivery of two or more pizzas this month.
 b. Determine the mean and variance of the number of pizzas delivered to students each month.

Answers:

- a. $P(X \geq 2) = 0.6$ b. $\mu = 1.7$ $\sigma^2 = 0.81$.

4. USE table 1 in the text to answer this question. A certain type of tomato seed germinates 90% of the time. A backyard farmer planted 25 seeds.

- a. What is the probability that exactly 20 germinate?
 b. What is the probability that 20 or more germinate?
 c. What is the probability that 24 or fewer germinate?
 d. What is the expected number of seeds that germinate?

Answers:

- a. $P(X = 20) = .0646$ b. $P(X \geq 20) = .9666$
 c. $P(X \leq 24) = .9282$ d. $E(X) = 22.5$

5. A student majoring in accounting is trying to decide on the number of firms to apply to. The student expects to receive a job offer from 70% of the firms. The student decides to apply to only four firms. Determine the probability distribution of the number of job offers. That is, calculate the probability for each of the values 0, 1, 2, 3, and 4.

Answers:

$$P(X = 0) = .0081 \quad P(X = 1) = .0756 \quad P(X = 2) = .2646 \quad P(X = 3) = .4116 \quad P(X = 4) = .2401$$

6. Use table 2 in the text to answer this question. The number of accidents that occur at a busy intersection is Poisson distributed with a mean of 3.5 per week. Find the probability of the following events.

a. No accidents in 1 week b. Five or more accidents in 1 week c. One accident today

Answers:

a. .0302 b. .2746 c. .3033

Chapter 8

1. The weekly output of a steel mill is a uniformly distributed random variable that lies between 110 and 175 metric tons.

- a. Compute the probability that the steel mill will produce more than 150 metric tons next week.
b. Determine the probability that the steel mill will produce between 120 and 160 metric tons next week.

Answers:

$$f(x) = \frac{1}{(175 - 110)} = \frac{1}{65} \quad 110 < x < 175$$

$$a. \quad P(X > 150) = (175 - 150) \frac{1}{65} = .3846 \quad P(120 < X < 160) = (160 - 120) \frac{1}{65} = .6154$$

2. Find:
- | | |
|-----------------------|----------------------|
| $P(Z < 1.60)$ | Answer: .9452 |
| $P(Z > 1.87)$ | Answer: .0307 |
| $P(Z < 2.57)$ | Answer: .9949 |
| $P(1.04 < Z < 2.03)$ | Answer: .1280 |
| $P(-1.30 < Z < 0.70)$ | Answer: .6612 |
| $P(Z > 0)$ | Answer: .5 |
| $P(Z > 4.0)$ | Answer: 0 |

3. X is normally distributed with mean 1,000 and standard deviation 250. What is the probability that X lies between 800 and 1,100?

Answer: .4435

4. The long-distance calls made by the employees of a company are normally distributed with a mean of 6.3 minutes and a standard deviation of 2.2 minutes. Find the probability that a call
- lasts between 5 and 10 minutes.
 - lasts more than 7 minutes.
 - lasts less than 4 minutes.

Answers:

- a. .6759 b. .3745 c. .1469

5. The top-selling Red and Voss tire is rated 70,000 miles, which means nothing. In fact, the distance the tires can run until they wear out is a normally distributed random variable with a mean of 82,000 miles and a standard deviation of 6,400 miles.

- What is the probability that a tire wears out before 70,000 miles?
- What is the probability that a tire lasts more than 100,000 miles?

Answers:

- a. .0301 b. .0025

6. The coffee shop in the business school is open until 9:00 P.M. each weekday. The amount of coffee sold after 8:00 P.M. each day is normally distributed with a mean of 15 cups and a standard deviation of 3 cups. At 8:00 P.M., two new pots of coffee are prepared, each containing 10 cups. If demand exceeds supply, more coffee will have to be prepared. What is the probability that they will not have to prepare more coffee?

Answers: .9525

7. The debt-to-income ratio is an important economic indicator. A large ratio may indicate that a particular household's debt is unsustainable. Assume that this ratio is normally distributed with a mean and standard deviation of 1.5 and .5, respectively. Determine the 90th and 99th percentiles.

Answers: 90th percentile: 2.14 99th percentile: 2.665

8. The amount of time devoted to studying statistics each week by students who achieve a grade of A in the course is a normally distributed random variable with a mean of 7.5 hours and a standard deviation of 2.1 hours.

- What proportion of A students study for more than 10 hours per week?
- Find the probability that an A student spends between 7 and 9 hours studying.
- What proportion of A students spend fewer than 3 hours studying?

Answers:

- a. $P(X > 10) = .1170$ b. $P(7 < X < 9) = .3559$ c. $P(X < 3) = .0162$

Chapter 9

1. Given a normal population whose mean is 50 and whose standard deviation is 5, find the probability that a random sample of
 - a. 4 has a mean between 49 and 52.
 - b. 16 has a mean between 49 and 52.
 - c. 25 has a mean between 49 and 52.

Answers:

a. $P(49 < \bar{X} < 52) = .4435$ b. $P(49 < \bar{X} < 52) = .7333$ c. $P(49 < \bar{X} < 52) = .8185$

2. The number of pizzas consumed per month by university students is normally distributed with a mean of 10 and a standard deviation of 3.
 - a. What proportion of students consume more than 12 pizzas per month?
 - b. What is the probability that in a random sample of 25 students more than 11 pizzas are consumed?

Answers:

a. $P(X > 12) = .2514$ b. $P(\bar{X} > 11) = .0475$

3.
 - a. The probability of success on any trial of a binomial experiment is 25%. Find the probability that the proportion of successes in a sample of 500 is less than 22%.
 - b. Repeat part (a) with $n = .800$.
 - c. Repeat part (a) with $p = 1,000$.

Answers:

a. $P(\hat{P} < .22) = .0606$

b. $P(\hat{P} < .22) = .0250$

c. $P(\hat{P} < .22) = .0143$

4. The proportion of eligible voters in the next election who will vote for the incumbent is assumed to be 55%. What is the probability that in a random sample of 500 voters less than 49% say they will vote for the incumbent?

Answers:

$P(\hat{P} < .49) = .0035$