

Name: _____ *Key*

1. Environmental Protection Agency (EPA) fuel economy estimates for automobile models tested recently predicted a mean of 24.76 mpg and a standard deviation of 6.19 mpg for highway driving. Use the Empirical Rule to complete parts a) and b).
 - (a) (4 points) What percentage of autos get between 18.57 and 37.14 mpg?
 - a. 68%
 - b. 95%
 - ☒ c. 83.85%
 - d. 81.5%
 - (b) (4 points) Describe the gas mileage of the worst 2.5% of cars.
 - ☒ a. The worst 2.5% of cars get less 12.38 mpg.
 - b. The worst 2.5% of cars get more 12.38 mpg.
 - c. The worst 2.5% of cars get less 6.19 mpg.
 - d. The worst 2.5% of cars get less than 18.57 mpg.
2. (4 points) There are 3 different Mathematics courses, 5 different Science courses, and 4 different History courses. If a student must take one of each, how many different ways can this be done?
 - a. 12
 - ☒ b. 60
 - c. 15
 - d. 345
3. (4 points) Suppose that A, B are not mutually exclusive events, with $P(A) = 0.2$ and $P(B) = 0.7$ and $P(A \text{ and } B) = 0.1$. Find $P(A \text{ or } B)$.
 - a. 0.9
 - ☒ b. 0.8
 - c. 0.6
 - d. 0.1
4. (4 points) A basketball player hits three-point shots 64% of the time. If she takes 4 shots during a game, what is the probability that she misses the last three shots?
 - ☒ a. 0.03
 - b. 0.05
 - c. 0.5
 - d. 0.04

5. (4 points) License plates are made using 2 letters followed by 2 digits. How many plates can be made if repetition of letters is not allowed but repetition of digits is allowed?

a. 650,000
b. 676,000
c. 468,000
d. none of the above

6. (4 points) If two cards are drawn at random without replacement from a standard deck, find the probability that the second card is red, given that the first card was a heart.

a. $1/13$
b. $25/52$
c. $24/51$
d. $25/51$

7. (12 points) A survey of 20 students found that the number of books owned by each student was as follows:

10, 8, 12, 4, 9, 12, 10, 8, 2, 18, 9, 12, 11, 8, 0, 14, 5, 15, 10, 20

Use this data to answer the following. Round answers to one decimal place.

- (a) Find the standard deviation of the data.

$$s = 4.9$$

- (b) Find the variance of the data.

$$24.01$$

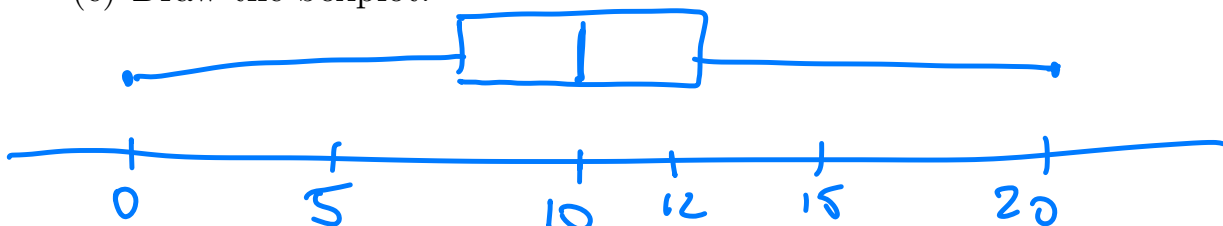
- (c) Find the 5 number summary.

$$\begin{aligned} \min &= 0 \\ Q_1 &= 8 \\ \text{Med} &= 10 \\ Q_3 &= 12 \\ \max &= 20 \end{aligned}$$

- (d) How many of these students are considered outliers with respect to number of books owned?

$$IQR = Q_3 - Q_1 = 12 - 8 = 4$$

- (e) Draw the boxplot.



8. (10 points) A test is given to a group of students; the grades and gender of the students is summarized in the table below:

	A	B	C	Total
Male	8	17	10	35
Female	8	13	13	34
Total	16	30	23	69

If one student is chosen at random, determine the following probabilities.

Write your answer as fractions.

- (a) What is the probability that the chosen student is a male?

$$\frac{35}{69}$$

- (b) What is the probability that the chosen student is a student who is female and got a C grade.

$$\frac{13}{69}$$

- (c) What is the probability that the chosen student is a male given the student got an A.

$$\frac{8}{16} = \frac{1}{2}$$

- (d) What is the probability that the chosen student is a female given the student got an A.

$$\frac{8}{16} = \frac{1}{2}$$

9. (10 points) A card is selected at random from a standard deck. **Write your answer as fractions.**

(a) Find probability of selecting a heart.

$$13/52$$

(b) Find probability of selecting the Queen of hearts.

$$1/52$$

(c) Find the probability of selecting a club **or** an Ace.

$$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52}$$

(a) Find the probability of selecting a face card **or** a 2.

$$\frac{12}{52} + \frac{4}{52} = \frac{16}{52}$$

(b) Find the probability of selecting a Jack **or** a high card.

$$\frac{4}{52} + \frac{20}{52} - \frac{4}{52} = \frac{20}{52}$$

10. (12 points) Let A, B be events, with $P(A) = 0.4$, $P(B) = 0.6$, and $P(A|B) = 0.20$.

Calculate the following probabilities for parts a through d, and give your answer as a decimal rounded to two decimal places.

(a) $P(B') = 1 - P(B) = 1 - 0.6 = 0.4$

(b) $P(A \text{ and } B) = P(B) P(A|B) = (0.6)(0.2) = 0.12$

(c) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.4 + 0.6 - 0.12 = 0.88$

(d) $P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{0.12}{0.4} = 0.3$

(e) Are events A and B independent? Justify your answer by showing what formula you used to decide on the answer.

NO $P(A \text{ and } B) \neq P(A) \cdot P(B)$
 $0.12 \neq 0.24$

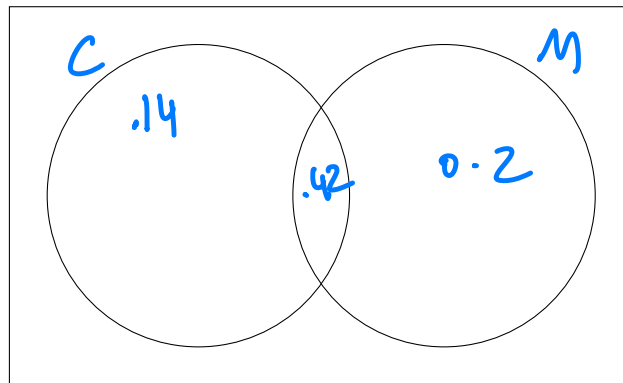
Standard deck

2♥	2♦	2♣	2♠
3♥	3♦	3♣	3♠
4♥	4♦	4♣	4♠
5♥	5♦	5♣	5♠
6♥	6♦	6♣	6♠
7♥	7♦	7♣	7♠
8♥	8♦	8♣	8♠
9♥	9♦	9♣	9♠
10♥	10♦	10♣	10♠
J♥	J♦	J♣	J♠
Q♥	Q♦	Q♣	Q♠
K♥	K♦	K♣	K♠
A♥	A♦	A♣	A♠

11. (4 points) People with z-scores of 2.75 or above on a certain aptitude test are sometimes classified as geniuses. If aptitude test scores have a mean of 100 and a standard deviation of 8 points, what is the minimum aptitude test score needed to be considered a genius?

$$z = \frac{x - \bar{x}}{s} \quad 2.75 = \frac{x - 100}{8} \Rightarrow \underline{x = 122}$$

12. (12 points) Our survey found that 56% of college students live on campus, 62% have a campus meal program, and 42% do both.



- (a) What is the probability of picking a student who lives on campus but does not have a campus meal plan?

$$.14$$

- (b) What's the probability that a chosen student lives off campus and does not have a campus meal?

$$1 - (.14 + .42 + 0.2) = 0.24$$

- (c) What's the probability of picking a student who lives on campus or has a campus meal plan?

$$.14 + .42 + .2 = .76$$

- (d) If you randomly select 3 students, what is the probability that all 3 live on campus?

$$(.56)^3 = 0.176$$

- (e) If you randomly select 3 students what is the probability that none have campus meal.

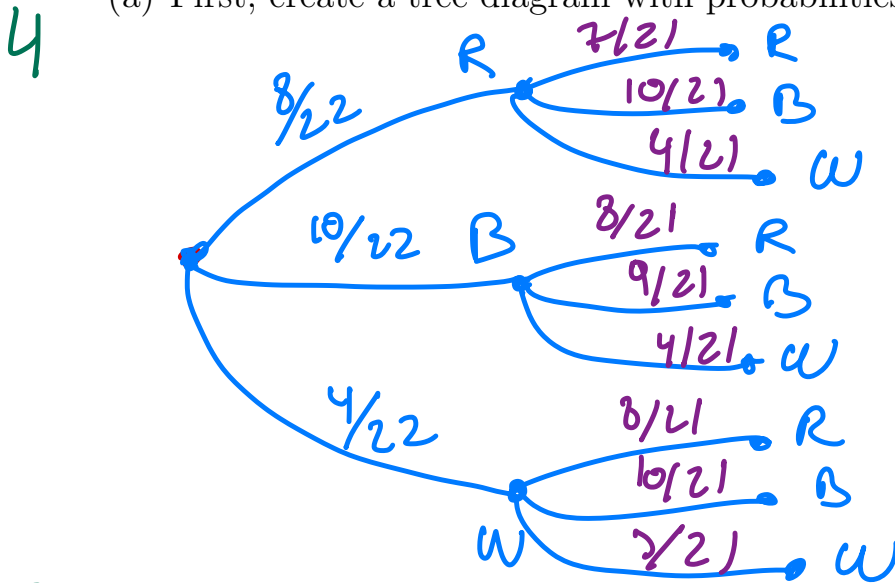
$$(.33)^3 = .05$$

- (f) *Bonus*: If you randomly select 4 students what is the probability that at least one lives on campus.

$$1 - (.44)^3 = 0.963$$

13. (12 points) A jar contains 8 red marbles, 10 blue marbles, and 4 white marbles. If two marbles are drawn randomly from the jar without replacement, find the probability of the given event, and write your answers as fractions.

- (a) First, create a tree diagram with probabilities on each possible outcome.



- 2 (b) The second ball is red, given that the first ball is white:

$$8/21 = 0.38$$

- 2 (c) The second ball is white, given that the first ball is red:

$$4/21 = 0.19$$

- 4 (d) Both balls are white:

$$\frac{4}{22} \cdot \frac{3}{21} = (0.18)(0.14) = 0.02$$