5.1 Probability Rules MATH 241 THOMPSON

1) What is the probability of an event that is impossible? Suppose that a probability is approximated to be zero based on empirical results. Does this mean that the event is impossible?

What is the probability of an event that is impossible?

0 (Type an integer or a decimal.)

Suppose that a probability is approximated to be zero based on empirical results. Does this mean that the event is impossible?

✔ No

2) *True or False*: In a probability model, the sum of the probabilities of all outcomes must equal 1.

Choose the correct answer below.

○ False

✔ True

3) Probability is a measure of the likelihood of a random phenomenon or chance behavior.

Choose the correct answer below.

○ False

✔ True

4) In probability, a(n) experiment is any process that can be repeated in which the results are uncertain.

5) Is the following a probability model? What do we call the outcome "brown"?

Color	Probability
red	0.1
green	0.2
blue	0.1
brown	0
yellow	0.2
orange	0.35

Is the table above an example of a probability model?

✔ A. No, because the probabilities do not sum to 1.

What do we call the outcome "brown"?

○ A. Not so unusual event

✔ B. Impossible event

Color	Probability
Red	0.2
Green	−0.2
Blue	0.1
Brown	0.4
Yellow	0.3
Orange	0.2

6) Why is the following not a probability model?

Click the icon to view the data table.

Determine why it is not a probability model. Choose the correct answer below.

- A. This is not a probability model because at least one probability is greater than 1.
- B. This is not a probability model because the sum of the probabilities is not 1.
- ✔ C. This is not a probability model because at least one probability is less than 0.
- D. This is not a probability model because at least one probability is greater than 0.

7) Which of the following numbers could be the probability of an event?

0.33, −0.44, 0.07, 1.14, 1, 0 **$0 \le P \le 1$**

The numbers that could be a probability of an event are 0,.07,.33,1 .

8) In a certain card game, the probability that a player is dealt a particular hand is 0.44. Explain what this probability means. If you play this card game 100 times, will you be dealt this hand exactly 44 times? Why or why not?

Choose the correct answer below.

- A. The probability 0.44 means that exactly 44 out of every 100 dealt hands will be that particular hand. Yes, you will be dealt this hand exactly 44 times since the probability refers to long-term behavior, not short-term.
- ✔ B. The probability 0.44 means that approximately 44 out of every 100 dealt hands will be that particular hand. No, you will not be dealt this hand exactly 44 times since the probability refers to long-term behavior, not short-term.

9) According to a certain country's department of education, 40.3% of 3-year-olds are enrolled in day care. What is the probability that a randomly selected 3-year-old is enrolled in day care?

The probability that a randomly selected 3-year-old is enrolled in day care is .403 .
(Type an integer or a decimal.)

10) Let the sample space be S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Suppose the outcomes are equally likely. Compute the probability of the event E = {4, 5, 6}.

P(E) = .3 (Type an integer or a decimal. Do not round.)

$$\frac{3}{10} = 0.3$$

11) Let the sample space be S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Suppose the outcomes are equally likely. Compute the probability of the event E = "an even number less than 10."

P(E) = .4 (Type an integer or a decimal. Do not round.)

$$\frac{4}{10} = 0.4$$

12) A survey of 500 randomly selected high school students determined that 324 play organized sports.

(a) What is the probability that a randomly selected high school student plays organized sports?
(b) Interpret this probability.

(a) The probability that a randomly selected high school student plays organized sports is .648.
(Round to the nearest thousandth as needed.)

$$\frac{324}{500} = 0.648$$

(b) Choose the correct answer below.
(Type a whole number.)

A. If 1,000 high school students were sampled, it would be expected that about 648 of them play organized sports.

13) A bag of 100 tulip bulbs purchased from a nursery contains 35 red tulip bulbs, 35 yellow tulip bulbs, and 30 purple tu bulbs.

(a) What is the probability that a randomly selected tulip bulb is red?
(b) What is the probability that a randomly selected tulip bulb is purple?
(c) Interpret these two probabilities.

(a) The probability that a randomly selected tulip is red is .35.
(Type an integer or a decimal. Do not round.)

(b) The probability that a randomly selected tulip bulb is purple is .3.
(Type an integer or a decimal. Do not round.)

(c) Select the correct choice below and fill in the answer boxes within your choice.
(Type whole numbers.)

A. If 100 tulip bulbs were sampled with replacement, one would expect about 35 of the bulbs to be red and about 30 of the bulbs to be purple.

14) In a national survey college students were asked, "How often do you wear a seat belt when riding in a car driven by someone else?" The response frequencies appear in the table to the right. (a) Construct a probability model for seat-belt use by a passenger. (b) Would you consider it unusual to find a college student who never wears a seat belt when riding in a car driven by someone else?

Response	Frequency
Never	105
Rarely	310
Sometimes	533
Most of the time	1095
Always	2252

(a) Complete the table below.

Response	Probability	
Never	.024	(Round to the nearest thousandth as needed.)
Rarely	.072	(Round to the nearest thousandth as needed.)
Sometimes	.124	(Round to the nearest thousandth as needed.)
Most of the time	.255	(Round to the nearest thousandth as needed.)
Always	.524	(Round to the nearest thousandth as needed.)

TOTAL is 4295

$$\frac{105}{4295} = 0.024$$

*** for each**

(b) Would you consider it unusual to find a college student who never wears a seat belt when riding ir by someone else?

A. No, because there were 105 people in the survey who said they never wear their seat belt.

B. No, because the probability of an unusual event is 0.

C. Yes, because P(never) < 0.05.

D. Yes, because 0.01 < P(never) < 0.10.

15) Clarice, John, Roberto, Marco, and Dominique work for a publishing company. The company wants to send two employees to a statistics conference. To be fair, the company decides that the two individuals who get to attend will have their names randomly drawn from a hat.

(a) Determine the sample space of the experiment. That is, list all possible simple random samples of size n = 2.

(b) What is the probability that John and Roberto attend the conference?

(c) What is the probability that Dominique attends the conference?

(d) What is the probability that John stays home?

(a) Choose the correct answer below. Note that each person is represented by the first letter in their name.

- A. CJ, CR, CM, CD
- B. CJ, CR, CM, CD, JR, JM, JD, RM, RD, MD, CC, JJ, RR, MM, DD
- C. CJ,CR,CM,CD,JR,JM,JD,RM,RD,MD,JC,RC,MC,DC,RJ,MJ,DJ,MR,DR,DM
- ✓ D. CJ, CR, CM, CD, JR, JM, JD, RM, RD, MD

(b) The probability that John and Roberto attend the conference is .1 **Has to have both J and R**

(Round to one decimal place as needed.)

(c) The probability that Dominique attends the conference is .4.

(Round to one decimal place as needed.) **Any with a D**

(d) The probability that John stays home is .6.

(Round to one decimal place as needed.) **Is when John does not attend the conference?**

16) A baseball player hit 60 home runs in a season. Of the 60 home runs, 22 went to right field, 20 went to right center f 8 went to center field, 8 went to left center field, and 2 went to left field.

(a) What is the probability that a randomly selected home run was hit to right field?

(b) What is the probability that a randomly selected home run was hit to left field?

(c) Was it unusual for this player to hit a home run to left field? Explain.

(a) The probability that a randomly selected home run was hit to right field is .367.

(Round to three decimal places as needed.)

(b) The probability that a randomly selected home run was hit to left field is .033.

(Round to three decimal places as needed.)

(c) Was it unusual for this player to hit a home run to left field?

- ✓ A. Yes, because P(left field) < 0.05.

17) You suspect a 6-sided die to be loaded and conduct a probability experiment by rolling the die 400 times. The outcome of the experiment is listed in the following table. Do you think the die is loaded? Why?

Full data set

Value of Die	Frequency	Value of Die	Frequency
1	75	4	60
2	72	5	69
3	64	6	60

Do you think the die is loaded?

- ✓ A. No, because each value has an approximately equal chance of occurring.
- B. Yes, because the probabilities are not the same.
- C. Yes, because two of the values have a higher probability of occurring than expected under the assumption of equally likely outcomes.

Another of #17, since there is a big change in frequency

You suspect a 6-sided die to be loaded and conduct a probability experiment by rolling the die 400 times. The outcome of the experiment is listed in the following table. Do you think the die is loaded? Why?

Full data set

Value of Die	Frequency	Value of Die	Frequency
1	108	4	50
2	114	5	45
3	39	6	44

Do you think the die is loaded?

A. Yes, because the probabilities are not the same.

B. No, because each value has an approximately equal chance of occurring.

C. Yes, because two of the values have a higher probability of occurring.

18) In a recent survey, it was found that the median income of families in country A was $57,400. What is the probability that a randomly selected family has an income greater than $57,400?

What is the probability that a randomly selected family has an income greater than $57,400?

$\frac{1}{2}$ (Type an integer or a decimal.)

19) Explain the Law of Large Numbers. How does this law apply to gambling casinos?

with which a certain outcome is observed gets closer to 1. This applies to casinos because they are able to make a profit in the long run because they have a small statistical advantage in each game.

B. As the number of repetitions of a probability experiment increases, the proportion with which a certain outcome is observed gets closer to 0. Casinos use the Law of Large Numbers to determine how many players gamble in certain games.

C. As the number of repetitions of a probability experiment increases, the proportion with which a certain outcome is observed gets closer to the probability of the outcome. Casinos use the Law of Large Numbers to determine how many players gamble in certain games.

D. As the number of repetitions of a probability experiment increases, the proportion with which a certain outcome is observed gets closer to the probability of the outcome. This applies to casinos because they are able to make a profit in the long run because they have a small statistical advantage in each game.

20) Describe what an unusual event is. Should the same cutoff always be used to identify unusual events? Why or why not?

A. An event is unusual if it has a low probability of occurring. The same cutoff should always be used to identify unusual events. An event is unusual regardless of the context of the event.

B. An event is unusual if it has a high probability of occurring. The same cutoff should not always be used to identify unusual events. Selecting a cutoff is subjective and should take into account the consequences of incorrectly identifying an event as unusual.

C. An event is unusual if it has a high probability of occurring. The same cutoff should always be used to identify unusual events. An event is unusual regardless of the context of the event.

D. An event is unusual if it has a low probability of occurring. The same cutoff should not always be used to identify unusual events. Selecting a cutoff is subjective and should take into account the consequences of incorrectly identifying an event as unusual.

21) Describe the difference between classical and empirical probability.

does not require that a probability experiment actually be performed. Rather, it relies on counting techniques, and requires equally likely outcomes.

B. The classical method obtains an exact probability of an event by conducting a probability experiment. The empirical method of computing empirical probabilities does not require that a probability experiment actually be performed. Rather, it relies on counting techniques, and requires equally likely outcomes.

C. The empirical method obtains an approximate empirical probability of an event by conducting a probability experiment. The classical method of computing probabilities does not require that a probability experiment actually be performed. Rather, it relies on counting techniques, and requires equally likely outcomes.