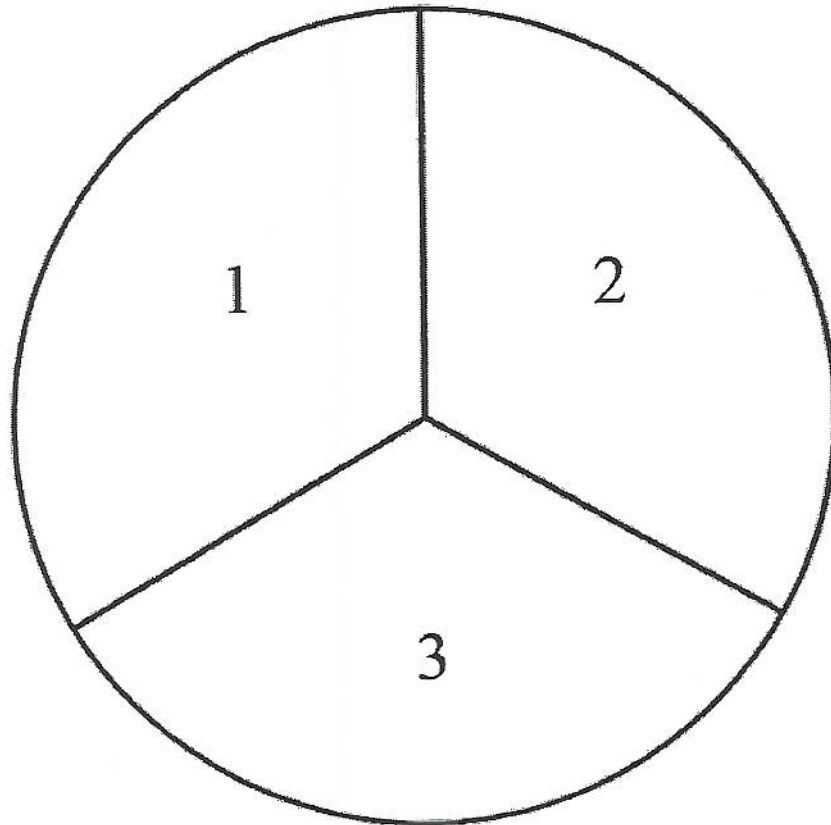
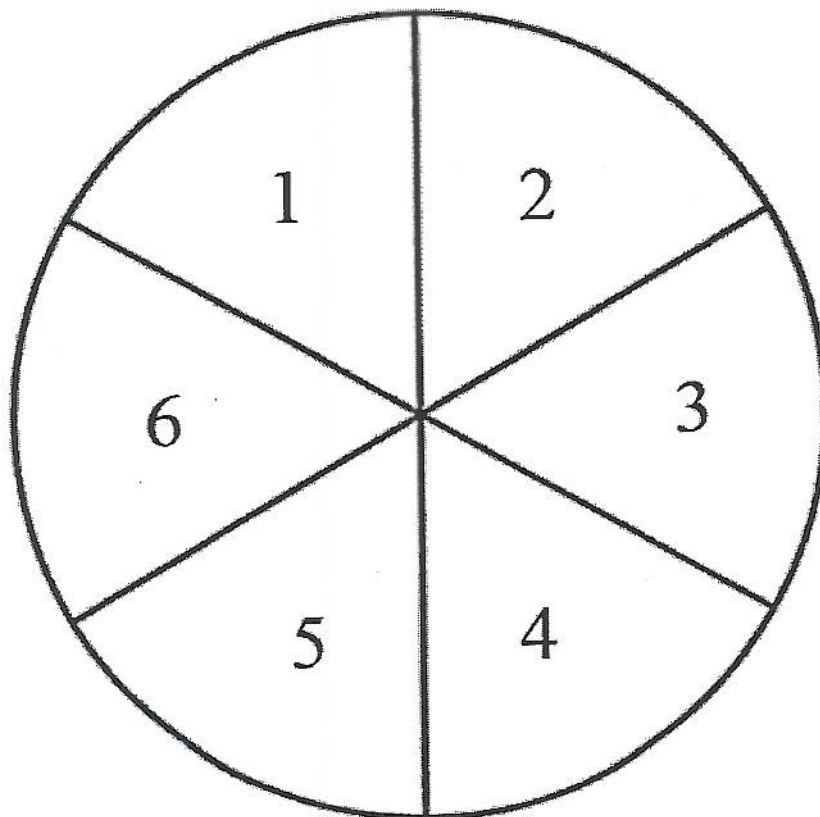


Spinner 1



Spinner 2



2

Alan is designing a probability game. He plans to present the game to people who will consider financing his idea. Here is a description of the game and the materials needed to play:

Rules of the game:

- The **Event Cards** are shuffled, and one is selected.
- Each player reads the description of the chance experiment and the description of the five possible outcomes.
- Players independently assign the numbers 1–5 (no repeats) to the five events described on the **Event Cards** based on how likely they think the event is to occur, with 5 being most likely and 1 being least likely.
- Once players have made their assignments, the chance experiment described on the **Event Cards** is performed. Points are then awarded based on the outcome of the chance experiment. If the event described on the **Event Cards** has occurred, the player earns the number of points corresponding to the number that player assigned to that event (1–5 points). If an event occurs that is not described on the **Event Cards**, then no points are awarded for that event.
- If an outcome is described by two or more events on the **Event Cards**, the player selects the higher point value.
- The chance experiment is repeated four more times with points being awarded each time the chance experiment is performed.
- The player with the largest number of points at the end of the game is the winner.

The game includes the following materials:

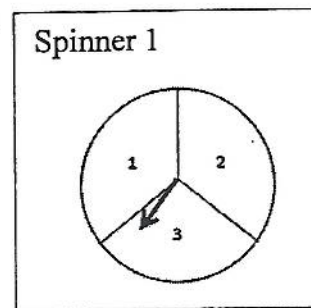
- Spinner 1 with three equal area sectors identified as 1, 2, and 3.
- A token bag contains six tokens. Four tokens are blue, with the letter “A” written on one token, “B” on another token, “C” on a third token, and “D” on a fourth token. Two tokens are red with the letter “E” written on one token and the letter “F” written on the other.
- A set of Event Cards, each describing a chance experiment and a set of five possible events based on the chance experiment.

Token bag:

Blue	Blue	Blue	Blue	Red	Red
A	B	C	D	E	F

4B

2R



Number of players: The game is played by two players (or two small groups of players) identified as Player 1 and Player 2.

Alan developed two **Event Cards** for his demonstration to the finance people. Each event card includes a scenario and tables in which the players can make their assignments and keep track of their scores.

Consider the first event card Alan developed:

Event Card 1

Chance experiment (directions): Spin Spinner 1 and randomly select a token from the token bag (four Blue tokens and two red tokens). Record the number from your spin and the color of the token selected in the score table below.

Five events of interest:

Outcome is an odd number on Spinner 1 and a red token from the token bag.	Outcome is an odd number on Spinner 1.	Outcome is an odd number on Spinner 1 and a blue token from the token bag.	Outcome is an even number from Spinner 1 or a red token from the token bag.	Outcome is not a blue token from the token bag.

Game Tools: **Spinner 1** (three equal sectors with the number 1 in one sector, the number 2 in the second sector, and the number 3 in the third sector)

Token Bag (Blue-A, Blue-B, Blue-C, Blue-D, Red-E, Red-F)

Player: _____

Scoring Table for Chance Experiment 1:

Turn	Outcome from Spinner 1	Outcome from the token bag	Points
1			
2			
3			
4			
5			

Here is an example of Alan demonstrating the first Event Card:

Event Card 1

Chance experiment (directions): Spin Spinner 1 and randomly select a token from the token bag (four Blue tokens and two red tokens). Record the number from your spin and the color of the token selected in the score table below.

Alan assigned the numbers 1–5 to the following descriptions as shown below. Once a number is assigned, it cannot be used again.

Five events of interest:

Outcome is an odd number on Spinner 1 and a red token from the token bag.	Outcome is an odd number on Spinner 1.	Outcome is an odd number on Spinner 1 and a blue token from the token bag.	Outcome is an even number from Spinner 1 or a red token from the token bag.	Outcome is not a blue token from the token bag.
3	1	4	2	5

Game Tools: Spinner 1 (three equal sectors with the number 1 in one sector, the number 2 in the second sector, and the number 3 in the third sector)

Token Bag (Blue-A, Blue-B, Blue-C, Blue-D, Red-E, Red-F)

Alan is now ready to take his five turns. The results were recorded from the spinner and the token bag. Based on the results, Alan earned the points indicated for each turn.

Player: Alan

Scoring Card for Chance Experiment 1:

Turn	Outcome from Spinner 1	Outcome from the token bag	Points
1	2	Blue	2
2	1	Red	5
3	1	Red	5
4	3	Blue	4
5	2	Blue	2

Alan earned a total of 18 points. The game now turns to Player 2. Player 2 assigns the numbers 1–5 to the same description of outcomes. Player 2 does not have to agree with the numbers Alan assigned. After five turns, the player with the most number of points is the winner.

5

Name: _____

Date: _____ Period: _____

1. Would you change any of the assignments of 1–5 that Alan made? Explain your answer.

2. Assign the numbers 1–5 to the event descriptions based on what you think is the best strategy to win the game.

Outcome is an odd number on Spinner 1 and a red token from the token bag.	Outcome is an odd number on Spinner 1.	Outcome is an odd number on Spinner 1 and a blue token from the token bag.	Outcome is an even number from Spinner 1 or a red token from the token bag.	Outcome is not a blue token from the token bag.

3. Carry out a turn by observing an outcome from spinning Spinner 1 and picking a token. Record your results and total points in the table below.

4. Complete four more turns (for a total of five) and determine your final score. Record your results and total points in the table below.

Player:

Scoring Table for Event Card 1:

Trial	Outcome from Spinner 1	Outcome from the token bag	Points based on your assignment of numbers to the events
1			
2			
3			
4			
5			
Total Score			

5. If you changed the numbers assigned to the descriptions, was your score better than Alan's score? Did you expect your score to be better? Explain. If you did not change the numbers from those that Alan assigned, explain why you did not change them.

6. Spinning Spinner 1 and drawing a token from the token bag is a *chance experiment*. One possible outcome of this experiment is (1, Blue-A). A *sample space* for a chance experiment is the set of all possible outcomes. What is the sample space for the chance experiment of Event Card 1?

7. Are the outcomes in the sample space equally likely? Explain your answer.

8. An *event* is a collection of outcomes from the sample space.

One event of interest for someone with Event Card 1 is "Odd number on Spinner 1 and a red token." What are the outcomes that make up this event? List the outcomes of this event in the first row of the Table 1 (below #10 on the next page).

7

Name: _____

Date: _____ Period: _____

9. What is the probability of getting an odd number on Spinner 1 and picking a red token from the token bag? Enter this probability in Table 1 (below #10).
10. Complete Table 1 by listing the outcomes for the other events and their probabilities based on the chance experiment for this Event Card.

Table 1

Event	Outcomes	Probability
Odd number on Spinner 1 and a red token from the token bag		
Odd number on Spinner 1		
Odd number on Spinner 1 and a blue token from the token bag		
Even number on Spinner 1 or a red token from the token bag		
Not picking a blue token from the token bag		

11. Based on the above probabilities, how would you assign the numbers 1 to 5 to each of the game descriptions? Explain.

Outcome is an odd number on Spinner 1 and a red token from the token bag.	Outcome is an odd number on Spinner 1.	Outcome is an odd number on Spinner 1 and a blue token from the token bag.	Outcome is an even number from Spinner 1 or a red token from the token bag.	Outcome is not a blue token from the token bag.

8

Name: _____

Date: _____ Period: _____

12. If you changed any of the points assigned to the game descriptions, play the game again at least three times and record your final scores for each game. Do you think you have the best possible assignment of numbers to the events for this Event Card? If you did not change the game descriptions, also play the game so that you have at least three final scores. Compare your scores with other members of your class. Do you think you have the best assignment of numbers to the events for this Event Card?

Game 1:

Trial	Outcome from Spinner 1	Outcome from the token bag	Points based on your assignment of points in #10
1			
2			
3			
4			
5			
Total Score			

Game 2:

Trial	Outcome from Spinner 1	Outcome from the token bag	Points based on your assignment of points in #10
1			
2			
3			
4			
5			
Total Score			

Game 3:

Trial	Outcome from Spinner 1	Outcome from the token bag	Points based on your assignment of points in #10
1			
2			
3			
4			
5			
Total Score			

13. Why might you not be able to answer the question of whether or not you have the best assignment of numbers to the game descriptions with at least three final scores?

14. Write your answers to the following questions independently, and then share your responses with a neighbor.

a. How did you make decisions about how to assign point values from 1 to 5?

b. How do the ideas of probability help you make decisions?

15. How would you change the strategy of assigning the numbers 1–5 if the lowest score was the winner of the game?

Lesson Summary

- The **sample space** of a chance experiment is the collection of all possible outcomes for the experiment.
- An **event** is a collection of outcomes of a chance experiment.
- For a chance experiment in which outcomes of the sample space are equally likely, the probability of an event is the number of outcomes in the event divided by the number of outcomes in the sample space.
- Some events are described in terms of “or,” “and,” or “not.”

Problem Set

Consider a second Event Card that Alan created for his game:

Event Card 2

Directions (chance experiment): Spin Spinner 1, and spin Spinner 2. Record the number from Spinner 1, and record the number from Spinner 2.

Tools: Spinner 1: A spinner with 3 equal sectors.

Spinner 2: A spinner with 6 equal sectors.

Five events of interest:

Outcome is an odd number on Spinner 2.	Outcome is an odd number on Spinner 1 and an even number on Spinner 2.	Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 7.	Outcome is an even number on Spinner 2.	Outcome is the sum of 2 from the numbers received from Spinner 1 and Spinner 2.

Player:

Scoring Table for Event Card 2:

Turn	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Name: _____

Chance Experiments Problem Set

Date: _____

Period: _____

1. Prepare Spinner 1 and Spinner 2 for the chance experiment described on this second Event Card.
2. What is the sample space for the chance experiment described on this Event Card?
3. Based on the sample space, determine the outcomes and the probabilities for each of the events on this scenario card. Complete the table below.

Event	Outcomes	Probability
Outcome is an odd number on Spinner 2.		
Outcome is an odd number on Spinner 1 and an even number on Spinner 2.		
Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 7.		
Outcome is an even number on Spinner 2.		
Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 2.		

4. Use the Event Card 2 on page 1 to assign the numbers 1–5 to the events described on the Event Card.

5. Determine at least three final scores based on the numbers you assigned to the events.

Player:

Turn	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Player:

Turn	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Player:

Turn	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Lesson Summary

- The **sample space** of a chance experiment is the collection of all possible outcomes for the experiment.
- An **event** is a collection of outcomes of a chance experiment.
- For a chance experiment in which outcomes of the sample space are equally likely, the probability of an event is the number of outcomes in the event divided by the number of outcomes in the sample space.
- Some events are described in terms of “or,” “and,” or “not.”

Problem Set

Consider a second Event Card that Alan created for his game:

Event Card 2

Directions (chance experiment): Spin Spinner 1, and spin Spinner 2. Record the number from Spinner 1, and record the number from Spinner 2.

Tools: Spinner 1: A spinner with 3 equal sectors.

Spinner 2: A spinner with 6 equal sectors.

Five events of interest:

Outcome is an odd number on Spinner 2.	Outcome is an odd number on Spinner 1 and an even number on Spinner 2.	Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 7.	Outcome is an even number on Spinner 2.	Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 2.
4	3	2	5	1

Player:

Scoring Table for Event Card 2:

Turn	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

13

Name: _____

Date: _____ Period: _____

1. Prepare Spinner 1 and Spinner 2 for the chance experiment described on this second Event Card.
2. What is the sample space for the chance experiment described on this Event Card?

There are 18 outcomes on this Event Card.

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)

(the first number is the outcome from Spinner 1, and the second number is the outcome from Spinner 2)

3. Based on the sample space, determine the outcomes and the probabilities for each of the events on this scenario card. Complete the table below.

Event	Outcomes	Probability
Outcome is an odd number on Spinner 2.	(1,1), (1,3), (1,5), (2,1), (2,3), (2,5), (3,1), (3,3), (3,5)	<i>The probability is $\frac{9}{18}$, which is 0.5.</i>
Outcome is an odd number on Spinner 1 and an even number on Spinner 2.	(1,2), (1,4), (1,6), (3,2), (3,4), (3,6)	<i>The probability is $\frac{6}{18}$, which is approximately 0.333.</i>
Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 7.	(1,6), (2,5), (3,4)	<i>The probability is $\frac{3}{18}$, which is approximately 0.167.</i>
Outcome is an even number on Spinner 2.	(1,2), (1,4), (1,6), (2,2), (2,4), (2,6), (3,2), (3,4), (3,6)	<i>The probability is $\frac{9}{18}$, which is 0.5</i>
Outcome from the numbers received from Spinner 1 and Spinner 2 is the sum of 2.	(1,1)	<i>The probability is $\frac{1}{18}$, which is approximately 0.056.</i>

4. Use the Event Card 2 on page 1 to assign the numbers 1–5 to the events described on the Event Card.

19

Name: _____

Date: _____ Period: _____

5. Determine at least three final scores based on the numbers you assigned to the events.

Player:

Trial	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Player:

Trial	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Player:

Trial	Outcome from Spinner 1	Outcome from Spinner 2	Points
1			
2			
3			
4			
5			
Total Score			

Answers will vary.

15

Name: _____

Date: _____ Period: _____

1. Alan also included a fair coin as one of the scenario tools. Develop an Event Card that uses the coin and one of the spinners. Include a description of the chance experiment and descriptions of five events relevant to the chance experiment.

Event Card 3

Directions (chance experiment):

Tools: Fair coin

Spinner ___:

Five events of interest:

2. Determine the sample space for your chance experiment. Then, complete the table below for the five events on your Event Card. Assign the numbers 1–5 to the descriptions you created.

Event	Outcomes	Probability

3. Use the Event Card 3 on page 1 to assign the numbers 1–5 to the events described on the Event Card, then determine a final score for your game based on 5 turns.

Player:

Scoring Table for Event Card 3:

Trial	Outcome from Fair Coin	Outcome from Spinner ____	Points based on your assignment of numbers to the events
1			
2			
3			
4			
5			
Total Score			

1. For the chance experiment described in Event Card 1, why is the probability of the event “spinning an odd number and randomly selecting a blue token” not the same as the probability of the event “spinning an even number and randomly selecting a blue token”? Which event would have the greater probability of occurring, and why?
2. Why is the probability of the event “spinning an odd number from Spinner 1 *and* randomly selecting a blue token” not equal to the probability of “spinning an odd number from Spinner 1 *or* randomly selecting a blue token”?
3. If one of the red token is changed to a blue token, what is the probability of the event “spinning an odd number from Spinner 1 and randomly selecting a red token from the token bag”?