It Just Depends: Games and Simulations for Exploring Compound Events

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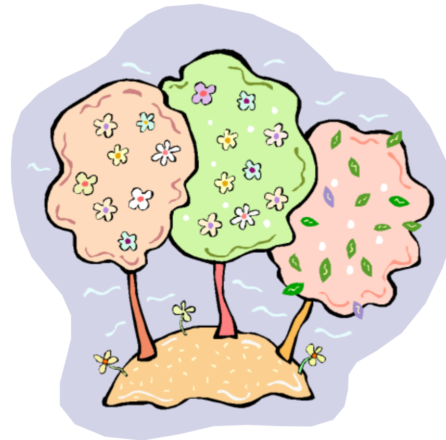
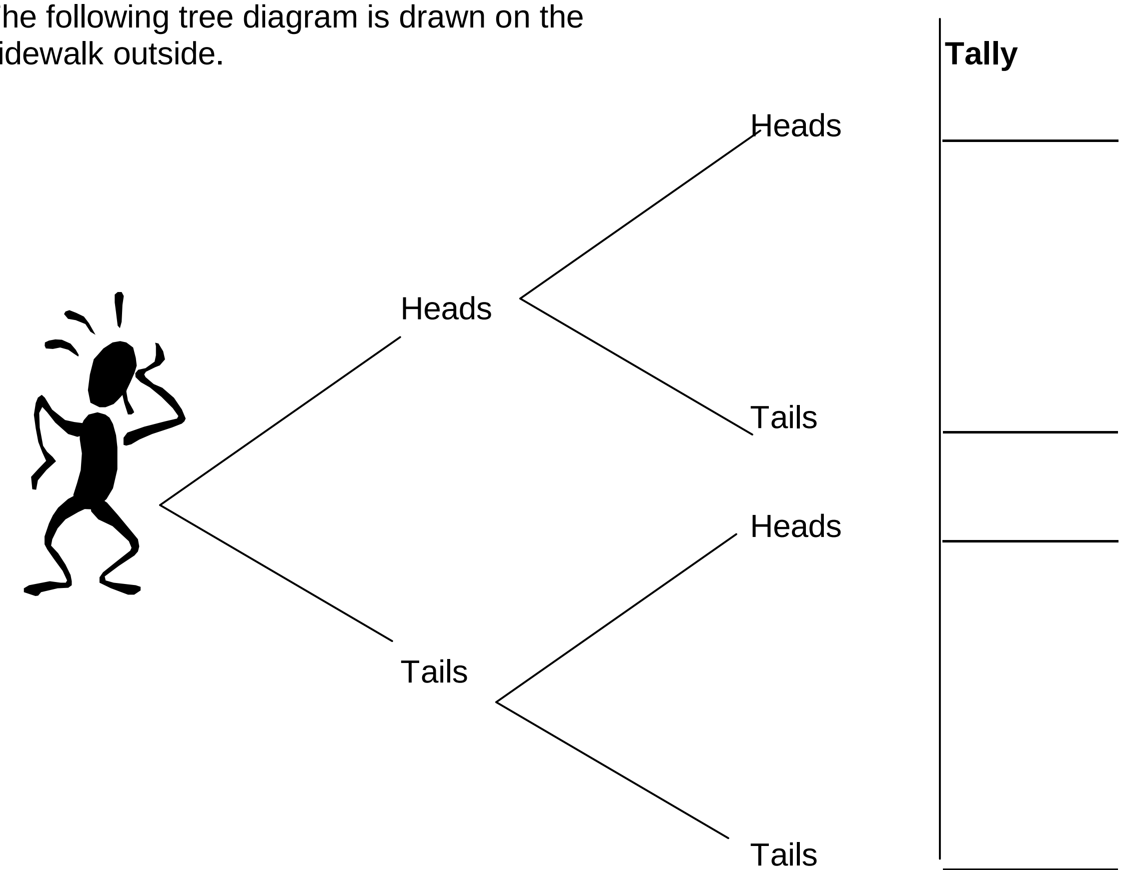
Sidewalk Trees



Tree diagrams are used to represent many different situations.

What is the probability that if I flip a coin twice in a row I will get two heads?

The following tree diagram is drawn on the sidewalk outside.



Flip a coin twice and record your result in the tally section. Repeat this experiment five times for each person in your group.

What is the sample space for this experiment?

What is the group experimental probability of getting two heads?

What is the theoretical probability of getting two heads?

Rock, Paper, Scissors, and Trees

Play a game of Rock, Paper, Scissors with a partner. Remember that rock crushes scissors, paper covers rock, and scissors cut paper.

Keep track of who wins. What did the winner choose?

Who Won	What did they choose?

Do you think this game is fair? Why or Why not?

Make a tree diagram to represent the possible outcomes for the game.

Calculate the theoretical probability for each outcome.

Is Rock, Paper, Scissors fair? Why or Why not?

Exploring **Independent** Events

1) Count the number of chips in Bag #1.

__________ yellow __________ blue __________ red

2) If you take one chip from the bag what is the probability, written as a fraction, that you will choose a…..

__________ yellow __________ blue __________ red

3) Choose one chip from the bag. Then **replace it** and choose another chip from the bag. Each time you chose a chip were there the same number of chips in the bag?

These events are **independent** because when you replace the first chip after it is drawn, you have the same number of chips in the bag as you did before you drew the first chip. **The probability of the second chip drawn is unaffected by the chip you drew first.**

4) Draw a tree diagram to represent the possible outcomes. Notice the probability of each outcome is the same. Each outcome is **equally likely**. Write the probabilities on the branches of the tree.

5) To find the probability of two **independent events we multiply the probability of the first event by the probability of the second event.**

Find each of the following probabilities.

__________ red-yellow __________ red-blue

__________ red- red __________ yellow-yellow

6) Count the number of chips in Bag #2.

__________ yellow __________ blue __________ red

7) If you take one chip from the bag what is the probability, written as a fraction, that you will choose a…..

__________ yellow __________ blue __________ red

8) Choose one chip from the bag. Then **replace it** and choose another chip from the bag. Each time you choose a chip were there the same number of chips in the bag?

These events are **independent** because when you replace the first chip after it is drawn, you have the same number of chips in the bag as you did before you drew the first chip. **The probability of the second chip drawn is unaffected by the chip you drew first.**

9) Draw a tree diagram to represent the possible outcomes. Notice the probability of each outcome is not the same. These outcomes are ***not equally likely***. Write the probabilities on the branches of the tree.

10) To find the probability of two **independent events we multiply the probability of the first event by the probability of the second event.**

Find each of the following probabilities.

__________ red-yellow __________ red-blue

__________ red- red __________ yellow-yellow

Practice:

Each letter of the word LUCKY is written on a separate slip of paper. The five slips of paper are placed in a paper bag and two slips are drawn at random. The first letter is replaced before the second letter is drawn.

Is this problem an example of independent events?

Find the probability the first letter is L and the second letter is K.

Exploring **Dependent** Events

1) Count the number of chips in Bag #1.

__________yellow__________blue _________red

2) If you take one chip from the bag what is the probability, written as a fraction, that you will choose a…..

__________yellow__________blue__________red

3) Choose one chip from the bag. **Do not replace it** and choose another chip from the bag. Each time you choose a chip were there the same number of chips in the bag?

4) Start with all the chips in your bag. Draw out a red chip **and don't replace it**. What is the probability, written as a fraction, of drawing a red chip?

5) Count the number of chips that remain in your bag.

__________yellow__________blue _________red

6) What is the probability of drawing each of the following colors with a second draw if the first chip is **not replaced**?

__________yellow__________blue__________red

These events are ***dependent*** because when you do not replace the first chip drawn, you have a different number of chips in the bag for the second draw. **The probability of the second chip drawn is affected by the chip you drew first.**

7) Draw a tree diagram to represent the possible outcomes when a chip is drawn from the bag, not replaced, and then another chip is drawn from the bag.

8) To find the probability of two **dependent events we multiply the probability of the first event by the probability of the second event. Don't forget the probability of the second event is affected by what happens in the first event.**

Find each of the following probabilities.

__________ red-yellow __________ red-blue

___________ red- red ___________ yellow-yellow

9) Count the number of chips in Bag #2.

__________yellow__________blue _________red

10) If you take one chip from the bag what is the probability, written as a fraction, that you will choose a…..

__________yellow__________blue__________red

11) Choose one chip from the bag. **Do not replace it** and choose another chip from the bag. Each time you chose a chip were there the same number of chips in the bag?

12) Start with all the chips in your bag. Draw out a red chip and **don't replace it**. What is the probability, written as a fraction, of drawing a red chip?

13) Count the number of chips that remain in your bag.

__________yellow__________blue _________red

14) What is the probability of drawing each of the following colors with a second draw if the first chip is **not replaced**?

__________yellow__________blue__________red

These events are ***dependent*** because when you do not replace the first chip drawn, you have a different number of chips in the bag for the second draw. **The probability of the second chip drawn is affected by the chip you drew first.**

15) Draw a tree diagram to represent the possible outcomes when a chip is drawn from the bag, not replaced, and then another chip is drawn from the bag.

16) To find the probability of two **dependent events we multiply the probability of the first event by the probability of the second event. Don't forget the probability of the second event is affected by what happens in the first event.**

Find each of the following probabilities.

__________ red-yellow __________ red-blue

__________ red- red __________ yellow-yellow

Practice:
Each letter of the word LUCKY is written on a separate slip of paper. The five slips of paper are placed in a paper bag and two slips are drawn at random. The first letter is not replaced before the second letter is drawn.

Is this problem an example of independent or dependent events?

Find the probability the first letter is L and the second letter is K.

What Word Is In The Bag?

With Replacement

Draw one letter out of your bag. Record what it is and put it back in the bag. Guess what the word is in your bag. Repeat this process until you think you know the word. Then open your bag and see if you are right.

Draw 1: Letter____________________ Word Guess____________________

Draw 2: Letter____________________ Word Guess____________________

Draw 3: Letter____________________ Word Guess____________________

Draw 4: Letter____________________ Word Guess____________________

Draw 5: Letter____________________ Word Guess____________________

Draw 6: Letter____________________ Word Guess____________________

Draw 7: Letter____________________ Word Guess____________________

Draw 8: Letter____________________ Word Guess____________________

Draw 9: Letter____________________ Word Guess____________________

Draw 10: Letter____________________ Word Guess____________________

Without Replacement

Draw one letter out of your bag. Record what it is and leave it out of the bag. Guess what the word is in your bag. Repeat this process until you think you know the word. Then open your bag and see if you are right.

Draw 1: Letter___________________ Word Guess____________________

Draw 2: Letter___________________ Word Guess____________________

Draw 3: Letter___________________ Word Guess____________________

Draw 4: Letter___________________ Word Guess____________________

Draw 5: Letter___________________ Word Guess____________________

Draw 6: Letter___________________ Word Guess____________________

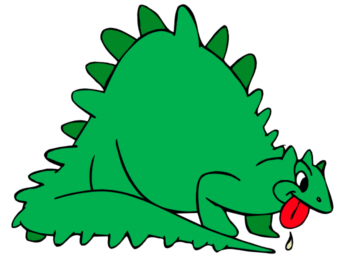
Draw 7: Letter___________________ Word Guess____________________

Draw 8: Letter___________________ Word Guess____________________

Draw 9: Letter___________________ Word Guess____________________

Draw 10: Letter___________________ Word Guess____________________

Monsters and Dinosaurs



Version 1
A game is played with two players. Player A draws a creature from the bag and then puts it back. Player B then draws a creature. Player A wins if the creatures are both monsters or both dinosaurs. Player B wins if one monster and one dinosaur are drawn.

Do you think this game is fair? Why or why not?

Play this game 25 times in your group. Record whether Player A or Player B wins in the chart below.

Player A wins (two dinosaurs or two monsters)	Player B wins (one monster and one dinosaur)

What is the experimental probability of two dinosaurs or two monsters being drawn?

What is the experimental probability of one monster and one dinosaur being drawn?

Draw a tree diagram to represent the possible outcomes of this game.

What is the theoretical probability of two dinosaurs or two monsters being drawn?

What is the theoretical probability of one monster and one dinosaur being drawn?

Is this game mathematically fair? Why or why not?

Version 2
A game is played with two players. Player A draws a creature from the bag and does not put it back. Player B then draws a creature. Player A wins if the creatures are both monsters or both dinosaurs. Player B wins if one monster and one dinosaur are drawn.

Do you think this game is fair? Why or why not?

Play this game 25 times in your group. Record whether Player A or Player B wins in the chart below.

Player A wins (two dinosaurs or two monsters)	Player B wins (one monster and one dinosaur)

What is the experimental probability of two dinosaurs or two monsters being drawn?

What is the experimental probability of one monster and one dinosaur being drawn?

Draw a tree diagram to represent the possible outcomes of this game.

What is the theoretical probability of two dinosaurs or two monsters being drawn?

What is the theoretical probability of one monster and one dinosaur being drawn?

Is this game mathematically fair? Why or why not?

Extension
1) Write a new set of rules for winning a game using two monsters and two dinosaurs.
2) Draw a tree diagram to represent the new set of possible outcomes. Write the probabilities on the branches.
3) What is the sample space for your game?
4) What is the theoretical probability of winning the game?
5) What is the theoretical probability of losing the game?
6) Play your game 25 times to test your predictions.
7) What is the experimental probability of winning your game?

Funny Frog Match

This is a two player game. Place all the cards face down on the table. Each player draws a card. Compare the cards. If they match then Player A wins. If they do not match Player B wins.

Do you think this is a fair game? Why or why not?

Play this game 25 times and keep a tally of who wins each game in the table below.

Player A wins (cards are the same)	Player B wins (cards are different)

What is the experimental probability that the two cards drawn are the same?

What is the experimental probability that the two cards drawn are different?

Draw a tree diagram to represent the possible outcomes of the game. Write the probabilities on the branches.

What is the theoretical probability that the two cards drawn are the same?

What is the theoretical probability that the two cards drawn are different?

If you were going to play this game again, which player would you want to be? Why?

The Racing Game activity can be found in

Bright, G.W., Frierson, D., Tarr, J.E., Thomas, C. (2003). *Navigating through Probability in Grades 6-8.* Reston, VA: National Council of Teachers of Mathematics.

RESOURCES

Aspinwall, L., and Shaw, K.L. (2000). Enriching students' mathematical intuitions with probability games and tree diagrams. *Mathematics Teaching in the Middle School,* 6 (4), 214-220.

Bright, G.W., Frierson, D., Tarr, J.E., Thomas, C. (2003). *Navigating through Probability in Grades 6-8.* Reston, VA: National Council of Teachers of Mathematics.

Dessart, D.J., and DeRidder, C.M. (1999). Readers write: Is rock, scissors, and paper a fair game? *Mathematics Teaching in the Middle School,* 5 (1), 4-5.

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