Eureka Math™

Grade 7, Module 5

Student File_B

Contains Exit Ticket,
and Assessment Materials

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10 9 8 7 6 5 4 3 2 1

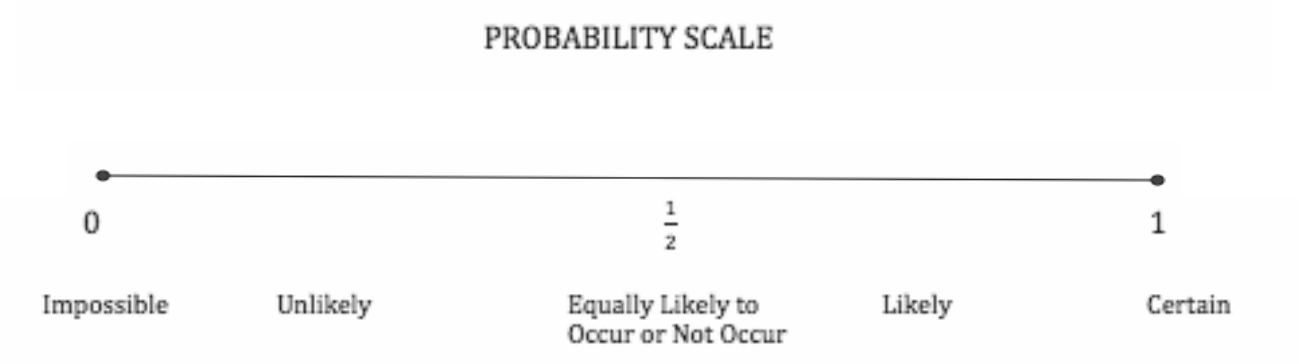
Exit Ticket Packet

Name _____ Date_____

Lesson 1: Chance Experiments

Exit Ticket

Decide where each of the following events would be located on the scale below. Place the letter for each event on the appropriate place on the probability scale.



The numbers from 1 to 10 are written on small pieces of paper and placed in a bag. A piece of paper will be drawn from the bag.

A. A piece of paper with a 5 is drawn from the bag.

B. A piece of paper with an even number is drawn.

C. A piece of paper with a 12 is drawn.

D. A piece of paper with a number other than 1 is drawn.

E. A piece of paper with a number divisible by 5 is drawn.

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Name _____ Date_____

Lesson 2: Estimating Probabilities by Collecting Data

Exit Ticket

In the following problems, round all of your decimal answers to three decimal places. Round all of your percents to the nearest tenth of a percent.

A student randomly selected crayons from a large bag of crayons. The table below shows the number of each color crayon in a bag. Now, suppose the student were to randomly select one crayon from the bag.

Color	Number
Brown	10
Blue	5
Yellow	3
Green	3
Orange	3
Red	6

1. What is the estimate for the probability of selecting a blue crayon from the bag? Express your answer as a fraction, decimal, or percent.

2. What is the estimate for the probability of selecting a brown crayon from the bag?

3. What is the estimate for the probability of selecting a red crayon *or* a yellow crayon from the bag?

4. What is the estimate for the probability of selecting a pink crayon from the bag?

5. Which color is most likely to be selected?

6. If there are 300 crayons in the bag, how many red crayons would you estimate are in the bag? Justify your answer.

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Lesson 3: Chance Experiments with Equally Likely Outcomes

Exit Ticket

The numbers 1–10 are written on note cards and placed in a bag. One card will be drawn from the bag at random.

1. List the sample space for this experiment.

2. Are the events selecting an even number and selecting an odd number equally likely? Explain your answer.

3. Are the events selecting a number divisible by 3 and selecting a number divisible by 5 equally likely? Explain your answer.

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Lesson 4: Calculating Probabilities for Chance Experiments with Equally Likely Outcomes

Exit Ticket

An experiment consists of randomly drawing a cube from a bag containing three red and two blue cubes.

1. What is the sample space of this experiment?

2. List the probability of each outcome in the sample space.

3. Is the probability of selecting a red cube equal to the probability of selecting a blue cube? Explain.

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Lesson 5: Chance Experiments with Outcomes That Are Not Equally Likely

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Carol is sitting on the bus on the way home from school and is thinking about the fact that she has three homework assignments to do tonight. The table below shows her estimated probabilities of completing 0, 1, 2, or all 3 of the assignments.

Number of Homework Assignments Completed	0	1	2	3
Probability	$\frac{1}{6}$	$\frac{2}{9}$	$\frac{5}{18}$	$\frac{1}{3}$

1. Writing your answers as fractions in lowest terms, find the probability that Carol completes
   a. Exactly one assignment

   b. More than one assignment

   c. At least one assignment

2. Find the probability that the number of homework assignments Carol completes is not exactly 2.

3. Carol has a bag containing 3 red chips, 10 blue chips, and 7 green chips. Estimate the probability (as a fraction or decimal) of Carol reaching into her bag and pulling out a green chip.

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Lesson 6: Using Tree Diagrams to Represent a Sample Space and to Calculate Probabilities

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In a laboratory experiment, two mice will be placed in a simple maze with one decision point where a mouse can turn either left (L) or right (R). When the first mouse arrives at the decision point, the direction it chooses is recorded. Then, the process is repeated for the second mouse.

1. Draw a tree diagram where the first stage represents the decision made by the first mouse and the second stage represents the decision made by the second mouse. Determine all four possible decision outcomes for the two mice.

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2. If the probability of turning left is 0.5 and the probability of turning right is 0.5 for each mouse, what is the probability that only one of the two mice will turn left?

3. If the researchers add food in the simple maze such that the probability of each mouse turning left is now 0.7, what is the probability that only one of the two mice will turn left?

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Lesson 7: Calculating Probabilities of Compound Events

Exit Ticket

In a laboratory experiment, three mice will be placed in a simple maze that has just one decision point where a mouse can turn either left (L) or right (R). When the first mouse arrives at the decision point, the direction he chooses is recorded. The same is done for the second and the third mouse.

1. Draw a tree diagram where the first stage represents the decision made by the first mouse, the second stage represents the decision made by the second mouse, and so on. Determine all eight possible outcomes of the decisions for the three mice.

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2. Use the tree diagram from Problem 1 to help answer the following question. If, for each mouse, the probability of turning left is 0.5 and the probability of turning right is 0.5, what is the probability that only one of the three mice will turn left?

3. If the researchers conducting the experiment add food in the simple maze such that the probability of each mouse turning left is now 0.7, what is the probability that only one of the three mice will turn left? To answer the question, use the tree diagram from Problem 1.

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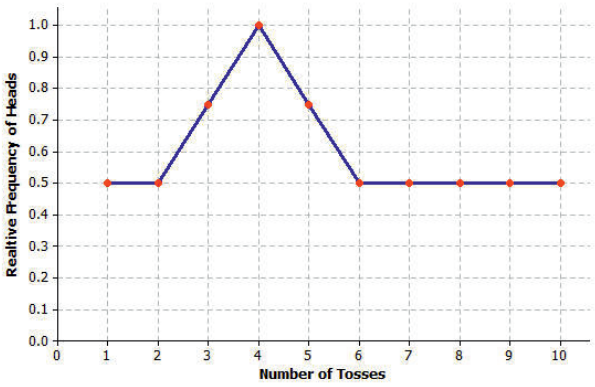
Lesson 8: The Difference Between Theoretical Probabilities and Estimated Probabilities

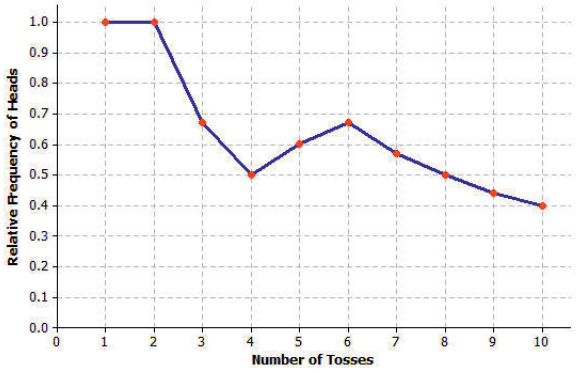
Exit Ticket

1. Which of the following graphs would *not* represent the relative frequencies of heads when tossing 1 penny? Explain your answer.

Graph A



Graph B



2. Jerry indicated that after tossing a penny 30 times, the relative frequency of heads was 0.47 (to the nearest hundredth). He indicated that after 31 times, the relative frequency of heads was 0.55. Are Jerry's summaries correct? Why or why not?

3. Jerry observed 5 heads in 100 tosses of his coin. Do you think this was a fair coin? Why or why not?

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Lesson 10: Conducting a Simulation to Estimate the Probability of an Event

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1. Nathan is your school's star soccer player. When he takes a shot on goal, he typically scores half of the time. Suppose that he takes six shots in a game. To estimate the probability of the number of goals Nathan makes, use simulation with a number cube. One roll of a number cube represents one shot.
   a. Specify what outcome of a number cube you want to represent a goal scored by Nathan in one shot.

   b. For this problem, what represents a trial of taking six shots?

   c. Perform and list the results of ten trials of this simulation.

   d. Identify the number of goals Nathan made in each of the ten trials you did in part (c).

   e. Based on your ten trials, what is your estimate of the probability that Nathan scores three goals if he takes six shots in a game?

2. Suppose that Pat scores 40% of the shots he takes in a soccer game. If he takes six shots in a game, what would one simulated trial look like using a number cube in your simulation?

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Lesson 11: Conducting a Simulation to Estimate the Probability of an Event

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Liang wants to form a chess club. His principal says that he can do that if Liang can find six players, including himself. How would you conduct a simulated model that estimates the probability that Liang will find at least five other players to join the club if he asks eight players who have a 70% chance of agreeing to join the club? Suggest a simulation model for Liang by describing how you would do the following parts.

a. Specify the device you want to use to simulate one person being asked.

b. What outcome(s) of the device would represent the person agreeing to be a member?

c. What constitutes a trial using your device in this problem?

d. What constitutes a success using your device in this problem?

e. Based on 50 trials, using the method you have suggested, how would you calculate the estimate for the probability that Liang will be able to form a chess club?

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Lesson 12: Applying Probability to Make Informed Decisions

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There are four pieces of bubble gum left in a quarter machine. Two are red, and two are yellow. Chandra puts two quarters in the machine. One piece is for her, and one is for her friend, Kay. If the two pieces are the same color, she is happy because they will not have to decide who gets what color. Chandra claims that they are equally likely to get the same color because the colors are either the same or they are different. Check her claim by doing a simulation.

a. Name a device that can be used to simulate getting a piece of bubble gum. Specify what outcome of the device represents a red piece and what outcome represents yellow.

b. Define what a trial is for your simulation.

c. Define what constitutes a success in a trial of your simulation.

d. Perform and list 50 simulated trials. Based on your results, is Chandra's equally likely model correct?

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Lesson 13: Populations, Samples, and Generalizing from a Sample to a Population

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What is the difference between a population characteristic and a sample statistic? Give an example to support your answer. Clearly identify the population and sample in your example.

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Lesson 14: Selecting a Sample

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Write down three things you learned about taking a sample from the work we have done today.

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Lesson 15: Random Sampling

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Identify each as true or false. Explain your reasoning in each case.

1. The values of a sample statistic for different random samples of the same size from the same population will be the same.

2. Random samples from the same population will vary from sample to sample.

3. If a random sample is chosen from a population that has a large cluster of points at the maximum, the sample is likely to have at least one element near the maximum.

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Lesson 16: Methods for Selecting a Random Sample

Exit Ticket

1. Name two things to consider when you are planning how to select a random sample.

2. Consider a population consisting of the 200 seventh graders at a particular middle school. Describe how you might select a random sample of 20 students from a list of the students in this population.

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Lesson 17: Sampling Variability

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Suppose that you want to estimate the mean time per evening students at your school spend doing homework. You will do this using a random sample of 30 students.

1. Suppose that you have a list of all the students at your school. The students are numbered $1, 2, 3, \ldots$. One way to select the random sample of students is to use the random digit table from today's class, taking three digits at a time. If you start at the third digit of Row 9, what is the number of the first student you would include in your sample?

2. Suppose that you have now selected your random sample and that you have asked the students how long they spend doing homework each evening. How will you use these results to estimate the mean time spent doing homework for *all* students?

3. Explain what is meant by *sampling variability* in this context.

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Lesson 18: Sampling Variability and the Effect of Sample Size

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Suppose that you wanted to estimate the mean time per evening spent doing homework for students at your school. You decide to do this by taking a random sample of students from your school. You will calculate the mean time spent doing homework for your sample. You will then use your sample mean as an estimate of the population mean.

1. The sample mean has *sampling variability*. Explain what this means.

2. When you are using a sample statistic to estimate a population characteristic, do you want the sampling variability of the sample statistic to be large or small? Explain why.

3. Think about your estimate of the mean time spent doing homework for students at your school. Given a choice of using a sample of size 20 or a sample of size 40, which should you choose? Explain your answer.

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Lesson 19: Understanding Variability When Estimating a Population Proportion

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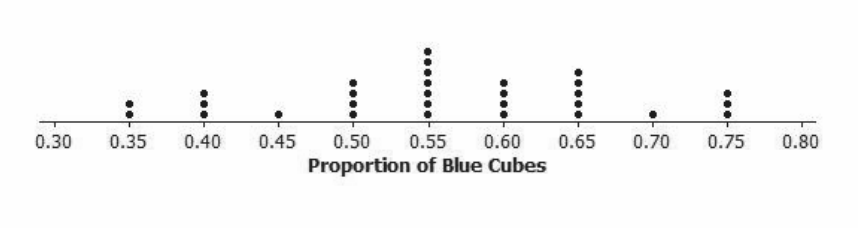
A group of seventh graders took repeated samples of size 20 from a bag of colored cubes. The dot plot below shows the sampling distribution of the sample proportion of blue cubes in the bag.



1. Describe the shape of the distribution.

2. Describe the variability of the distribution.

3. Predict how the dot plot would look differently if the sample sizes had been 40 instead of 20.

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Lesson 20: Estimating a Population Proportion

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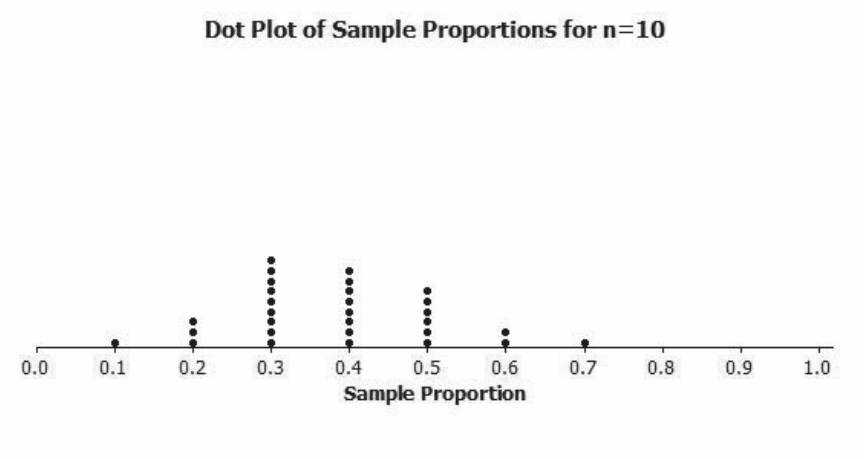
Thirty seventh graders each took a random sample of 10 middle school students and asked each student whether or not he likes pop music. Then, they calculated the proportion of students who like pop music for each sample. The dot plot below shows the distribution of the sample proportions.



1. There are three dots above 0.2. What does each dot represent in terms of this scenario?

2. Based on the dot plot, do you think the proportion of the middle school students at this school who like pop music is 0.6? Explain why or why not.

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Lesson 21: Why Worry About Sampling Variability?

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How is a *meaningful* difference in sample means different from a *non-meaningful* difference in sample means? You may use what you saw in the dot plots of this lesson to help you answer this question.

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Lesson 22: Using Sample Data to Compare the Means of Two or More Populations

Exit Ticket

Suppose that Brett randomly sampled 12 tenth-grade girls and boys in his school district and asked them for the number of minutes per day that they text. The data and summary measures follow.

Gender	Number of Minutes of Texting													Mean	MAD
Girls	98	104	95	101	98	107	86	92	96	107	88	95		97.3	5.3
Boys	66	72	65	60	78	82	63	56	85	79	68	77		70.9	7.9

1. Draw dot plots for the two data sets using the same numerical scales. Discuss the amount of overlap between the two dot plots that you drew and what it may mean in the context of the problem.

2. Compare the variability in the two data sets using the MAD. Interpret the result in the context of the problem.

3. From 1 and 2, does the difference in the two means appear to be meaningful? Explain.

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Lesson 23: Using Sample Data to Compare the Means of Two or More Populations

Exit Ticket

1. Do eleventh-grade males text more per day than eleventh-grade females do? To answer this question, two randomly selected samples were obtained from the Excel data file used in this lesson. Indicate how 20 randomly selected eleventh-grade females would be chosen for this study. Indicate how 20 randomly selected eleventh-grade males would be chosen.

2. Two randomly selected samples (one of eleventh-grade females and one of eleventh-grade males) were obtained from the database. The results are indicated below:

	Mean Number of Minutes per Day Texting	MAD (minutes)
Eleventh-Grade Females	102.55	1.31
Eleventh-Grade Males	100.32	1.12

Is there a meaningful difference in the number of minutes per day that eleventh-grade females and males text? Explain your answer.

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Assessment Packet

Name _____ Date _____

Round all decimal answers to the nearest hundredth.

1. Each student in a class of 38 students was asked to report how many siblings (brothers and sisters) he has. The data are summarized in the table below.

Number of Siblings	0	1	2	3	4	5	6
Count	8	13	12	3	1	0	1

   a. Based on the data, estimate the probability that a randomly selected student from this class is an only child.

   b. Based on the data, estimate the probability that a randomly selected student from this class has three or more siblings.

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c. Consider the following probability distribution for the number of siblings:

Number of Siblings	0	1	2	3	4	5	6
Probability	0.15	0.35	0.30	0.10	0.05	0.03	0.02

Explain how you could use simulation to estimate the probability that you will need to ask at least five students the question, "Are you an only child?" before you find one that is an only child.

2. A cell phone company wants to predict the probability of a seventh grader in your city, City A, owning a cell phone. Records from another city, City B, indicate that 201 of $1{,}000$ seventh graders own a cell phone.

a. Assuming the probability of a seventh grader owning a cell phone is similar for the two cities, estimate the probability that a randomly selected seventh grader from City A owns a cell phone.

b. The company estimates the probability that a randomly selected seventh-grade male owns a cell phone is 0.25. Does this imply that the probability that a randomly selected seventh-grade female owns a cell phone is 0.75? Explain.

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c. According to the data, which of the following is more likely?

- A seventh-grade male owning a cell phone
- A seventh grader owning a cell phone

Explain your choice.

Suppose the cell phone company sells three different plans to its customers:

- Pay-as-you-go: The customer is charged per minute for each call.
- Unlimited minutes: The customer pays a flat fee per month and can make unlimited calls with no additional charges.
- Basic plan: The customer is not charged per minute unless the customer exceeds 500 minutes in the month; then, the customer is charged per minute for the extra minutes.

Consider the chance experiment of selecting a customer at random and recording which plan she purchased.

d. What outcomes are in the sample space for this chance experiment?

e. The company wants to assign probabilities to these three plans. Explain what is wrong with each of the following probability assignments.

Case 1: The probability of pay-as-you-go is 0.40, the probability of unlimited minutes is 0.40, and the probability of the basic plan is 0.30.

Case 2: The probability of pay-as-you-go is 0.40, the probability of unlimited minutes is 0.70, and the probability of the basic plan is -0.10.

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Now, consider the chance experiment of randomly selecting a cell phone customer and recording both the cell phone plan for that customer and whether or not the customer exceeded 500 minutes last month.

f. One possible outcome of this chance experiment is (pay-as-you-go, over 500). What are the other possible outcomes in this sample space?

g. Assuming the outcomes of this chance experiment are equally likely, what is the probability that the selected cell phone customer had a basic plan and did not exceed 500 minutes last month?

h. Suppose the company randomly selects 500 of its customers and finds that 140 of these customers purchased the basic plan and did not exceed 500 minutes. Would this cause you to question the claim that the outcomes of the chance experiment described in part (g) are equally likely? Explain why or why not.

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3. In the game of darts, players throw darts at a circle divided into 20 wedges. In one variation of the game, the score for a throw is equal to the wedge number that the dart hits. So, if the dart hits anywhere in the 20 wedge, you earn 20 points for that throw.

a. If you are equally likely to land in any wedge, what is the probability you will score 20 points?

b. If you are equally likely to land in any wedge, what is the probability you will land in the upper right and score 20, 1, 18, 4, 13, or 6 points?

c. Below are the results of 100 throws for one player. Does this player appear to have a tendency to land in the upper right more often than we would expect if the player were equally likely to land in any wedge?

Points	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Count	7	9	2	6	6	3	5	2	4	7	2	6	4	6	5	7	4	6	5	4

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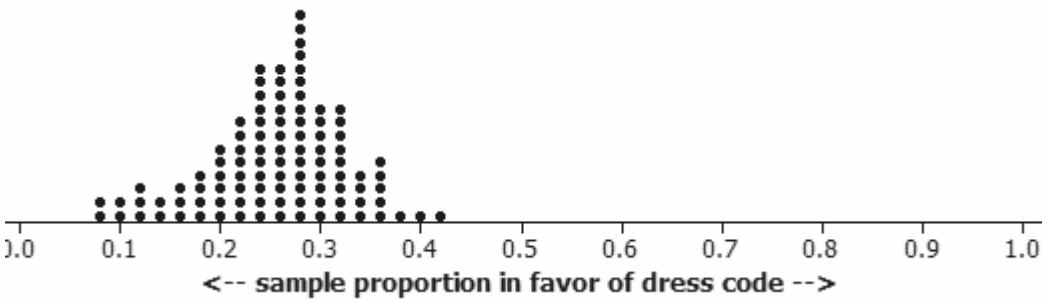
Name _____ Date _____

Round all decimal answers to the nearest hundredth.

1. You and a friend decide to conduct a survey at your school to see whether students are in favor of a new dress code policy. Your friend stands at the school entrance and asks the opinions of the first 100 students who come to campus on Monday. You obtain a list of all the students at the school and randomly select 60 to survey.

   a. Your friend finds 34% of his sample in favor of the new dress code policy, but you find only 16%. Which do you believe is more likely to be representative of the school population? Explain your choice.

   b. Suppose 25% of the students at the school are in favor of the new dress code policy. Below is a dot plot of the proportion of students who favor the new dress code for each of 100 different random samples of 50 students at the school.



   If you were to select a random sample of 50 students and ask them if they favor the new dress code, do you think that your sample proportion will be within 0.05 of the population proportion? Explain.

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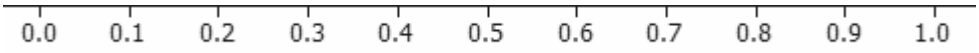
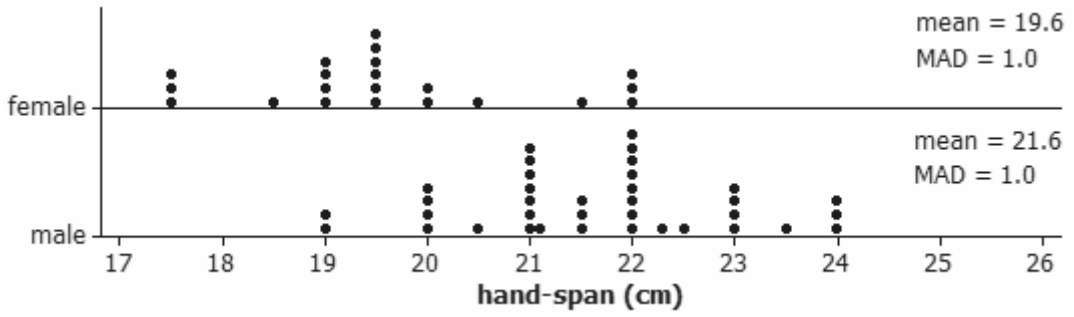
c. Suppose ten people each take a simple random sample of 100 students from the school and calculate the proportion in the sample who favors the new dress code. On the dot plot axis below, place 10 values that you think are most believable for the proportions you could obtain.



←Sample Proportion in Favor of Dress Code →

Explain your reasoning.

2. Students in a random sample of 57 students were asked to measure their handspans (the distance from the outside of the thumb to the outside of the little finger when the hand is stretched out as far as possible). The graphs below show the results for the males and females.



a. Based on these data, do you think there is a difference between the population mean handspan for males and the population mean handspan for females? Justify your answer.

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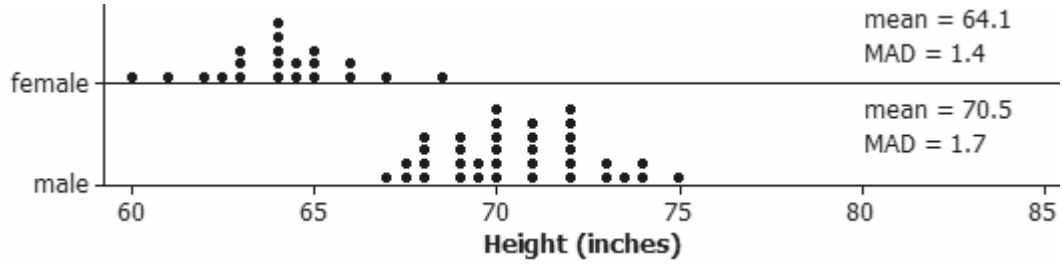
b. The same students were asked to measure their heights, with the results shown below.



Are these height data more or less convincing of a difference in the population mean height than the handspan data are of a difference in the population mean handspan? Explain.

3. A student purchases a bag of "mini" chocolate chip cookies and, after opening the bag, finds one cookie that does not contain any chocolate chips! The student then wonders how unlikely it is to randomly find a cookie with no chocolate chips for this brand.

   a. Based on the bag of 30 cookies, estimate the probability of this company producing a cookie with no chocolate chips.

   b. Suppose the cookie company claims that 90% of all the cookies it produces contain chocolate chips. Explain how you could simulate randomly selecting 30 cookies (one bag) from such a population to determine how many of the sampled cookies do not contain chocolate chips. Explain the details of your method so it could be carried out by another person.

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c. Now, explain how you could use simulation to estimate the probability of obtaining a bag of 30 cookies with exactly one cookie with no chocolate chips.

d. If 90% of the cookies made by this company contain chocolate chips, then the actual probability of obtaining a bag of 30 cookies with one chipless cookie equals 0.143. Based on this result, would you advise this student to complain to the company about finding one cookie with no chocolate chips in her bag of 30? Explain.

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