⬤Refine Reasoning About Random Samples

➤ **Complete the Example below. Then solve problems 1–8.**

Example

There are 150 cards in a bag. Each card is either black or red. Carter selects 5 cards at random, records the number of red cards, and returns the cards. He does this until he has 12 samples of 5 cards.

Carter's Results: 0, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 5

Kwame does the same, but he uses 10 cards in his samples.

Kwame's Results: 1, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 7

What is a reasonable estimate for the number of red cards in the bag?

Look at how you could show your work using percents.

The median number of red cards in Carter's samples is 2.

$\frac{2}{5} = 40\%$

The median number of red cards in Kwame's samples is 4.

$\frac{4}{10} = 40\%$

40% of 150 = 60

SOLUTION <u>A reasonable estimate is 60 red cards</u>

Apply It

1 A school has 800 students. The principal plans to order a tote bag for each student. They ask 120 students selected at random which color bag the student prefers. Based on this sample, how many bags of each color should the principal order? Show your work.

Color	Number of Students
Blue	48
Black	54
Gray	18

Blue
$\frac{48}{120} = \frac{320}{800}$

Black
$\frac{54}{120} = \frac{360}{800}$

Gray
$\frac{18}{120} = \frac{120}{800}$

38 400 ÷ 120   43 200 ÷ 120   14 400 ÷ 120

SOLUTION <u>The principal should order 320 blue, 360 black and 120 Gray bags.</u>
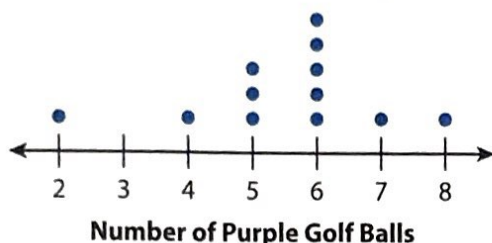
2 A box contains a mix of 800 golf balls. Some are white and the rest are purple. Each student in Mrs. Ramírez's class selects a random sample of 20 golf balls from the box, counts the purple golf balls, and returns the sample to the box.

CONSIDER THIS . You could use the mean or the median to make an estimate.

Samples from Mrs. Ramírez's Class

Number of Purple Golf Balls

$$\frac{2+4+15+30+7+8}{12} = \frac{66}{12} = 5.5$$

$$\frac{5.5}{20} \overset{\times 40}{\underset{\times 40}{=}} \frac{220}{800}$$

What is a reasonable estimate for the number of purple golf balls in the box? Show your work.

$$2\ 4\ 5\ 5\ 5\ 6 \mid 6\ 6\ 6\ 6\ 7\ 8$$
$$6$$

$$\frac{6}{20} \overset{\times 40}{\underset{\times 40}{=}} \frac{\times 240}{800}$$

SOLUTION A reasonable estimate is 240 purple (median). A reasonable estimate is 220 purple (mean)

PAIR/SHARE How would your confidence in your estimate change if there were 25 students in Mrs. Ramírez's class?

3 Mr. Shen selects 20 of his 140 students at random to survey about their pets. His survey indicates that 8 students have a dog, 9 students have a cat, 3 students have another kind of pet, and 5 students have no pets. How many of his students should Mr. Shen expect to have a cat?

CONSIDER THIS... Some students have more than one pet.

A 9

B 50

C 56

D 63

$$\frac{9}{20} \overset{\times 7}{\underset{\times 7}{=}} \frac{}{140}$$

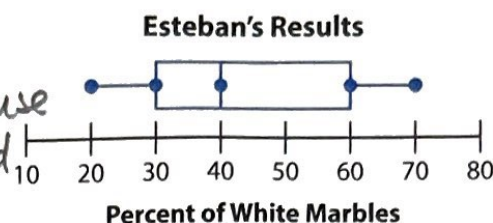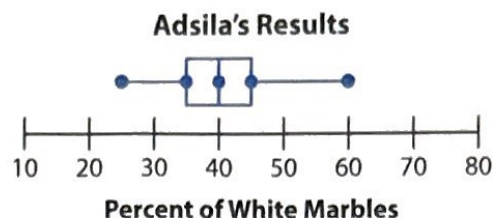Wilma chose B as the correct answer. How might she have gotten that answer?

If wilma added all the results it would seem like 25 students were asked. Some students had more than one kind of pet

$$\frac{9}{25} = \frac{}{140}$$

$$1260 \div 25$$

$$50.4$$

PAIR/SHARE How can you check your answer?

4 Adsila and Esteban have a bag that contains 250 marbles. Each marble is red, black, or white. Adsila and Esteban each select a sample of marbles from the bag, record the percent that are white, and return all the marbles to the bag. They each collect 15 samples. Their results are shown in the box plots. If you could only use one sample to make an estimate of the number of white marbles in the bag, would you rather use one of Adsila's samples or one of Esteban's? Why?

Adsila's Results

Percent of White Marbles
(scale: 10 20 30 40 50 60 70 80)

Esteban's Results

Percent of White Marbles
(scale: 10 20 30 40 50 60 70 80)

I would rather use Adsila's sample because her data is more tightly clustered around the center, so there is less chance of getting a misleading sample.

5 Emma has three random samples of the same size from a population of 650 people. In one sample, 78% of people have brown eyes. In another, 85% have brown eyes. In the third, 83% have brown eyes. About how many people with brown eyes should she expect are in the population? Show your work.

$$\frac{78+85+83}{3} = \frac{246}{3} = 82\%$$

82% of 650 = 533

Median
.83 · 650
539.5
540

SOLUTION *She should expect there to be 533 people with brown eyes (mean)*

6 A jar contains 1,800 marbles. James enters a contest to guess the number of any one color of marbles in the jar. He is allowed to take four random samples of 200 marbles each.

	Blue	Green	Red	White
Sample 1	44	37	70	49
Sample 2	58	34	54	54
Sample 3	52	29	59	60
Sample 4	47	30	72	51

a. In James's samples, the color _red_ has the most variation and the color _green_ has the least variation.
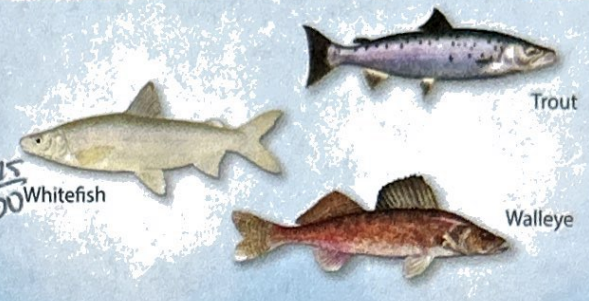
b. James can choose which color of marble to make his guess about. Which color do you think he should choose? Why?

James should choose green. Green has the least variation in his sample. So, his inference about green is most likely to be close to the real number

Blue 58-44 = 14
Green 37-29 = 8
Red 72-54 = 18
White 60-49 = 11

7 Aniyah studies the fish populations in a lake. She catches fish, tags them, identifies the type, and returns them to the lake. She takes two random samples in the winter and two in the summer. She organizes her data in the table at the right. Which inferences about the fish populations in the lake are reasonable? Select all the correct answers.

	Trout	Whitefish	Walleye	Sample Size
Winter	42	44	14	100
	46	42	12	100
Summer	91	84	25	200
	85	89	26	200

Trout

Walleye

Whitefish

A The total number of fish in the lake is 600.

B The walleye population comprises anywhere from 12% to 14% of the total population in both the winter and summer. $\frac{26}{200} = \frac{13}{100}$ ⑤ $\frac{51}{400} = 12.75$ /100

C The number of whitefish in the lake is greater than the number of trout. w T
259   264

D The ratios of the populations of trout, whitefish, and walleye are relatively stable from the winter to the summer.
T   wh   wa
w 88   86   26
s 176   173   51
0.5   0.50   0.51

E The populations of trout, whitefish, and walleye are approximately twice as large in the summer as in the winter.

8 **Math Journal** Write a word problem about taking a random sample and making an inference about the population. Then explain how to solve your problem.

End of Lesson Checklist

☐ **INTERACTIVE GLOSSARY** Write a new entry for *inference*. Tell what you do when you make an *inference* about a population from a random sample.

☐ **SELF CHECK** Go back to the Unit 5 Opener to check off skills and build Big Ideas.