

Chapter 1 Multiple Choice Practice

Directions. Identify the choice that best completes the statement or answers the question. Check your answers and note your performance when you are finished.

1. You measure the age (years), weight (pounds), and breed (beagle, golden retriever, pug, or terrier) of 200 dogs. How many variables did you measure?

- A. 1
- B. 2
- C. 3
- D. 200
- E. 203

2. You open a package of Lucky Charms cereal and count how many there are of each marshmallow shape. The distribution of the variable "marshmallow" is:

- A. The shape: star, heart, moon, clover, diamond, horseshoe, balloon.
- B. The total number of marshmallows in the package.
- C. Seven—the number of different shapes that are in the package.
- D. The seven different shapes and how many there are of each.
- E. Since "shape" is a categorical variable, it doesn't have a distribution.

3. A review of voter registration records in a small town yielded the following table of the number of males and females registered as Democrat, Republican, or some other affiliation.

	Male	Female
Democrat	300	600
Republican	500	300
Other	200	100

The proportion of males that are registered as Democrats is:

- A. 300
- B. 30
- C. 0.33
- D. 0.30
- E. 0.15

4. For a physics course containing 10 students, the maximum point total for the quarter was 200. The point totals for the 10 students are given in the stemplot below.

11	6	8	
12	1	4	8
13	3	7	
14	2	6	
15			
16			
17	9		

Which of the following statements is NOT true?

- A. In a symmetric distribution, the mean and the median are equal.
- B. About fifty percent of the scores in a distribution are between the first and third quartiles.
- C. In a symmetric distribution, the median is halfway between the first and third quartiles.
- D. The median is always greater than the mean.
- E. The range is the difference between the largest and the smallest observation in the data set.

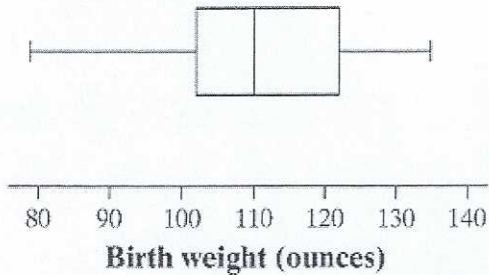
5. When drawing a histogram it is important to

- A. have a separate class interval for each observation to get the most informative plot.
- B. make sure the heights of the bars exceed the widths of the class intervals so that the bars are true rectangles.
- C. label the vertical axis so the reader can determine the counts or percent in each class interval.
- D. leave large gaps between bars. This allows room for comments.
- E. scale the vertical axis according to the variable whose distribution you are displaying.

6. A set of data has a mean that is much larger than the median. Which of the following statements is most consistent with this information?

- A. The distribution is symmetric.
- B. The distribution is skewed left.
- C. The distribution is skewed right.
- D. The distribution is bimodal.
- E. The data set probably has a few low outliers.

7. The following is a boxplot of the birth weights (in ounces) of a sample of 160 infants born in a local hospital.



About 40 of the birthweights were below

- A. 92 ounces.
- B. 102 ounces.
- C. 112 ounces.
- D. 122 ounces.
- E. 132 ounces.

8. A sample of production records for an automobile manufacturer shows the following figures for production per shift:

705 700 690 705

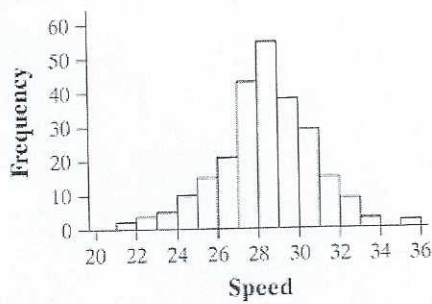
The variance of the sample is approximately

- A. 8.66.
- B. 7.07.
- C. 75.00.
- D. 50.00.
- E. 20.00.

9. You catch 10 cockroaches in your bedroom and measure their lengths in centimeters. Which of these sets of numerical descriptions are *all* measured in centimeters?

- A. median length, variance of lengths, largest length
- B. median length, first and third quartiles of lengths
- C. mean length, standard deviation of lengths, median length
- D. mean length, median length, variance of lengths.
- E. both (B) and (C)

10. A policeman records the speeds of cars on a certain section of roadway with a radar gun. The histogram below shows the distribution of speeds for 251 cars.



Which of the following measures of center and spread would be the best ones to use when summarizing these data?

- A. Mean and interquartile range
- B. Mean and standard deviation
- C. Median and range
- D. Median and standard deviation
- E. Median and interquartile range

Problem	Answer	Concept	Right	Wrong	Simple Mistake?	Need to Study More
1	C	Variables				
2	D	Categorical Variables				
3	D	Two-way table				
4	D	Distribution basics				
5	C	Constructing histograms				
6	C	Skewed distributions				
7	B	Interpreting boxplots				
8	D	Variance				
9	E	Summary statistics units				
10	B	Choosing statistics				

The following problem is modeled after actual Advanced Placement Statistics free response questions. Your task is to generate a complete, concise response in 15 minutes. After you generate your response, view two example solutions and determine whether you feel they are “complete,” “substantial,” “developing” or “minimal.” If they are not “complete,” what would you suggest to the student who wrote them to increase their score? Finally, you will be provided with a rubric. Score your response and note what, if anything, you would do differently to increase your own score.

Machine A		Machine			B
		*		14	*
				14	* * *
		* *		14	* * * * * * * *
		* *		14	* * * * *
				14	* * * *
				15	* * * *
				15	* * *
				15	*
				15	*

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How would you score these?

Student Response 1:

- a) Machine A has a slightly higher center than Machine B. Machine B has a much larger range. Machine A is approximately symmetric and Machine B is slightly skewed right. Neither machine has any extreme values.
- b) Machine B would be least likely to produce bags containing 15 oz of SugarBitz because it has a much wider range than Machine A.
- c) The company should report the mean weight of Machine B. Since the distribution is skewed to the right, the mean will be pulled higher towards the tail. Therefore, the mean will be higher than the median and will be closer to 15.

How would you score this response? Is it substantial? Complete? Developing? Minimal? Is there anything this student could do to earn a better score?

Student Response 2:

- a) Machine A is normal and Machine B is skewed. Both have a single peak and wide ranges.
- b) Machine B usually fills bags with about 14.6 oz of candy. Machine A usually fills bags with 15 oz of candy. Machine B is least likely to fill the bags with 15 oz. of candy.
- c) The mean because it is about 15.

How would you score this response? Is it substantial? Complete? Developing? Minimal? Is there anything this student could do to earn a better score?

Scoring Rubric

Use the following rubric to score your response. Each part receives a score of "Essentially Correct," "Partially Correct," or "Incorrect." When you have scored your response, reflect on your understanding of the concepts addressed in this problem. If necessary, note what you would do differently on future questions like this to increase your score.

Intent of the Question

The goals of this question are (1) to determine your ability to use graphical displays to compare and contrast two distributions and (2) to evaluate your ability to use statistical information to make a decision.

Solution

- (a) Both distributions are unimodal (single-peaked). However, Machine A's distribution is roughly symmetric while Machine B's is skewed to the right. The center of the weights for Machine A (median A = about 15) is slightly higher than that of Machine B (median B = about 14.5). There is more variability in the weights produced by Machine B. Machine A has one low value (14.1) that does not fall with the majority of weights. However, it does not appear to be extreme enough to be considered an outlier.
- (b) Both machines produce bags of varying weight. However, Machine B has a higher variability as evidenced by a wider overall range. Machine B would be least likely to produce a consistent weight for the snack bags.
- (c) The mean would be closer to the advertised 15 oz. weight. This is because in a skewed distribution, the mean is pulled away from the median in the direction of the tail. In Machine B's distribution, the peak is at about 14.5 oz so we would expect the mean to be higher and closer to 15 oz.

Scoring:

Parts (a), (b), and (c) are scored as essentially correct (E), partially correct (P), or incorrect (I).

Part (a) is essentially correct if you correctly identify similarities and differences in the shape, center, and spread for the two distributions.

Part (a) is partially correct if you correctly identify similarities and differences in two of the three characteristics for the two distributions.

Part (a) is incorrect if you only identify one similarity or difference of the three characteristics for the two distributions.

Part (b) is essentially correct if Machine B is chosen using rationale based on its measure of spread of the packaged weights.

Part (b) is partially correct if B is chosen, but the explanation does not refer to the variability in the weights.

Part (c) is incorrect if B is chosen and no explanation is provided OR if A is chosen.

Part (c) is essentially correct if the mean is chosen and the explanation addresses the fact that the mean will be greater than the median in a skewed right distribution. Part (c) is partially correct if the mean is chosen, but the explanation is incomplete or incorrect.

Part (c) is incorrect if the mean is chosen, but no explanation is given OR if the median is chosen.

NOTE: If Machine A was chosen in part (b) and the solution to part (c) indicates either the mean or median would be appropriate due to the fact that they will be approximately equal in a symmetric, mound-shaped distribution, part (c) should be scored as essentially correct.

4 Complete Response

All three parts essentially correct

3 Substantial Response

Two parts essentially correct and one part partially correct

2 Developing Response

Two parts essentially correct and no parts partially correct

One part essentially correct and two parts partially correct

Three parts partially correct

1 Minimal Response

One part essentially correct and one part partially correct

One part essentially correct and no parts partially correct

No parts essentially correct and two parts partially correct