Business Analytics Data Analysis and Decision Making 6th edition Albright Test Bank

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Ch2

1. A sample of a population taken at one particular point in time is categorized as:
   a. categorical b. discrete
   c. cross-sectional d. time-series

ANSWER: c
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

2. Excel® stores dates as:
   a. numbers b. variables
   c. records d. text

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

3. Researchers may try to gain insight into the characteristics of a population by examining a(n) _____ of the population.
   a. model
   b. sample
   c. exemplar
   d. replica

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

4. In order for the characteristics of a sample to be generalized to the entire population, the sample should be:
   a. symbolic of the population b. atypical of the population
   c. representative of the population d. illustrative of the population

ANSWER: c
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

5. Coding males as 1 and females as 0 in a data set illustrates the use of:
   a. nominal variables b. dummy variables
   c. numerical variables d. ordinal variables

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's Knowledge

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TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

6. *Gender* and *states of residence* are examples of ____ data.
   a. discrete b. continuous
   c. categorical d. ordinal

ANSWER: c
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

7. The daily closing values of the Dow Jones Industrial Average over a period of 30 days are best described as _____ data.
   a. cross-sectional b. discrete
   c. time-series d. nominal

ANSWER: c
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

8. Data that arise from counts are best described as _____ data.
   a. continuous b. nominal
   c. counted d. discrete

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

9. A variable is classified as ordinal if:
   a. there is a natural ordering of categories
   b. there is no natural ordering of categories
   c. the data arise from continuous measurements
   d. we track the variable through a period of time

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

10. Categorizing age variables as "young," "middle-aged," and "elderly" is an example of:
   a. counting
   b. ordering

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c. value adding
d. binning
e. categorizing

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

11. Age, height, and weight are examples of numerical data.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

12. Data can be categorized as cross-sectional or time series.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

13. All nominal data may be treated as ordinal data.
a. True
b. False

ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

14. Categorical variables can be classified as either discrete or continuous.
a. True
b. False

ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

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15. A population includes all elements or objects of interest in a study, whereas a sample is a subset of the population used to gain insights into the characteristics of the population.

a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

16. The number of car insurance policy holders is an example of a discrete numerical variable.

a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

17. A variable (or field or attribute) is a characteristic of members of a population, whereas an observation (or case or record) is a list of all variable values for a single member of a population.

a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

18. Phone numbers, Social Security numbers, and zip codes are typically treated as numerical variables.

a. True
b. False

ANSWER: False
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

19. *Cross-sectional* data are data on a population at a distinct point in time, whereas *time series* data are data collected over time.

a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge

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TOPICS: A-Head: 2-2 Basic Concepts
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20. A data set is typically a rectangular array of data, with observations in columns and variables in rows.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

21. Both ordinal and nominal variables are categorical.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

22. The median of a data set with 30 values would be the average of the 15^{th} and the 16^{th} values when the data values are arranged in ascending order.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
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A financial analyst collected useful information for 30 employees at Gamma Technologies, Inc. These data include each selected employees' gender, age, number of years of relevant work experience prior to employment at Gamma, number of years of employment at Gamma, number of years of post-secondary education, and annual salary.

23. Indicate the type of data for each of the six variables included in this set.
ANSWER:
Gender – categorical, nominal
Age – numerical, continuous
Prior experience – numerical, discrete
Gamma experience – numerical, discrete
Education – numerical, discrete
Annual salary – numerical, continuous
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-2 Basic Concepts
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24. The only meaningful way to summarize categorical data is with counts of observations in the categories.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-3 Descriptive Measures for Categorical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

25. Using dummy variables is an efficient way of determining counts of categorical variables.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-3 Descriptive Measures for Categorical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

26. How is the median defined if the number of observations is even?
    a. the average of the two middle observations
    b. the difference between the two middle observations
    c. the most frequent observation
    d. the difference between the highest and smallest observation
ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Categorical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

Statistics professor has just given a final examination in his statistical inference course. He is particularly interested in learning how his class of 40 students performed on this exam. The scores are shown below.

77 81 74 77 79 73 80 85 86 73
83 84 81 73 75 91 76 77 95 76
90 85 92 84 81 64 75 90 78 78
82 78 86 86 82 70 76 78 72 93

27. What are the mean and median scores on this exam?
ANSWER: Mean = 80.40, Median = 79.50
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Categorical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

28. A histogram that is positively skewed is also called:
    a. skewed to the right b. skewed to the left

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c. balanced d. symmetric

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

29. What measure of distribution relates to extreme events, such as a stock market crash?
a. asymmetric b. kurtosis
c. negatively skewed d. skewness

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

30. What is the most common type of chart for showing the distribution of a numerical variable?
a. time series graph b. histogram
c. bin d. box plot

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

31. As a measure of variability, what is defined as the maximum value minus the minimum value?
a. variance
b. standard deviation
c. mean
d. range
e. median

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

32. The median can also be described as the:
a. middle observation when the data values are arranged in ascending order
b. best estimate of the population mean based on multiple samples
c. second percentile
d. the average of all values

ANSWER: a
POINTS: 1

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DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
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33. The difference between the first and third quartile is called the:
    a. interquartile range
    b. interdependent range
    c. unimodal range
    d. bimodal range
    e. mid-range

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

34. If a value represents the 95^{th} percentile, this means that:
    a. 95% of all values are below this value
    b. 95% of all values are above this value
    c. 95% of the time you will observe this value
    d. there is a 5% chance that this value is incorrect
    e. there is a 95% chance that this value is correct

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

35. What are the three most common measures of central tendency?
    a. mean, median, and mode
    b. mean, variance, and standard deviation
    c. mean, median, and variance
    d. mean, median, and standard deviation
    e. first quartile, second quartile, and third quartile

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

36. The length of the box in the box plot portrays the:
    a. mean
    b. median
    c. range

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d. interquartile range
e. third quartile

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

37. With symmetric, "bell-shaped" distributions, approximately what percent of the observations are within two standard deviations of the mean?
a. 50%
b. 68%
c. 95%
d. 99.7%
e. 100%

ANSWER: c
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

38. The mode is best described as the:
a. middle observation
b. same as the average
c. 50^{th} percentile
d. most frequently occurring value
e. third quartile

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

39. The interquartile range (IQR) encompasses what percent of the observations?
a. lower 25%
b. middle 50%
c. upper 75%
d. upper 90%
e. 100%

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
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40. Which statement is true for the following data values: 7, 5, 6, 4, 7, 8, and 12?
    a. The mean, median, and mode are all equal.
    b. Only the mean and median are equal.
    c. Only the mean and mode are equal.
    d. Only the median and mode are equal.

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

41. The average score for a class of 30 students was 75. The 20 male students in the class averaged 70. The 10 female students in the class averaged:
    a. the same as the males
    b. higher than the males
    c. significantly lower than the males
    d. little lower than the males

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

42. If the mean is 75 and two observations have values of 65 and 85, what is the squared deviation of each?
    a. 100
    b. 20
    c. 400
    d. 10

ANSWER: a
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

43. Expressed in percentiles, the interquartile range is the difference between the:
    a. 10^{th} and 60^{th} percentiles
    b. 15^{th} and 65^{th} percentiles
    c. 20^{th} and 70^{th} percentiles
    d. 25^{th} and 75^{th} percentiles
    e. 35^{th} and 85^{th} percentiles

ANSWER: d
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension

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TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

44. A sample of 20 observations has a standard deviation of 4. The sum of the squared deviations from the sample mean is:
    a. 400
    b. 320
    c. 304
    d. 288
    e. 180
ANSWER: c
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

45. As a graphical tool, the histogram is ideal for showing whether the distribution of a numerical variable is symmetric or skewed.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

46. A distribution with a high kurtosis has almost all of its observations within three standard deviations of the mean.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

47. A frequency table indicates how many observations fall within each category, and a histogram is its graphical analog.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

48. In the term “frequency table,” frequency refers to the counts of observations in specified categories.

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a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

49. A distribution of a numerical variable with no skewness is said to be symmetric.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

50. Suppose that a sample of 10 observations has a standard deviation of 3. Then the sum of the squared deviations from the sample mean is 30.
a. True
b. False

ANSWER: False
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

51. A histogram is based on binning the variable, which means putting the variable into discrete categories.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

52. The mean is a measure of central tendency.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
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53. Unlike histograms, box plots depict only one aspect of a variable.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

54. In an extremely right-skewed distribution, the mean is much smaller than the median.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

55. Mean absolute deviation (MAD) is the average of the squared deviations.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

56. The median is one of the most frequently used measures of variability.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

57. Assume that the histogram of a data set is symmetric and bell shaped, with a mean of 75 and standard deviation of 10. Then, approximately 95% of the data values were between 55 and 95.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
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58. The value of the mean times the number of observations equals the sum of all of the data values.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

59. The difference between the largest and smallest values in a data set is called the range.
    a. True
    b. False
ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

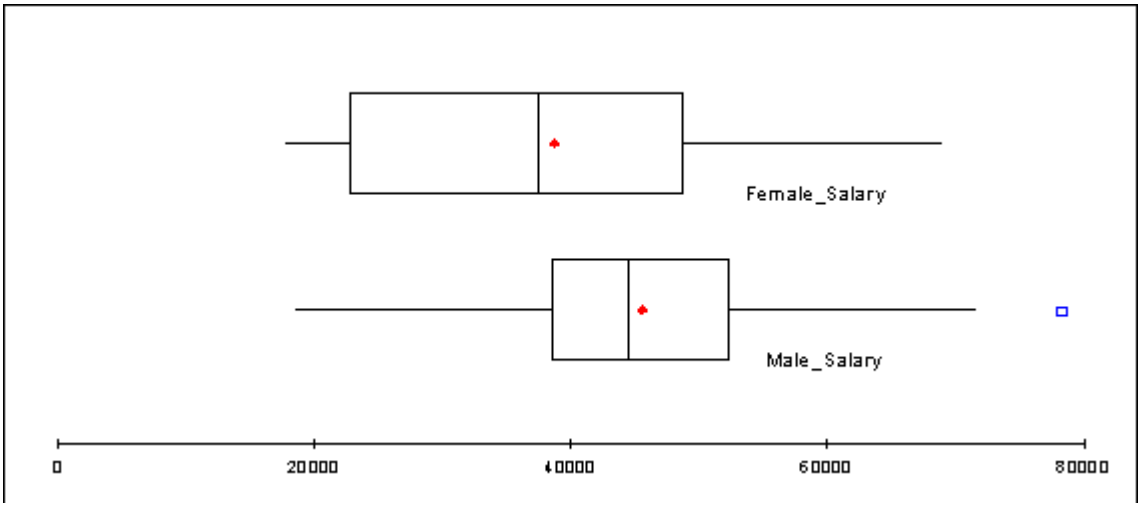
60. There are four quartiles that divide the values in a data set into four equal parts.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

61. A sample of 8 observations with a standard deviation of 2.50 has a sum of the squared deviations from the sample mean equal to 17.50.
    a. True
    b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

A manager for Marko Manufacturing, Inc. has recently been hearing some complaints that women are being paid less than men for the same type of work in one of their manufacturing plants. The box plots shown below represent the annual salaries for all salaried workers in that facility (40 men and 34 women).

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62. Would you conclude that there is a difference between the salaries of women and men in this plant? Justify your answer.

ANSWER: Yes. The men seem to have higher salaries than the women do in many cases. We can see from the box plots that the mean and median values for the men are both higher than for the women. You can also see from the box plots that the middle 50% of salaries for men is above the median for women. This means that if you were in the 25th percentile for men, you would be above the 50th percentile for women. You can also see that the mean and median salaries for the men are about $10,000 above those for the women.

POINTS: 1

DIFFICULTY: Moderate | Bloom's Application

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

63. How large must a person's salary should be to qualify as an outlier on the high side? How many outliers are there in these data?

ANSWER: A person's salary should be somewhere above $70,000. There is one male salary that would be considered an outlier (at approximately $80,000)

POINTS: 1

DIFFICULTY: Easy | Bloom's: Comprehension

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

64. What can you say about the shape of the distributions given the accompanying box plots?

ANSWER:

They both appear to be slightly skewed to the right (both have a mean > median). The total variation seems to be close for both distributions (with one outlier for the male salaries), but there seems to be more variation in the middle 50% for the women than for the men. There seem to be more men's salaries clustered more closely around the mean than for the women.

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Application

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

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Statistics professor has just given a final examination in his statistical inference course. He is particularly interested in learning how his class of 40 students performed on this exam. The scores are shown below.

77 81 74 77 79 73 80 85 86 73
83 84 81 73 75 91 76 77 95 76
90 85 92 84 81 64 75 90 78 78
82 78 86 86 82 70 76 78 72 93

65. Explain why the mean and median are different.

ANSWER: There are few higher exam scores that tend to pull the mean away from the middle of the distribution. While there is a slight amount of positive skewness in the distribution (skewness = 0.182), the mean and the median are essentially equivalent in this case.

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Analysis

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

The data shown below contains family incomes (in thousands of dollars) for a set of 50 families sampled in 2007 and 2017. Assume that these families are good representatives of the entire United States.

2007	2017	2007	2017	2007	2017
58	54	33	29	73	69
6	2	14	10	26	22
59	55	48	44	64	70
71	57	20	16	59	55
30	26	24	20	11	7
38	34	82	78	70	66
36	32	95	97	31	27
33	29	12	8	92	88
72	68	93	89	115	111
100	96	100	102	62	58
1	0	51	47	23	19
27	23	22	18	34	30
22	47	50	75	36	61
141	166	124	149	125	150
72	97	113	138	121	146
165	190	118	143	88	113
79	104	96	121		

66. Find the mean, median, standard deviation, first and third quartiles, and the 95th percentile for family incomes in both years.

ANSWER:

	Income 2007	Income 2017
Mean	62.820	67.120
Median	59.000	57.500
Standard deviation	39.786	48.087
First quartile	30.250	27.500
Third quartile	92.750	97.000
95th percentile	124.550	149.55

POINTS: 1

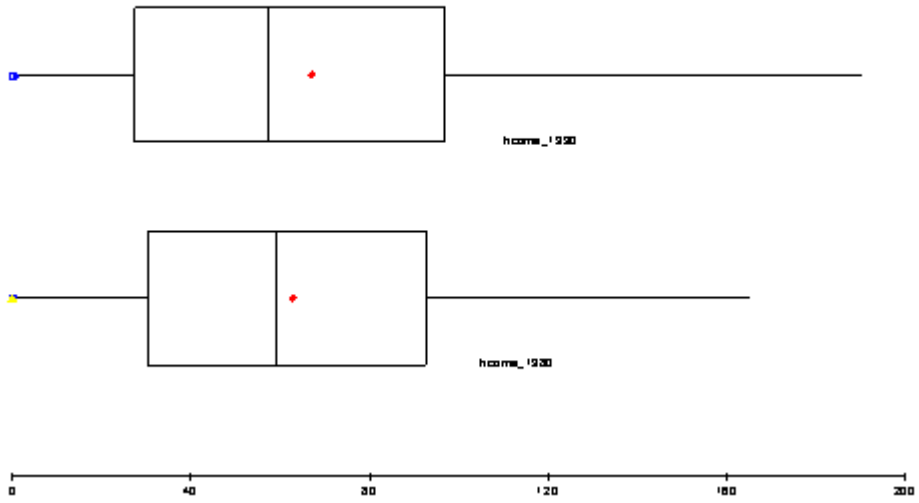
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DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

67. A political figure running for re-election claimed that the country was better off in 2017 than in 2007, because the average income increased. Do you agree?
ANSWER: It is true that the mean increased slightly, but the median decreased and the standard deviation increased. The 95th percentile shows that the mean increase might be because the rich got richer.
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

68. Generate a box plot to summarize the data. What does the box plot indicate?
ANSWER:



The box plot shows that there is not much difference between the two populations.
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Analysis
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

In an effort to provide more consistent customer service, the manager of a local fast-food restaurant would like to know the dispersion of customer service times in relation to their average value for the facility's drive-up window. The table below provides summary measures for the customer service times (in minutes) for a sample of 50 customers collected over the past week.

Count	50.000
Mean	0.873
Median	0.885
Standard deviation	0.432
Minimum	0.077
Maximum	1.608

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Variance	0.187
Skewness	-0.003

69. Interpret the variance and standard deviation of this sample.

ANSWER: The variance = 0.187 (minutes squared) and this represents the average of the squared deviations from the mean. The standard deviation = 0.432 (minutes) and is the square root of the variance. Both the variance and standard deviation measure the variation around the mean of the data. However, it is easier to interpret the standard deviation because it is expressed in the same units (minutes) as the values of the random variable (customer service time).

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Application

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

70. Are the empirical rules applicable in this case? If so, apply them and interpret your results. If not, explain why the empirical rules are not applicable here.

ANSWER: Considering that this distribution is only very slightly skewed to the left, it is acceptable to apply the empirical rules as follows:
Approximately 68% of the customer service times will fall between 0.873 ± 0.432, that is between 0.441 and 1.305 minutes.
Approximately 95% of the customer service times will fall between 0.873 ± 2(0.432), that is between 0.009 and 1.737 minutes.
Approximately 99.7% of the customer service times will fall between 0.873 ± 3(0.432), that is between 0 and 2.169 (lower end is set to zero because service times cannot assume negative values).

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Analysis

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

71. Explain why the mean is slightly lower than the median in this case.

ANSWER: The data is slightly skewed to the left. This causes the mean to be slightly lower than the median. It is important to understand that service times are bounded on the lower end by zero (it is impossible for the service time to be negative). However, there is no boundary on the maximum service time. Therefore, the smaller service times cause the mean to be somewhat lower than the median.

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Analysis

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

Below you will find summary measures on starting salaries for classroom teachers across the United States. You will also find a list of selected states and their average starting teacher salary. All values are in thousands of dollars.

Starting salaries for classroom teachers across the United States

	Measure
Count	51.000
Mean	35.890
Median	35.000
Standard deviation	6.226
Minimum	26.300
Maximum	50.300
Variance	38.763

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First quartile	31.550
Third quartile	40.050

Selected states and their average starting teacher salary (in thousands of dollars)

State	Salary
Alabama	31.3
Colorado	35.4
Connecticut	50.3
Delaware	40.5
Nebraska	31.5
Nevada	36.2
New Hampshire	35.8
New Jersey	47.9
New Mexico	29.6
South Carolina	31.6
South Dakota	26.3
Tennessee	33.1
Texas	32.0
Utah	30.6
Vermont	36.3
Virginia	35.0
Wyoming	31.6

72. Which of the states listed paid their teachers average salaries that exceed at least 75% of all average salaries?
ANSWER: Connecticut at 50.3; Delaware at 40.5; and New Jersey at 47.9 (all those > 40.05).
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

73. Which of the states listed paid their teachers average salaries that are below 75% of all average salaries?
ANSWER: Alabama at 31.3; Nebraska at 31.5; New Mexico at 29.6; South Dakota at 26.3; and Utah at 30.6 (all those < 31.55).
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

74. What salary amount represents the second quartile?
ANSWER: $35,000 (median)
POINTS: 1
DIFFICULTY: Easy | Bloom's Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

75. How would you describe the salary of Virginia's teachers compared to those across the entire United States? Justify your answer.
ANSWER:

Virginia' teacher salary = $35,000, which is also the median. Virginia is at the 50th percentile, meaning that 50% of the teachers' salaries across the U.S. are below the Virginia teacher salary and 50% of the

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salaries are above.

POINTS: 1
DIFFICULTY: Moderate | Bloom's: Analysis
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

Suppose that an analysis of a set of test scores reveals that: $Q_1 = 45$, $Q_2 = 85$, and $Q_3 = 105$.

76. What do these statistics tell you about the shape of the distribution?
ANSWER:

The fact that $Q_2 - Q_1 = 40$ is greater than $Q_3 - Q_2 = 20$ indicates that the distribution is skewed to the left.

POINTS: 1
DIFFICULTY: Moderate | Bloom's: Analysis
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

77. What can you say about the relative position of each of the observations 34, 84, and 104?
ANSWER: Since 34 is less than Q_1, the observation 34 is among the lowest 25% of the values. The value 84 is a bit smaller than the middle value, which is $Q_2 = 85$. Since $Q_3 = 105$, the value 104 is larger than about 75% of the values.
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

78. Calculate the interquartile range. What does this tell you about the data?
ANSWER:

IQR = $Q_3 - Q_1 = 60$. This means that the middle 50% of the test scores are between 45 and 105.

POINTS: 1
DIFFICULTY: Moderate | Bloom's: Analysis
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

The following data represent the number of children each family has in a sample of 10 families from Chicago: 4, 2, 1, 1, 5, 3, 0, 1, 0, and 2.

79. Compute the mean number of children.
ANSWER: Mean = 1.90
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

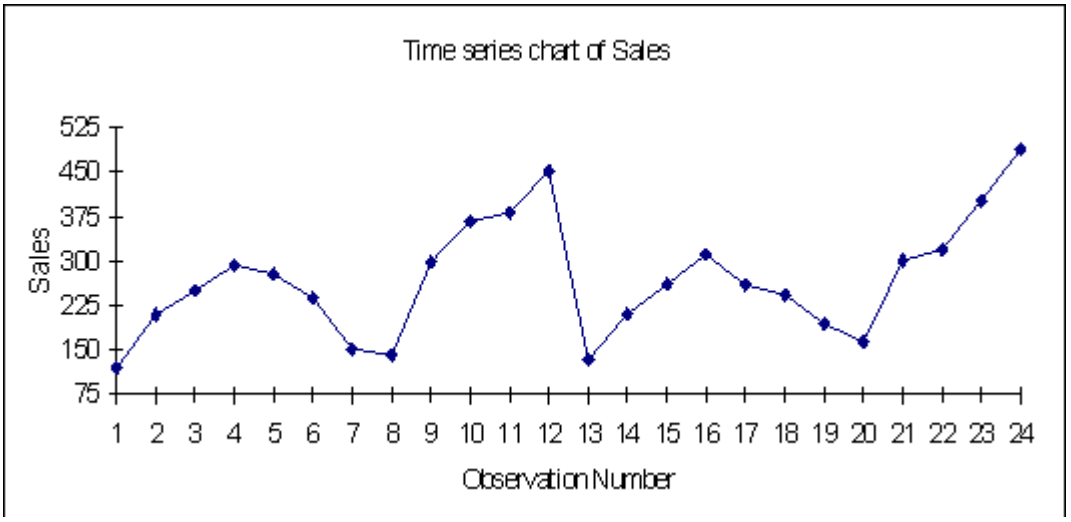
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80. Compute the median number of children.
ANSWER: Median = 1.5
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

81. Is the distribution of the number of children symmetrical or skewed? How do you know?
ANSWER: The distribution is positively skewed because the mean is larger than the median.
POINTS: 1
DIFFICULTY: Easy | Bloom's Knowledge
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

82. The data below represents monthly sales for two years of beanbag animals at a local retail store (Month 1 represents January and Month 12 represents December). Given the time series plot below, do you see any obvious patterns in the data? Explain.



ANSWER:

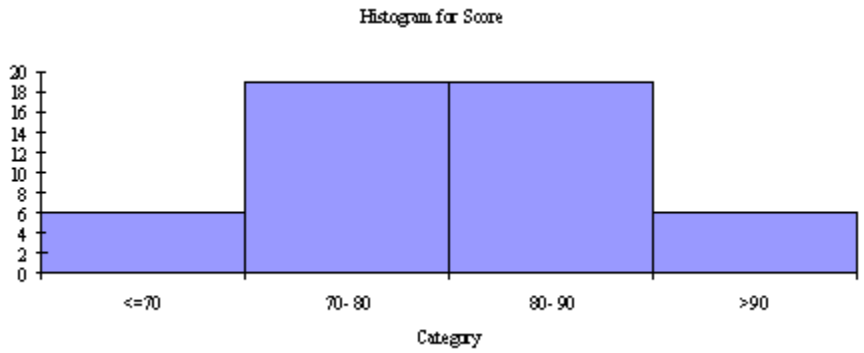
This is a representation of seasonal data. There seems to be a small increase in months 3, 4, and 5 and a large increase at the end of the year. The sales of this item seem to peak in December and have a significant dropoff in January.

POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

83. An operations management professor is interested in how her students performed on her midterm exam. The histogram shown below represents the distribution of exam scores (where the maximum score is 100) for 50 students.

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Based on this histogram, how would you characterize the students' performance on this exam?

ANSWER: Exam scores are fairly normally distributed. Majority of scores (76%) are between 70 and 90 points, while 12% of scores are above 90 and 12% of scores are 70 or below.

POINTS: 1

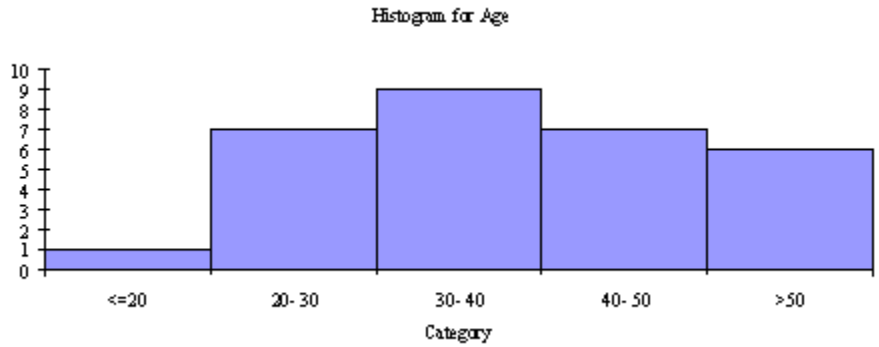
DIFFICULTY: Moderate | Bloom's: Application

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

A financial analyst collected useful information for 30 employees at Gamma Technologies, Inc. These data include each selected employees' gender, age, number of years of relevant work experience prior to employment at Gamma, number of years of employment at Gamma, number of years of post-secondary education, and annual salary.

84. Based on the histogram shown below, how would you describe the age distribution for these data?



ANSWER: The age distribution is skewed slightly to the right. Largest grouping is in the 30-40 range. This means that most workers are above the age of 30 years and only one worker is 20 years old or younger.

POINTS: 1

DIFFICULTY: Moderate | Bloom's: Analysis

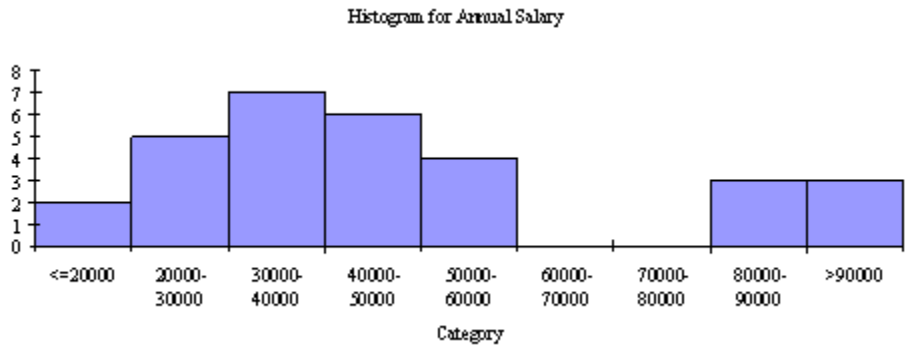
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

85. Based on the histogram shown below, how would you describe the salary distribution for these data?

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ANSWER: The salary distribution is skewed to the right. There appears to be several workers who are being paid substantially more than the others. If you eliminate those above $80,000, the salaries are fairly normally distributed around $35,000.

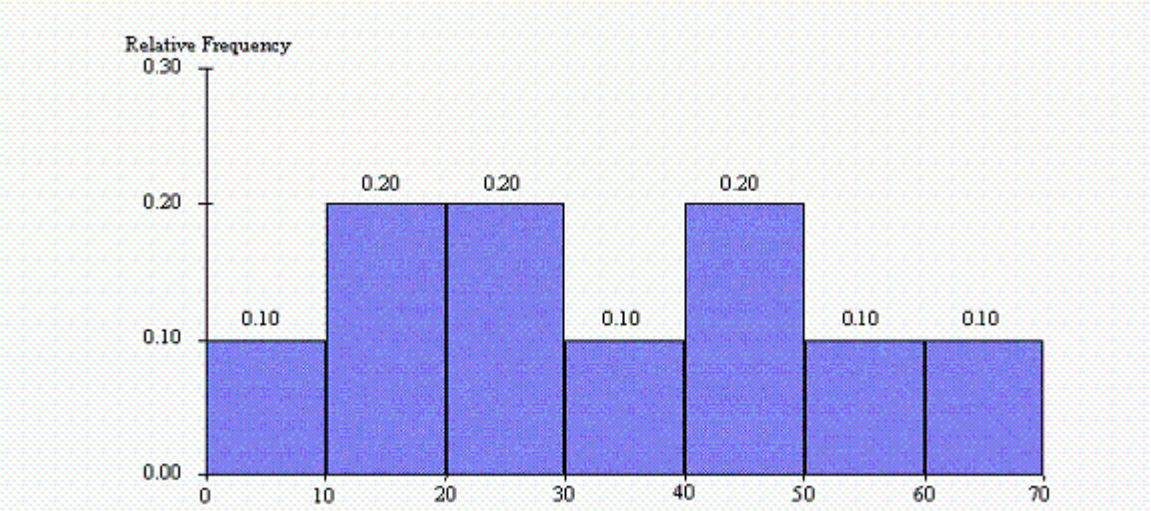
POINTS: 1

DIFFICULTY: Moderate | Bloom's: Analysis

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Statistical Inference

The histogram below represents scores achieved by 250 job applicants on a personality profile.



86. What percentage of the job applicants scored between 30 and 40?

ANSWER: 10%

POINTS: 1

DIFFICULTY: Easy | Bloom's: Comprehension

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

87. What percentage of the job applicants scored below 60?

ANSWER: 90%

POINTS: 1

DIFFICULTY: Easy | Bloom's: Comprehension

TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables

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OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

88. How many job applicants scored between 10 and 30?
ANSWER: 100
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

89. How many job applicants scored above 50?
ANSWER: 50
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

90. Seventy percent of the job applicants scored above what value?
ANSWER: 20
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

91. Half of the job applicants scored below what value?
ANSWER: 30
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

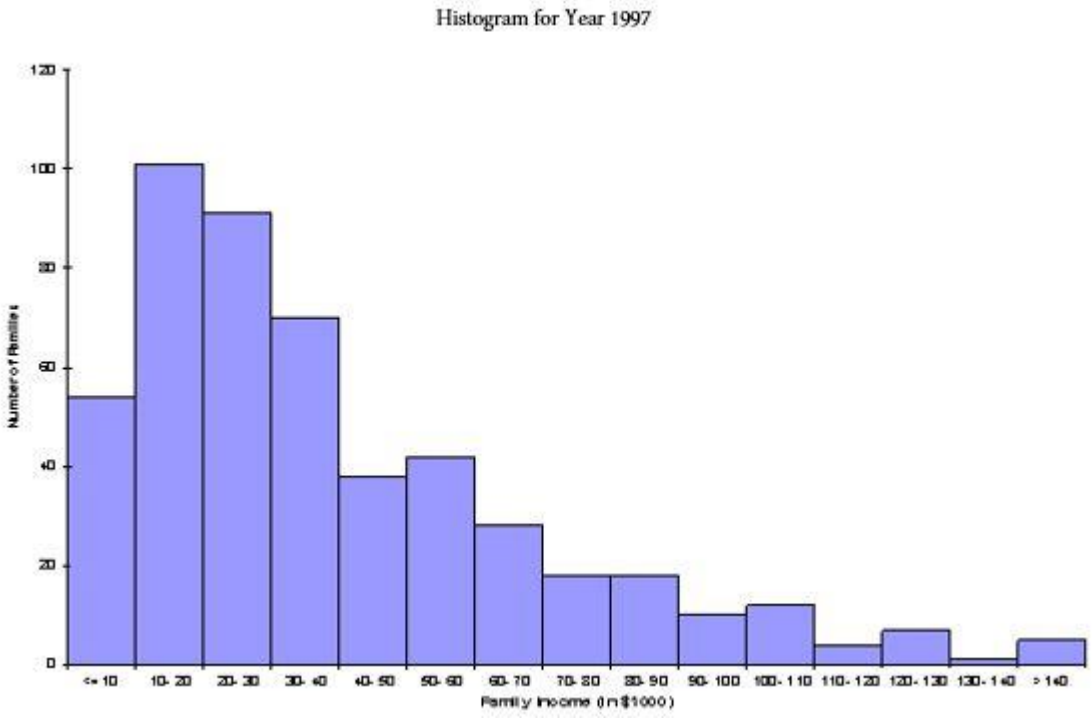
92. A think tank of economists is interested in how the distribution of family income has changed in Country X during the last 20 years. The summary measures and histograms shown below are generated for a sample of 500 family incomes, using the 1997 and 2017 income for each family in the sample.

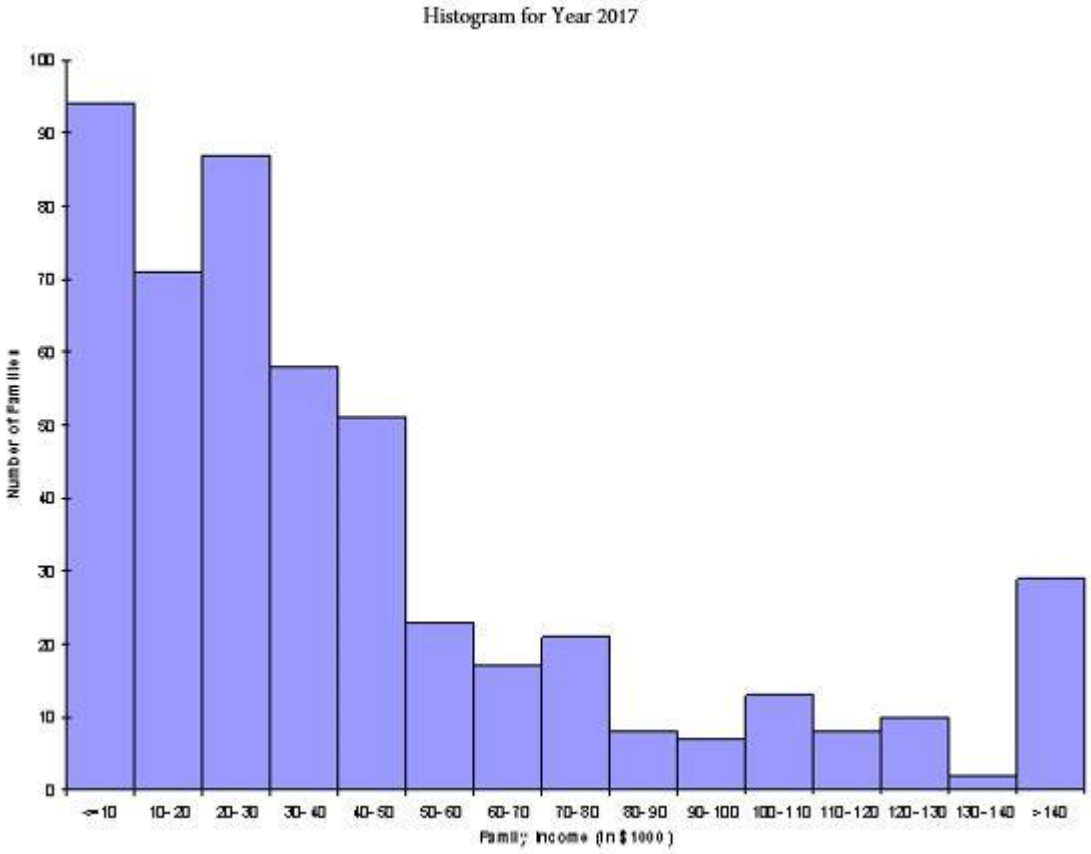
Summary Measures (in thousands of dollars):

	Year 1997	Year 2017
Mean	40.216	45.916
Median	32.000	30.000
Standard deviation	31.350	46.992
First quartile	17.000	16.000
Third quartile	54.000	56.000
5th percentile	9.000	6.000
95th percentile	102.100	151.100

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Based on these results, discuss as completely as possible how the distribution of family income in Country X changed from 1997 to 2017.

ANSWER: These summary measures say quite a lot. The mean has increased for 2005 when compared with 1985,

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although the median has decreased. There is also more variation. In fact, the 5th percentile has decreased slightly for 2005 when compared with 1985, whereas the 95th percentile is much larger -- indicating that the rich people are getting richer (assume an analysis that does not take in inflation as a factor). This behavior is also evident in the two histograms, which use the same categories for ease of comparison.

POINTS: 1
DIFFICULTY: Moderate | Bloom's: Analysis
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

93. In a generic box plot, the asterisk inside the box indicates the location of the:
a. mean b. median
c. minimum value d. maximum value

ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

94. In a generic box plot, the vertical line inside the box indicates the location of the:
a. mean
b. median
c. mode
d. minimum value
e. maximum value

ANSWER: b
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-4 Descriptive Measures for Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

95. Abby has been keeping track of what she spends to stream movies. The last seven week's expenditures, in dollars, were 6, 4, 8, 9, 6, 12, and 4. The mean amount Abby spends on streaming movies is $7.
a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Moderate | Bloom's: Application
TOPICS: A-Head: 2-4 Descriptive Measures of Numerical Variables
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

96. Where will you find "time" on a time series graph?
a. horizontal axis
b. first column
c. vertical axis

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d. last column

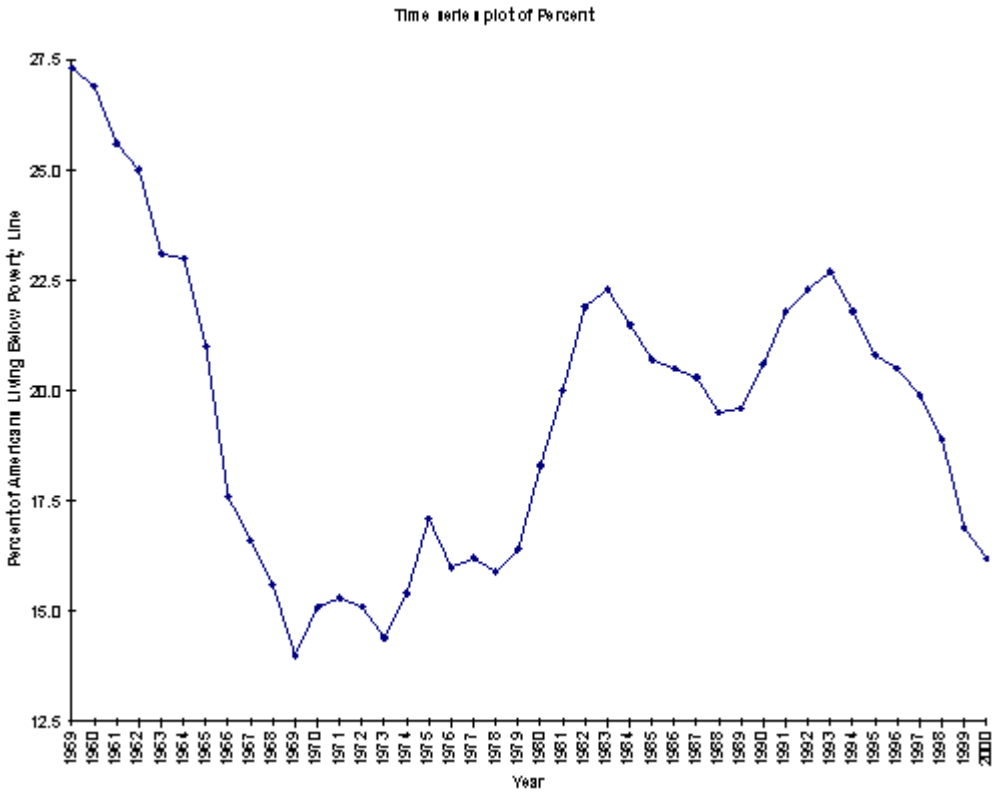
ANSWER: a
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-5 Time Series Data
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

97. The core purpose of time series graphs is to detect historical patterns in the data.

a. True
b. False

ANSWER: True
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-5 Time Series Data
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

98. Researchers are conducting a review of the "war against poverty" in the latter half of the twentieth century. As part of their analysis, the proportion of Americans under the age of 18 who lived below the poverty line for each of the years 1959 through 2000 is used to generate the following time series plot.



How successful was the United States in its efforts to win “the war against poverty” for the nation’s children during this time period?

ANSWER: Americans were relatively unsuccessful in winning the war on poverty in the 1990s. This is especially true when you compare the poverty rates in that decade with those of the years from 1969 through 1979. However, at least the curve trends downwards at the end of the twentieth century.

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POINTS: 1
DIFFICULTY: Easy | Bloom's Comprehension
TOPICS: A-Head: 2-5 Time Series Data
OTHER: BUSPROG: Analytic | DISC: Statistical Inference

99. Time series graphs chart the values of one or more time series, using time on the vertical axis.
a. True
b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Knowledge
TOPICS: A-Head: 2-5 Time Series Data
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

100. Because they represent such extreme values, outliers should be eliminated from statistical analyses.
a. True
b. False
ANSWER: False
POINTS: 1
DIFFICULTY: Easy | Bloom's: Comprehension
TOPICS: A-Head: 2-6 Outliers and Missing Values
OTHER: BUSPROG: Analytic | DISC: Descriptive Statistics

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