# *Introduction to Statistics An Active Learning Approach 2nd edition Carlson Solutions Manual*

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# Reading Questions

## Chapter 2: Central Tendency

1. What measure of central tendency is used when data are measured on a nominal scale?

a. Mean

b. Median

*c. Mode

2. What is the median for this set of scores? 3, 3, 3, 4, 4, 5, 5, 5

a. 3

*b. 4

c. 5

3. What measure of central tendency should be used with ordinal data?

a. Mean

*b. Median

c. Mode

4. What measure of central tendency is obtained by adding all of the scores and then dividing by the number of scores?

*a. Mean

b. Median

c. Mode

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5. What measure of central tendency is the value that has half of the scores above it and half of the scores below it?

a. Mean

*b. Median

c. Mode

6. What measure of central tendency should be used when the data are interval and there are extreme scores in the distribution?

a. Mean

*b. Median

c. Mode

7. Extreme scores are also called:

*a. outliers

b. modes scores

8. What measure of central tendency should be used when a distribution of scores measured on the interval or ratio scale of measurement is skewed?

a. Mean

*b. Median

c. Mode

9. When a distribution of scores is skewed, the median and mean will be similar.

True

*False

10. What does $\sum X$ tell you to do?

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*a. Sum the scores (*X*s)

b. Compute the mean

11. What does *N* represent?

*a. The number of scores

b. Measurement categories

12. A statistical formula is:

*a. a helpful set of instructions indicating how to compute something.

b. a bunch of meaningless symbols I should skip when I'm reading.

13. Which of the following is the best way to compute the mean for the following data?

| *X* | *f* |
|---|---|
| 3 | 4 |
| 2 | 7 |
| 1 | 5 |

*a. $M = (3(4) + 2(7) +1(5))/16$

b. $M = (3+2+1)/3$

c. $M = ((3+2+1) + (4 + 7 +5))/6$

14. The sample mean is represented by:

*a. *M*.

b. μ.

c. both *M* and μ.

15. The population mean is represented by:

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a. *M*.

*b. μ.

c. both *M* and μ.

16. Find the median of this list of scores: 5, 6, 4, 7, 8. [Hint: what is the first step to finding the median?]

a. 4

b. 5

*c. 6

17. Find the median of this frequency table of scores:

| *X* | *f* |
|---|---|
| 3 | 4 |
| 2 | 7 |
| 1 | 5 |
| 0 | 1 |

a. 1

*b. 2

c. 3

18. Find the mode of this set of scores:

| *X* | *f* |
|---|---|
| 3 | 4 |

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| | |
|---|---|
| 2 | 7 |
| 1 | 5 |
| 0 | 1 |

a. 1

*b. 2

c. 3

19. When entering data into SPSS, you can enter a frequency table of the data; you do not have to enter each score individually.

True

*False

20. What is the mean of these data?

*a. 73.0

b. 75

c. 70

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1. c.

2. a.

3. a.

4. b.

5. b.

6. b.

7. e.

8. e.

9. a.

10. b.

11. b.

12. a.

13. a.

14. a.

15. b.

16. d.

17. c.

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1. c.

2. b.

3. b.

4. a.

5. b.

6. b.

7. a.

8. b.

9. b.

10. a.

11. a.

12. a.

13. a.

14. a.

15. b.

16. c.

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17. b.

18. b.

19. b.

20. a.

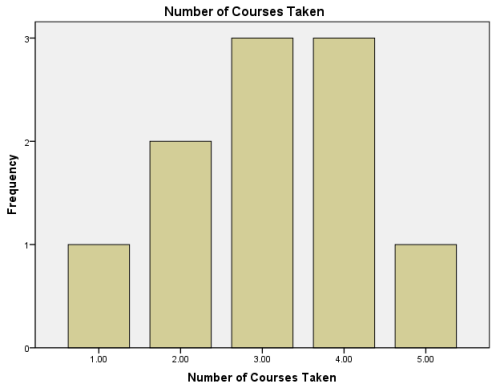
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# ACTIVITY 2-1

**1.**

| X | f |
|---|---|
| 5 | 1 |
| 4 | 3 |
| 3 | 3 |
| 2 | 2 |
| 1 | 1 |

**2.** Frequency bar graph of the data.




**3.** 3.1; Answers are in the activity in the paragraph after question 3.
**4.** 3; Answers are in the activity in the paragraph after question 3.
**5.** Both 3 and 4
**6.** Mean
**7.** Mode
**8.** Median
**9.** Mean
**10.** Median
**11.** Median
**12.** A
**13.** C
**14.** C. The mode is the only option because it is nominal data. It is fine as a measure of central tendency, but it misses the most important aspect of the data. Although 460 correctly disagreed with the false statement, "Do you agree that patients' memories of past events are improved by hypnosis?", 408 psychologists agreed with this false statement.
**15.** A
**16.** B
**17.** B
**18.** There are 16 scores total.

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**19.** 10 (answer is in the text)

**20.**

| Scores Below the Mean | |
|---|---|
| Score | Deviation (X-M) |
| 8 | 8-10 = -2 |
| 8 | 8-10 = -2 |
| 9 | 9-10=-1 |
| 9 | 9-10=-1 |
| 9 | 9-10=-1 |
| 9 | 9-10=-1 |
| ∑(X-M) = -8 | |

| Scores At the Mean | |
|---|---|
| Score | Deviation (X-M) |
| 10 | 10-10=0 |
| 10 | 10-10=0 |
| 10 | 10-10=0 |
| ∑(X-M) = 0 | |

| Scores Above the Mean | |
|---|---|
| Score | Deviation (X-M) |
| 11 | 11-10 = 1 |
| 11 | 11-10 = 1 |
| 11 | 11-10 = 1 |
| 11 | 11-10 = 1 |
| 11 | 11-10 = 1 |
| 11 | 11-10 = 1 |
| 12 | 12-10 =2 |
| ∑(X-M) = 8 | |

**21.** The sum for all negative deviation scores = -8
The sum for all positive deviation scores = +8

**22.** 0

**23.** 5; Answer in text

**24.**
2-5 = -3
3-5 = -2
3-5 = -2
4 – 5 = -1
4 – 5 = -1
4 – 5 = -1
4 – 5 = -1
4 – 5 = -1
4 – 5 = -1

**25.** -13

**26.**
6-5 = 1
6-5 = 1
6-5 = 1
7-5 = 2
7-5 = 2
8-5 = 3
8-5 = 3

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**27.** 13
**28.** 0

**29.** A
**30.**

| X | f |
|---|---|
| 2 | 0 |
| 3 | 2 |
| 4 | 5 |
| 5 | 1 |
| 6 | 1 |
| 7 | 0 |
| 8 | 1 |

**31.** 4 and 6
**32.** 4.5 (average of 4 and 5, the middle two numbers); 2, 3, 4, 4, **4, 5**, 5, 6, 6, 6,
**33.** M = 45/10 = 4.5

**34.**

| **Score** | **Deviation Scores: (*X* – *M*)** |
|---|---|
| 2 | 2-4.5 = -2.5 |
| 3 | 3-4.5 = -1.5 |
| 4 | 4-4.5 = -.5 |
| 4 | 4-4.5 = -.5 |
| 4 | 4-4.5 = -.5 |
| 5 | 5-4.5 = .5 |
| 5 | 5-4.5 = .5 |
| 6 | 6-4.5 = 1.5 |
| 6 | 6-4.5 = 1.5 |
| 6 | 6-4.5 = 1.5 |

**35.** 0
**36.** C
**37.** B

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EDITION
2

# AN INTRODUCTION TO STATISTICS

## An Active Learning Approach

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# An Introduction to Statistics
# An Active Learning Approach

## Chapter 2: Central Tendancy


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# Topics to Cover

- Compute and interpret the mean, the median, and the mode
- Identify when to use the mean, the median, or the mode when describing a distribution's central tendency


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# Central Tendency

- The “center” of scores
  - Mean
    - the arithmetic average
  - Median
    - the middle score
  - Mode
    - the most frequently occurring score

| *Measure of central tendency* | *When to use the measure* |
|---|---|
| Mean | With interval/ratio data that are normally distributed;<br>no outliers |
| Median | With ordinal data<br>With interval/ratio data that are skewed or have outliers |
| Mode | With nominal data |

**Figure 2.1: When to Use Measures of Central Tendency**

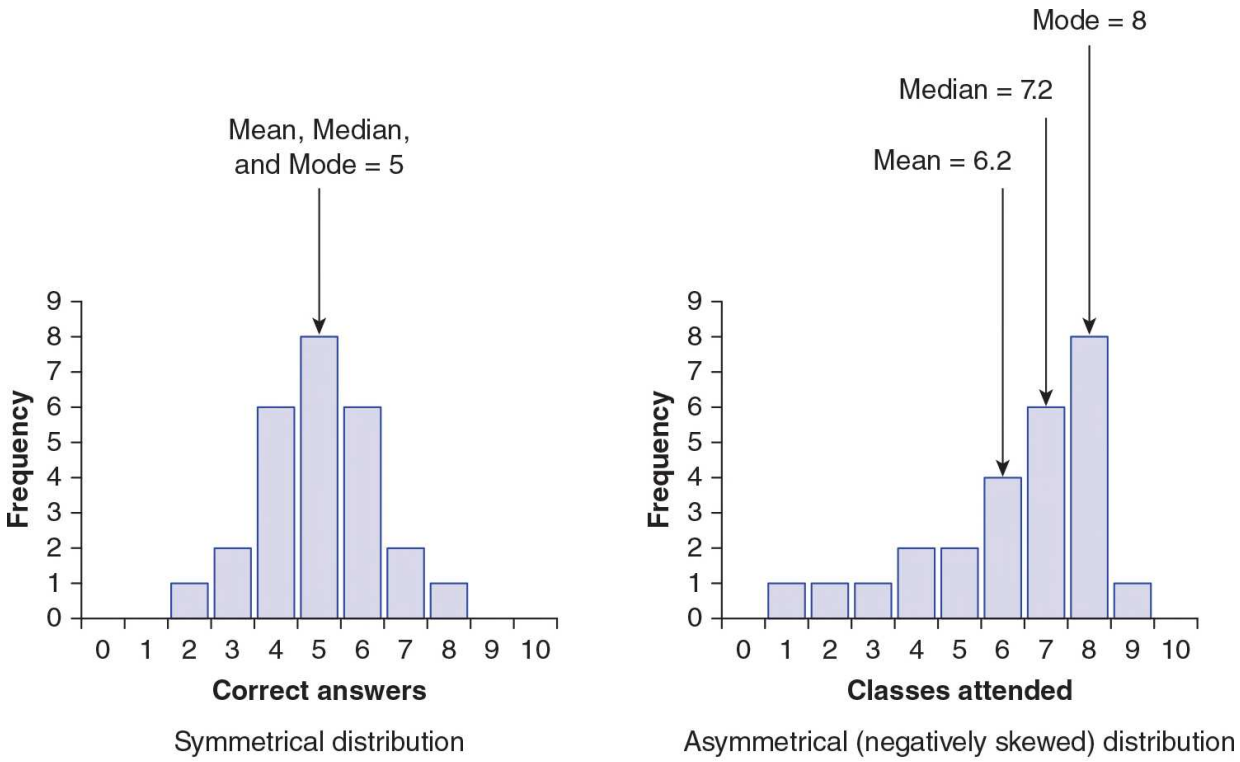



**Figure 2.2: A Bar Graph of Symmetrical Data (Correct Answers) and a Bar Graph of Negatively Skewed Data (Classes Attended)**

# Computing the Mean

- Add the scores and divide by the number of scores
- Statistical formula:
- $M$ - sample mean
- $\sum X$ - sum of $x$
- $N$ - number of scores

$$M = \frac{\sum X}{N}$$

# Computing the Mean

- Example

$$M = \frac{\sum X}{N} = \frac{100 + 70 + 80 + 90 + 50 + 60 + 70 + 80 + 90 + 40}{10} = \frac{730}{10} = 73$$

# Computing the Mean

- Computing the mean from a frequency distribution
- $\sum(Xf)$ – multiply each score by the number of people who had the score to get $\sum X$

| $X$ | $f$ |
|---|---|
| 100 | 1 |
| 90 | 2 |
| 80 | 2 |
| 70 | 2 |
| 60 | 1 |
| 50 | 1 |
| 40 | 1 |

**Table 2.1: Frequency Distribution Table of Variable Scores**

# Computing the Mean

- Computing the mean from a frequency distribution
- Example

$$\sum X = 100(1) + 90(2) + 80(2) + 70(2) + 60(1) + 50(1) + 40(1) = 730$$

$$M = \frac{\sum X}{N} = \frac{730}{10} = 73$$

# Computing the Mean

- Computing the population mean
- Statistical formula:

$$\mu = \frac{\sum X}{N}$$

- $\mu$ - population mean; Greek letter “myoo”

# Find the Median

- The median is the midpoint of a distribution of scores.
- Begin by putting scores in order from lowest to highest.


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# Find the Median

- When *N* is odd, there is one middle score.
- 7, 7, 6, 6, 6, 5, 4, 3, 1
- When *N* is even, compute the average of the two middle scores. Add 70 and 80, then divide by 2. The median is 75.
- 40, 50, 60, 70, 70, 80, 80, 90, 90, 100

| $X$ | $f$ |
|---|---|
| 100 | 5 |
| 90 | 7 |
| 80 | 8 |
| 70 | 10 |
| 60 | 6 |
| 50 | 9 |
| 40 | 3 |

The 24th and 25th scores are in this group of 10 scores.

**Table 2.3: Frequency Distribution Table for a Larger Set of Scores With Median Identified.**

# Find the Mode

- The mode is the most frequently occurring score in the distribution.
- To locate the mode in the frequency distribution table, you look for the measurement category (*X* value) with the highest frequency.

| *X* | *f* |
|---|---|
| 100 | 5 |
| 90 | 7 |
| 80 | 8 |
| **70** | **10** |
| 60 | 6 |
| 50 | 9 |
| 40 | 3 |

**Table 2.4: Frequency Distribution Table for a Larger Set of Scores With the Mode Bolded**

Compute and interpret the mean, the median, and the mode

# SPSS

# SPSS Data File

- To compute measures of central tendency using SPSS, you will need to begin by entering the data.
- You cannot enter a frequency distribution table into SPSS; instead you must enter individual scores.

| $X$ | $f$ |
|---|---|
| 100 | 1 |
| 90 | 2 |
| 80 | 2 |
| 70 | 2 |
| 60 | 1 |
| 50 | 1 |
| 40 | 1 |

**Table 2.5: Frequency Distribution Table of the Variable Called Scores.**

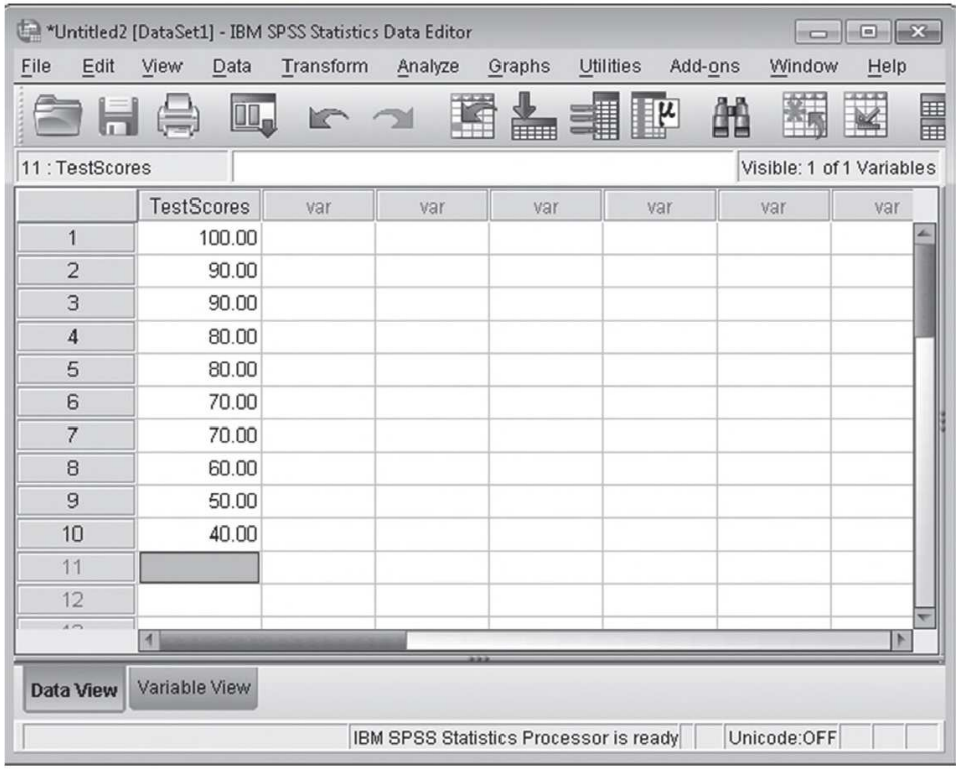



**Figure 2.3: SPSS Screenshot of the Data Entry Screen of the Variable Labeled Test Scores.**

# Obtaining Measures of Central Tendency Using SPSS

- Click on the Analyze menu. Choose Descriptive Statistics and then Frequencies (see Figure 2.4).
- Move the variable(s) of interest into the Variable(s) box (see Figure 2.5).
- Make sure the Display Frequency Tables box is checked if you want a frequency distribution table. Uncheck the box if you do not want a frequency table.

# Obtaining Measures of Central Tendency Using SPSS

- Click on the Statistics button.
- Click on the boxes for mean, median, and mode, and then click on the Continue button (see Figure 2.6).
- Click OK.

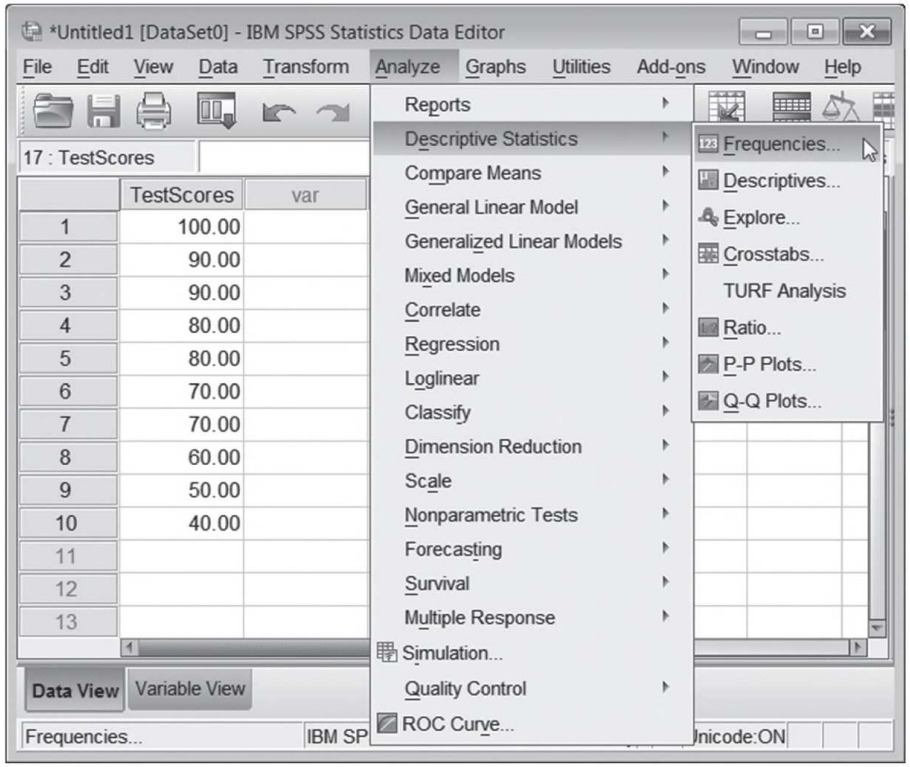



**Figure 2.4: SPSS Screenshot of the Analyze Menu for Descriptive Statistics.**

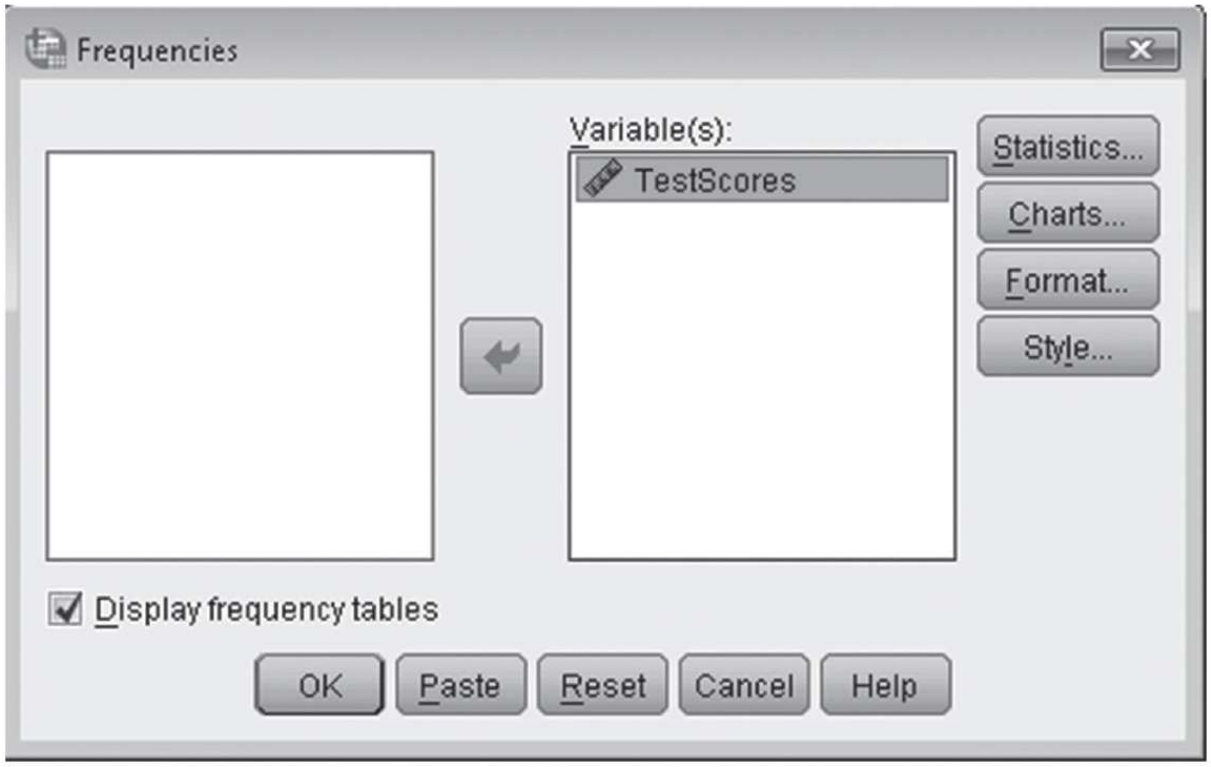



**Figure 2.5: SPSS Screenshot of Choosing the Variables for Descriptive Statistics.**


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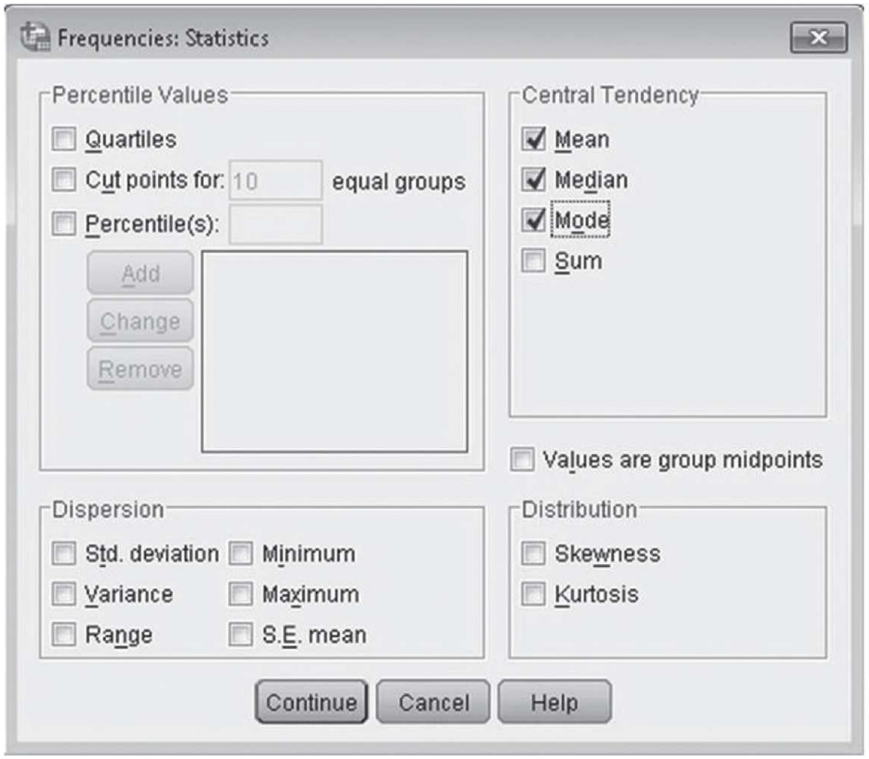



**Figure 2.6: SPSS Screenshot of Choosing Measures of Central Tendency.**

**Statistics**

testscores

| | | |
|---|---|---|
| N | Valid | 10 |
| | Missing | 0 |
| Mean | | 73.0000 |
| Median | | 75.0000 |
| Mode | | 70.00[a] |

a. Multiple modes exist. The smallest value is shown

**testscores**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 40.00 | 1 | 10.0 | 10.0 | 10.0 |
| | 50.00 | 1 | 10.0 | 10.0 | 20.0 |
| | 60.00 | 1 | 10.0 | 10.0 | 30.0 |
| | 70.00 | 2 | 20.0 | 20.0 | 50.0 |
| | 80.00 | 2 | 20.0 | 20.0 | 70.0 |
| | 90.00 | 2 | 20.0 | 20.0 | 90.0 |
| | 100.00 | 1 | 10.0 | 10.0 | 100.0 |
| | Total | 10 | 100.0 | 100.0 | |

**Figure 2.7: SPSS Output for the Central Tendency of the Variable Score.**