

**MEASURES OF CENTRAL TENDENCY (AVERAGES)**

NAME \_\_\_\_\_ WRITE ANSWERS TO #1- #6 ON THESE PAGES

1. Refer to the continuous frequency diagram provided with Problem Set #5C, showing a hypothetical distribution of income in \$000 among U.S. households. According to this diagram,

- (a) *modal* household income is about \_\_\_\_\_
- (b) *median* household income is about \_\_\_\_\_
- (c) *mean* household income is about \_\_\_\_\_

*Note:* you have already answered question (b) as Question 6(g) in Problem Set #5C

2. *Twenty* households have a total of *fifty* children. Among these twenty households (circle NO if the answer cannot be determined from information given),

- (a) the *modal* number of children is \_\_\_\_\_ or NO
- (b) the *median* number of children is \_\_\_\_\_ or NO
- (c) the *mean* number of children is \_\_\_\_\_ or NO

3. A survey of households measures the variable NUMBER OF CHILDREN in each household. The frequency distribution of this variable is shown:

	<u># of children</u>	<u>relative frequency</u>
	0	10%
	1	26%
(a) the <i>modal</i> number of children per household is _____	2	16%
	3	14%
	4	10%
(b) the <i>median</i> number of children per household is _____	5	8%
	6	6%
	7	4%
(c) the <i>mean</i> number of children per household is _____	8	3%
	9	2%
	10	<u>1%</u>
		100%

4. A group of people has a total of \$100. The \$100 is then redistributed within the group, some people getting more and others less than before (but the total remains \$100). As a result of this redistribution (CIRCLE EVERY STATEMENT THAT IS TRUE),

- (A) the mode of the distribution of \$ may change.
- (B) the median of the distribution of \$ may change.
- (C) the mean of the distribution of \$ may change.

5. An instructor gives a test to students, on which scores anywhere from 0 to 50 can be achieved. Not having access to SPSS or even a calculator, he laboriously calculates the modal, median, and mean scores using paper and pencil. The instructor determines that the modal score is 37, the median score is 35, and the mean score is 32.238. Just before returning the tests, the instructor notices that one question that seemingly every student had gotten wrong was scored incorrectly and that therefore every student's score must be raised by three points.
- (a) Does the instructor have to recalculate these scores from scratch? What are the new modal, median, and mean scores?

The instructor initially awarded students fractional points (e.g.,  $2\frac{1}{2}$ ) on some questions, and therefore some students had fractional overall scores (e.g.,  $39\frac{1}{2}$ ). So, after adding the three points to all scores, the instructor decides that such fractions are confusing and (since the only fractions involved were  $\frac{1}{2}$ 's) decides to get rid of them by doubling every student's overall score (so the range of possible scores is now from 0 to 100).

- (b) Does he have to recalculate these scores from scratch? What are the new modal, median, and mean scores?

Finally, for some reason that can't be explained (except that it makes a good problem set question), the instructor then decides to award 5 additional points to the scores of the students who scored in the top 20% of the class.

- (c) Does this affect the median score? If so what is the new median?

- (d) Does this effect the mean score? If so, what is the new mean?

6. A UMBC student is entering the last semester of his senior year. He has completed 105 credits with a cumulative GPA of 1.80. He is signed up to take 15 credits (five 3-credit courses) in his last semester.
- (a) What semester GPA does he need to graduate with a cumulative GPA of 2.0 or better?
  - (b) Can he graduate with a cumulative GPA of 2.0 even if he gets a C in one of his five remaining courses?
  - (c) Can he graduate with a cumulative GPA of 2.0 even if he gets a D in one of the five courses?
  - (d) Can he graduate with a cumulative GPA of 2.0 even if he gets a D in one of the five courses?
7. You record the *height* and *weight* of every person in a large representative sample of adult Americans and then calculate the *median* and *mean* values of each variable. You find the median and mean values are just about the same for one of these variables but substantially different for the other. For which variable — height or weight — are the median and mean values substantially different and, for that variable, which measure of central tendency — median or mean — would have the higher value? Briefly explain your reasoning. For the variable (pertaining to individuals in the sample) *number of siblings*, would the median and mean values be about the same or would one average value be distinctly higher than the other? If the latter, which would be higher and why?
8. Some years ago Congress passed tax cut legislation at the urging of President Bush. Many Democrats and other critics claim that the tax cuts are *skewed* toward the rich. Both sides have made claims about how the tax cut will affect “the average American household.” President Bush claimed that “92 million American households will keep an average of \$1083 more of their own money.” What kind of average do you think the President was referring to? What kind of average do you think Democrats and other critics might choose to focus on?
9. In Garrison Keillor’s (of National Public Radio’s *A Prairie Home Companion*) mythical hometown of Lake Wobegon, Minnesota, “all the men are handsome, all the women are strong, and all the children are above average.” Is it in fact possible for all cases to be above average? Failing this, is it possible for no cases to be below average? You should think about different shapes a frequency distribution may have and also about the different types of averages that may be used.

*Note.* The remaining questions are taken or adapted from early editions of David S. Moore, *Statistics: Concepts and Controversies*, a text book previously used in this course.

10. Last year a small accounting firm paid each of its five clerks \$22,000, two junior accountants \$50,000 each, and the firm's owner \$270,000. What is the mean salary paid at this firm? How many of the employees earn less than the mean? What is the median salary? What is the mode of the salaries?
11. Identify which measure of central tendency (mean, median, or mode) is the appropriate “average” in each of the following situations:
  - (a) Someone declares, “The average American is a white female.”
  - (b) Middletown is considering imposing an income tax on citizens. The city government wants to know the average income of citizens so that it can estimate the total tax base.
  - (c) In an attempt to study the standard of living of typical families in Middletown, a sociologist estimates the average family income in that city.
12. According to the Department of Commerce, the mean and median prices of new houses sold in the United States in 1989 were \$129,900 and \$159,000. Which of these numbers is the mean, and which is the median? Explain your answer.
13. The mean age of 5 persons in a room is 30 years. A 36-year-old person walks in. What is now the mean age of the persons in the room? Suppose that the median age is 30 years and a 36-year-old person enters. Can you find the new median age from this information?
14. You wish to measure the average speed of vehicles on the interstate highway on which you are driving, so you adjust your speed until the number of vehicles passing you equals the number you are passing. Have you found the mean speed, the median speed, or the modal speed of vehicles on the highway?
15. A news article reports that of the 411 players on National Basketball Association rosters in February 1998, only 139 “made more than the league average salary” of \$2.36 million. Is \$2.36 million the mean or median salary for NBA players? How do you know?
16. You are planning a party and want to know how many cans of soda to buy. A genie offers to tell you either the mean number of cans guests will drink or the median number of cans. Which measure of central should you ask for? Why? To make your answer concrete, suppose there will be 30 guests and the genie can tell either that the mean will be 5 cans or the median will 3 cans. Given either projection, can you determine how many cans you should have on hand?