**MARKS**
4
(1, 1, 2)

4. 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.
   (a) What is the average salary paid at the firm? Show your reasoning.
   (b) What is the median salary? Show your reasoning.
   (c) What is the standard deviation of the salaries? Show your calculations.

(a) Total salary bill = $5 \times \$22{,}000 + 2 \times \$50{,}000 + \$270{,}000$
$= \$480{,}000$;
hence, average salary = $\$480{,}000/(5+2+1) = \$60{,}000$.

\$ 60,000 (a)
Average

(b) The salaries in order in \$×1,000 are:
22 22 22 22 22 50 50 270;
with 8 observations, the median is the average of the *4*th and *5*th members of the ordered data set: \$22,000.

\$ 22,000 (b)
Median

(c) Using the calculation formula for s.d. on the third side of Figure 4.8, we obtain \$85,790.44.
[The sum of the observations is 480,000, the sum of their squares is 80,320,000,000.]

\$ 85,790 (c)
S.d.

**MARKS**
3
(1, 1, 1)

5. This year, the firm in Question 4 pays the same salaries as last year to the clerks and junior accountants, while the owner's take increases to \$430,000.
   (a) How does this change affect the average salary? Show your reasoning.
   (b) How does the change affect the median salary? Show your reasoning.
   (c) Explain briefly, *without calculation*, how the change affects the standard deviation of the salaries.

(a) The total salary bill increases by \$430,000 – \$270,000 = \$160,000;
hence, the average will *in*crease by \$160,000/8 = \$20,000.

Increases by \$20,000 (a)
Effect on average

(b) The salaries in order in \$×1,000 are now:
22 22 22 22 22 50 50 430;
with 8 observations, the median is the average of the *4*th and *5*th members of the ordered data set: \$22,000, which is *unaffected*.

None (b)
Effect on median

(c) The *substantial* increase in the owner's salary makes it even *more* of an outlier than in (a); because of the *squaring* of differences from the average in calculating the s.d., this increase in the outlier will increase the s.d. *substantially* [for interest, by \$56,196 to \$141,986].

Increases substantially (c)
Effect on s.d.

**MARKS**
2

6. The average and median salaries of major league baseball players in 1993 were \$490,000 and \$1,160,000. Which of these two values is the average and which is the median? Explain your reasoning briefly.

The distribution of players' salaries has a lower limit of 0 (in principle) and a long *right* tail, corresponding to the small proportion of highly-paid exceptional players.
Because the distribution is skewed to the *right*, the average is *greater than* the median.
Hence, of the two numbers given, \$1,160,000 is the average and \$490,000 is the median.

\$ 1,160,000
Average

\$ 490,000
Median