Mean, Median and Mode

Introduction

Measures of central tendency, or averages, are used in a variety of contexts and form the basis of statistics.

Mean (Arithmetic Mean)

To calculate the arithmetic mean of a set of data we must first add up (sum) all of the data values (x) and then divide the result by the number of values (n).

Since $\sum$ is the symbol used to indicate that values are to be summed (see *Sigma Notation*) we obtain the following formula for the mean ($\bar{x}$).

$$\bar{x} = \frac{\sum x}{n}$$

Example

Find the mean of: $6, 8, 11, 5, 2, 9, 7, 8$

$$x = \frac{\sum x}{n} = \frac{6+8+11+5+2+9+7+8}{8} = \frac{56}{8} = 7$$

Median

The median value of a set of data is the middle value of the ordered data. That is, the data must be put in numerical order first.

Worked examples

Find the median of the following:

a) $11, 4, 9, 7, 10, 5, 6$

Ordering the data gives $4, 5, 6, \boxed{7}, 9, 10, 11$

and the middle value is 7.

b) $1, 3, 0.5, 0.6, 2, 2.5, 3.1, 2.9$

Ordering the data gives $0.5, 0.6, 1, \boxed{2,\ 2.5}\ 2.9, 3, 3.1$

Here there is a middle pair 2 and 2.5. The median is between these 2 values

i.e. the mean of them $\frac{2+2.5}{2} = 2.25$

In general the median is at the $\frac{(n+1)}{2}$th value.

Mode

The modal value of a set of data is the most frequently occurring value.

Worked example

Find the mode for:

$2, 6, 3, 9, 5, 6, 2, 6$

It can be seen that the most frequently occurring value is 6. (There are 3 of these).

Exercises

1. Find the mode, median and mean of the following:
   a) $3, 12, 11, 7, 5, 5, 6, 4, 10$
   b) $16, 19, 10, 24, 19$
   c) $8, 2, 8, 5, 5, 8$
   d) $28, 39, 42, 29, 39, 40, 36, 46, 41, 30$
   e) $133, 215, 250, 108, 206, 159, 206, 178$
   f) $76, 94, 76, 82, 78, 86, 90$
   g) $52, 61, 49, 52, 49, 52, 41, 58$

2. The exchange route for sterling against the US dollar for 15 days in January 2003 is given in the following table. Calculate the mean, median and mode of this data.

1.5977	1.6028	1.6108	1.6067	1.5995	1.6064	1.6080	1.6054
1.6098	1.6049	1.6064	1.6179	1.6082	1.6095	1.6134	

3. The following data is the hourly pay in pounds offered to shop assistants in a survey of job vacancies for June 2003 based in Reading.

5.00	4.21	4.97	5.00	5.00	5.29	5.05	5.50	5.79	5.00	5.40
5.20	5.10	5.06	4.50	4.50	5.50	4.50	5.00	5.00	5.50	

Calculate the mean, median, and mode of this data.

Answers

1. a) 5, 6, 7 b) 19, 19, 17.6 c) 8, 6.5, 6 d) 39, 39, 37 e) 206, 192, 181.875
   f) 76, 82, 83.14 g) 52, 52, 51.75
2. mean = \$1.6072 median = \$1.6067 mode = \$1.6064
3. mean = £5.05 median = £5.00 mode = £5.05