Title: Averages

Target: On completion of this worksheet you should understand the differences between the mean, median and the mode and be able to calculate these averages.

An average is a representative value of the data. There are three main types of average: the mean, the median and the mode.

The mode is the most frequent value. The median is the middle value when the data is arranged in order of magnitude. The mean is the total of all values divided by the number of values.

**Exercise**

Find the mode for the following:
1. 4, 2, 6, 4, 3, 4, 7, 1, 0
2. 5, 8, 6, 1, 0, 2, 5, 4, 6, 3
(Answers: 4; 5 and 6)

**Examples**

1. The number of goals scored by a football team in 9 matches are: 3, 3, 0, 1, 2, 2, 0, 0, 1. Find the mode. The value which occurs most frequently is 0 so the mode is 0.

2. In the next 8 matches they scored: 4, 3, 1, 3, 0, 4, 4, 3. Find the mode. In this case both 3 and 4 occur three times so there are two modes 3 and 4.

3. The scores for the next 4 matches are: 2, 1, 0, 3. What is the mode? Each value occurs the same number of times so there is no mode.

**MEDIAN**

Examples
Find the median for each of the previous examples.

1. First arrange in order: 0, 0, 0, 1, 1, 2, 2, 3, 3. Now find the middle value 0, 0, 0, 1, 1, , 2, 2, 3, 3. Notice that there are 9 values and the median is the 5th value or (9+1)/2.

2. The values arranged in order are: 0, 1, 3, 3, 3, 4, 4, 4. This time there are two middle values. To find the median add the values and divide by 2. The median is 3. The median falls between the 4th and 5th values or (8+1)/2.

3. In order we have: 0, 1, 2, 3. Again there are two middle values, 1 and 2 so the median is (1 + 2)/2 = 1.5. The median is the (4+1)/2 = 2.5th value i.e. between the 2nd and 3rd values.
In general if there are n values then the median is the \((n+1)/2\) value. For example if there are 11 values then the median is the \((11+1)/2 = 6^{th}\) value. If there are 10 values then the median is the \((10+1)/2 = 5.5^{th}\) value ie between the 5\(^{th}\) and 6\(^{th}\) values.

**Examples cont.**

2. Find the mean for the grouped frequency distribution:

<table>
<thead>
<tr>
<th>class</th>
<th>f</th>
<th>x</th>
<th>fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 -</td>
<td>15</td>
<td>5</td>
<td>75</td>
</tr>
<tr>
<td>6 -</td>
<td>21</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>8 -</td>
<td>12</td>
<td>9</td>
<td>108</td>
</tr>
<tr>
<td>10 - 12</td>
<td>2</td>
<td>11</td>
<td>22</td>
</tr>
</tbody>
</table>

\(\Sigma f = 50\) \(\Sigma fx = 352\)

Mean = \(\frac{352}{50} = 7.04\)

**Exercise**

Find the median for the questions in the last exercise.

(Answers: 4, 4.5)

### MEAN

Mean = total of all values
number of values

**Examples**

Find the mean for the previous examples:

1. mean = \(\frac{3+3+0+1+2+2+0+0+1}{9} = 1.33\)

2. mean = \(\frac{4+3+1+3+0+4+4+3}{8} = 2.75\)

3. mean = \(\frac{2+1+0+3}{4} = 1.5\)

**Exercise**

Find the mean for the questions in the last exercise.

(Answers: 3.44, 4)

**Examples**

1. Find the mean for the following frequency distribution:

<table>
<thead>
<tr>
<th>x</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

We need to total the x values. There are 3 lots of 2 and 5 lots of 3 etc so

\(\Sigma x = 3 \times 2 + 5 \times 3 + 8 \times 4 + 4 \times 5 + 1 \times 6 = 79\)

\(\Sigma x\) is the total of the x values. We say sigma x). There are 21 values altogether

\(\Sigma f = 3+5+8+4+1 = 21\)

mean = \(\frac{\Sigma x}{\Sigma f} = 79 = 3.76\)

**Exercise**

Find the mean for each of the following:

1.

<table>
<thead>
<tr>
<th>x</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>23</td>
<td>41</td>
<td>65</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

2. The goals scored by a football team in 20 matches are:

<table>
<thead>
<tr>
<th>goals</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

3. A company packs disks in boxes of 100. Sixty boxes are examined and the number of faulty disks are counted:

<table>
<thead>
<tr>
<th>Faulty disks</th>
<th>0-2</th>
<th>3-5</th>
<th>6-8</th>
<th>9-11</th>
<th>12-14</th>
<th>15-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of boxes</td>
<td>12</td>
<td>19</td>
<td>14</td>
<td>10</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

(Answers: 13.62, 1.45, 5.9)