Cumulative Frequency Distribution

A cumulative frequency distribution gives the total number of values that fall *below* various

class boundaries of frequency distribution.

Example

The following table shows the frequency distribution of the contents in milliliters of a sample of 25 one liter bottles of soda.

Content	Frequency
970 to less then 990	5
990 to less than 1010	10
1010 to less than 1030	5
1030 to less than 1050	3
1050 to less than 1070	2
	Total no of bottles: 25

The Cumulative Frequency Distribution Table would be as follows:

Content	Cumulative Frequency	Relative Frequency
Less than 990	5	5/25
Less than 1010	5+10 = 15	15/25
Less than 1030	5+10 +5=20	20/25
Less than 1050	3 + 5 + 10 + 5=23	23/25
Less than 1070	2+3+5+10 + 5 = 25	25/25

Measures of Central Tendency

Tables and graphs describe a data set. However, we are also interested in finding a typical numerical value to help us describe a data set. These typical numerical values are called Measures of Central Tendency. And they are the mean (or the average), the median and the mode.

Raw data is ungrouped data. Data represented in the form of a frequency distribution is called grouped data. The measures of central tendency describe both grouped and ungrouped data.

Mean

A **sample mean** refers to the average of a set of data. The **sample mean** can be used to calculate the central tendency, standard deviation and the variance of a data set. The standard deviation and variance will be defined in the next class.

Sample Mean: sum of data values/sample size

If the data is $x_1, x_2, x_3, \dots\dots, x_n$, then the mean $\bar{x}$ is $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1+x_2+\cdots+x_n}{n}$

Example

Uncle Bob wants to know the average age at the party to choose an activity. There will be 6 kids aged 13 and also 5 babies aged 1 year old.
What is the mean?

The sample is 1 ,1, 1, 1, 1, 13, 13, 13, 13, 13, 13

Therefor the mean is: $\bar{x} = \frac{1+1+1+1+1+13+13+13+13+13+13}{11} = \frac{83}{11} = 7.5$

The mean age is 7.5 approximately so he gets a jumping castle. The 13 year old teenagers are embarrassed and the 1 year old babies can't jump.

Median
The median is the middle number when the numbers are sorted (usually in increasing order). So for the above example, the mean:

1 1 1 1 1 ***13*** 13 13 13 13 13

The median is 13 so uncle Bob chooses a disco party!

Sometimes for the median number, there are two middle numbers so you would have to take the average of these two numbers

Example For the data 3, 4, **7**, **9**, 12, 15 , the two middle numbers are 7 and 9. Therefore, the median Is $\frac{7+9}{2} = 8$

Mode
The mode is the number that occurs the most in a data set. For example, in the sample about the age of the party participants, the mode is 13.
In some data sets, you could have more than one mode value. However, the median and mean values are unique values.

Example In his end of the year exam, Joe scored the following:

Science	34%
English	90%
History	87%
Math	34%
Geography	55%

What is the mean, the median and the mode values?

Mean = $\frac{34+90+87+34+55}{5}$ = 60%

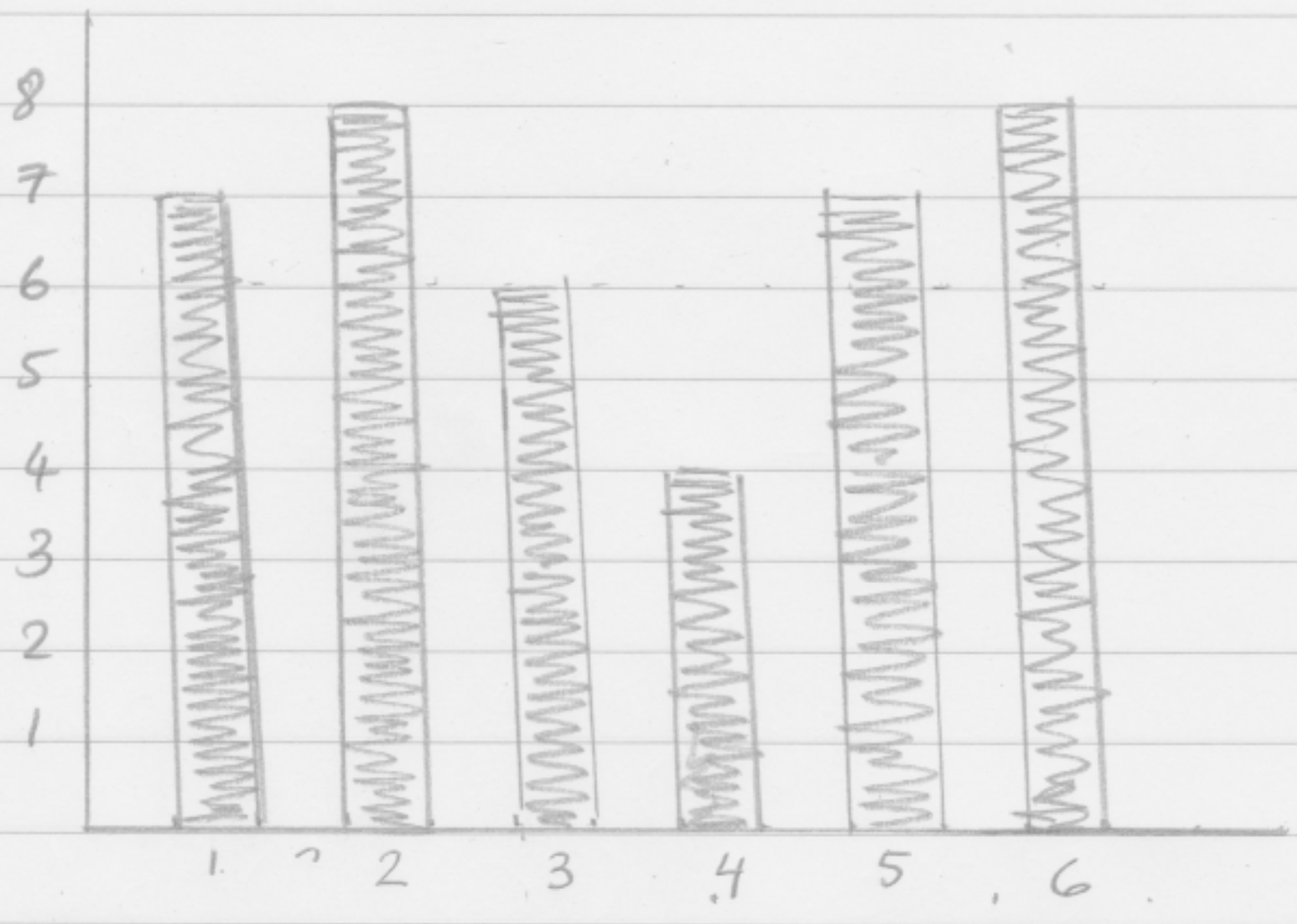
For the median, we would have to sort the data as: 34, 34, 55, 87, 90
The middle number is 55. Therefore, Median= 55%
The mode of the above sample is 34 since it is the only number that occurs twice.

Example
The table below shows the average temperatures for London, England for each month of the year. What is the Mean? Median? And Mode?

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature	38	39	43	46	52	58	62	62	57	51	44	42

The mean is (38+39+43+46+52+58+62+62+57+51+44+42)/12 = 49.5 degrees Fahrenheit
For the Median, we have to sort the numbers as follows: 38, 39, 42, 43, 44, 46, 51, 52, 57, 58, 62, 62
The middle two numbers are 46 and 51. Therefore, the Median= (46+51)/2 = 48.5degrees Fahrenheit
The mode is 62 since it is the only number that occurs twice.

Example Emma rolled a die a number of times and recorded her results in a bar graph



The bar graph shows that Emma scored [1] 7 times, scored [2] 8 times, scored [3] 6 times and so on and so forth.

The number of times that she rolled the die is:

$7+8+6+4+7+8$

And her total score is $7(1)+2(8)+3(6)+4(4)+5(7)+6(8)=140$

$$\text{Mean} = \frac{140}{40} = 3.5$$

1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, (3, 3), 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6

Middle Numbers

$$\Rightarrow \text{Median} = \frac{3+3}{2} = 3$$

Mode = 2 and 6 since they occur the most.