Lesson 4

4.1 Skew & Standard Deviation

Fortune smiles on Lucky Lucy

Example

Over the course of a lucky year, Lucy finds the following lucky seven coins simply sitting on the ground.

10p   2p   1p   5p   2p   1p   £2

(i)   Find the median of her lucky finds.

(ii)   Find the mean of her lucky finds.

(iii)   Find the standard deviation of her lucky finds.

(iv)   Evaluate the skew of the lucky finds, as given by;
$$skew \; = \; \frac{3\,(mean \; - \; median\,)}{standard\;deviation}$$

(v)   Explain what your part **(iv)** answer is telling you about the distribution of the lucky finds.

4.2 Exercise

Question 1
S1 examination question from January 2006, Q1 (edited)

Over a period of time, the number of people x leaving a hotel each morning was recorded. These data are summarised below.

| 27 | 29 | 29 | 32 | 32 | 33 | 35 | 36 | 40 | 41 |

| 44 | 48 | 49 | 52 | 53 | 53 | 56 | 56 | 56 | 58 |

| 60 | 61 | 64 | 65 | 72 | 73 | 81 |

For these data,
(**a**)   write down the mode

[1 mark]

(**b**)   find the values of the three quartiles

[3 marks]

Given that $\Sigma x = 1335$ and $\Sigma x^2 = 71801$, find
(**c**)   the mean and the standard deviation of these data

[4 marks]

One measure of skewness is found using

$$\frac{mean - mode}{standard\ deviation}$$

(**d**)   Evaluate this measure to show that these data are negatively skewed

[2 marks]

(**e**)   Give two other reasons why these data are negatively skewed

[4 marks]

Question 2

S1 examination question from May 2008, Q1 (edited)

The age in years of the residents of two hotels are shown below.

Abbey Hotel

2	11	15	17	19	21	23	28	29	32
33	33	35	36	36	37	39	39	39	39
40	45	47	47	48	49	58			

Balmoral Hotel

26	34	34	37	40	40	45	45	46	49
50	50	50	50	51	53	56	56	57	62
63	63	64	65	67	70	71	75		

For the Balmoral Hotel,

(a)   write down the mode of the age of the residents

[1 mark]

(b)   find the values of the lower quartile, the median and the upper quartile

[3 marks]

(**c**) (**i**) Find the mean, $\bar{x}$, of the age of the residents.

(**ii**) Given that $\Sigma x^2 = 81\ 213$ find the standard deviation of the age of the residents.

[4 marks]

One measure of skewness is found using

$$\frac{mean\ -\ mode}{standard\ deviation}$$

(**d**) Evaluate this measure for the Balmoral Hotel

[2 marks]

For the Abbey Hotel, the mode is 39, the mean is 33.2, the standard deviation is 12.7 and the measure of skewness is − 0.454

(**e**) Compare the two age distributions of the residents of each hotel

[3 marks]

Question 3

S1 examination question from June 2014, Q1 (edited)

A random sample of 35 homeowners was taken from each of the villages Greenslax and Penville and their ages were recorded.   The results are summarised below.

Greenslax

27	28	37	38	39	40	44	44	44	52
52	55	56	56	61	61	62	64	65	66
68	71	71	73	74	76	76	76	78	82
83	84	88	89	94					

Penville

25	25	26	27	28	28	29	31	31	31
32	33	34	34	35	36	37	39	40	41
42	44	47	50	50	55	55	55	62	65
66	66	70	75	99					

Some of the quartiles for these two distributions are given in the table below.

	Greenslax	Penville
Lower quartile, Q_1	a	31
Median, Q_2	64	39
Upper quartile, Q_3	b	55

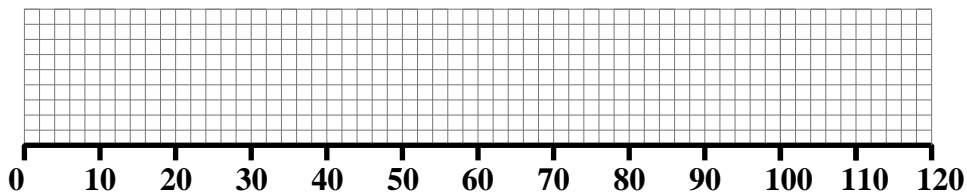(**a**)   Find the value of a and the value of b

[2 marks]

An outlier is a value that falls either

more than $1.5 \times (Q_3 - Q_1)$ above Q_3

or   more than $1.5 \times (Q_3 - Q_1)$ below Q_1

(b)   Draw a box plot to represent the data from Penville.
Show clearly any outliers.

[4 marks]

(c)   State the skewness of each distribution.
Justify your answers.

[3 marks]