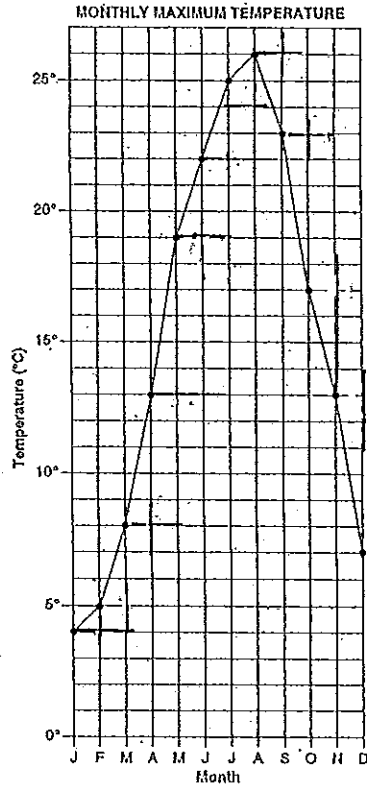


YEAR 10 ADV MATHS (CHALLENGE)

11/6/04  
STATISTICS

1. The graph below shows the monthly maximum temperatures in Tokyo.



(i) What is the range of the monthly maximum temperatures?

(ii) Find the mean and standard deviation of the monthly maximum temperatures. ldp

2. The prices of houses sold one month by a real estate agent are...  
\$250,000, \$280,000, \$240,000, \$300,000, \$290,000, \$550,000 ldp

a Calculate the i mean ii median price

b Which of these measures (mean or median) is the most appropriate average to use for these prices? Give reasons.

3. Melanie scored 67 in a Science test in which the mean was 56 and the standard deviation 11. In an English test, for which the mean was 54 and the standard deviation 8, she scored 60.

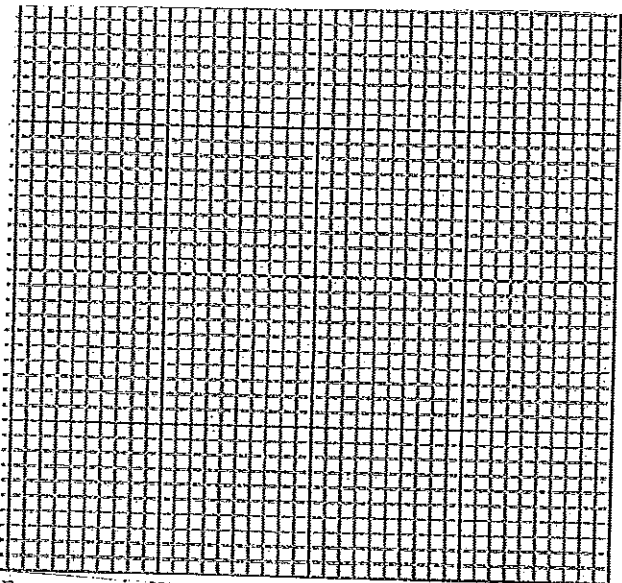
a In which subject did she perform better, given that the classes are of equal ability?

b What mark would Melanie have to have scored in English for her performance to be equivalent to that in Science?

In an experiment, two dice were thrown forty times and the total score in each case was recorded, as shown in the table.

Score	Frequency	Cumulative frequency
2	1	
3	2	
4	2	
5	2	
6	5	
7	7	
8	5	
9	5	
10	9	
11	1	
12	1	

- (i) Complete the cumulative frequency column.
- (ii) Using the graph paper below, draw on the same diagram a cumulative frequency histogram and a cumulative frequency polygon.



- (iii) From your graph, estimate the median and the interquartile range of the scores.

5. The heights in centimetres of a sample of 25 girls in New South Wales are recorded in 7 classes in the table below.

Height range (cm)	Midpoint (cm)	Frequency
140-149	144.5	1
150-159	154.5	11
160-169	164.5	9
170-179	174.5	-----
180-189	184.5	1
190-199	194.5	0
200-209	204.5	1

- (i) The frequency for the 170-179 cm-class is missing. How do we know it must be 2?
- (ii) What is the modal class?
- (iii) Calculate the mean.
- (iv) Calculate the standard deviation.

6. The Cavetto Pasta Company employs seventy people.

The annual income of the employees is shown in the frequency distribution table below.

Annual income \$	Class centre $x$	Number of employees $f$	$fx$
10 000-19 999	15 000	16	240 000
20 000-29 999	25 000	24	600 000
30 000-39 999	35 000	11	A
40 000-49 999	45 000	9	405 000
50 000-59 999	55 000	7	385 000
60 000-69 999	65 000	3	195 000
		$\Sigma f = 70$	$\Sigma fx =$

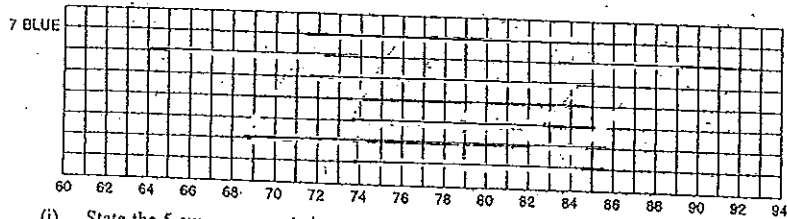
- (i) Calculate the value of A in the  $fx$  column.
- (ii) Calculate  $\Sigma fx$ .
- (iii) Determine the mean annual income.
- (iv) In which annual income class does the median of this distribution lie?
- (v) Using the information in the table and your calculator, find the standard deviation of this distribution.
- (vi) Cavetto Pasta wish to employ another eight people. Four of these new employees will earn \$15 000 p.a. each, and the other four will earn \$65 000 p.a. each.

What will be the effect of these new employees on the standard deviation of income distribution at Cavetto Pasta? Give a brief reason for your answer.

7. The table below shows test results for students in two ungraded classes.

7 Blue	68	78	85	89	80	76	65	83
7 Green	69	76	84	82	82	72	76	83

The box-and-whisker plot drawn is for 7 Blue.



- (i) State the 5 summary statistics required to draw the box-and-whisker plot for 7 Green.

- (ii) On the same grid as 7 Blue, draw a box-and-whisker plot for 7 Green.  
 (iii) Based on these test results, are the two classes of equal ability? Justify your answer by referring to shape, spread and location of the two sets of data.

8. The scores below represent quiz results for a Latin class of 12 students on a Pre-test and Post-test.

Pre-test: 0 1 5 7 8 10 10 11 11 13 15 20  
 Post-test: 10 11 12 12 16 19 21 25 27 29 29 30

- (i) Display the data in a back-to-back stem-and-leaf plot, using the stem given.

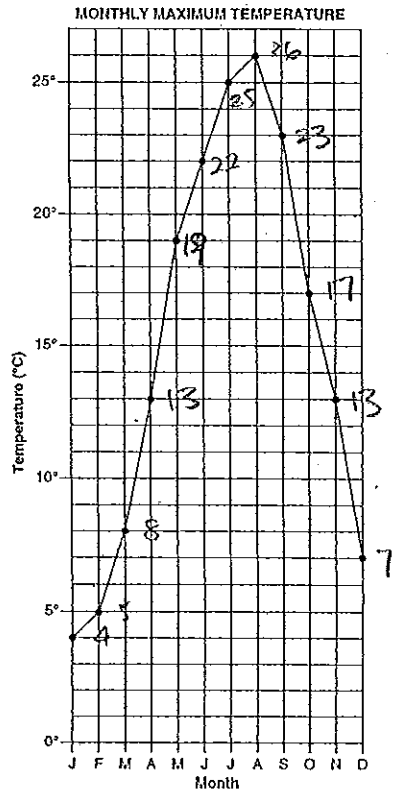
Pre-test	Stem	Post-test
	0	
	1	
	2	
	3	

- (ii) Between the pre-test and the post-test, the Latin teacher used a new series of practice exercises. Is she justified in thinking that the exercises improved the performance of the students on the post-test? Consider location, spread, and shape of the data to help justify your answer.

The weights of a large sample of 18 year old males is normally distributed with a mean of 74 kg and standard deviation of 6.5 kg. Between what limits would you expect the weights of

- a. the middle 68% of these males to lie  
 b. the middle 95% of these males to lie

1. The graph below shows the monthly maximum temperatures in Tokyo.



(i) What is the range of the monthly maximum temperatures?

$26 - 4 = 22$

1/1

(ii) Find the mean and standard deviation of the monthly maximum temperatures. (1dp)

mean = 15.2 (1dp)  
s.d = 7.6 (1dp)

2/2

Page 1

2. The prices of houses sold one month by a real estate agent are:  
\$250,000, \$280,000, \$240,000, \$300,000, \$290,000, \$550,000 (1dp)

a Calculate the i) mean ii) median price

i) \$ 318 333.30 ✓

ii) \$285000 ✓

240 000, 250 000, 290 000, 290 000, 300 000, 550 000  
2

b Which of these measures (mean or median) is the most appropriate average to use for these prices? Give reasons.

The median because most of the prices are around the median price there is also an outlier of \$550,000 which is not close to the rest of the scores.

2/2

3. Melanie scored 67 in a Science test in which the mean was 56 and the standard deviation, 11. In an English test, for which the mean was 54 and the standard deviation 8, she scored 60.

a In which subject did she perform better, given that the classes are of equal ability?

$z = \frac{x - \bar{x}}{\sigma}$  (science)

$= \frac{67 - 56}{11}$

$z = 1$

$z = \frac{x - \bar{x}}{\sigma}$  (english)

$= \frac{60 - 54}{8}$

$z = 0.75$

She performed better in science.

Science  $\bar{x} = 56$ ,  $\sigma = 11$   
English  $\bar{x} = 54$ ,  $\sigma = 8$

2/2

b What mark would Melanie have to have scored in English for her performance to be equivalent to that in Science?

$1 = \frac{x - 54}{8}$

$8 = x - 54$

$62 = x$

she would have to score 62.

2/2

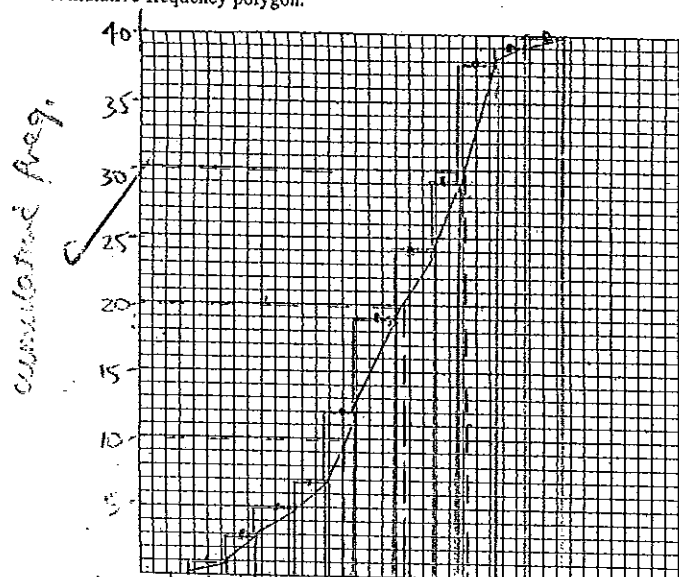
11/11

In an experiment, two dice were thrown forty times and the total score in each case was recorded, as shown in the table.

Score	Frequency	Cumulative frequency
2	1	1
3	2	3
4	2	5 ✓
5	2	7
6	5	12 ✓
7	7	19 ✓
8	5	24 ✓
9	5	29
10	9	38 ✓
11	1	39 ✓
12	1	40

(i) Complete the cumulative frequency column.

(ii) Using the graph paper below, draw on the same diagram a cumulative frequency histogram and a cumulative frequency polygon.



(iii) From your graph, estimate the median and the interquartile range of the scores.  
 $\bar{x} = 8$   
 9.5 - 6  
 ∴ interquartile range = 3.5

5. The heights in centimetres of a sample of 25 girls in New South Wales are recorded in 7 classes in the table below.

Height range (cm)	Midpoint (cm)	Frequency
140-149	144.5	1
150-159	154.5	11
160-169	164.5	9
170-179	174.5	-----
180-189	184.5	1
190-199	194.5	0
200-209	204.5	1

- (i) The frequency for the 170-179 cm class is missing. How do we know it must be 2? It must be 2 because the freq. column must equal 25. (25 girls in the sample). ∴  $25 - 23 = 2$
- (ii) What is the modal class?  
160-169 ✓
- (iii) Calculate the mean.  
162.5 ✓
- (iv) Calculate the standard deviation.  
12 ✓

6. The Cavetto Pasta Company employs seventy people.

The annual income of the employees is shown in the frequency distribution table below.

Annual income \$	Class centre x	Number of employees f	fx
10 000-19 999	15 000	16	240 000
20 000-29 999	25 000	24	600 000
30 000-39 999	35 000	11	A 385 000
40 000-49 999	45 000	9	405 000
50 000-59 999	55 000	7	385 000
60 000-69 999	65 000	3	195 000
		$\Sigma f = 70$	$\Sigma fx =$

- (i) Calculate the value of A in the fx column.  
A = 385 000 ✓
- (ii) Calculate  $\Sigma fx$ .  
 $\Sigma fx = 2210000$  ✓
- (iii) Determine the mean annual income.  
\$31571.43 ✓
- (iv) In which annual income class does the median of this distribution lie?  
\$20000 - \$29999 ✓
- (v) Using the information in the table and your calculator, find the standard deviation of this distribution.  
14331.4 (1 dp) ✓
- (vi) Cavetto Pasta wish to employ another eight people. Four of these new employees will earn \$15000 p.a. each, and the other four will earn \$65000 p.a. each.  
What will be the effect of these new employees on the standard deviation of income distribution at Cavetto Pasta? Give a brief reason for your answer.

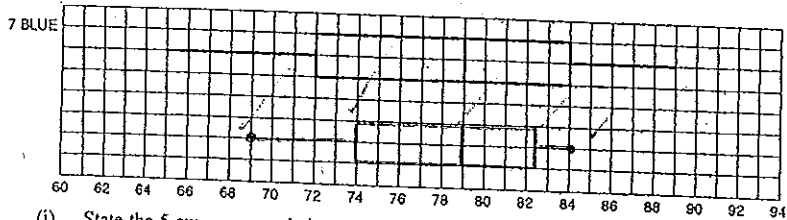
17/17

7. The table below shows test results for students in two ungraded classes.

7 Blue	68	78	85	89	80	76	65	83
7 Green	69	76	84	82	82	72	76	83

69 72 76 76 82 82 83 84

The box-and-whisker plot drawn is for 7 Blue.



(i) State the 5 summary statistics required to draw the box-and-whisker plot for 7 Green.

Lowest score = 69 ✓

Highest score = 84 ✓

Lower Quartile = 74 ✓

Median = 79 ✓

Upper Quartile = 82.5 ✓

(ii) On the same grid as 7 Blue, draw a box-and-whisker plot for 7 Green.

(iii) Based on these test results, are the two classes of equal ability? Justify your answer by referring to shape, spread and location of the two sets of data.

7 Blue had a larger spread of results than 7 Green. Both classes had the same median and 7 Green's results were more clustered than 7 Blue.

5/5  
4/1  
2/1/2

8. The scores below represent quiz results for a Latin class of 12 students on a Pre-test and Post-test.

Pre-test: 0 1 5 7 8 10 10 11 11 13 15 20  
Post-test: 10 11 12 12 16 19 21 25 27 29 29 30

(i) Display the data in a back-to-back stem-and-leaf plot, using the stem given.

Pre-test	Stem	Post-test
87510	0	
531100	1	012269
0	2	15799
	3	0

(ii) Between the pre-test and the post-test, the Latin teacher used a new series of practice exercises. Is she justified in thinking that the exercises improved the performance of the students on the post-test? Consider location, spread, and shape of the data to help justify your answer.

Yes because there wasn't anyone who scored between 0-9 in the post-test showing an improvement compared to the pre-test where 5 students scored between 0-9. In the pre-test, the scores were clustered around the 0-19 area whereas the clustered area in the post test was around 10-29 area. In the pre-test, no one scored in the 30 area whereas 1 person scored 30 in the post test.

The weights of a large sample of 18 year old males is normally distributed with a mean of 74 kg and standard deviation of 6.5 kg. Between what limits would you expect the weights of

a the middle 68% of these males to lie

67.5 to 80.5 ✓

b the middle 95% of these males to lie

61 to 87 ✓

2/1

2/1

1/1

1/1  
14/14