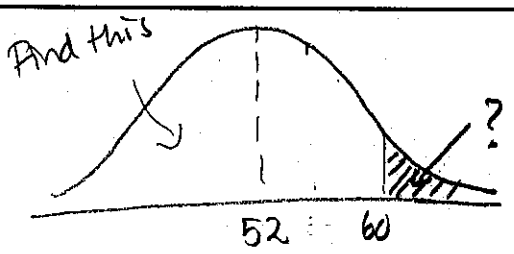
Stress test - topic 2 and 4

1a. *[2 marks]*

Malthouse school opens at 08:00 every morning.

The daily arrival times of the 500 students at Malthouse school follow a normal distribution. The mean arrival time is 52 minutes after the school opens and the standard deviation is 5 minutes.

Find the probability that a student, chosen at random arrives at least 60 minutes after the school opens.



$\sigma = 5$ min

$P(X > 60)$

$P(X < 60) = 0.945\ldots$

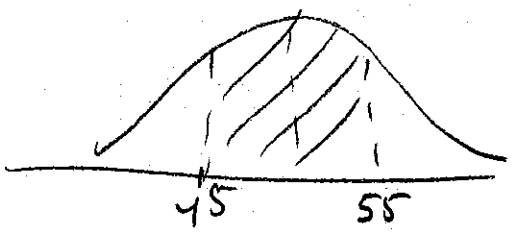
$P(X > 60) = 1 - 0.945\ldots = 0.0548$

calc. 2nd distr 2: normalcdf enter
(-E99, 60, 52, 5) enter ($\Rightarrow 0.945\ldots$)
1 - 2nd ans

1b. *[2 marks]*

Find the probability that a student, chosen at random arrives between 45 minutes and 55 minutes after the school opens.

$P(45 < X < 55) = 0.645$



[calc 2nd distr 2: normalcdf enter
(45, 55, 52.5) enter]

1c. *[2 marks]*

A second school, Mulberry Park, also opens at 08:00 every morning. The arrival times of the students at this school follows exactly the same distribution as Malthouse school.

Given that, on one morning, 15 students arrive at least 60 minutes after the school opens, estimate the number of students at Mulberry Park school.

(5.48% out of the total number of students is equal to 15)

$0.0548 \times X = 15$

$X = \frac{15}{0.0548}$ $X = 274$

2a. *[2 marks]*

Each month the number of days of rain in Cardiff is recorded.
The following data was collected over a period of 10 months.

11 13 8 11 8 7 8 14 *x* 15

For these data the **median** number of days of rain per month is 10.

Find the value of *x*.

median without x

7 8 8 8 11 11 13 14 15

x must be (9) to get a median = 10
(If x is "to the right" median will be 11)
(If x is "to the left" median becomes 9.5)

2b. *[2 marks]*

Find the standard deviation

2.69
(calc: stat, 1:edit, in L1: 7 8 8 8 9 11 11 13 14 15, stat→calc
1 varstat, enter, 2nd L1 enter. Look at σ-sign)

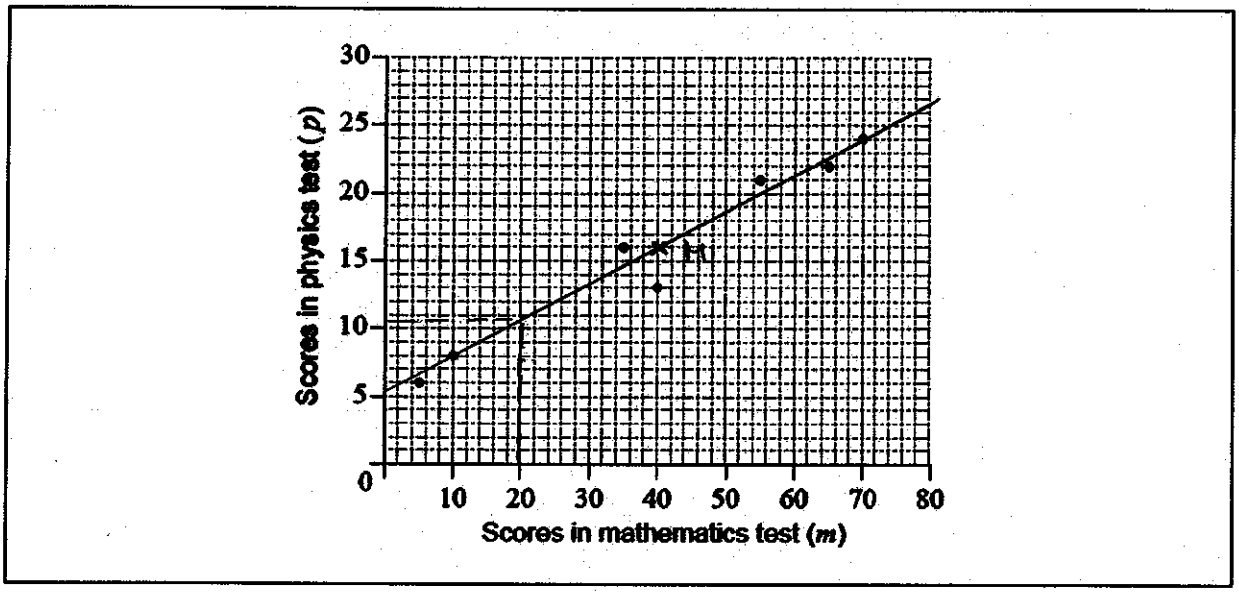
2c. *[2 marks]*

Find the interquartile range.

IQR = 13 − 8 = 5
(Find UQ and LQ in the same list as above)

3a. *[2 marks]*

The following scatter diagram shows the scores obtained by seven students in their mathematics test, m, and their physics test, p.



The mean point, M, for these data is (40, 16).

Plot and label the point $M(\bar{m}, \bar{p})$ on the scatter diagram.

3b. *[2 marks]*

Draw the line of best fit, by eye, on the scatter diagram. (Must go through M and extended to the y-axis)

USE RULER!

3c. *[2 marks]*

Using your line of best fit, estimate the physics test score for a student with a score of 20 in their mathematics test.

10.5 (use ruler, show in the diagram)

4a. *[1 mark]*

On one day 180 flights arrived at a particular airport. The distance travelled and the arrival status for each incoming flight was recorded. The flight was then classified as on time, slightly delayed, or heavily delayed.

The results are shown in the following table.

		Distance travelled			
		At most 500 km	Between 500 km and 5000 km	At least 5000 km	TOTAL
Arrival Status	On time	19	17	16	52
	Slightly delayed	13	18	14	45
	Heavily delayed	28	15	40	83
	TOTAL	60	50	70	180

A χ^2 test is carried out at the 10 % significance level to determine whether the arrival status of incoming flights is independent of the distance travelled.

State the alternative hypothesis.

The arrival status and the distance travelled are dependent classifications

4b. *[2 marks]*

Calculate the expected frequency of flights travelling at most 500 km and arriving slightly delayed.

$\frac{60 \times 45}{180} = 15$

4c. *[1 mark]*

Write down the number of degrees of freedom.

$(3-1)(3-1) = 2 \times 2 = 4$

4d. *[2 marks]*

Write down the χ^2 statistic.

$\chi^2_{calc} = 9.55$

4h. *[2 marks]*

Given that this flight was not heavily delayed, find the probability that it travelled between 500 km and 5000 km.

$\frac{35}{180}$ $(17+18=35)$

4i. *[3 marks]*

Two flights are chosen at random from those which were slightly delayed. (45)

Find the probability that each of these flights travelled at least 5000 km.

$\frac{14}{45} \times \frac{13}{44} = \frac{91}{990}$

(calc : $(14 \div 45) \times (13 \div 44)$ enter math frac enter)

4e. *[1 mark]*

Write down the associated p-value.

0.0488

4f. *[2 marks]*

The critical value for this test is 7.779.

State, with a reason, whether you would reject the null hypothesis.

Reject H_0 (The classifications are dependent)

1. Since $\chi^2_{calc} > \chi^2_{critical} \Rightarrow 9.55 > 7.779$

2. P-value < significant level $0.0488 < 0.1$

4g. *[2 marks]*

A flight is chosen at random from the 180 recorded flights. Write down the probability that this flight arrived on time.

$\frac{52}{180}$