A-Level Applied Mathematics
Statistics Revision

GRADE GRABBER STATISTICS

(With answers)

A-Level Applied Mathematics

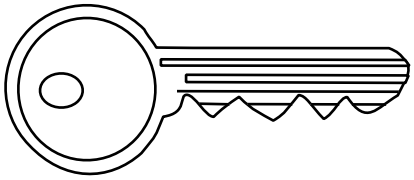
Grade Grabber 1

Statistics Revision

Total Marks : 30

Question 1

When moving into his new house, Charlie is given a box containing eight similar keys. He has been told that three of them will open his front door.



Desparate for a cup of tea, Charlie tries the keys one by one, throwing away any that don't open the door ! What is the probability that Charlie gets into his house before having to try a fourth key ? Give your answer to three decimal places.

[3 marks]

Question 2

A potato crisp manufacturer claims to offers a prize in 5 out of every 15 packets sold.

(i) Matilda buys 40 packets of these crisps.
Let X be the number of packets of Matilda's crisps that contain a prize.
Give three conditions that X satisfies and which will, in consequence, allow X to be modelled as a binomial distribution.

[3 marks]

(ii) After opening all 40 packets, Matilda is disappointed to have only nine prizes. She writes a letter of complaint to trading standards.
Trading standards decides to carry out a hypothesis test at the 5% significance level to determine if Matilda's complaint is justified.
State the null and alternative hypothesis, and determine what the outcome of the hypothesis test will be.

[5 marks]

Question 3

A shoe maker believes that there is a relationship between width, w mm and length, l mm, of adult human feet. A random sample of size 10 is taken from a shoe shop and the relevant data is presented in the table below.

w (mm)	96	99	104	90	94	105	98	96	90	104
l (mm)	213	214	216	205	210	212	216	203	193	217

The shoe maker plans to use a linear regression model based on these data and interpolate or extrapolate as necessary to estimate the length of other human feet from their width.

(a) **(i)** Explain what is meant by interpolation

[1 mark]

(ii) Explain the dangers of interpolation

[1 mark]

The shoe maker attempts to calculate r, the product moment correlation coefficient, and obtains a value of 2.04

(b) Explain how he should know that this is incorrect without carrying out any further calculations.

[1 mark]

(c) Use your calculator to find the correct value of the product moment correlation coefficient, r.

[1 mark]

(d) Stating your hypothesis clearly test, at the 1% significance level, whether or not there is evidence that the product moment correlation coefficient for the population is positive.

[3 marks]

(e) Explain what your test in part (d) suggests about adult human feet

[1 mark]

Question 4

A firework manufacture produces Big Bang™ rockets and the metal boxes used to store and safely transport them to festivals. A Big Bang™ rocket has a length which is normally distributed with mean 23 cm and standard deviation 0.5 cm.

The metal boxes are, internally, 23.8 cm long. Six random Big Bang™ rockets are placed by a machine into each box. If any Big Bang™ rocket does not fit into the box the rocket will be damaged and health and safety regulations state that neither it nor any of the other Big Bang™ rockets in the box may be used. Instead the entire box and all rockets it contains must be returned for a replacement.

(i) What is the probability of a Big Bang™ rocket being damaged when it is being placed into its box ?
Assume that the internal length of the box is exactly 23.8 cm.

[2 marks]

(ii) What is the probability of all six Big Bang™ rockets NOT being damaged when they are placed into their box ?

[2 marks]

(iii) What is the probability that a box has to be returned because is contains Big Bang™ rockets that were dameaged when they were placed in their box ?

[1 mark]

(iv) Every working day, 800 metal boxes are shipped.
Using a normal distribution approximation, estimate the probability that more than 225 boxes will contain damaged Big Bang™ rockets and so will be returned.

[4 marks]

(v) Based on your calculations, what advice or recommendations would you give the firework manufacturer ?
Give reasoning for your anser.

[2 mark]