

Goodness of Fit Tests (Year 1) (From OCR 4768)

Q1, (Jun 2010, Q3b)

Benford's Law predicts the following probability distribution for the first significant digit in some large data sets.

Digit	1	2	3	4	5	6	7	8	9
Probability	0.301	0.176	0.125	0.097	0.079	0.067	0.058	0.051	0.046

On one particular day, the first significant digits of the stock market prices of the shares of a random sample of 200 companies gave the following results.

Digit	1	2	3	4	5	6	7	8	9
Frequency	55	34	27	16	15	17	12	15	9

Test at the 10% level of significance whether Benford's Law provides a reasonable model in the context of share prices. [7]

Q2, (Jan 2013, Q4b)

A calculator has a built-in random number function which can be used to generate a list of random digits. If it functions correctly then each digit is equally likely to be generated. When it was used to generate 100 random digits, the frequencies of the digits were as follows.

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	6	8	11	14	12	9	15	5	14	6

Use a goodness of fit test, with a significance level of 10%, to investigate whether the random number function is generating digits with equal probability. [8]

Q3, (Jun 2016, Q2a)

A genetic model involving body colour and eye colour of fruit flies predicts that offspring will consist of four phenotypes in the ratio 9:3:3:1.

A random sample of 200 such offspring is taken. Their phenotypes are found to be as follows.

Phenotype	Brown body Red eye	Brown body Brown eye	Black body Red eye	Black body Brown eye
Frequency	125	37	32	6
Relative proportion from model	9	3	3	1

Carry out a test, using a 2.5% level of significance, of the goodness of fit of the genetic model to these data. [9]

Q4, (Jun 2017, Q2ii)

In a different round of the contest, the judges were instructed to award only integer marks between 3 and 10 inclusive. One of the organisers believes that the eight possible marks are equally likely to be awarded. To check this he obtains the following random sample of 80 marks awarded.

Mark	3	4	5	6	7	8	9	10
Frequency	5	6	10	9	14	16	14	6

Carry out a goodness of fit test, with a significance level of 10%, to investigate the organiser's belief. **[8]**

Q5, (OCR 4734, Jun 2014, Q2)

In a study of the inheritance of skin colouration in corn snakes, a researcher found 865 snakes with black and orange bodies, 320 snakes with black bodies, 335 snakes with orange bodies and 112 snakes with bodies of other colours. Theory predicts that snakes of these colours should occur in the ratios 9:3:3:1. Test, at the 5% significance level, whether these experimental results are compatible with theory. **[6]**

Q6, (OCR 4734, Jun 2012, Q7i)

A study was carried out into whether patients suffering from a certain respiratory disorder would benefit from particular treatments. Each of 90 patients who agreed to take part was given one of three treatments *A*, *B* or *C* as shown in the table.

Treatment	<i>A</i>	<i>B</i>	<i>C</i>
Number in group	31	25	34

- (i) It is claimed that each patient was equally likely to have been given any of the treatments. Test at the 5% significance level whether the numbers given each treatment are consistent with this claim. **[6]**
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