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| **Pearson Edexcel Level 3** |
| **GCE Further Mathematics** **Advanced Subsidiary** **Paper 2: Further Mathematics options****Option 2E: Further Statistics 1**  |
| **Sample assessment material for first teaching September 2017** **Time: 40 minutes** | **Paper Reference(s)** |
| **8FM0/2E** |
| **You must have:** **Mathematical Formulae and Statistical Tables** **Calculator** |

**Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

**Instructions**

• Use black ink or ball-point pen.

• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).

• Fill in the boxes at the top of this page with your name, centre number and candidate number.

• Answer all the questions and ensure that your answers to parts of questions are clearly labelled.

• Answer the questions in the spaces provided – there may be more space than you need.

• You should show sufficient working to make your methods clear. Answers without working may not gain full credit.

• Inexact answers should be given to three significant figures unless otherwise stated.

**Information**

• A booklet ‘Mathematical Formulae and Statistical Tables’ is provided.

• There are 8 questions in this question paper. The total mark for this paper is 80.

• The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

**Advice**

• Read each question carefully before you start to answer it.

• Try to answer every question.

• Check your answers if you have time at the end.

 • If you change your mind about an answer, cross it out and put your new answer and any working underneath.

**SECTION A**

**Answer ALL questions.**

**1.** A university foreign language department carried out a survey of prospective students to find out which of three languages they were most interested in studying.

A random sample of 150 prospective students gave the following results.

|  |  |  |
| --- | --- | --- |
|  |  | **Language** |
|  |  | **French** | **Spanish** | **Mandarin** |
| **Gender** | **Male** | 23 | 22 | 20 |
| **Female** | 38 | 32 | 15 |

A test is carried out at the 1% level of significance to determine whether or not there is an association between gender and choice of language.

(*a*) State the null hypothesis for this test.

**(1)**

(*b*) Show that the expected frequency for females choosing Spanish is 30.6.

**(1)**

(*c*) Calculate the test statistic for this test, stating the expected frequencies you have used.

**(3)**

(*d*) State whether or not the null hypothesis is rejected. Justify your answer.

**(2)**

(*e*) Explain whether or not the null hypothesis would be rejected if the test was carried
out at the 10% level of significance.

**(1)**

**(Total for Question 1 is 11 marks)**

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**2.** The discrete random variable *X* has probability distribution given by

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | –1 | 0 | 1 | 2 | 3 |
| P(*X* = *x*) | *c* | *a* | *a* | *b* | *c* |

The random variable *Y* = 2 – 5*X*

Given that E(*Y*) = – 4 and P( *Y*  ≥ –3) = 0.45

(*a*) find the probability distribution of *X*.

**(7)**

Given also that E(*Y* 2) = 75

(*b*) find the exact value of Var (*X*)

**(2)**

(*c*) Find P(*Y* > *X*)

**(2)**

**(Total for Question 2 is 11 marks)**

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**3.** Two car hire companies hire cars independently of each other.

Car Hire A hires cars at a rate of 2.6 cars per hour.

Car Hire B hires cars at a rate of 1.2 cars per hour.

(*a*) In a one-hour period, find the probability that each company hires exactly 2 cars.

**(2)**

(*b*) In a one-hour period, find the probability that the total number of cars hired by the two companies is 3.

**(2)**

(*c*) In a two-hour period, find the probability that the total number of cars hired by the two companies is less than 9.

**(2)**

On average, 1 in 250 new cars produced at a factory has a defect.

In a random sample of 600 new cars produced at the factory,

(*d*) (i) find the mean of the number of cars with a defect,

 (ii) find the variance of the number of cars with a defect.

**(2)**

(*e*) (i) Use a Poisson approximation to find the probability that no more than 4 of the
cars in the sample have a defect.

 (ii) Give a reason to support the use of a Poisson approximation.

**(2)**

 **(Total for Question 3 is 10 marks)**

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**4.** The discrete random variable *X* follows a Poisson distribution with mean 1.4.

(*a*) Write down the value of

1. P(*X* = 1)

 (ii) P(*X* ≤ 4)

**(2)**

The manager of a bank recorded the number of mortgages approved each week over
a 40 week period.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of mortgages approved** | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| **Frequency** | 10 | 16 | 7 | 4 | 2 | 0 | 1 |

(*b*) Show that the mean number of mortgages approved over the 40 week period is 1.4.

**(1)**

The bank manager believes that the Poisson distribution may be a good model for the number of mortgages approved each week.

She uses a Poisson distribution with a mean of 1.4 to calculate expected frequencies as follows.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Number of mortgages approved** | 0 | 1 | 2 | 3 | 4 | 5 or more |
| **Expected frequency** | 9.86 | *r* | 9.67 | 4.51 | 1.58 | *s* |

(*c*) Find the value of *r* and the value of *s*, giving your answers to 2 decimal places.

**(2)**

The bank manager will test, at the 5% level of significance, whether or not the data can be modelled by a Poisson distribution.

(*d*) Calculate the test statistic and state the conclusion for this test. State clearly the degrees of freedom and the hypotheses used in the test.

**(6)**

**(Total for Question 4 is 11 marks)**

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**TOTAL FOR SECTION A IS 40 MARKS**

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**TOTAL FOR PAPER IS 80 MARKS**