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| date Number               | Candidate    | Centre Number | Pearson Edexcel International Advanced Level |
|                           |              |               | Statistics Advanced/Advance                  |
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| eference<br><b>T02/01</b> | Paper Refere |               | Sample Assessment Mate                       |
|                           |              |               | Sample Assessment Mate                       |

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra 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). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer all 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.
- Values from the statistical tables should be quoted in full. When a calculator is used, the answer should be given to an appropriate degree of accuracy.

## Information

- The total mark for this paper is 75.
- 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.

Turn over ▶

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|   | Explain what you understand by                                                                                                                                                    |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | (a) a population,                                                                                                                                                                 |
|   | (1)                                                                                                                                                                               |
|   | (b) a statistic.                                                                                                                                                                  |
|   | (1)                                                                                                                                                                               |
|   | A researcher took a sample of 100 voters from a certain town and asked them who they would vote for in an election. The proportion who said they would vote for Dr Smith was 35%. |
|   | (c) State the population and the statistic in this case.                                                                                                                          |
|   | (2)                                                                                                                                                                               |
|   | (d) Explain what you understand by the sampling distribution of this statistic. (1)                                                                                               |
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| 2. | Bhim and Joe play each other at badminton and for each game, independently of all others, the probability that Bhim loses is 0.2                          |   |
|    | Find the probability that, in 9 games, Bhim loses                                                                                                         |   |
|    | (a) exactly 3 of the games, (3)                                                                                                                           |   |
|    | (b) fewer than half of the games. (2)                                                                                                                     |   |
|    | Bhim attends coaching sessions for 2 months. After completing the coaching, the probability that he loses each game, independently of all others, is 0.05 |   |
|    | Bhim and Joe agree to play a further 60 games.                                                                                                            |   |
|    | (c) Calculate the mean and variance for the number of these 60 games that Bhim loses. (2)                                                                 |   |
|    | (d) Using a suitable approximation calculate the probability that Bhim loses more than 4 games.                                                           |   |
|    | (3)                                                                                                                                                       |   |
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| A rectangle has a perimeter of 20 cm. The length, $X$ cm, of one side    | of this rectangle is |
|--------------------------------------------------------------------------|----------------------|
| uniformly distributed between 1 cm and 7 cm.                             |                      |
| Find the probability that the length of the longer side of the rectangle | is more than 6 cm    |
| long.                                                                    |                      |
|                                                                          | (5)                  |
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**4.** The lifetime, X, in tens of hours, of a battery has a cumulative distribution function F(x) given by

$$F(x) = \begin{cases} 0 & x < 1 \\ \frac{4}{9}(x^2 + 2x - 3) & 1 \le x \le 1.5 \\ 1 & x > 1.5 \end{cases}$$

(a) Find the median of X, giving your answer to 3 significant figures.

(3)

(b) Find, in full, the probability density function of the random variable X.

(3)

(c) Find  $P(X \ge 1.2)$ 

**(2)** 

A camping lantern runs on 4 batteries, all of which must be working. Four new batteries are put into the lantern.

(d) Find the probability that the lantern will still be working after 12 hours.

**(2)** 

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| 5. A company has a large number of regular users logging onto its website. On average 4 users every hour fail to connect to the company's website at their first attempt.                                               |    |
| (a) Explain why the Poisson distribution may be a suitable model in this case. (1)                                                                                                                                      |    |
| Find the probability that, in a randomly chosen 2 hour period,                                                                                                                                                          |    |
| (b) (i) all users connect at their first attempt,                                                                                                                                                                       |    |
| (ii) at least 4 users fail to connect at their first attempt. (5)                                                                                                                                                       |    |
| The company suffered from a virus infecting its computer system. During this infection it was found that the number of users failing to connect at their first attempt, over a 12 hour period, was 60.                  |    |
| (c) Using a suitable approximation, test whether or not the mean number of users per hour who failed to connect at their first attempt had increased. Use a 5% level of significance and state your hypotheses clearly. |    |
| (9)                                                                                                                                                                                                                     |    |
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| A company claims that a quarter of the bolts sent to them are faulty. To test this clanumber of faulty bolts in a random sample of 50 is recorded.                                                                                       | nim the        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| (a) Give two reasons why a binomial distribution may be a suitable model for the n of faulty bolts in the sample.                                                                                                                        | number         |
|                                                                                                                                                                                                                                          | (2)            |
| (b) Using a 5% significance level, find the critical region for a two-tailed test hypothesis that the probability of a bolt being faulty is $\frac{1}{4}$ . The probability of re in either tail should be as close as possible to 0.025 |                |
|                                                                                                                                                                                                                                          | (0)            |
| (c) Find the actual significance level of this test.                                                                                                                                                                                     | (2)            |
| In the sample of 50 the actual number of faulty bolts was 8.                                                                                                                                                                             |                |
| (d) Comment on the company's claim in the light of this value. Justify your answer                                                                                                                                                       | er. <b>(2)</b> |
| The machine making the bolts was reset and another sample of 50 bolts was Only 5 were found to be faulty.                                                                                                                                | taken.         |
| (e) Test at the 1% level of significance whether or not the probability of a faulty b decreased. State your hypotheses clearly.                                                                                                          | olt has        |
|                                                                                                                                                                                                                                          | (6)            |
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7. The random variable Y has probability density function f(y) given by

$$f(y) = \begin{cases} ky(a-y) & 0 \le y \le 3\\ 0 & \text{otherwise} \end{cases}$$

where k and a are positive constants.

- (a) (i) Explain why  $a \ge 3$ 
  - (ii) Show that  $k = \frac{2}{9(a-2)}$

(6)

Given that E(Y) = 1.75

(b) show that a = 4 and write down the value of k.

**(6)** 

For these values of a and k,

(c) sketch the probability density function,

**(2)** 

(d) write down the mode of Y.

**(1)** 

| Question 7 continued | Leav<br>blan |
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