

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

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## Pearson Edexcel Level 3 GCE

Time 2 hours

Paper  
reference

**9ST0/03**

### Statistics

Advanced

**PAPER 3: Statistics in Practice**

**You must have:**

Statistical formulae and tables booklet  
Calculator

Total Marks

**Candidates may use any calculator allowed by Pearson regulations.  
Calculators must not 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** 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.
- Unless otherwise stated, inexact answers should be given to three significant figures.
- Unless otherwise stated, statistical tests should be carried out at the 5% significance level.

### Information

- A booklet 'Statistical formulae and tables' is provided.
- There are 6 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.

Turn over ►

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Q:1/1/1/1/1/1/



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Answer ALL questions. Write your answers in the spaces provided.

- 1 Following an illness, patients might need therapy in order to help improve their balance. The therapy offered is called standard balance training.

Giovanni, a physiotherapist, thinks that his patients may be helped further by using a video game designed to improve balance.

He designs an experiment to test his theory.

He randomly assigns patients to one of two groups.

One group receives a course of therapy including standard balance training and the video game. The other group receives only standard balance training.

- (a) State which of the two groups described above is the **control** group.

(1)

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- (b) Explain, in context, why Giovanni **randomly** assigns each patient to one of the two groups.

(1)

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- (c) Explain why Giovanni's experiment design is not double-blind.

(1)

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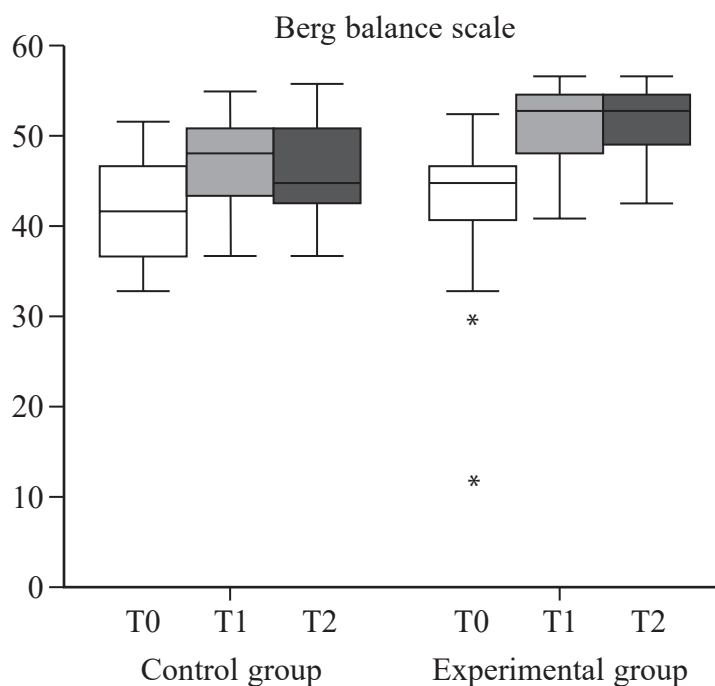
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### Question 1 continued

At the start of the therapy (T0), Giovanni measures the patients' ability to balance using the "Berg balance scale".

He repeats this measure at the end of the course of therapy (T1), and at a follow-up appointment one month later (T2).

Giovanni displays his results using box and whisker plots, shown in **Figure 1**.



[Source: <http://dx.doi.org/10.1155/2014/580861>]

**Figure 1**

A **higher score** on the Berg balance scale indicates **better** balance.

(d) Make **four** distinct comments, in context, about Giovanni's experiment and on his results using the information shown in **Figure 1** only.

(4)



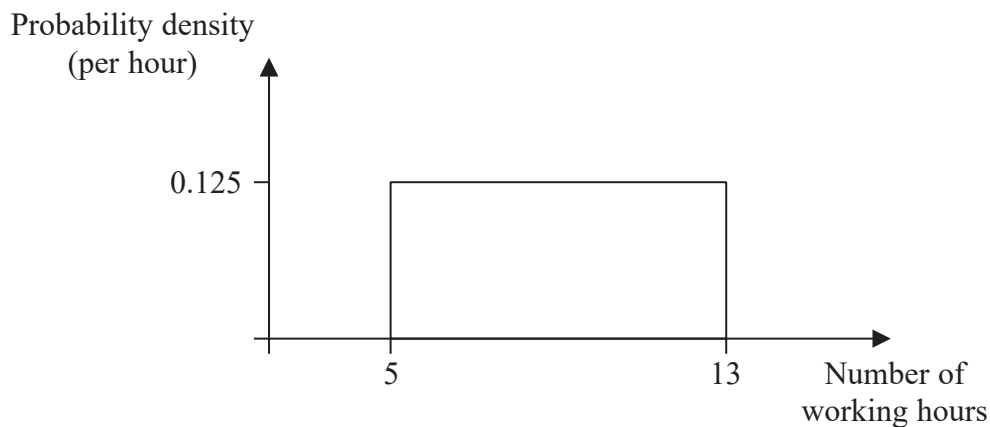


- 2 Shelly works as a project manager for a clothing design company. She is in charge of a project to produce a new jacket design. A pattern is then made of her design.

Shelly sends the pattern to the sample production department to be made into a sample jacket. From past experience, it is known that it should take between 5 and 13 working hours for a sample jacket to be produced from a pattern.

The uniform distribution is considered a suitable model for the time taken to produce such a sample jacket from a pattern.

A diagram of Shelly's modelling distribution is shown in **Figure 2**.



**Figure 2**

- (a) Explain why the height of the modelling distribution in **Figure 2** is 0.125

(1)



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**Question 2 continued**

Use Shelly's model and **Figure 2** to answer parts (b) to (e).

(b) State the expected time that it will take to produce her sample jacket from the pattern.

(1)

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(c) State the probability that it will take less than 4 hours to produce her sample jacket from the pattern.

(1)

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**Question 2 continued**

One week, Shelly sends the pattern to the sample production department on Tuesday, 7 hours before it closes for the day.

- (d) Calculate the probability that her sample jacket will be produced from the pattern before the sample production department closes on Tuesday.

(1)

That same week, Shelly's boss would like the sample jacket to be produced from the pattern by 11 am on Wednesday.

The sample production department opens at 8 am.

- (e) Given that the sample jacket was **not** produced from the pattern before the sample production department closed on Tuesday, calculate the probability that it is ready by 11 am on Wednesday.

(2)

(Total for Question 2 is 6 marks)















4 Petra is an engineer who works on an offshore wind farm.

Petra organises the repairs of wind turbines that fail. The wind farm contract states that wind turbines must be repaired on the same day that they fail.

Failures appear to happen at random, and at a fairly consistent rate over the year.

In order to organise repairs, Petra uses a Poisson model with  $\lambda = 2.8$  for the number of failures per year for each wind turbine.

[Data source: <https://doi.org/10.1177%2F0957650915597560>]

Use Petra's model to answer (a) to (f).

(a) Calculate the standard deviation of the number of failures per year for a wind turbine at the wind farm.

(1)

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(b) Find the probability that a wind turbine at the wind farm fails exactly three times in a given year.

(1)

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(c) Find the probability that a wind turbine at the wind farm fails more than seven times over a three-year period.

(2)

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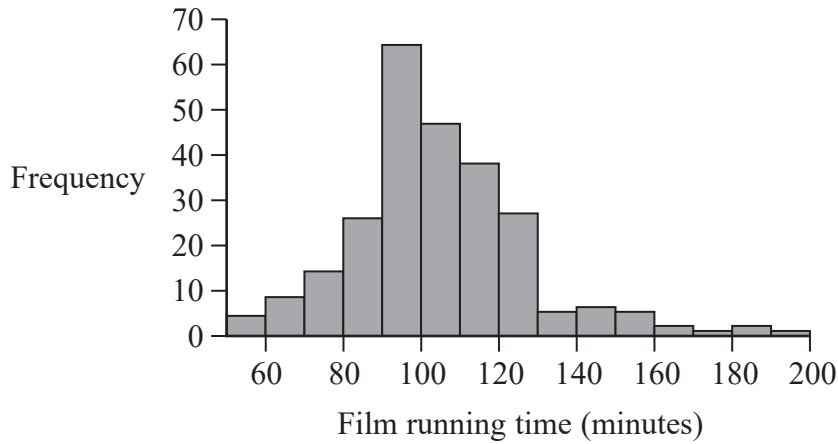




5 Dennis and Viola are doing a course in film studies. They want to conduct a study into the factors affecting film running times. They start by investigating the distribution of film running times.

Dennis and Viola extract a random sample of 250 films from a database containing the names and dates of all films ever made and look up the running time of each film in their sample on the internet.

They use graphing software to produce a histogram of their results, shown in **Figure 5**.



[Data sources: [www.cinematics.lv](http://www.cinematics.lv), [www.imdb.com](http://www.imdb.com)]

**Figure 5**

Viola believes that a normal distribution might be a suitable model for film running times.

(a) Explain **one** feature of **Figure 5** that supports Viola’s belief.

(1)

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(b) Explain **one** feature of **Figure 5** that does not support Viola’s belief.

(1)

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**Question 5 continued**

Viola and Dennis make the necessary adjustment to their data.

They calculate the  $\chi^2$  test statistic to be 13.04 (to 2 d.p.)

(e) Use this information to complete their  $\chi^2$  goodness-of-fit test.

You must state appropriate hypotheses.

(4)

(Total for Question 5 is 11 marks)

















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