

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

Pearson Edexcel Level 3 GCE

Tuesday 10 June 2025

Afternoon (Time: 2 hours)

Paper reference

9ST0/02

Statistics

Advanced

PAPER 2: Statistical Inference

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.

- 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.

- 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.*

- 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.

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

- 1 Since 2006 the RAC, a roadside assistance organisation, have used the RAC Pothole Index to monitor the state of UK roads.

The Index is a measure of how often, on average, an RAC member requests roadside assistance for a breakdown where damage from a pothole or other road surface defect was most likely the cause of the breakdown.

An Index of 1.2 would mean the likelihood of pothole damage had increased by 20% compared to 2006

A reporter sees that the most recently reported figure was 2.0 and wishes to write an article about the likelihood of pothole damage, which she claims is now twice as great as in 2006

[Source: How to report a pothole and claim for damage online | RAC Drive]

- (a) Explain why the reporter is correct in her interpretation of the value of 2.0

(1)

For the years 2014 to 2021, the Pothole Index for each quarter was recorded, the summary statistics are shown below.

$$\sum x = 70.05 \quad \sum (x - \bar{x})^2 = 6.5596 \quad n = 32$$

- (b) Test to see whether, on average, this evidence would have supported the reporter's claim between 2014 and 2021

(8)



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- 2 In the game of tennis, players score points in a number of ways.

An **ace** is a tennis stroke in which a player beginning the point strikes the ball so that their opponent is unable to make contact with the ball. This wins the point for the player beginning the point.

Daniil, a TV commentator, believes that the number of aces has begun to decrease over recent years.

He collected data from a website for the **total** number of aces for each of the top 10 male professionals for the 2018 and 2023 French Open tournaments.

This is shown in **Figure 1**

2018 Number of Aces	2023 Number of Aces
12	10
14	19
27	20
37	27
40	32
44	36
47	42
55	43
57	45
76	50

Figure 1

[Source: Infosys Slam Leaderboard – Roland-Garros – The 2018/23 Roland-Garros Tournament official site (rolandgarros.com)]

- (a) Conduct a suitable distribution free test to investigate Daniil's belief.

(9)



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Question 2 continued

Lined area for writing the answer to Question 2.



Question 2 continued

- (b) Discuss briefly whether you think the results of this hypothesis test could be used generally for the number of aces in the game of tennis.

Ensure your answer includes **two** distinct comments.

(2)

Since 1989, special technology has been used at major tournaments which allows the speed of a tennis player's serve to be measured.

A speed of 163.4 mph was recorded for a male tennis player in 2012, and is believed to be the fastest serve ever.

- (c) Give **two** distinct reasons why this belief may not be true.

(2)

(Total for Question 2 is 13 marks)



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- 3 Sedentary lifestyles are widely discussed as a possible contributor to increased health issues in later life.

Sedentary behaviour is defined as any waking behaviour characterised by a low energy expenditure whilst resting for more than 4.5 hours a day.

In a large study of EU countries in 2013, it was found that 56.4 percent of adults in the UK exhibited sedentary behaviour.

[Source: Changes in sedentary behaviour in European Union adults between 2002 and 2017
| BMC Public Health | Full Text (biomedcentral.com)]

In 2017, a further study found that 47.5 percent of 120 adults in the UK exhibited sedentary behaviour.

- (a) Investigate, using a **critical region method**, whether there has been a decrease in the proportion of adults in the UK exhibiting sedentary behaviour between 2013 and 2017

(6)



Question 3 continued

- (b) State the actual probability of a Type I error in (a)

Explain, in the context of the test, what a Type I error in (a) would indicate.

(2)

- (c) Describe the effect that an increase in the sample size in 2017 would have on the power of the test.

(1)

(Total for Question 3 is 9 marks)

- 4 In December 2022, a study of 2000 adults in the UK found that, for all types of holiday, women take longer to pack their suitcase than men.

[Source: Women take longer to pack than men, whether it's for a work trip or a two-week holiday – digitalhub (swnsdigital.com)]

Katy works for an international airline and has decided to investigate whether the results of the 2022 study are true for her company's customers.

Prior to a long-haul flight, she asks customers of the airline how long it had taken for them to pack their suitcase. Her results, in minutes, are shown below.

Males	41	12	16	25	30	60	15	45	60		
Females	60	78	92	43	45	65	25	30	50	53	62

- (a) Using a ***t*-test**, investigate whether the results of the study are true for the airline's customers.

(9)



Question 4 continued

- (b) State **two** assumptions Katy must make about the population distribution in order for the results in (a) to be valid.

(2)



- (c) Without repeating comments made in (b), give **three distinct** reasons for why Katy's analysis may not be reliable.

(3)

(Total for Question 4 is 14 marks)



- 5 Andy is a manager at an engineering firm that produces components for aeroplanes.

Part of his role requires him to monitor the assistant managers.

Matt, who has recently been promoted to assistant manager, on a temporary basis, must hit two targets to maintain his promotion.

The first is that he must spend a total of 60 minutes each day carrying out a walkabout of the factory floor. The purpose of the walkabout sessions is to monitor production, so it is a requirement that their timing must be unpredictable to the engineers.

Matt uses a specialised stopwatch to record **both** the starting and stopping time for each of the walkabout sessions each day.

- (a) Explain why a uniform distribution with probability density of 0.125 can be used to model the time spent on walkabout in each hour of the eight-hour shift.

(2)



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Question 5 continued

Quality assurance tests are completed on components when the automatic checks on the assembly line have been unable to approve them immediately.

The second target that Matt must meet is that there should be no significant difference between his and Andy's judgements whilst carrying out the quality assurance tests.

During a random week, Andy reviewed Matt's quality assurance tests. He agreed with 22 of Matt's judgements but felt that 8 were incorrect.

- (c) Carry out a suitable hypothesis test, at the 1% level of significance, to investigate whether there is a significant difference between Andy's and Matt's quality assurance judgements.

(5)

Question 5 continued

- (d) Using your answers from (b) and (c), write a short report explaining whether Matt should keep his promotion on a permanent basis.

Ensure your response is written in a form which could be understood by the general public.

(5)

(Total for Question 5 is 19 marks)



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- 6 Restaurants often display their menus outside. Diners therefore often form an impression of the restaurant before setting foot on the premises.

An investigation was carried out to see whether the font style of a menu influenced the perceived expense of a restaurant.

Diners were shown a series of menus and were asked to estimate the likely cost of a meal at the restaurant in pounds, as shown in **Figure 3**

		Font style			Total
		<i>Handwritten</i>	Traditional	Modern	
Colour of the menu	White	26.40	18.30	31.20	75.90
	Black	25.30	18.40	30.50	74.20
	Green	21.00	17.00	22.00	60.00
	Blue	22.30	17.20	23.00	62.50
Total		95.00	70.90	106.70	272.60

Figure 3

$$\sum \sum x_{ij}^2 = 6450.32$$

- (a) Conduct an ANOVA test to investigate whether the font style of a menu has a significant effect on the perceived expense of a meal.

(11)



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Question 6 continued

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Question 6 continued

- (b) Suggest an appropriate font style the restaurant should use if it wants to appeal to customers on a lower budget.

Use numerical justification to support your suggestion.

(2)

- (c) Test to see whether the use of the colour of the menu proved to be an effective blocking factor in (a)

(3)

(Total for Question 6 is 16 marks)

TOTAL FOR PAPER IS 80 MARKS

