

Beaulieu College



Mathematics Department

GRADE 12

ADVANCED PROGRAMME MATHEMATICS

Preliminary Examination Paper 2

STATISTICS

Time: 1 Hour

100 marks

Date: 27 July 2017

Examiner: Ms A Smith

Moderator: Mr J Ruiz-Mesa

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of 5 pages and an Information Booklet of 2 pages (iii–iv).
Please check that your question paper is complete.
 2. Answer all the questions on the folio pages.
 3. Approved, non-programmable, non-graphical calculators may be used, unless otherwise stated.
 4. Diagrams are not drawn according to scale.
 5. Work neatly and show all the necessary steps in your calculations.
 6. Write your name on the question paper and folio pages.
 7. Round off answers to FOUR decimal places unless stated otherwise.
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NAME: _____

GRADE 12

Question 1

- 1.1 A radar unit is used to measure speeds of cars on a road. The speeds are normally distributed with a mean of 90 km/h and a standard deviation of 10 km/h .
- (a) Determine the probability that a randomly selected car will be travelling at more than 100 km/h . (6)
- (b) If only 8% of the cars travel faster than $p \text{ km/h}$, determine p . (8)
- 1.2 In a survey, 160 out of a random sample of 480 teenagers were found to fit the medical definition of obese.
- (a) Calculate a 94% confidence interval for the population proportion of obese teenagers. (6)
- (b) Describe, in words, what this confidence interval means statistically. (2)
- [22]**
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Question 2

- 2.1 Bits are sent over a communications channel in packets of 12. If the probability of a bit being corrupted over this channel is 0,1 and such errors are independent, what is the probability that no more than 2 bits in a packet are corrupted? (8)
- 2.2 A batch of 100 printed circuit cards is populated with semiconductor chips. Jeffrey selects 20 of these at random without replacement for function testing. The original batch contains 30 defective cards.
- Determine the probability that he chooses exactly seven defective cards. (6)
- [14]**
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Question 3

Historically, evening long-distance calls from a Johannesburg have averaged 15,2 minutes per call with a standard deviation of 5 minutes. Nikola thinks that the average long-distance call has decreased. She takes a random sample of 11 evening long-distance calls. The duration of the calls, in minutes, are shown below:

15,1 13,7 12,6 16,3 13,4 12,9 14,1 14,7 15,8 14,5 14,2

It may be assumed that the population of this year's call times is normally distributed also with a standard deviation of 5 minutes.

- 3.1 State, with a reason, whether Nikola should use a one-tailed or a two-tailed hypothesis test. (2)
- 3.2 Determine whether the sample provides significant evidence, at the 3% level of significance, that the average long-distance call has decreased. Specifically mention the conclusion of Nikola's findings. (10)
- [12]**
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Question 4

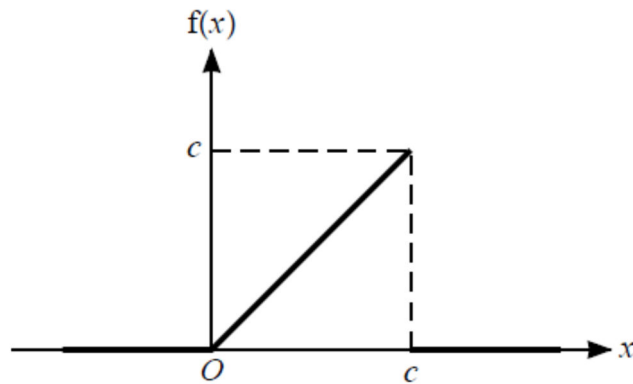
In a group of 100 sports car buyers, 70 bought alarm systems, 30 purchased bucket seats, and 20 purchased neither one of the two.

- If a car buyer chosen at random bought an alarm system, what is the probability they also bought bucket seats? (6)
- [6]**
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(Please turn over for Question 5.)

Question 5

The diagram shows the graph of the probability density function, f , of a random variable X .



- 5.1 Determine the value of the constant c , leaving your answer in simplest surd form. (4)
- 5.2 Determine the value of a such that $P(a < X < 1) = 0,1$ (8)
- 5.3 Determine $E(X)$, the expected value if the formula for the Expected Value of a random variable X over the domain $[a; b]$ is given as $\mu = E(X) = \int_a^b x.f(x)dx$. (6)

[18]

Question 6

A research firm wants to determine the maximum distance at which each of 9 drivers can read a newly designed road sign. They hope to improve road safety by examining the relationship between age (x) and sign legibility distance (y). The table below lists the data.

x (Age)	24	28	29	32	35	49	55	63	74
y (Distance in metres)	149	155	140	128	137	116	128	106	109

- 6.1 Determine the equation of a suitable regression line from which a value of y can be estimated for a given value x . (4)

- 6.2 Determine the value of the correlation coefficient for the data, and state what this indicates about the data. (2)
- 6.3 Estimate the sign legibility distance if a driver's age is 18. (2)
- 6.4 Comment on the reliability of this estimate. (2)
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- [10]**

Question 7

Lehumo is judging a "potjiekos" competition. Contestants have to randomly draw cards from three hats to determine the ingredients they have to use in their stew, namely "Meat", "Vegetables" and "Spices".

The "Meat" hat contains five cards, the "Vegetables" hat contains four cards and the "Spices" hat contains seven cards. None of the cards are the same.

- 7.1 How many ways can Lehumo arrange the 16 cards in a row if he keeps the cards from each hat together? (5)
- 7.2 Calculate the probability that if Lehumo chooses six cards at random, there are two from each hat. (5)
- 7.3 Calculate the number of different ways in which Lehumo can choose seven of the cards if he selects exactly three cards from the "Spices" hat and at least one card from each of the other two hats. (8)
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- [18]**

Total: [100]