Beaulieu College
A division of Kyalami Schools (NPC)

GRADE 12

ADVANCED PROGRAMME MATHEMATICS

Preliminary Examination Paper 2

STATISTICS

Time:	1 Hour		100 marks
Date:	23 September 2020		
Examiner:	Ms A Smith	Moderator:	Mr J Ruiz-Mesa

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of 6 pages and an Information Booklet of 2 pages (iii-iv). Please check that your question paper is complete.
2. Answer all the questions in the ANSWER BOOKLET.
3. Approved, non-programmable, non-graphical calculators may be used, unless otherwise indicated.
4. Work neatly and show all the necessary steps in your calculations.
5. Round off your answers to FOUR decimal digits, unless otherwise indicated.

QUESTION 1

1.1 A bowl of sweets contains 8 chocolates and 5 toffees. Keaarshen randomly takes out three sweets and eats them. Determine the probability that

(a) 2 toffees and 1 chocolate are eaten, in any order. (5)

(b) the second sweet eaten is a toffee. (7)

1.2 From a survey done at the restaurant where she works, Michelle found that 56% of the customers ordered coffee, 36% ordered a soft drink and the rest ordered something else to drink.

(a) From a random sample of 40, how many customers can Michelle expect to order something other than coffee or a soft drink. (2)

(b) Given a random sample of 8 customers, determine the probability that at most 6 customers orders a soft drink. (7)

(c) A random sample of 180 customers was taken. Using the normal approximation, determine the probability that more than 110 ordered coffee. (8)

[29]

QUESTION 2

2.1 The probability of a customer buying X loaves of bread at William's Bakery is shown in table below:

X	1	2	3	4
$P(X=x)$	$\frac{3}{38}$	$\frac{6}{38}$	$\frac{11}{38}$	$\frac{18}{38}$

(a) Determine the mean and standard deviation of the number of loaves of bread bought per customer. (6)

(b) Determine a formula for the probability mass function. (7)

2.2 The probability density function for the lifespan of a certain insect species is given by:

$$f(x)=\begin{cases} \frac{-3}{16}x^2+\frac{3}{4} & \text{for} \quad 0\le x\le k \\ 0 & \text{otherwise} \end{cases}$$ where x is the age of the insect in years.

Determine k, the maximum lifespan of these insects. (8)

[21]

QUESTION 3

A very prestigious cross-country race takes place annually in the town of Baleka. In 2019 the times taken by all the competitors to complete the race were normally distributed about a mean of $\mu = 90$ minutes and standard deviation σ.

3.1 If 80% of the competitors took less than 2 hours to complete the race, what is the value of σ to the nearest minute? (6)

3.2 Only the top 5% of the competitors are awarded the famous 'Mvundla' award. Assuming that σ is equal to 36 minutes, determine the cut-off time for this award. (6)

[12]

QUESTION 4

4.1 The 95% confidence interval for the mean length of life (in hours) of a particular brand of light bulb is $(1\,023{,}3\ ;\ 1\,101{,}7)$. This interval is based on results from a random sample of 36 light bulbs, where the length of the life of the lightbulbs are normally distributed.

(a) Determine the mean of the sample. (2)

(b) Determine the standard deviation of the sample. (8)

4.2 It is believed that 15% of the population in South Africa have blue eyes. If a random sample of South Africans is taken, how large would the sample have to be, to be 98% sure of obtaining an estimate to within 5%? (8)

4.3 The university bookstore tells prospective students that the average cost of its textbooks is R920 per book, with a standard deviation of R150. The engineering students think that the average cost of their books is higher than the average for all students. To test the bookstore's claim against their alternative, the engineering students collect a random sample of size 45 and calculate $\bar{x} = \text{R}973{,}40$.

Conduct a hypothesis test at a 3% level of significance to see if the students' claim is supported. (10)

[28]

QUESTION 5

Three girls and four boys must be seated in a row of seven chairs.

5.1 Determine the total number of ways in which the children can be seated. (2)

5.2 Determine the number of ways in which the children can be seated if each arrangement is to be symmetrical. (8)

[10]

Total: [100]

EXAMINATION NUMBER:	2	0	1	0	1	2	0	2	0			

MARKING GRID

Question	Statistics
1	**/29**
2	**/21**
3	**/12**
4	**/28**
5	**/10**
TOTAL MARK	**/100**