Beaulieu College

GRADE 12

ADVANCED PROGRAMME MATHEMATICS

Preliminary Examination Paper 2

STATISTICS

Time:	1 Hour		100 marks
Date:	31 July 2019		
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 hockey coach has to choose a team of 11 players from a group of 10 men and 7 women.

(a) If there is no restriction on the number of team members of each gender, determine in how many different ways the coach can choose the team. (2)

(b) If the team is chosen at random from the group, determine the probability that it consists of 6 men and 5 women. (4)

1.2 Seven women and four men are placed randomly in a line. Determine the probability that the men are separated. (6)

1.3 Twelve cards are drawn, without replacement, from an ordinary deck of 52 playing cards. Determine the probability that two or more of the cards are hearts. (8)

[20]

QUESTION 2

2.1 The probability mass function of the discrete random variable X is given by:

$$P(X = x) = \frac{1}{18}(x + 2) \text{ for all } x \in \{3\,;4\,;5\}.$$

(a) Determine the expected value of the probability mass function. (4)

(b) Determine the variance of the probability mass function. (5)

2.2 The probability density function of X is given by:

$$f(x) = \begin{cases} 0,75 - 0,25x & \text{for} \quad 0 \le x \le 4 \\ 0 & \text{otherwise} \end{cases}$$

Determine the median of this distribution. (8)

[17]

QUESTION 3

A machine fills small cans with soda water. The volume of soda water delivered by the machine is normally distributed with a mean of 153 ml and a standard deviation of 1,6 ml.

Each can is able to hold a maximum of 155 ml of soda water. Printed on each can is 'Contents 150 ml'.

3.1 Determine the probability that the volume of soda water delivered by the machine causes a can to overflow. (6)

3.2 A pack of 12 cans may be assumed to be a random sample of cans filled by the machine. Determine the probability that, in a pack, exactly ten of the cans have a content of more than 150 ml. (9)

3.3 It is known that 75% of all the cans filled by the machine have a volume of between $153 - b$ ml and $153 + b$ ml. Determine the value of b. (6)

[21]

(*Please turn over for Question 4.*)

QUESTION 4

Applications for passport renewals are accompanied by exactly one photograph each. The records at a passport office show that the probability of a photograph being unusable is 0,15.

4.1 Determine the probability that in a random sample of 40 applications, exactly 6 photographs are unusable. (6)

4.2 Calculate the mean and the standard deviation for the number of photographs that are unusable in a random sample of 40 applications. (4)

4.3 Using the normal approximation, determine the probability that in a random sample of 40 applications, more than 3 but fewer than 10 photographs are unusable. (6)

[16]

QUESTION 5

5.1 A machine fills bags with frozen peas. Measurements taken over several weeks have shown that the weights of the bags are normally distributed with a standard deviation of 2,2 grams.

Following maintenance on the machine, a quality control inspector selected a sample of 8 bags of peas. The weights, in grams, of the bags are given below:

910,4 908,7 907,2 913,2 905,6 911,1 909,5 907,9

(a) Calculate a 95% confidence interval for the mean weight of a bag of frozen peas filled by the machine, following the maintenance. (6)

(b) Sam calculated an $\alpha\%$ confidence interval for the same sample to be $(908,08\,;910,32)$. Determine the value of α. (6)

5.2 A marketing company needs to estimate the proportion of residents in a large city who own a 4G mobile phone. It wishes to estimate this proportion to within 0,05 with a confidence of 98%.

Given that the proportion of residents who own a 4G mobile phone is known to be 30%, determine the sample size necessary in order to meet the company's need. (6)

[18]

QUESTION 6

Your neighbour has 2 children. You learn that he has a son, Joe. What is the probability that Joe's sibling is a brother?

(Hint: First draw a tree diagram to represent ALL the possible outcomes.) (8)

[8]

Total: [100]

EXAMINATION NUMBER:	1	9	1	0	1	2	0	2	0			

MARKING GRID

Question	Statistics
1	**/20**
2	**/17**
3	**/21**
4	**/16**
5	**/18**
6	**/8**
TOTAL MARK	**/100**