ADVANCED PROGRAMME MATHEMATICS
ELECTIVE MODULE: STATISTICS

Time: 1 hour

100 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 4 pages and an Information Booklet of 4 pages (i – iv). Please check that your question paper is complete.

2. Non-programmable and non-graphical calculators may be used, unless otherwise indicated.

3. All necessary calculations must be clearly shown and writing should be legible.

4. Diagrams have not been drawn to scale.

5. Give probabilities correct to 4 decimal places.

STATISTICS

QUESTION 1

1.1   A local fisherman caught 10 lobsters, 3 of which were undersized. Mr Lugard, an inspector of the Sea Fisheries Branch, inspects the fisherman's catch by choosing a random sample of 4 lobsters. What is the probability that the sample contains no undersized lobsters? (7)

1.2   A computer manufacturing company is subjected to the following quality control procedure. A random sample of 10 computers is tested, with each computer tested individually. If there is one or more defective computers among the 10 tested, the entire consignment is rejected. The probability of a computer being defective is known to be 1%.

   (a)   What is the probability that the entire consignment is rejected? (6)

   (b)   If a sample of 20 computers (instead of 10) was tested, and the consignment was rejected if two or more proved defective, calculate the probability of rejecting the consignment. (7)

   (c)   Explain which quality control procedure is to the advantage of the computer manufacturing company. (1)

[21]

QUESTION 2

Mishka has 4 chores to perform before getting to school by 07h30. The time (in minutes) to perform each chore is normally distributed with the mean and standard deviation as given in the table:

	Mean (μ)	Standard deviation (σ)
Shower	5	0,5
Get dressed	4	1,0
Eat breakfast	10	3,5
Drive to school	15	5,0

2.1   It is calculated that the standard deviation for completing all the chores is $\sigma = 6{,}205$. Show that the total mean time for completing all the chores is $\mu = 34$ minutes. (2)

(Use the results from 2.1 in 2.2 and 2.3)

2.2   If Mishka gets up at 06h50, what is the probability that she will be late for school? (8)

2.3   At what time (to the nearest minute) should she get up to have a 99% chance of not being more than 3 minutes late? (8)

[18]

QUESTION 3

3.1   The height, x mm, and the weight, y kg, of each boy at Carvalheiro School were recorded and a scatter diagram was then plotted. The equation of the regression line of y on x is found to be $y = 0{,}09x - 90$. The sample weights are found to be distributed about a mean of 54 kg.

    (a)   Determine the sample mean of the heights of the boys at Carvalheiro School.   (2)

    (b)   Find the estimated weight of a boy whose height is 1,5 m.   (2)

    (c)   What correlation coefficient between the boys' height and weight would you expect to find? Justify your answer.   (2)

3.2   A probability density function is given by:

$$f(x) = \begin{cases} \dfrac{k}{9}x(3-x) & \text{for } 0 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

    (a)   Show that $k = 2$ (8)

    (b)   Find P $(x > 1)$ (4)

[18]

QUESTION 4

4.1   A machine is supposed to produce bolts with a mean diameter of 20 mm and a standard deviation of 0,2 mm. A random sample of 40 bolts has a mean of 20,05 mm. Make a decision whether or not the machine needs adjustment, using a 5% level of significance.   (10)

4.2   Kerri-Lyn calculated a 97% confidence interval for the population mean percentage of a geography test from a sample of 50 candidates to be (60; 66). Calculate

    (a)   the sample mean percentage mark.   (2)

    (b)   the standard deviation.   (7)

[19]

QUESTION 5

5.1 The probability that Sam goes swimming on any day is 0,2. On a day when he goes swimming, the probability that he has a burger for supper is 0,75. On a day when he does not go swimming, the probability that he has a burger for supper is x. The probability that Sam has a burger for supper on any day is 0,5.

   (a) Find x. (8)

   (b) Given that Sam had a burger for supper, find the probability that he went swimming that day. (3)

5.2
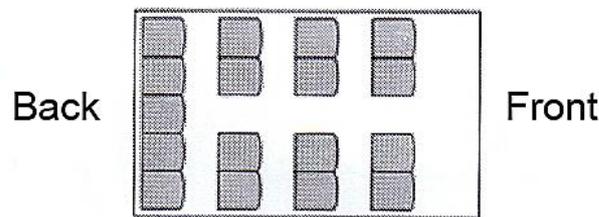
   The diagram shows the seating plan for passengers in a touring bus, which has 17 seats arranged in 4 rows. The back row has 5 seats and the other 3 rows have 2 seats on each side. 11 passengers get on the touring bus.

   (a) How many possible seating arrangements are there for the 11 passengers? (2)

   (b) How many possible seating arrangements are there if only a specific group of 5 people may sit in the back row? (5)

   (c) Of the 11 passengers, 5 are unmarried and the other 6 consist of 3 married couples.
   In how many ways can 2 married couples and 1 other person, who may or may not be married, be chosen from the 11 passengers? (6)

   [24]

Total: 100 marks