SAHETI SCHOOL

PRELIMINARY EXAMINATION 2021

GRADE 12 - ADVANCED PROGRAMME MATHEMATICS

PAPER 2- STATISTICS

Time: 1 hour   **Total: 100**

Examiner: P R Mhuka   Moderators: S McConkey
                                                                                           N Eleftheriades

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1.   This question paper consists of 5 pages. Please check that your paper
             is complete.

2.   Read the questions carefully.

3.   Answer all the questions.

4.   Number your answers exactly as the questions are numbered.

5.   You may use an approved non-programmable and non-graphical
             calculator, unless otherwise stated.

6.   **Answers must be rounded off to four decimal places.**

7.   All the necessary working details must be clearly shown.

8.   It is in your own interest to write legibly and to present your work neatly.

Page 1 of 5

QUESTION 1:

A group of 8 friends travel to the airport in two taxis, P and Q. Each taxi can take 4 passengers.

a) The 8 friends divide themselves into two groups of 4, one group for taxi P and one group for taxi Q, with Jon and Sarah travelling in the same taxi.

   Find the number of different ways in which this can be done. (3)

b) Each taxi can take 1 passenger in the front and 3 passengers in the back. Mark sits in the front of taxi P and Jon and Sarah sit in the back of taxi P next to each other.
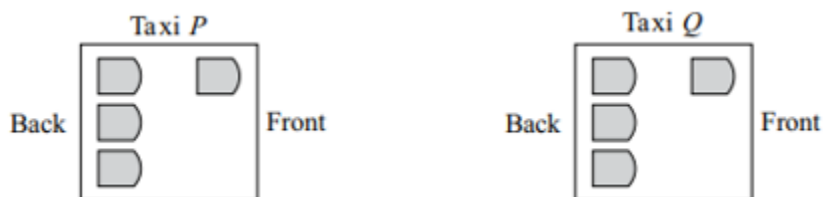
   Find the number of different seating arrangements that are now possible for the 8 friends. (4)

   [7]

QUESTION 2:

Bag A contains 4 balls numbered $2, 4, 5, 8$. Bag B contains 5 balls numbered $1, 3, 6, 8, 8$. Bag C contains 7 balls numbered $2, 7, 8, 8, 8, 8, 9$. One ball is selected at random from each bag.

- Event X is 'exactly two of the selected balls have the same number'
- Event Y is ' the ball selected from bag A is numbered 4'

a) Find $P(X)$. (6)

b) Find $P(X \cap Y)$ and hence determine whether or not events X and Y are independent. (4)

c) Find the probability that two balls are numbered 2, given that exactly two of the selected balls have the same number. (3)

   [13]

QUESTION 3:

The discrete random variable X has the probability mass function where k is a constant.

$$P(X = x) = \begin{cases} kx & x = 2, 4, 6 \\ k(x-2) & x = 8 \\ 0 & \text{otherwise} \end{cases}$$

a) Calculate the value of k (5)

b) Calculate $E(X)$ and $E(X^2)$ (7)

c) Calculate $Var(X)$ (2)

[14]

QUESTION 4:

a) Often in buying a product at a supermarket, there is a concern about the item being underweight. Suppose there are 20 "one kilogram" packages of frozen vegetables on display and 3 of them are underweight. A consumer buys 5 of the 20 packages at random.
What is the probability of at least one of the five being underweight? (6)

b) A petrol station finds that its daily sales, in litres, are normally distributed with mean $4\,520$ and standard deviation 560.

1) Find on how many days of the year (365 days) the daily sales can be expected to exceed 3 900 litres. (6)

The daily sales at another petrol station are X litres, where X is normally distributed with mean m and standard deviation 560.
It is given that $P(X > 8\,000) = 0{,}122$.

2) Find the value of m. (4)

3) Find the probability that daily sales at this petrol station exceed 8 000 litres on fewer than 2 of 6 randomly chosen days. (5)

[21]

QUESTION 5:

a) A six-sided die is suspected of bias. The die is thrown 100 times and is found that the score is 2 on 20 throws. It is given that the probability of obtaining a score of 2 on any throw is p.

    1) Find an approximate 94% confidence interval for p.   (6)

    2) Use your answer to part 1 to comment on whether the die may be biased. (1)

b) In a study, 20 randomly selected managers were found to spend a mean time of 2,4 hours per day on paperwork. The standard deviation of the 20 scores was 1,30 hours. Construct a 98% confidence interval for the mean time spent on paperwork by all managers and write down the margin of error.   (6)

c) Vehicles approaching a certain road junction from town A can either turn left, turn right or go straight on. Over time it has been noted that of the vehicles approaching this junction from town A, 55% turn left, 15% turn right and 30 % go straight on. The direction a vehicle takes at the junction is independent of the direction any other vehicle takes at the junction.

    1) Find the probability that, of the next three vehicles approaching the junction from town A, one goes straight on and the other two either both turn left or both turn right.   (5)

    2) Three vehicles approach the junction from town A. Given that all three drivers choose the same direction at the junction, find the probability that they all go straight on.   (5)

    3) Of the 90 cars approaching the junction during peak hour, use a suitable approximation to find the probability that between 42 and 59 cars turned left on the junction.   (7)

                                                                                   [30]

QUESTION 6:

a) Among 157 African men, the mean systolic blood pressure was 146 mm Hg with a standard deviation of 27. We wish to know, based on this data, if we may conclude that the mean systolic blood pressure for a population of African men is greater than 140. Use $\alpha = 0,03$. (7)

b) The U-Scan facility was recently installed at a Woolies. The store manager would like to know if the mean checkout time using the standard checkout method is longer than using the U-Scan. She gathered the following sample information. The time is measured from when the customer enters the line until their bags are in the trolley. Hence the time includes both waiting in line and checking out.

Customer Type	Sample Mean	Population standard deviation	Sample size
Standard	5.50 minutes	0.40 minutes	50
U-Scan	5.30 minutes	0.30 minutes	100

Investigate, at the 1% level of significance, if the checkout method is longer using the U-scan. (8)

[15]