SOUTH WEST REGIONAL MOCK EXAMINATION
GENERAL EDUCATION

THE TEACHERS' RESOURCE UNIT (TRU)
IN COLLABORATION WITH

THE REGIONAL INSPECTORATES OF PEDAGOGY AND

THE SUBJECT TEACHERS' ASSOCIATIONS (STA)

WEDNESDAY, 06/04/2022   ADVANCED LEVEL

Subject Title	Mathematics with statistics
Paper Number	Paper 3
Subject Code Number	0770

THREE HOURS

INSTRUCTIONS TO CANDIDATES

Full marks may be obtained for answers to ALL questions.

All questions carry equal marks.

You are reminded of the necessity for good English and orderly presentation in your answers.

Mathematical formulae and tables published by the GCE Board are allowed.

In calculations, you are advised to show all the steps in your working, giving your answer at each stage.

Electronic calculators are allowed.

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1. The times taken by a group of students to complete a test are shown in the table below.

Time, in minutes	15 - 19	20 - 24	25 - 29	30 -34	35 - 39
Number of students	2	5	12	8	3

Calculate, giving the answers in two decimal places,
(a) the mean
(b) the standard deviation of the time used by the students to complete the test   **8 marks**

The following day, the same test was administered to an independent group of 20 students in another school. The mean and standard deviation of the time taken by this second group of students to complete the test were obtained as 28.20 minutes and 6.00 minutes respectively.

Obtain, giving the answers in two decimal places,
(c) the mean
(d) the standard deviation of the time taken by the two groups of students to complete the test   **5 marks**

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2. (i) Two events A and B are such that $P(A) = \frac{1}{3}$, $P(B) = \frac{3}{5}$ and $P(A \cup B) = \frac{11}{15}$
   (a) Show that A and B are independent.
   (b) Calculate the values of $P(A/B)$ and $P(B/A)$ **6 marks**

   (ii) A trader receives merchandise from two suppliers, Andrew and Bernard, with 60% being supplied by Andrew. It has been observed that 30% of the merchandise supplied by Andrew and 20% of the merchandise supplied by Bernard are always of doubtful quality.
   (c) Draw a tree diagram to illustrate this information.
   (d) The trader places an order for 10000 pieces of merchandise. Estimate the number of pieces that are expected to be of doubtful quality.
   (e) Find the probability that a doubtful quality piece received was supplied by Bernard.   **7 marks**

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3. The probability density function of a continuous random variable X, $f(x)$, is defined by

$$f(x) = \begin{cases} \frac{x}{2k}(2-x), & 0 \le x \le 2, \\ 0, & \text{elsewhere.} \end{cases}$$

Find the value of the constant k.
Calculate the mean and variance of X.
Show that the 80th percentile of X, e, satisfies the equation $5e^3 - 15e^2 + 16 = 0$.   **(3, 7, 3) marks**

4. (i) A random variable X has a probability mass function defined by

$$f(x) = \begin{cases} c(x+1), & x = 0,1,2,3, \\ 0, & \text{otherwise.} \end{cases}$$

   (a) Determine the value of the constant c.
   (b) Find the mean and variance of X.   **7 marks**

   (ii) In the first trial of an experiment, the probability of success is $\frac{2}{5}$.

   In the second trial, the probability of success will be $\frac{1}{5}$ if the first trial was successful, but it will be $\frac{4}{5}$ if the first trial was not successful.

   If Y is defined as "the number of successes", show that Y is a random variable.   **6 marks**

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5. (i) A poultry farmer usually transports her chickens to the market in boxes with each box containing 10 chickens. The independent probability that a chicken will die from a box before reaching the market is $\frac{1}{5}$.

A box of chickens is to be taken to the market.

(a) Find the probability that exactly 8 chickens will reach the market alive.

Two boxes of chickens are to be taken to the market.

(b) Find the probability that exactly 2 chickens will die before the consignment gets to the market. **7 marks**

(ii) Averagely, 2 vehicles arrive a check point every 5 minutes.
   Find the probability that on a certain day,

(c) exactly 3 vehicles will arrive the check point between 7:50am and 8:00am

(d) at least 4 vehicles will be checked between 8:15pm and 8:30pm **6 marks**

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6. (i) The lifetimes of a certain brand of Christmas bulbs are normally distributed with mean 1512 hours and standard deviation σ hours. Given that 20% of these bulbs have lifetimes exceeding 1600 hours, calculate σ, giving your answer correct to the nearest hour. **4 marks**

(ii) A machine delivers flour into bags whose contents have a labeled mass of 25 kg. The mass of flour delivered by the machine is known to be normally distributed with a mean of 25.05 kg and standard deviation of 0.25 kg.

(a) Determine the probability that the mass of flour in a bag exceeds 25 kg.

(b) Calculate the mass of flour exceeded by exactly 95% of the bags.
   A customer buys 40 bags of flour.

(c) Determine the probability that the *mean* mass per bag of flour exceeds 25 kg. **9 marks**

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7. (i) Briefly define the following as used in statistics.
   (a) 95% confidence interval
   (b) Type I error
   (c) Type II error
   (d) Critical region **4 marks**

(ii) The masses of phone components produced by a certain machine are normally distributed with mean 15.4 g and standard deviation 2.3 g. A component is randomly selected. Find the probability that its mass is
   (e) less than 12.56 g
   (f) greater than 19.57 g. **4 marks**
   After the machine has undergone some servicing, a randomly selected 81 phone components produced by the machine was found to have a mean mass of 15.0 g but the standard deviation did not change.
   Does this provide evidence, at the 5% level of significance of a reduction of the mean mass of components produced by this machine? **5 marks**

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8. The table below shows the marks obtained by 8 candidates in Mathematics and Physics at a given examination.

Mathematics, x	50	35	60	85	25	65	90	40
Physics, y	40	26	44	62	28	30	60	42

a) Calculate the product moment correlation coefficient for this data.

b) Find an equation of the regression line of Physics marks on Mathematics marks.

c) A candidate was late for more than 30 minutes and so was not allowed to write the Physics paper. Estimate the marks that this candidate would have scored in Physics if she obtained 58 marks in Mathematics.

(9, 2, 2) marks