PAPER 2

1. Two events A and B are such that  = 0.1,  = 0.8, and P(A only) = 0.3, find;

 a) P(A)

 b)  5mks

2. The probability that an item is defective in a certain bath is 0.2.

 a) Find the probability that 3 items out of 10 items are defective.

 b) Find the value of n, the batch size given that  = 0.9648.

5mks

3. Particles of weight 12N, 8N and 4N act at points (1, 3), (0, 2) and (1, 0) respectively. Find the centre of gravity of the particles. 5mks

4. The table below shows the cost y shillings for fuel consumed by a vehicle in a distance x kilometres.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distance (x km) | 10 | 20 | 30 | 40 |
| Cost (Shs. Y) | 14,800 | 15,600 | 16,400 | 17,200 |

 Use linear interpolation or extrapolation to calculate the;

 a) cost of fuel consumed for a distance of 45 km.

 b) distance Ssekyanzi traveled if he put fuel of Shs. 16,000. 5mks

5. Two forces of magnitude 8N and PN are inclined at an angle 60o.

Find P if the resultant is of magnitude 17N. 5mks

6. Use trapezium rule to estimate  using six ordinates and hence

 calculate the percentage error in the estimate. 5mks

8. For a discrete random variable X, the cumulative distribution function F(x) is as shown below;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 1 | 2 | 3 | 4 | 5 |
| F(x) | 0.2 | 0.32 | 0.67 | 0.9 | 1.0 |

 Find;

 i) P(x > 2)

 ii) Expectation of x (E(x)). 5mks

9. Below are marks scored by students of a certain school in the National Mathematics contest;

|  |  |
| --- | --- |
| Marks | Number of students |
| 10-15 | 2 |
| 15-25 | 8 |
| 25-30 | 17 |
| 30-35 | 26 |
| 35-45 | 24 |
| 45-50 | 16 |
| 50-60 | 6 |
| 60-80 | 1 |

1. Draw a histogram for the above data. Use it to find the modal

mark.

 b) Calculate the;

 i) Mean mark

 ii) Semi-interquartile range

10. A car of mass, Mkg is pulling a trailer of mass Mkg along a straight horizontal road. The resistive forces acting on the car and trailer are 300N and 200N respectively. At the instant when the car has an acceleration 0.3ms-2, the tractive force is 2000N.

 a) Show that M( + 1) = 5000

 b) Given that the tension in the two-bar is 500N at this instant, find the

value of M and . 12mks

11. The heights of a newly developed variety of maize plant can be modeled by a normal distribution with mean 2m and standard deviation of 40cm. A random sample containing 50 maize plants is taken and the mean height calculated.

 a) What is the probability that the sample mean lies between 195cm

and 205cm?

1. Calculate the 95% confidence interval for the mean of this sample.

12mks

12. a) Show that the New-Raphson formula for finding the root of the

equation; **e1/x = x** is given by;

 xn+1 = , n = 0, 1, 2, 3, ……..

 b) i) Draw a flow chart to illustrate the use of algorithm for

computing and printing the approximate root correct to 3 decimal places.

1. Taking xo = 1.70, perform a dry run for your flow chart.

14. The probability density function of X is given by;

 f(x) = 

 where a and k are constants.

 i) Show that k = 

 ii) Given that the mean of x is 1, find the values of a and k.

 iii) Sketch the graph of p.d.f of x.

 iv) Find the variance of x. 12mks

15. a) Numbers X and Y were estimated with maximum possible errors of

x and y respectively. Show that the maximum possible relative error in the estimation of xy2 is given by; 

  + 2. 6mks

b) Given that a = 1.50, b = 13.3 and c = 9.200, are all rounded off to the given decimal places. Find the minimum value of;

 i) 

 ii) 

 iii)  +  +  6mks

1. Events A and B are such that P(A) =$ \frac{1}{2}$ , P(B) = $\frac{3}{8}$ and P(A/B) = $\frac{7}{12}$

     Find

1. P(A$∩$B) (02 marks)
2. P($^{B}/\_{\overbar{A}}$) (03 marks)

2. Forces 2i – 3j, 7i + 9j, -6i – 4j, -3i – 2j act on a lamina at points (1,-1), (1, 1),

     (-1,-1), (1, 1) respectively. Determine

1. The resultant of the forces.     (02 marks)
2. The sum of their moments about (0, 0). (02 marks)
3. What effect does the force have on the body? (01 mark)

3. The table below gives the values of x and their corresponding values of f(x)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 2 | 3 | 4 | 5 |
| f(x) | 3.88 | 5.11 | 8.14 | 11.94 |

     Use linear interpolation to determine the value of:

1. f(x) when x=2.15     (02 marks)
2. x when f(x) = 10.72     (03 marks)

4. A die is tossed 40 times and the probability of getting a six on any one of the tosses is 0.122.Esimate the probability of getting between 6 to 10 sixes. (5 marks)

5. Two masses P and Q of mass 5kg and 2kg respectively are connected by alight     inextensible string passing over a fixed pulley at the edge of the table. Mass P rests on the     rough surface of the table while mass Q hangs freely. If the system is in limiting     equilibrium, find the coefficient of friction between the mass P and the table.                                             (5 marks)

6. (i) show that the equation $e^{x}-2x-1=0$ has a root between x=1 and x=1.5                                                  (2 marks)

    (ii) Use linear interpolation to obtain an approximate root.               (3 marks)

7. The table below shows prices of food, housing and transport expended by a family in 1990     and 1994.

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Price in 1990(Shs) | Price in 1994 (Shs) | Weight (w) |
| Food | 5500 | 6000 | 4 |
| Housing | 4800 | 5200 | 2 |
| Transport | 1600 | 2000 | 1 |

           Calculate a weighted price index for the figures for 1994 based on 1990. (5 marks)

8. Two particles A and B start together from a point O and slide down in a vertical plane     along smooth straight wires inclined at angles 30o and 60o respectively. The wires are on     the same side of the vertical. Taking **i** and **j** as unit vectors in the horizontal vertical     directions respectively. Show that the acceleration of the particle B relative to A is ½g j (5 marks)

**SECTION B (60 MARKS)**

9. (i) Use the trapezium rule to estimate the area of y = 3x between the X-axis ,x=1  and x=2, using five sub intervals. Give your answer correct to 4 significant figures.                                                                        (5 marks)

      (ii) Find the exact value of the area

                                  (3 marks)

 (iii) Find the percentage error in calculations (i) and (ii) above. (2 marks

 (iv) Two positive real numbers N1 and N2 are rounded off to give n1 and n2 respectively.

            Determine the maximum relative error in n1n2 for N1N2. State any assumptions made.                                     (3marks)

10. The data below shows marks obtained by 50 students in a test:

 76 17 57 63 12 96 38 46 82 48

 61 93 44 19 70 60 71 18 40 54

 50 27 62 42 63 52 53 38 62 25

 62 23 32 81 31 63 64 18 70 27

 52 81 35 63 38 37 44 19 70 32

1. Construct a grouped frequency distribution table with equal class intervals of 10 marks starting with the 10-19 Class group. (3marks)
2. Draw a histogram and use it to estimate the modal mark. (3marks)
3. Calculate the mean and standard deviation of the marks. (6marks)

11. A particle P moving with a constant velocity 2i +3j + 8k, passes through a point with       position vector 6i – 11j + 4k at the same instant, a particle Q passes through a point with       position vector i-2j +5k, moving with constant velocity 3i+4j-7k. Find the

1. Position and velocity of P relative to P at that instant. (4 marks)
2. Time that elapses before the particles are nearest to one another. (4 marks)
3. Shortest distance between P and Q in the subsequent motion. (4 marks)

12. (a) P and Q are intersecting sets as shown in the Venn Diagram below.

 P Q

 x y z

 0.15

Given that P(P) = 0.6, P($^{\overbar{P}}/\_{Q}$) = $\frac{5}{7} $and P(P$∪$Q) = 0.85,find

1. The values of x,y and z (4 marks)

(ii) P($^{P}/\_{\overbar{Q}}$) (2 marks)

    b). A box contains 4 white balls and on black ball. A second box contains 1 white ball             and 4 black balls. A ball is drawn at random from the first box and put into the             second box.Then a ball is taken from the second box and put into the first box .Find             the probability that a white ball will be picked when a ball is selected from the first            box.    (6 marks)

14. (a) Show that the Newton Raphson formula for finding the root of the equation

 2x3 + 5x – 8 = 0 is 4xn3+8

 6xn2 + 5 (4 marks)

      (b) Taking the first approximation to the root of the above equation as 1.2, draw a flow       diagram which reads and prints the number of iterations and the root. Carry out a dry   run of the flow chart and obtain the root with an error of less than 0.001. (8 marks)

15. A random variable X has a distribution probability function given as

 kx : 0≤x≤1

 f(x) = k(4-x2): 1≤x≤2

 0 : elsewhere

(i) Find the constant k (3 marks)

(ii) Determine E(X) and Var(X) (6 marks)

(iii) Find the cumulative distribution function, F(X) and sketch it. (3 marks)

1. Show that the equation $xe^{x}-x-1=0$ has a root between **0.5** and **1** hence using linear interpolation once estimate the root to **two** decimal places.
2. To a motorist travelling due North at 50km/hr, the wind appears to come from North West at 60mk/hr. Find the true velocity of the wind.
3. Aand B are events such that P(A) = ⅗ and 3 P(A∩B) = 2P(AI∩B) = P(AI∩BI). Find $P\left(^{A}/\_{B^{I}}\right)$
4. The volume V of the pipe of height h and internal and external radii r and R is given as;$ V=πh\left(R^{2}-r^{2}\right)$. Measurements are made as follows:

$$h=3.5cm, r=2.1cm and R=2.8cm$$

(All rounded off to 1 decimal place).

Find the limits within which the exact value of V lies.

1. ABC is a right angled triangle in which forces of 8N, 6N and PN act.

Given that forces are in equilibrium, find the values of P and Q.

Q

A

6N

PN

8N

C

B

1. The fair tetrahedral each numbered 1 to 4 are thrown at ago and the sum of the numbers on the faces on the ground are noted. If they are thrown 6 times, find the probability of getting a sum of 3 at least 4 times.
2. An adjudicator at a music competition involving four teams changed his original (correct ranks) due to influence peddling, by interchanging the 1st and 2nd positions and the 3rd and 5th positions.

Calculate the rank correlation coefficient for the two judgements, and comment on the impact of the changes on the overall performance.

1. Two particles A and B of mass 3kg and 2kg are moving with velocities;

$4\wideutilde{i}-6\wideutilde{j} $and$ 2\wideutilde{i}-7\wideutilde{j}$ respectively when they collided.Immediately after collision, A moves on in the same direction as before, but with half its original speed.

 Find the velocity of B just after the collision.

**SECTION B (60 MARKS)**

*Answer any* **five***questions from this section*

1. $X$ is a continuous random variable such that;

$$F\left(x\right)= a tan^{-1}\left(x\right) ; 0\leq x\leq 1$$

 $ bx ; 1\leq x\leq 2$

 $1 ; x\geq 2$

1. Find the values of the constants $a$and $b$.
2. Show that the mean $μ=\frac{In2}{π}+\frac{3}{4}$
3. Find the $p\left(\left|x-μ\right|<0.5\right)$
4. (a) In an examination which consists of 100 questions, a student has a

probability of 0.6 of getting each question correct. The student fails the examination if he obtains a mark less than 55 and obtains a distinction for a name of 68 or more. Calculate;

1. the probability that he fails the examination
2. the probability that he obtains a distinction.

(b) A sample of 15 leaves was obtained from a certain plant and their length in centimetres were recorded:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.60, | 5.85, | 5.13, | 3.94, | 5.61, | 4.08, | 4.71, | 4.29, | 6.01, |
| 5.46, | 5.80, | 6.33, | 4.43, | 4.90, | 5.09. |  |  |  |

 Obtain the unbiased estimates of mean and variance of length of leaves.

 Given that the length of leaves are normally distributed, calculate the

 95% confidence limits of the average length of leaves from a large

sample of plants.

1. (a) Show that the iterative formula for finding the sixth root of a

number$α$ is given by;$X\_{n+1}=\frac{5}{6}\left(X\_{n}+\frac{α}{5x\_{n}5}\right) n=0, 1, 2…$….

(b) Draw a flow chart that reads $α$ and the first approximation $x\_{0},$ computes and prints $α$ on the sixth root of $α$ with an error of less than 0.00001 without exceeding 3 iterations. Hence find $62^{⅙}$, taking $x\_{o}=2.0$

1. (a) Use trapezium to estimate the area bounded by the curve;

$y=x sinx,$the$x-$axis and the inner $x=0$ and $x=π.$

Using 6 sub intervals, give your answer to 3 decimal places.

$$π$$

$$0$$

$$x sinx dx;$$

(b) Find the exact value of correct to three decimal places.

(c) Determine the relative error in your calculation in (a) above.

 How can this error be reduced?

1. The height of 250 SPC recruits were recorded in a survey during the training as shown:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Height | 170 –  | 175 –  | 180 –  | 185 –  | 190 –  | 950 –  |
| No of recruits | 18 | 34 | 58 | 42 | 24 | 10 |

1. Calculate the mean height.
2. Plot a cumulative frequency curve for the data and find the median

height.

1. Find the probability that a result chosen at random has a height

greater than 179cm.