OUR LADY OF AFRICA S.S NAMILYANGO (OLAN)

A LEVEL APPLIED MATHEMATICS P425/2 SEMINAR QUESTIONS 2022

PROBABILITY

1. (a). Two events A and B are such that $P(A) = \frac{8}{15}$, $P(B) = \frac{1}{3}$, and $P(A/B) = \frac{1}{5}$. Calculate the probabilities that;

(i). Both occur

(ii).Only one of the two events occurs

(iii).Neither of the events occurs

(b). A box contains 4 pink counters, 3 green counters and 3 yellow counters. Three counters are drawn at random one after the other without replacement

(i). Find the probability that the third counter drawn is green and the first two are of the same colour.

(ii).Find the expected number of pink counters drawn.

2. (a).In an interview, 30% of the students failed and 10% of the students achieved the distinctions. Last year, the pass mark was 84 and the minimum distinction mark was 154. If the marks of the students were normally distributed, find the probability that a student chosen at random scored more than 155 marks.

(b). If 20% of loan applicants received by the bank are rejected, find the percentage that among 450 loan applications, only 90 will be rejected.

3. (a). Two biased tetrahedrons have each of their faces numbered 1 to 4. The chance of getting any one face showing uppermost is inversely proportional to the number on it. If the two tetrahedrons are thrown and the number on the upper most face noted, determine the probability that the faces show the same number.

(b). If it is a fine day, the probability that Sir Fred goes to play football is $\frac{9}{10}$ and the probability that Bob goes is ¾. If it is not fine, Sir Fred's probability is ½ and Bob's is ¼ . Their decisions are independent. In general it is known that it is twice as likely to be fine as not fine.
(i). Determine the probability that both go to play
(ii). If they both go to play, what is the probability that it is a fine day.

4. (a). X is a discrete random variable which takes all integers from 1 to 40 such that $P(X = x) = kx$; $x = 1,2,3,\dots,40$.

(i)Find the value of the constant k.

(ii).Compute the standard deviation of X.

(iii). Find $P(x < 35/x > 20)$.

(b). X is a random variable such that;

$$f(x) = \begin{cases} \beta(1 - 2x); & -1 \le x \le 0 \\ \beta(1 + 2x); & 0 \le x \le 2 \\ 0 & ; elsewhere. \end{cases}$$

(i)   Sketch the pdf, $f(x)$

(ii)   Determine the value of the constant, β

(iii) Find the mean of x

(iv)   Find the 60th Percentile

STATISTICS

5. (a). For a particular set of observations $\sum f = 20$, $\sum fx^2 = 16143$ and $\sum fx = 563$. Find the value of the;

(i). Mean

(ii). Standard deviation

(b). A set of digits consists of m zeros and n ones.

(i). Find the mean of this set of data.

(ii). Hence show that the standard deviation of the set of digits is $\frac{\sqrt{mn}}{m+n}$

(c). A physics student measured the time required in seconds for a trolley to run down slopes of varying gradients and obtained the following results.

32.5, 34.5, 33.5, 29.3, 30.9, 31.8. Calculate the mean time and standard deviation

6. (a). The table below shows the distribution of weights of a group of animals.

Mass(kg)	Frequency
21-25	10
26-30	20
31-35	15
36-40	10
41-50	30

51-65	45
66-75	5

(i)   Construct a histogram for the above data and use it to estimate the mode.

(ii)   Calculate the median for the above data.

(b)The distribution below shows the weights of babies in Gombe hospital 3, 5, 3, 9, 6, 8, 20, 19, 24, 14, 12. Find the;

(i). Upper quartile   (ii). Lower quartile   (iii). Median   (iv). Variance

(v). Standard deviation.

7. Eight candidates seeking admission to a university course sat for a written and oral test. The scores were as shown in the table below.

Written X	55	54	35	62	87	53	71	50
Oral Y	57	60	47	65	83	56	74	63

(i). Draw a scatter diagram for this data

(ii). Draw a line of best fit on your scatter diagram

(iii). Use the line of best fit to estimate the value of Y when X=70.

(iv). Calculate the rank correlation coefficient. Comment on your result.

8. The table below shows the expenditure of restaurant for the year 2014 and 2016.

Item	Prices(shs)		weight
	2014	2016	
Milk (per litre)	1000	1300	0.5
Eggs (per tray)	6500	8300	1
Sugar (per kg)	3000	3800	2
Blue band	7000	9000	1

Taking 2014 as the base year, calculate for 2016 the;

   i.   Price relative for each item

    ii.   Simple aggregate price index
    iii.   Weighted aggregate price index and comment on your result
    iv.   In 2016, the restaurant spent shs. 4,500 on buying these items. Using the index obtained in (iii), find how much the restaurant could have spent in 2014.

NUMERICAL ANALYSIS

9(a). Use the trapezium rule to estimate the area of 5^{2x} between the $x-axis, x = 0, and\ x = 1$, using 5 sub-intervals. Give your answer correct to 3dps.

(b). Find the exact value of $\int_0^1 5^{2x} dx$

(c). Determine the percentage error in the two calculations in (a) and (b) above.

(d). How should the error be reduced.

10(a). Show graphically that the $x^3 + 5x^2 - 3x - 4 = 0$ has roots between 0 and -1.

(b). Use the Newton Raphson method to calculate the root of the equation in (a) correct to 2dps.

11(a). Given that $y = sec(45^0 \pm 10\%),$ find the limit within which the exact value of y lies

(b). Construct a flow chart that computes and prints the average of the squares of the first six counting numbers. Perform a dry run for your flow chart.

12. If the numbers x and y are approximations with errors Δx and Δy respectively;

(a). Show that the maximum absolute error in the approximations of $x^2 y$ is given by $|2xy\Delta x| + |x^2 y|$. Hence find the limits within which the true value of $x^2 y$ lies given that $x = 2.8 \pm 0.016\ and\ y = 1.44 \pm 0.008$.

(b) Given two numbers $x = 3.815\ and\ y = 2.43,$ find the absolute error in the quotient $\frac{y}{x}$, truncate to 3dps. Hence, find the least and greatest value of $\frac{y}{x}$, correct to two decimal places.

MECHANICS

13.   (a) At 8:00am , a bus initially packed at a stage A, starts moving along a straight road with acceleration $a = (4t)kmh^{-2}$, which acceleration continues until $t = 5hours,$ where upon it cease and the bus uniformly retards at $20kmh^{-2}$ to stage B, Determine the;
    (i)   Time when the bus reaches stage B.
    (ii)   Distance between A and B

(iii)   Sketch a velocity- time graph to represent the above journey of the bus.

14.   Two bodies P and Q are simultaneously projected from a point O with the same speed but at different angles of elevation, and they both pass through a point c which is at a horizontal distance $2h$ from O and at a height h above the level of O. The body P is projected at an angle $tan^{-1}(2)$ *above the horizontal.* Show that;

(a)   The speed of projection is $\sqrt{\dfrac{10gh}{3}}$

(b)   Q is projected at an angle $tan^{-1}\left(\dfrac{4}{3}\right)$ to the horizontal

(c)   The time interval between the arrivals of the two bodies at C is $(3-\sqrt{5})\sqrt{\dfrac{2h}{3g}}$

15.   At 10:00am, ship A moving at $20kmh^{-1}$ due east is 10km south east of another ship B. If B is moving at $14kmh^{-1}$ in the direction S30⁰W and the ships maintain their velocities, find the;

(a) time when the ships are closest together,

(b) shortest distance between the ships,

(c) bearing of A from B at that time.

16.   The figure below shows a uniform beam of length 0.8m and mass 1kg. the beam is hinged at A and has a load of mass 2kg attached at B.
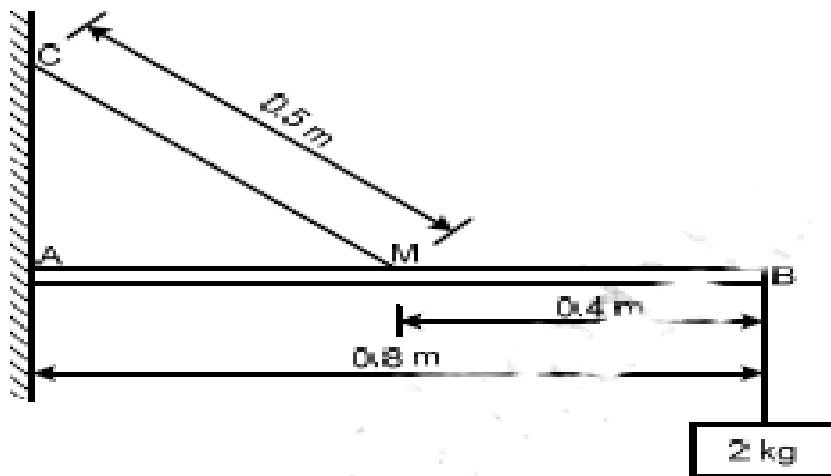
The beam is held in a horizontal position by a light inextensible string of length 0.5m. The string joins the midpoint M of the beam to a point C vertically above A. Find the

(i)   Tension in the string

(ii)   Magnitude and direction of the force exerted by the hinge

17.   The resultant of the forces $F_1 = \begin{pmatrix} 3 \\ a-c \end{pmatrix}, F_2 = \begin{pmatrix} 2a+3c \\ 5 \end{pmatrix}, F_3 = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ acting on a particle is $\begin{pmatrix} 10 \\ 12 \end{pmatrix}$. *Find the;*
   (i)   Values of a and c
   (ii)   Magnitude of force F_2

(b) Five forces of magnitudes 3N, 4N, 4N, 3N, and 5N, act along the lines AB, BC, CD, DA, and AC respectively, of a square ABCD of side 1m. the direction of the forces is given by the order of the letters. Taking AB and AD as reference axes, find the magnitude and direction of the resultant force.

WISHING YOU GREAT SUCCESS IN YOUR UNEB EXAMINATIONS

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