P425/2

APPLIED MATHEMATICS

PAPER 2

JULY/AUG 2024

3 HOURS

ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2024

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

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INSTRUCTIONS TO CANDIDATES

- *Attempt all the **eight** questions in section A and only **five** questions from section **B**.*
- *Any additional question(s) answered will not be marked.*
- *All necessary working must be shown clearly.*
- *Any graphical number should fully be attempted on a graph paper.*
- *Silent non-programmable scientific calculator and mathematical tables with a list of formulae may be used.*
- *In numerical work take acceleration due to gravity (g) to be $9.8ms^{-2}$.*

SECTION A: (40 MARKS)

Answer all the questions in this section.

1. A car is travelling at $20ms^{-1}$, a driver observes an obstacle that is at a distance of 30m away and starts braking. Determine the;
   (a) Retardation.
   (b) Time it takes to stop. *(5marks)*

2. The time, to the nearest seconds taken by 100 students to solve a given problem are as shown below.

Time in seconds	30-49	50-64	65-69	70-74	75-79
No. of students	10	30	25	20	15

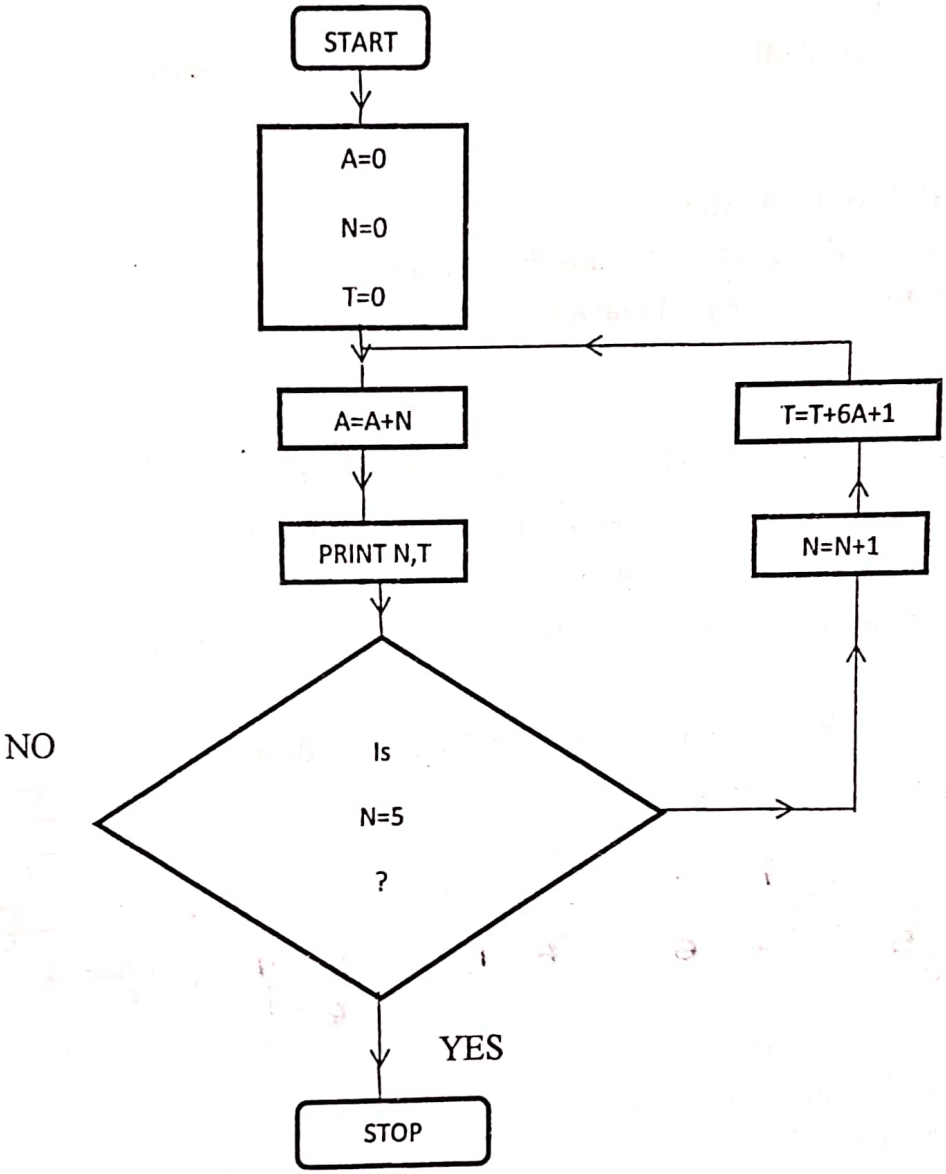
Determine the;
(a) Mean.
(b) Number less than 64.5. *(5marks)*

3. Given that $x = 4.23, y = 2.1$ and $z = 3.2$ have percentage errors of 2, 3 and 4 respectively. Determine the;
   (a) Errors in x, y and z.
   (b) Maximum value in $\frac{xy}{z}$. *(5marks)*

4. A uniform rod AB of mass 5kg rests on a smooth horizontal floor at A and is supported at 4m from A, if the length of the rod is 6m with B above A. determine the reaction at the support, when the rod is resting at 60^0 above the floor. *(5marks)*

5. Two events A and B are such that P(A)=0.7, P(B)=0.4 and P(A/B)=0.3. determine;
   (a) Probability that either A or B occurs.
   (b) P(A/(AUB)). *(5marks)*

6. Perform a dry run for the flow chart below.



State the relationship between N and T. ***(5marks)***

7. A shell of mass 5kg is fired from a gun of mass 2,000kg, the shell leaves the gun with a speed of $400ms^{-1}$. Determine the;
   (a) Speed of recoil of the gun.
   (b) Retardation when the retarding force of the gun is 4000N.

(5marks)

8. A biased coin is tossed six times. The coin is such that the ratio of the tail to the head is 1:2, determine the probability of getting:
   (a) Atleast 5 heads.
   (b) Between 1 and 3 tails. *(5marks)*

SECTION B (60 MARKS)
Answer any five questions from this section.
All questions carry equal marks.

9. A particle is initially at position (3, -1, 4)m and has velocity (v)=$(2t^3 + 16)\underset{\sim}{i} + \left(\frac{9}{2}t^2 - 4t + 15\right)\underset{\sim}{j} + \left(\frac{-3}{2}t^2 - 8\right)\underset{\sim}{k} ms^{-1}$, determine the;
   (a) Acceleration and its magnitude at t = 3s.
   (b) Displacement and distance at t = 2s *(12marks)*

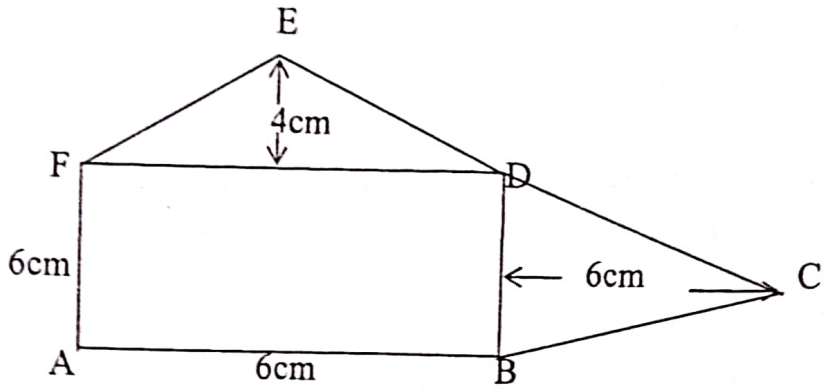
10. The table below shows the results scored by twelve students in physics (x) and mathematics (y)

Physics	28	20	40	28	21	22	31	36	29	30	24	25
Mathematics	30	20	40	28	22	25	45	35	27	31	23	27

   (a) Construct a scatter diagram, draw the line of best fit and comment.
   (b) Calculate the rank correlation co-efficient and comment on significance at 5%. *(12marks)*

11. (a) Show graphically that the equations $y = e^{-3x}$ *and* $y = cosx$ have a root in the interval $1.2 \leq x \leq 2$ correctthe initial approximation (x_0) to 1 decimal place.
   (b) Using the initial approximation (x_0) from the graph above and the Newton Raphson method find the root correct it to three decimal places. *(12marks)*

12. The figure ABCDEF is made up of three laminas that are as indicated in the diagram below.



Determine the centre of gravity from AF and AB taken as the y and x axes respectively. State it as a co-ordinate. ***(12marks)***

13. The table below shows the number of apples put in boxes A, B and C.

Apples	boxes		
	A	B	C
Green	4	7	3
Red	7	5	11

A box is randomly selected and two apples are selected from it without replacement. Box A is twice as likely to be picked as B. while A and C have the same chance of being picked.

(a) Determine the probability that both apples are;

(i) Of the same colour.

(ii) From box B, given that they are of the same colour.

(b) If X is the number of green apples taken, construct the probability density function of X, hence find the mean and standard deviation. ***(12marks)***

14. (a) Use the trapezium rule with 6 ordinates to estimate $\int_0^{\frac{3}{4}} \sqrt{(1-x^2)}\, dx$ correct it to 3 decimal places.

(b) Find the exact value of the expression in part (a) above correct to 3 decimal places. Hence find the error and state how the error may be reduced. ***(12marks)***

15. (a) A car travelling at $30ms^{-1}$ has no tendency to side slip on a track of radius 250m banked at θ to the horizontal. Find the angle θ.

(b) If speed is increased to $40ms^{-1}$. It is about to slip upwards, determine the co-efficient of friction.

(c) Hence find the minimum speed required for it to slide downwards. ***(12marks)***

16. A continuous random variable X has probability density function $f(x)$that is as indicated below.

$$f(x) = \begin{cases} \frac{x}{3} - \frac{2}{3} & ; \ 2 \le x \le 3 \\ a & ; \ 3 \le x \le 5 \\ 2 - bx & ; \ 5 \le x \le 6 \\ 0 & ; \ otherwise \end{cases}$$

Where a and b are constants. Determine the;

(a) Values of a and b,

(b) Cumulative distribution function $(F(x))$,

(c) Hence from part (b) above $P(2.5 < X < 3.5)$. ***(12marks)***

END