P425/2
APPLIED MATHEMATIC
PAPER 2
JULY 2011
3 HOURS

UGANDA ADVANCED CERTIFICATE OF EDUCATION MOCKS 2011

APPLIED MATHEMATICS

PAPER 2

3 HOURS

INSTRUCTIONS:

- Answers all the eight questions in Section A and five from Section B.
- All workings must be shown clearly.
- Begin each answer on a fresh page.
- Where necessary for numerical work take g= 9.8ms^{-2}.
- State the degree of accuracy at the end of each answer given.

SECTION A (40 MARKS)

Answer all questions in this section

1. Two events A and B are such that P(A) = $^3/_5$, $P(B/A') = \frac{1}{3}$, $P(B'/A) = \frac{1}{4}$, Find:

   i) P(B)

   ii) P(A'/B) **(5marks)**

2. Given that X = 4.8654 and Y = 2.80
   i) State the maximum possible errors in X and Y.
   ii) Determine the absolute error in XY.
   iii) Find the limits within which XY lies correct to 4 decimals places. **(5 marks)**

3. A coin is biased such that it is thrice as likely to show heads as tails. The coin is tossed five times. Calculate the probability that.

   i) Exactly three heads are obtained.
   ii) More than three heads are obtained **(5marks)**

4. Initially a particle is at the origin O and is projected with a velocity $a\underset{\sim}{i}$ ms^{-1}. After t seconds, the particle is at the point with position vector $(30\underset{\sim}{i} - 10\underset{\sim}{j})$m. Find the values of t and a. **(5marks)**

5. Use the trapetium rule to estimate the integral

   $$\int_{0.5}^{1.5} \frac{X}{2X+1}\, dx$$

   Using 5 sub – intervals giving your answer to 2dp. **(5marks)**

6. Two forces of magnitude PN and QN, have a resultant of $2\sqrt{7}$ N when the angle between their lines of action is 30, the resultant is of magnitude $2\sqrt{13}$ N. calculate the values of P and Q.**(5marks)**

7. Residents of Katwe were asked how long it took them to travel to owino market on a particular morning. A cumulative frequency distribution was formed.

Time taken	<5	<10	<15	<20	<25	<30	<35	<40	< 45
Cumulative frequency	28	45	81	143	280	349	374	395	400

   i) Form a frequency distribution table for the data and draw the Histogram.
   ii) Estimate the mode using the Histogram in (i) above. **(5marks)**

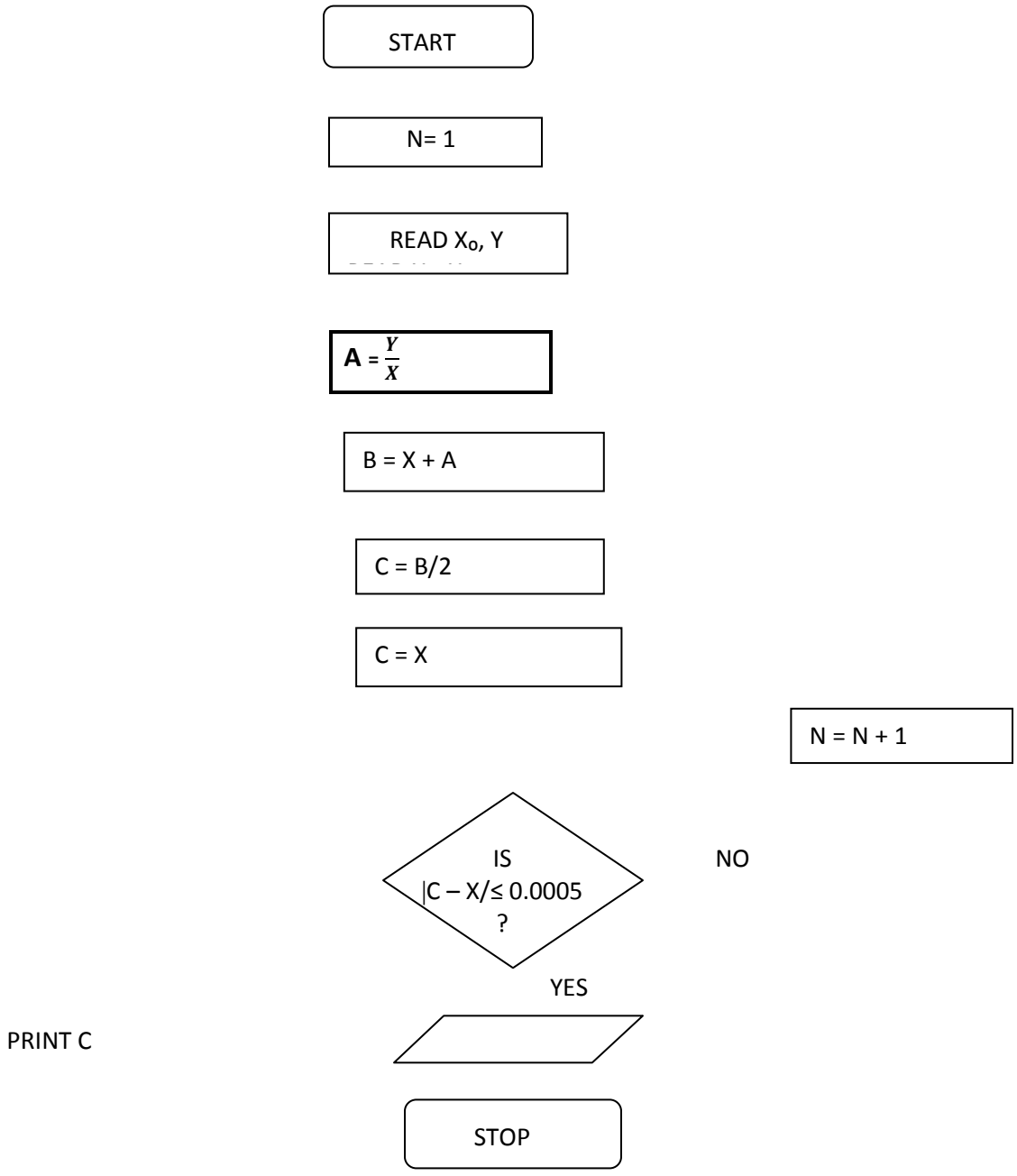
8. An elastic string AB of natural length ℓm and modulus of elasticity 2mg N has one end A fixed . A particle of mass m kg is attached to the end B and performs a horizontal circle with angular velocity $\sqrt{\frac{3g}{4l}}$rads^{-1}. Find: -

   i) the extension in the string
   ii) the cosine of the angle between the string and the vertical. **(5marks)**

SECTION B (60MARKS)

Answer any five questions from this section. All questions carry equal marks

9. a) Study the flow chart below and answer the questions that follow.



i) Perform a dry run for the flow chart $x_o = 2$, Y = 5.
ii) State the purpose of the flow chart.

b) Draw a flow chart for computing and printing out the mean of the square roots of the first 10 natural numbers. **(12 marks)**

10. The heights of a newly developed variety of maize plant can be modelled 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?

b) Calculate the 95% confidence interval for the mean of this sample. **(12marks)**

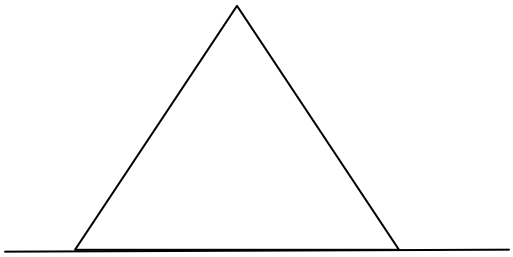
11. A continuous random variable x has a cumulative distribution function F(*x*) given by

$$F(X)\begin{cases} 0 & x \le 0 \\ \dfrac{kx \overset{2}{\leftarrow}}{2} & 0 \le x \le 1 \\ kx + a & 1 \le x \le 2 \\ b(5 - x)(x - 1) & 2 \le x \le 3 \\ 1 & x \ge 3 \end{cases}$$

Determine

i) The values of K, a and b
ii) The median of x
iii) The pdf, f(x)
iv) P [(3 ≤ 2x ≤5)/ x ≥ 0.5] **(12marks)**

12. The diagram shows two uniform rods AB and BC of equal length, smoothly jointed together at B.



End A is freely hinged to a rough horizontal surface and C stands on the same surface, coefficient of friction, μ =0.6. A,B and C all lie in the same vertical plane. The weights of AB and BC are respectively 2W and W. if end C is at the point of slipping, find

a) the value of angle θ.

b) the magnitude and direction of the reaction at A. **(12marks)**

13. a) Show that one of the roots of the equations $e^x - 2x = 1$ is zero and the other lies between x = 1 and x = 1.5 hence use linear interpolation once to find a better approximation of the root that lies between 1 and 1.5.

b) Use Newton – Raphson formular to find the root in (a) above to two decimal places. **(12marks)**

14. Adjudicators X, Y and Z attended music competitions in a certain school and awarded marks as follows

Competitor		A	B	C	D	E	F	G
Adjudicator	X	89	85	82	76	72	64	51
	Y	77	82	86	69	80	76	69
	Z	76	86	88	80	69	74	86

a) Calculate the rank correlation coefficient between

i) X and Y
ii) X and Z
ii) Y and Z

b) Hence establish the three prize winners starting with the first.

c) Comment on your result. **(12marks)**

15. a) A pump draws water from a tank and issues it at a speed of $8ms^{-1}$ from the end of a pipe of cross-sectional area of $0.01m^2$ situated 10m above the level from which the water is drawn. Find the rate at which the pump is working (take density of water = $1000kgm^{-3}$)

b) A car of mass 800kg is pulling a trailer of mass 200kg up a hill inclined at an angle $\sin^{-1}\left(\frac{1}{14}\right)$ to the horizontal. When the total force exerted by the engine is 1000N the car and the trailer move up the hill at a steady speed. Find the total frictional resistance to the motion of the car and trailer during this motion.
If the frictional resistance on the car is 280N, find the tension in the coupling between the car and the trailer. **(12marks)**

16. Two bodies P and Q of mass 150g and 250g respectively are free to move on a straight horizontal track. Initially Q is at rest and P is moving towards Q with a velocity of $40ms^{-1}$. Immediately after the impact Q has a velocity of $8ms^{-1}$ relative to P. Calculate the: -

i) Velocities of each body after impact

ii) Magnitude of the impulse imparted on Q by P

b) A toy boat of mass 0.2kg starts on one side of a pond and is given an initial velocity of 0.5ms-1 towards the other side. The boat experiences a resisting force of (0.0001 + 0.002v)N, where Vms^{-1} is the speed of the boat.
Given that the boat just reaches the other side, find the width of the pond. **(12marks)**

~ END ~