BUGANDA EXAMINATIONS COUNCIL MOCKS

Uganda advanced Certificate of Education

Applied Mathematics

Paper 2

3hours

INSTRUCTIONS TO CANDIDATES:

- *Answer **ALL** the eight questions in Section A and* <u>ONLY</u> *5 from Section B.*

- *All working MUST be clearly shown.*

- *Mathematical tables with a list of formulars and graph paper will be provided.*

- *Use a silent non programmable calculator.*

- *State the level of accuracy for answers got and indicate (tab) for Mathematics tables and (cal) for calculator used.*

- *Begin each answer on a fresh paper and use g = 9.8 m/s for numerical work.*

SECTION A (40 MARKS)

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

   i). $P(A \cap B)$

   ii). $P\left(^B/_{\bar{A}}\right)$.   *(05 marks)*

2. A discrete random variable x has a cumulative distribution function (c.d.f) as shown below.

X	1	2	3
F(x)	K	4k	9k

   Find
   i). k
   ii). Mean k
   iii). $P(x \geq 2)$.   *(05 marks)*

3. Three men A, B and C took part in a shooting contest. The probability that A hits the target is $\frac{1}{3}$, B and C have corresponding probabilities of $\frac{1}{5}$ and $\frac{1}{7}$.

   (i)   Make a tree diagram for the above.

   (ii) Find the probability that only two men will hit the target.   *(05 marks)*

4. Use the trapezium rule with 5 ordinates to estimate:

   $$\int_0^4 xe^{-x}\, dx$$, correct to 3 decimal places.   *(05 marks)*

5. Two examiners V and W each marked the papers of ten candidates who sat a mathematics examination. The table shows the examiners' ranking of the candidates. Calculate spearman's rank, correlation coefficient and comment on your result.

   Table 1

Examiners	A	B	C	D	E	F	G	H	I	J
V	5	3	6	1	4	7	2	10	8	9
W	6	3	7	2	5	4	1	10	9	8

   (05 marks)

6. A particle of weight 20N rests on a rough horizontal ground and the coefficient of friction between the particle and ground is µ. Force P acting upwards at 30^0 to the horizontal, is just enough to move the particle. Show that $P = \dfrac{40\mu}{\mu + \sqrt{3}}$. **(05marks)**

7. Over a long period, it's found that the mass of soap powder in certain packets is normally distributed with standard deviation of 15g. Find the 95% confidence limits for mean of the distribution if the mean of a random sample of size 25 is 842g. **(05 marks)**

8. A particle initially is at a point $P_0 = (3i + 5j - 8k)$m with a constant speed of 25m/s in direction of $\underline{u} = 3j + 5k$. Find;
The constant velocity of the particle and its final position after 10 seconds. **(05marks)**

SECTION B (60 MARKS)

9. The table below shows the distribution of marks of 80 students in S.6 mock examination.

Marks	10-<20	20-<30	30-<40	40-<50	50-<60	60-<70	70-<80	80-<90	90-<100
No. Of students	2	3	9	10	14	19	11	8	4

a) Calculate;
   i. Mean
   ii. Standard deviation.
b) Plot an ogive for the distribution and use it to estimate;
   (i) Median
   (ii) Pass mark if 60 students passed.

(12 marks)

10a) Box A contains 4 red sweets and 3 green sweets. Box B contains 5 red sweets and 6 green ones. Box A is twice likely to be picked as box B. If a box is chosen at random and two sweets are removed from it one at a time without replacement,

   (i) Find the probability that the two sweets removed are of same colour.

   (ii) Construct the probability distribution table for the number of red sweets picked.

   (iii) Find the mean number of red sweets. **(7marks)**

b) A random variable has a pdf given by $f(x) = \begin{cases} k(1-x^2), & 0 \le x \le 1 \\ 0, & elsewhere \end{cases}$

Determine;

   (i) the value of the constant k.

   (ii) Mean of x. **(5marks)**

11a) Show that the Newton Raphson Formula for approximating the root of equation

$xe^x = 10 - 5x$ is $X_{n+1} = \dfrac{X_n^2 e^{X_n} + 10}{e^{X_n}(X_n + 1) + 5}$.

b)   Draw a corresponding flow chart that;
  i.   Reads the initial approximation X_0.
  ii. Counts the number of interactions as 4.
  iii. Computes the root to two decimal places.
  iv. Prints the root. Hence perform a dry run taking X_0 as 1.13.

(12 marks)

12a) A uniform beam of weight W and length 2b rests in equilibrium with one end, A, against a smooth vertical wall and the other end, B on a rough horizontal floor. The plane through AB meets the line of intersection of the wall and the floor at point O.

  iii.   Calculate the normal reactions at A and B.

  iv. Show that friction force is $\dfrac{W}{2\tan\theta}$, where θ is angle the beam makes with horizontal.

  v.   If the beam slips when a man of weight 2W climbs $\dfrac{3}{2}b$ upward and $\tan\theta = 3$, find the coefficient of friction between the floor and the beam.   *12 marks)*

13. An aircraft A is 8km due north of another aircraft B. Both are flying at the same height with constant velocity 150kmh^{-1} due west and 200kmh^{-1} N30^{0}W respectively. After what time will the aircraft be closest together and how far apart will they be by then?   *(12 marks)*

14a) The table below shows the values of function f(x) at a set of points.

x	0.9	1.0	1.1	1.2
f(x)	0.266	0.242	0.218	0.192

Use linear interpolation to find;
  i.   Value of   f(1.04)
  ii.   The value of x corresponding to f(x)=0.25.   *(06 marks)*

b)i)   Given that A=bcsinϴ as the formula to finding area of a triangle with error $|\Delta A|$ and the sides b and c subtending an angle ϴ with errors $|\Delta b|$, $|\Delta c|$ and $|\Delta\theta|$ respectively. Prove that the expression for percentage error in area is given by;

$(\left|\dfrac{\Delta b}{b}\right| + \left|\dfrac{\Delta c}{c}\right| + \cot\theta|\Delta\theta|)100\%$

  ii)   The dimensions of a rectangle are 6.2cm and 5.36cm.
 iii)   Find the range within which the area of the rectangle lie.   *(06 marks)*

15a) The diagram below shows the three forces **P, R** and mg acting on a particle of mass m and as a result, producing the acceleration a horizontally. The surface is smooth. **R** is the normal reaction.
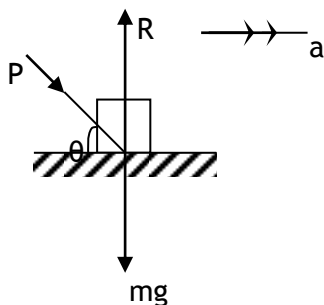
Prove that $\tan\theta = \dfrac{R-mg}{ma}$ *(05 marks)*

(b) A pulley system has loads 6kg and 3kg at the ends of the string and a movable pulley of mass 2kg as shown in the figure below.
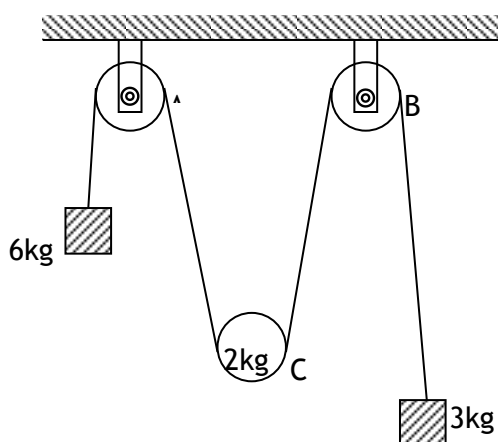
Assuming that the pulleys A B and C are smooth, find;
a. the acceleration of C.
b. The tension in the string. (Leave acceleration due to gravity as g in your solution) *(07 marks)*

16. In a school of 800 students their average weight is 54.5kgand standard deviation is 6.8kg. if the weight of the students is assumed to be normally distributed, find;

(i) Probability that a student picked at random weighs 52.8 or less kg.
(ii) The number of students who weigh over 75kg.
(iii) The weight range of the middle 56% of the students in the school. *(12 marks)*

END