FORM TP 2014134

TEST CODE **02205032**

MAY/JUNE 2014

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

APPLIED MATHEMATICS

MATHEMATICAL APPLICATIONS

UNIT 2 – Paper 032

1 hours 30 minutes

13 JUNE 2014 (p.m.)

This examination paper consists of THREE sections: Discrete Mathematics, Probability and Distributions, and Particle Mechanics.

Each section consists of 1 question.
The maximum mark for each section is 20.
The maximum mark for this examination is 60.
This examination consists of 4 printed pages.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. DO NOT open this examination paper until instructed to do so.
2. Answer ALL questions from the THREE sections.
3. Unless otherwise stated in the question, all numerical answers MUST be given exactly OR to three significant figures as appropriate.

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Examination Materials:

Mathematical formulae and tables (Revised 2010)
Electronic calculator
Ruler and graph paper

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

MODULE 1: DISCRETE MATHEMATICS

1. (a) The propositions p and q are such that p is $2 + 2 = 6$ and q is $1 + 2 = 3$.

(i) Write down a Boolean expression for

$2 + 2 \neq 6$ and if $2 + 2 = 6$ then $1 + 2 = 3$. **[3 marks]**

(ii) Construct a truth table for the expression obtained in (a) and show that its truth value is $\sim p$. **[4 marks]**

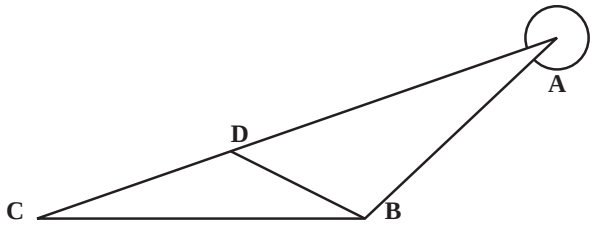
(b) Use logic gates to draw a circuit for $\sim (p \wedge q) \vee r$. **[3 marks]**

(c) The table below gives the profit, in dollars, to be gained by shipping four packages *A*, *B*, *C* and *D* by GX Courier, YG Courier, IL Courier and AB Courier.

	GX Courier	**YG Courier**	**IL Courier**	**AB Courier**
A	45	47	48	49
B	55	53	50	50
C	45	46	43	48
D	52	54	49	52

Use Hungarian algorithm to allocate EACH package to a courier service so as to maximize the profit. **[7 marks]**

(d) The diagram below shows the routes a student may use to get from *C* to *A*.



(i) Find the different paths the student may use to get to *A* from *C*. **[2 marks]**

(ii) State the degree of *A*. **[1 mark]**

Total 20 marks

GO ON TO THE NEXT PAGE

SECTION B

MODULE 2: PROBABILITY AND DISTRIBUTIONS

2. (a) The continuous random variable X has cumulative distribution function F given by

$$F(x) = \begin{cases} 0, & x \leq 3 \\ k\,(x-3), & 3 \leq x \leq 6 \\ 1, & x \geq 6 \end{cases}$$

where k is a constant.

Determine

(i) the value of k **[3 marks]**

(ii) $P(4 < X \leq 5)$ **[3 marks]**

(iii) the median of X **[3 marks]**

(iv) the probability density function of X **[3 marks]**

(v) $E(X)$. **[4 marks]**

(b) A discrete uniform random variable Y has the probability density function f given by

$$f(y) = \begin{cases} \frac{1}{6}, & y = 1, 2, 3, 4, 5, 6 \\ 0, & \textit{otherwise} \end{cases}$$

Determine

(i) $E(Y)$ **[2 marks]**

(ii) $E(3Y + 2)$. **[2 marks]**

Total 20 marks

SECTION C

MODULE 3: PARTICLE MECHANICS

Take $g = 10\ \text{ms}^{-2}$

3. (a) A car travelling at 90 kmh^{-1} is brought to rest with a constant retardation in a distance of 50 m. Calculate

(i) the retardation **[3 marks]**

(ii) the time taken for the car to be brought to rest. **[3 marks]**

(b) A block is pulled up a smooth plane inclined at an angle of $\sin^{-1}\left(\frac{1}{30}\right)$ to the horizontal at a constant speed of 12 ms^{-1}. The work done against gravity in 2 seconds is 360 J. Find the weight of the block. **[5 marks]**

(c) A particle *D* of mass 3*m* kg rests on a rough plane inclined at 30° to the horizontal. *D* is attached to one end of a light, inextensible string which passed over a smooth, weightless pulley which is fixed at the top of the plane and has a particle *E* of mass 4*m* kg hanging freely at the other end. If the frictional force is equal to one-quarter of the normal reaction of *D*, calculate the acceleration of *D*. **[9 marks]**

Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.