



ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

HIGHER NATIONAL DIPLOMA

IN

INFORMATION TECHNOLOGY

SUBJECT: Operations Research

PAPER NO: 710/SO2

OCTOBER/NOVEMBER 2013 EXAMINATION

REQUIREMENTS

1. Non-programmable calculator
2. Statistical Formulae and Tables

INSTRUCTIONS TO CANDIDATE

1. Answer ALL questions.
2. Each question carries 20 marks.
3. Show all working clearly.
4. Where degree of accuracy is not specified, give answer to 3 decimal places.

This paper consists of 4 printed pages.

QUESTION 1

- a) i) Verify that the equation $x^3 - 5x - 40 = 0$ has a root between $x = 3$ and $x = 4$ (2 marks)
- ii) Use the Newton-Raphson method to find the roots of $x^3 - 5x - 40 = 0$ correct to three significant figures. (8 marks)
- b) Use the trapezium rule with 4 ordinates to estimate:
 $\int_0^1 \frac{1}{(10x^2)} dx$ (10 marks)

QUESTION 2

- a) The following set of activities of precedence relationships have been developed with respect to a construction project.

Activity	Immediate Predecessors	Estimated duration (wks)
A	-	2
B	A	4
C	B	10
D	C	6
E	C	4
F	E	5
G	D	7
H	E,G	9
I	C	7
J	F,I	8
K	J	4
L	J	5
M	H	2
N	K,L	6

- i) Construct a network diagram for these activities. (6 marks)
- ii) Determine the critical path for the project and hence the minimum duration of the project. (2 marks)
- b) Patrons arrive at a small post office at the rate of 30 per hour. Service by the clerk on duty takes an average of 1 minute per customer.
- i) Calculate the mean customer time spent waiting in a line. (3 marks)
- ii) Calculate the average time spent receiving or waiting for service. (3 marks)
- iii) Find the mean number of patrons in line. (3 marks)
- iv) Find the mean number of patrons receiving or waiting for service. (3 marks)

QUESTION 3

- a) If x is a continuous random variable (c.r.v) with probability density function
 $f(x) = KX, 0 \leq x \leq 5$

- i) Evaluate K (2 marks)
 ii) Calculate $E(X)$ (3 marks)
 iii) Find $P(2 \leq x \leq 4)$ (3 marks)

- b) Independent continuous random variables x y have respective probability density function.

$$f(X) = x/4; 1 \leq x \leq 3 \text{ and } g(y) = \frac{1}{2}; 2 \leq y \leq 4$$

- i) Calculate the expectation of $4y - 3x$ (6 marks)
 ii) Calculate the variance of $4y - 3x$ (6 marks)

QUESTION 4

- a) A group of eight Polytechnic students were tested in Operations Research (OR) and Advanced Computer Networks (ACN) and the ranking in the two subjects are given in a table below:

Subject	1	2	3	4	5	6	7	8
OR	2	7	6	1	4	3	5	8
ACN	3	6	4	2	5	1	8	7

Calculate the Spearman's Correlation Coefficient and interpret it. (10 marks)

- b) The annual demand for soft drinks at Delta beverages is 32 000 crates. The ordering cost is \$500 per order and the cost of holding a crate of soft drinks in inventory for 1 year is \$0,35.

Calculate:

- i) The economic order quantity (EOQ). (4 marks)
 ii) The total annual minimum cost if the cost of 1 crate is \$120. (4 marks)
 iii) The length of an inventory cycle. (2 marks)

QUESTION 5

- a) Solve the maximising assignment problem below:

	W	X	Y	Z
A	25	18	23	14
B	38	15	53	23
C	15	17	41	30
D	26	28	36	29

(10 marks)

- b) The number of people asking for emergency dental treatment per day at a surgery A is a Poisson variate with a mean value of 2. The number of requests for emergency treatments per day at surgery B is an independent Poisson variate with a mean value of 1. Find to 3 significant figures the probability that:

- i) Both Surgeries have exactly two requests for emergency treatment. (4 marks)
- ii) Less than two people in total ask for emergency treatment at either or both surgeries. (6 marks)

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