PAN AFRICA CHRISTIAN UNIVERSITY

Where Leaders are Made

UNIVERSITY EXAMINATIONS: 2025/2026

EXAMINATION FOR THE DIPLOMA IN INFORMATION TECHNOLOGY

DICT0124

OPERATIONS RESEARCH

END TERM EXAMINATION

DATE: THURSDAY 11TH DECEMBER, 2025 TIME:11:00AM-1:00PM
DURATION: 2 HOURS

INSTRUCTIONS: Question One is Compulsory, Choose Three Other Questions

SECTION A (COMPULSORY)

QUESTION ONE (15 MARKS) COMPULSORY

a. State the main objective of Operations Research. [1 Mark]
b. Formulate an LP problem to maximize profit for two products using limited labour and materials. [3 Marks]
c. A network administrator wants to minimize bandwidth costs. How can Operations Research assist? [2 Marks]
d. A company wants to minimize transport costs between three factories and four warehouses. Which OR technique and model should be used? [2 Marks]
e. Write an objective function for minimizing total operating cost. [2 Marks]
f. Develop an LP model for optimal staff scheduling in a call centre. [2 Marks]
g. A server processes 10 jobs per hour, and jobs arrive at 8 per hour. Calculate the average number of jobs in the queue (Lq). [3 Marks]

SECTION B: (ANSWER ANY THREE (3) QUESTIONS IN THIS SECTION)

QUESTION TWO (15 marks)

a. What are the three essential components of a Linear Programming problem? [3 Marks]
b. A farmer grows maize (X_1) and beans (X_2) on 10 acres. Maize requires 2 acres per unit, beans require 1 acre per unit. Profit is Ksh. 300 for maize and Ksh. 200 for beans. Formulate the LP model. [3 Marks]
c. Formulate an LP problem for allocating bandwidth between two data servers to maximize throughput. [3 Marks]
d. Evaluate the advantages of using Linear Programming in decision-making. [3 Marks]
e. Assess the limitations of Linear Programming in real-world applications. [3 Marks]

QUESTION THREE (15 marks)

a. What is problem formulation in Operations Research? [2 Marks]
b. Explain why problem formulation is considered the foundation of Operations Research. [2 Marks]
c. Develop an OR model for determining the best location for a new warehouse. [3 Marks]
d. Formulate a linear programming model for maximizing profit given two products that require limited labor and materials. [4 Marks]
e. Design a Linear Programming model for a factory that produces two products using limited raw materials and labour. [4 Marks]

QUESTION FOUR (15 marks)

a. What is the main objective of Operations Research in ICT project management? [2 Marks]
b. List three ICT-related areas where Operations Research can be applied. [3 Marks]
c. Describe how Queuing Theory is useful in ICT customer support systems. [3 Marks]
d. Explain why constraints are necessary in Linear Programming. [2 Marks]
e. Analyze how OR can enhance network traffic management in large organizations. [3 Marks]
f. Break down how Operations Research could be applied to optimize cloud service pricing strategies. [2 Marks]

QUESTION FIVE (15 marks)

a. What is Excel Solver? [2 Marks]
b. A farmer grows maize (X_1) and beans (X_2) on 10 acres. Maize requires 2 acres per unit, beans require 1 acre per unit. Profit is Ksh. 300 for maize and Ksh. 200 for beans. Formulate the LP model. [3 Marks]
c. Develop a model for allocating time between teaching and research to maximize productivity. [3 Marks]
d. An institution wants to distribute 100 Mbps of bandwidth between two campuses to maximize user satisfaction.
   i. What are the decision variables? [2 Marks]
   ii. Derive the Objective function. [1 Mark]
   iii. List the constraints [2 Marks]
e. A college ICT department provides support to two campuses (A and B). Each technician costs KSh. 2,000 per day. Campus A needs at least 3 technicians daily. Campus B needs at least 2 technicians daily. There are only 6 technicians available. You are required to help the department minimize total cost while service both campuses satisfactorily. [2 Marks]

QUESTION SIX (15 marks)

a. Explain the following terms used in Operations Research [3 Marks]
   i. Optimization
   ii. System
   iii. Model
b. Why is model formulation a critical stage in OR? [2 Marks]
c. Analyze one advantage and one disadvantage of Simulation. [2 Marks]
d. Evaluate one advantage of using Linear Programming in decision-making. [2 Marks]
e. Explain why problem formulation is considered the foundation of Operations Research. [2 Marks]
f. Describe the relationship between decision variables and the objective function. [2 Marks]
g. Why is defining constraints important in modeling? [2 Marks]