

2023

**COMPUTER SCIENCE — HONOURS**

**Paper : DSE-B-1 and DSE-B-2**

*The figures in the margin indicate full marks.  
Candidates are required to give their answers in their own words  
as far as practicable.*

**Paper : DSE-B-1**

**(Operations Research)**

**Full Marks : 50**

Answer *question no. 1* and *any four* questions from the rest.

2×5

1. Answer *any five* questions :

- Explain the rules to determine a saddle point.
- Why are artificial variables required in a LPP?
- What are the essential characteristics of linear programming model?
- What is an unbalanced transportation problem?
- What do you understand by initial basic feasible solution?
- Define degeneracy in the context of transportation problem.
- Explain North-West corner rule for a transportation problem.
- Describe the pivot operation in the Simplex method.

2. (a) Solve the following problem using graphical method :

$$\begin{aligned} \text{Maximize} \quad & Z = 3x_1 + 4x_2 \\ \text{Subject to} \quad & x_1 + x_2 \leq 5 \\ & 0 \leq x_1 \leq 4 \\ & 0 \leq x_2 \leq 3 \\ & 3x_1 + 2x_2 \geq 4 \end{aligned}$$

(b) What is a zero-sum game?

8+2

3. (a) Define artificial variable. Why do we need them?

(b) Use Simplex method to find the initial basic feasible solution of the following problem :

$$\begin{aligned} \text{Maximize} \quad & Z = 2x_1 + 3x_2 + 5x_3 - x_4 \\ & x_1 + 3x_2 + 2x_4 \leq 3 \\ & 2x_1 + 3x_2 \leq 4 \\ & x_2 + 3x_3 + 2x_4 \leq 5 \\ & x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

2+8

Please Turn Over

4. (a) Write down the steps involved in converting a primal problem to a dual problem.

6+4

(b) Construct the dual of the following primal problem :

$$\begin{aligned} \text{Maximize } & Z = 5x_1 + 6x_2 + 4x_3 \\ \text{Subject to } & x_1 + 2x_2 + x_3 \leq 10 \\ & 2x_1 - x_2 + 3x_3 = 8 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

5. What is the basic structure of a transportation problem? What is the difference between balanced and unbalanced problem? Obtain initial feasible solution of transportation problem using north-west corner rule.

Source	Destination			Supply
	A	B	C	
1	2	7	4	5
2	3	3	1	8
3	5	4	7	7
4	1	6	2	14
Demand	7	9	18	

2+2+6

6. (a) Explain formally an assignment problem.

(b) Find the initial basic feasible solution for the assignment problem with the following matrix using Hungarian method.

		Location			
		1	2	3	4
Persons	A	10	16	8	15
	B	8	6	11	5
	C	12	15	16	11
	D	14	9	13	12

2+8

7. Consider the following two-person zero-sum game :

		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
		A <sub>1</sub>	5.0	6.0
A <sub>2</sub>	1.0	2.0	0.1	
A <sub>3</sub>	9.0	1.0	9.0	

(a) Verify that the strategies  $(\frac{1}{6}, 0, \frac{5}{6})$  for A and  $(\frac{49}{54}, \frac{5}{54}, 0)$  for B are optimal or not. Then determine the value of the game.

(3)

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(b) Show that the optimal value of the game equals  $\sum_{i=1}^3 \sum_{j=1}^3 a_{ij} x_i y_j$ . 6+4

8. (a) What is the difference between CPM and PERT?

(b) What is a critical activity as far as CPM is not considered?

(c) For the following table construct a project network. 2+2+6

Activity	Predecessor(s)	Duration (weeks)
A : Manuscript proofreading by editor	—	3
B : Sample pages preparation	—	2
C : Book cover design	—	4
D : Artwork preparation	—	3
E : Author's approval of edited manuscript and sample pages	A, B	2
F : Book formatting	E	4
G : Author's review of formatted pages	F	2
H : Author's review of artwork	D	1
I : Production of printing plates	G, H	2
J : Book production and binding	C, I	4

**Paper : DSE-B-2**  
**(Programming Using Python)**  
**Full Marks : 50**

Answer question no. 1 and any four questions from the rest.

1. Answer any five questions :

2x5

- (a) Define Python interpreter.
- (b) Write down characteristics of Tuple data type.
- (c) "There is no use of + operator in Python strings."- Comment.
- (d) Identify different string formats available in Python with example.
- (e) Write down usage of pass statement with a small code snippet.
- (f) Briefly discuss about negative indexing in Python string.
- (g) Let List1 = ['1', 'a', "abc", '2', "Def", 'z'], what is the output of List1.sort( )?
- (h) Let Dict = {x : x\*\*3 for x in range(10) if x % 2 == 1} print(Dict). Write the output.

2. (a) Write a program in Python to reverse a string given as user input.
- (b) What do you mean by deep copy and shallow copy in Python?
- (c) Write a code snippet illustrating MRO (Method Resolution Order) in multiple inheritance. 3+3+4
3. (a) Discuss the method to split Python strings. What is the function used to perform the said operation? Give examples.
- (b) Differentiate dynamically typed language from statically typed language. Give suitable examples.
- (c) What is the purpose of range( ) function and how is it used in list type? 4+4+2
4. (a) Explain the steps involved in opening and closing a file in Python.
- (b) Write a code snippet to sort a list containing names of all the months of a year in descending order.
- (c) Write down the method that tells us about the number of times a specified value appears in a tuple with a suitable example. 4+4+2
5. Consider a Python dictionary, student\_records, representing information about students. Each student's record includes their name, age and the subjects they are enrolled in.
  - (a) Create a dictionary with a student name as Aman, Age as 19 and Subject as 'CMSA'.
  - (b) Add another record for a student named Binay, Age as 18 and subject as 'ZOOA'.

- (c) Access and print the age of Aman.
- (d) Write a loop to iterate over the student records and print each student's name, age and subject on separate lines. 3+2+2+3
6. (a) Discuss different ways of deleting an element from a list with examples.
- (b) What is the purpose of self keyword?
- (c) Write down code snippet for the problem given below :
- There is a class AccountBalance in Python that has member variables : accountnumber, customername and balance. Write necessary functions to show at least two transactions with respect to a deposit and a withdrawal from an account. Now, withdrawal is only possible if a customer has maintained minimum of 1000.00 rupees in account. — Ensure it with checking in function. 3+1+6
7. (a) What is Lambda in Python?
- (b) Differentiate between mutable and immutable data type in Python.
- (c) What is `__init__` ?
- (d) Discuss with a code snippet, input and output to remove white space from any position of a Python string. 2+3+1+4
8. (a) List two advantages of using a set over a list for certain operations in Python.
- (b) Explain the purpose of the `pop()` method for dictionaries in Python.
- (c) What is the use of 'Del' statement? Explain with example.
- (d) Explain how error handling works in Python with suitable code snippet. 2+2+2+4
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