2024

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.

1. Answer ***any five*** questions: 2×5

(a) What is a Zero-sum game?

(b) When can you use graphical method of linear programming problems?

(c) What is a critical path?

(d) What is pay-off in Game theory?

(e) How many constraints in the dual problem will be there, if the primal problem has two constraints and three variables?

(f) What are the similarities between the assignment problem and transportation problem?

(g) Prove that dual of the dual is primal.

(h) What do you understand about the initial basic feasible solution?

2. (a) What is an assignment problem? When is an assignment problem balanced?

(b) The owner of a small machine shop has four mechanics available to be assigned to jobs. Five jobs are offered with the expected profit for each mechanic on each job as given in the table below. Find the assignment of mechanics to jobs that will result in maximum profit. 2+8

Job → / Mechanic ↓	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

3. Consider the following problem :

Maximize : $Z = 2x_1 + 3x_2 - 4x_3$

subject to : $2x_1 + x_2 + x_3 \leq 2$

$-4x_1 + 3x_3 \geq 4$

$x_1 - 5x_2 + x_3 = 5$

$x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

(a) Formulate the dual of the given problem.

(b) State and explain the advantages of duality. 7+3

4. (a) Use the graphical method to solve the following LPP :

Maximize $Z = 3x + 2y$

subject to : $2x + y \geq 2$

$3x + 4y \leq 12$

$x, y \geq 0.$

(b) What are the essential characteristics of a linear programming model? 8+2

5. (a) A small project consists of seven activities. The details of these activities are given below.

(duration is in days)

Activity	Immediate Predecessor	Most Likely	Optimistic	Pessimistic
A	—	3	1	7
B	A	6	2	14
C	A	3	3	3
D	B, C	10	4	22
E	B	7	3	15
F	D, E	5	2	14
G	D	4	4	4

Draw a network diagram for this project. Find the critical path and the expected project completion time.

(b) What is critical path? Differentiate between PERT and CPM. 7+(1+2)

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

	B1	**B2**	**B3**
A1	5.0	6.0	7.0
A2	1.0	2.0	0.1
A3	9.0	1.0	9.0

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

(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

7. (a) What do you mean by degeneracy in Transportation problem?

(b) Solve the following Transportation problem : 3+7

	D_1	D_2	D_3	D_4	a_j
O_1	6	4	2	7	8
O_2	5	1	4	6	14
O_3	6	5	2	5	9
O_4	4	3	2	1	15
b_j	7	13	12	10	

8. (a) Solve the following LPP using Simplex method :

Maximize : $Z = 6x_1 + 8x_2$

subject to : $30x_1 + 20x_2 \leq 300$

$5x_1 + 10x_2 \leq 110$

$x_1, x_2 \geq 0.$

(b) What do you mean by objective function in Optimization problem? 8+2

Please Turn Over

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 : 2×5

(a) Define Python interpreter.

(b) Differentiate between mutable datatype and an immutable datatype.

(c) What are the differences between set and dictionary?

(d) What is the use of 'self' keyword in Python?

(e) How does list constructor work?

(f) State the difference between .py and .pyc files.

(g) How are the following statements different from each other?

```
list2 = listl
list2 = listl.copy()
```

(h) "An item in a set cannot be accessed through index."— Comment.

2. (a) Discuss the method to join Python strings. Give examples.

(b) Explain the use of split () method in Python.

(c) What is the purpose of `range ()` function? How can you use `range` function to create a list? 4+2+(2+2)

3. (a) Discuss with examples the different modes to open a file in Python.

(b) Write a code snippet to sort a dictionary according to the values.

(c) Explain with an example how exceptions are handled in Python. 3+3+4

4. Consider a Python dictionary of sports which represents information about sports — name, indoor/outdoor type, number of players involved and season of sports.

(a) Create a dictionary with sports name "football", number of players are 11 and type as outdoor.

(b) Add another record for a sports name cricket and other necessary values. 5+5

5. Consider three Python lists as follows :

```
list1 = [1,2,3,4,5]
list2 = [2,4,6,8]
list3 = [1,3,7,3]
res = []
```

(a) What will be the value of `res` after the following code is executed?

```
res.extend (i for i in list1 if i not in (list2 + list3))
```

(b) Write a code snippet to display all elements in `list2` which are not in `list1`.

(c) Write a code snippet to display the duplicate elements of `list3`.

(d) Write a Python function that accepts a list as an argument and returns true if the list is an empty list and false otherwise. 2+2+2+4

6. (a) Write Python statements to print the following regarding current date and time :

- Date and time
- Year
- Day of the week (e.g. Sunday)
- Month name

(b) Write the purposes of `super` keywords.

(c) Write Python statements to perform the following tuple operations :

- Print all items from the third position to the end.
- Add a tuple to the end of another tuple.
- Loop through a tuple.
- Multiply contents of a tuple. 4+2+4

7. (a) What are the differences between 'pass' and 'continue' statement in Python?

(b) "try block can't exist without any except block." — Justify your answer.

(c) str = 'Python is very easy programming!!!'. What is the output of print(str[:7]) and print(str[–5]) and print(str[: :])? 3+4+3

8. (a) What is range() function and how it is used in lists? Give the code snippet.

(b) Write a program that copies one Python script into another in such a way that all comment lines are skipped and not copied in the destination file.

(c) How does list can be used as QUEUE data structure with a proper code snippet? 3+4+3
