Tribhuvan University
Institute of Science and Technology
2070

✡

Bachelor Level / First Year/ Second Semester/ Science
Computer Science and Information Technology (CSc.152)
(Discrete Structure)

Full Marks: 80
Pass Marks: 32
Time: 3 hours.

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

Attempt all questions:

Group A (10x2=20)

1. What is compound proposition? Discuss implication with suitable example.

2. Which rule of inference is used in the following argument?
   Ram is hard working. If Ram is hard working, then he is intelligent. Therefore Ram is intelligent.

3. What is the coefficient of $x^{12} y^{13}$ in the expansion of $(2x - 3y)^{25}$?

4. Is the sequence $\{a_n\}$ a solution of the recurrence relation $a_n = -3a_{n-1} + 4a_{n-2}$ if $a_n = 2n$?

5. Define linear homogeneous recurrence relation of degree k with constant coefficients.

6. What is phrase-structure grammar?

7. What is regular expression?

8. What is chromatic number of a graph?

9. What is spanning tree?

10. State max-flow min-cut theorem.

Group B (5x4=20)

11. How many bit strings of length eight either start with a 1 bit or end with the two bits 00?

12. Discuss the importance of recurrence relations in the analysis of divide-and-conquer algorithms.

13. Let G be the grammar with vocabulary V= {S, 0, 1}, set of terminals T = {0, 1}, starting symbol S, and productions P = {S → 11S, S → 0}. What is L(G), the language of this grammar?

14. Discuss adjacency matrix representation of a graph with suitable example.

15. Prove that "a simple graph is connected if and only if it has a spanning tree".

Group C (5x8=40)

16. What is mathematical induction? Use mathematical induction to prove that $1.1! + 2.2! + \ldots + n.n! = (n + 1)! - 1$, wherenever n is a positive integer.

17. Solve the recurrence relation $a_n = 2a_{n-1} + a_{n-2} - 2a_{n-3}$ for $n \geq 3$, $a_0 = 3$, $a_1 = 6$ and $a_2 = 9$.

OR

Find the explicit formula for the Fibonacci numbers. Use $f_n = f_{n-1} + f_{n-2}$ as recursive condition and $f_0 = 0$ and $f_1 = 1$ as initial condition.

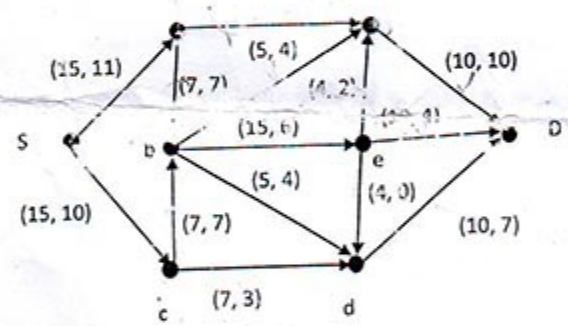
18. Discuss finite state machine without output with suitable example. What are the strings in the regular set specified by the regular expression 0* 1*?

19. Define an Euler circuit and Euler path in an undirected graph. How can it be determined whether an undirected graph has an Euler circuit and an Euler path? Explain with suitable example.

20. Define maximal flow and minimal cut and state and prove min-cut max-flow theorem.

OR

Find a maximal flow for the network shown in the figure below:



2CSc.151-2070✡

Tribhuvan University
Institute of Science and Technology
2070
✡

Bachelor Level / First Year/ Second Semester/ Science
Computer Science and Information Technology (CSc 151)
(Digital Logic)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

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

Long Answer Questions:
Attempt any two questions. (2x10=20)

1. Explain magnitude comparator and also design a logic diagram for a 4 bit magnitude comparator.

2. What do you mean by ripple counter? Explain with timing diagram.

3. Explain the full subtractor with using decoder.

Short Answer Questions:
Attempt any eight questions. (8x5=40)

4. Design a half adder logic using only NAND gates.

5. Convert the following decimal numbers into hexadecimal and octal.
   (a) 334 (b) 225

6. Explain the k – map with three variables.

7. Explain the combinations logic with example.

8. Differentiate between Multiplexer and Demultiplexer.

9. Mention the difference types of shift registers.

10. What do you mean by Ripple counter.

11. Explain the decoder and design with universal gates.

12. What do you mean by clocked RS flip – flop? Explain.

13. Write short notes on (**any two**):
    (a) Flip flop
    (b) Synchronous counter
    (c) Digital systems

2CSc.154-2067✡

Tribhuvan University
Institute of Science and Technology
2070
✡

Bachelor Level / First Year/ Second Semester/ Science
Computer Science and Information Technology (CSc.154)
(Data Structure and Algorithm)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

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

Section A

Attempt any two questions. (2x10=20)

1. Trace out Infix to Postfix conversion algorithm with given Infix expression.

   A +(((B – C) * (D – E) + F)/G) $ (H – I)

   Evaluate the postfix expression acquired from above for the given values:

   A = 6, B = 2, C = 4, D = 3, E = 8, F = 2, G = 3, H = 5 and I = 1.

2. Explain the structure of Doubly Linked List (DLL). Differentiate the difference between DLL and Doubly Circular Linked List (DCLL). Explain the procedures to insert a node in DLL at the beginning and at the last.

3. Define Binary Search Tree (BST). Write an algorithm to insert a node in non-empty BST. Construct BST from the data:

   10, 20, 30, 25, 27, 7, 4, 23, 26, 21.

Section B

Attempt any eight questions. (8x5=40)

4. Write c function to insert an item circular queen in array implementation. Write assumptions, you need.

5. What is an algorithm? What is to anlyze in algorithm? Define Big C – Oh notation for time complexity measurement of algorithm.

6. State TOH problem. Explain a recursive algorithm to solve the problem.

7. Trace selection – sort algorithm for the following data:

   42, 23, 74, 11, 65, 58, 94, 86.

8. What is Hashing? What collision means? State collision resolution techniques. Explain one of them in brief.

9. What is weighted graph? Explain Depth-first traversal of a graph.

10. Create a fluffman tree for the following set of data:

Characters	a	b	c	d	e	f
Probability	·48	·13	·11	·16	·07	·05
Encode	0	101	100	111	1101	1100

11. What is dynamic memary allocation? How it is achieved for declaring tow dimensional array? Explain.

12. Explain efficiency of
    a) Binary Searching
    b) Quick Sort.

13. Write short notes on (any two):
    a) Queue in circular linked list
    b) ADT
    c) MST (Minimum Cost Spanning Tree) of a graph.

Tribhuvan University
Institute of Science and Technology
2070
✡

Bachelor Level / First Year /Second Semester/Science
Computer Science and Information Technology
(MTH. 155 – Linear Algebra)

Full Marks: 80
Pass Marks: 32
Time: 3 hours.

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

Attempt all questions:

Group A (10×2=20)

1. Why the system $x_1 - 3x_2 = 4$; $-3x_1 + 9x_2 = 8$ is inconsistent? Give the graphical representation?

2. Define linear combination of vectors. If v_1, v_2, v_3 are vectors, write the linear combination of $3v_1 - 5v_2 + 7v_3$ as a matrix times a vector.

3. Is $\begin{pmatrix} 2 & 3 & 4 \\ 2 & 3 & 4 \\ 2 & 3 & 4 \end{pmatrix}$ invertible matrix?

4. Define invertible linear transformation.

5. Let S be the parallelogram determined by the rectors $b_1 = (1, 3)$ and $b_2 = (5, 1)$ and let $A = \begin{pmatrix} 1 & -1 \\ 0 & 2 \end{pmatrix}$. Compute the area of the image S under the mapping $x \to Ax$.

6. Define vector space.

7. Show that the entries in the vector $x = (1, 6)$ are the co-ordinates of x relative to the standard basis (e_1, e_2).

8. Is $\lambda = -2$ an eigen value of $\begin{pmatrix} 7 & 3 \\ 3 & -1 \end{pmatrix}$?

9. Find the inner product of (1, 2, 3) and (2, 3, 4).

10. Compute the norm between the vectors $4 = (7, 1)$ and $v = (3, 2)$.

Group B (5×4=20)

11. A linear transformation T: $\mathbb{R}^2 \to \mathbb{R}^2$ is defined by

$$T(x) = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -x_2 \\ x_1 \end{bmatrix}.$$

Find the image under T of $u = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$, $v = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ and $u + v = \begin{bmatrix} 6 \\ 4 \end{bmatrix}$.

12. If $A = \begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix}$ and $x = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$ compute $(Ax)^T$, $x^T A^T$ and xx^T. Can you compute $x^T A^T$?

13. If $b_1 = (2, 1)$, $b_2 = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$, $x = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$ and $B = \{b_1, b_2\}$, find the co-ordinate vector $[x]_B$ of x relative to B.

14. Find the eigen values of $A = \begin{pmatrix} 2 & 3 \\ 3 & -6 \end{pmatrix}$.

15. Show that $\{v_1, v_2, v_3\}$ is an orthogonal set, where $v_1 = (3, 1, 1)$, $v_2 = (-1, 2, 1)$, $v_3 = (-1/2, -2, 7/2)$.

Group C (5×8=40)

16. Let $a_1 = (1, 2, -5)$, $a_2 = (2, 5, 6)$ and $b = (7, 4, -3)$. Determine whether b can be generated as a linear combination of a_1 and a_2. That is, determine whether x_1 and x_2 exist such that

$$x_1 a_1 + x_2 a_2 = b$$

has solution, find it.

OR

Determine if the following system is consistent

$$x_2 - 4x_3 = 8$$

$$2x_1 - 3x_2 + 2x_3 = 1$$

$$5x_1 - 8x_2 + 7x_3 = 1.$$

17. Compute the multiplication of partitioned matrices for

$$A = \left[\begin{array}{ccc|cc} 1 & -3 & 2 & 0 & -4 \\ 1 & 5 & -2 & 3 & -1 \\ \hline 0 & 4 & -2 & 7 & -1 \end{array}\right] \text{ and } B = \left[\begin{array}{cc} 6 & 4 \\ -2 & 1 \\ -3 & 7 \\ \hline -1 & 3 \\ 5 & 2 \end{array}\right].$$

18. Let $b_1 = (1, 0, 3)$, $b_2 = (2, 1, 8)$, $b_3 = (1, -1, 2)$ and $x = (3, -5, 4)$. Does $B = \{b_1, b_2, b_3\}$ form a basis? Find $[x]_B$, for x.

19. Diagonalize the matrix , if possible

$$A = \begin{bmatrix} -1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}.$$

20. When two vectors u and v are orthogonal? If u and v are vectors, prove that $[\text{dist}(u, -v)]^2 = [\text{dist}(u, v)]^2$ iff $u \cdot v = 0$.

OR

Find a least square solution of $Ax = b$ for

$$A = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} -3 \\ -1 \\ 0 \\ 2 \\ 5 \\ 1 \end{bmatrix}.$$

Tribhuvan University

Institute of Science and Technology

2070

✡

Bachelor Level / First Year /Second Semester/Science
Computer Science and Information Technology
(CSC 153 – Microprocessor)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

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

Section A

Attempt any TWO questions: (10×2=20)

1. Explain with block diagram of SAP – 1 computer.

2. Write an assembly language program for 8086 microprocessor to read a string from keyboard and display each work in separate line. The length of input string can be up to 60 characters.

3. List out the instructions for arithmetic and logic operation in 8085 microprocessor and explain with example. Also mention the effect on flags by each instruction.

Section B

Attempt any EIGHT questions: (8×5=40)

4. What is flag? Explain its importance with suitable example.

5. Discuss the bus system in 8085 microprocessor.

6. Draw the timing diagram of instruction MVI A, 36H and explain it.

7. Explain the function of following signals:
   - ALE
   - INTR
   - TRAP

8. Write a program in 8085 microprocessor to subtract 16 bit number at 2000H from a 16 bit number at 2010H and store the result at 2020H.

9. Discuss the importance of interrupt in microprocessor based system. Explain how interrupt controller (8259) can be used to handle interrupts.

10. Observe the following program and write the content of Accumulator, register B and flags after execution of each instruction. (assume initially all flags are reset).

```
MVI A, 45H
MVI B, 66H
ADD B
ANI 63H
HLT
```

11. What are the various registers in 8086 microprocessor? Explain the function of each register.

12. Discuss ADD MUL and DIV instruction of 8086 with suitable examples.

13. Explain briefly on keyboard and display controller.

Tribhuvan University
Institute of Science and Technology
2070
✡

Bachelor Level / First Year/ Second Semester/ Science
Computer Science and Information Technology (STA. 159)
(Statistics II)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

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

All notations have the usual meanings.

Group A

Attempt any two questions: (2x10=20)

1. Describe the advantages of carrying out a sample survey in preference to a complete enumeration survey. Under what circumstances can complete enumeration be recommended in preference to a sample survey.

2. What is meant by Randomized block design? Give the analysis of variance of the design. What are the usual assumption mode in the analysis of a Randomized block design.

3. (a) What is questionnaire? What are requisities of a good questionnaire?

   (b) What is Latin Square Design? Under what conditions this design can be used?

Group B

Attempt any eight questions. (8x5=40)

4. A population of 800 is divided into 3 strator. Their sizes and standard deviations are given below:

	I	II	III
Number:	**300**	**300**	**300**
Size:	**200**	**300**	**300**
Standard deviation	**6**	**8**	**12**

A stratified random sample of size 120 is to be drawn from the population. Determine the sizes of sample from the three strata in case of

(i) proportional allocation

(ii) Neyman's optimum allocation.

5. What do you understand by systematic sampling? What are the advantages of systematic sampling?

6. In PPS with replacement, show that an unbiased estimator of population total Y is

$$\hat{Y}_{PPS} = \frac{1}{n}\sum_{i=1}^{n} \frac{Y_i}{P_i}$$

Derive the expression for the variance $\hat{Y}_{PPS}$.

7. Clearly state the procedure of drawing a random sample in cluster sampling plan. In a simple random sampling without replacement of x cluster from a population of N clusters each containing M elements. Derive an unbiased estimator of the parameter $\overline{Y}$, population mean per element.

8. Explain the principles of replication, randomization and local control in experimental design pointing out the role of each one plays in the valid and accurate interpretation of data.

9. Write down (a) layout of two way ANOVA with its assumption (b) effect model (c) ANOVA table.

10. A agricultural research organization wants to study the effect of four types of fertilizens at random in 6 plots of land. Port of calculation are shown below:

Source of variation	Sum of squares	Degrees of freedom	M.SS	F test
Between fertilizer	2940	-	-	-
Within samples	-	-	-	-
Total	6212			

a) Fill in the blanks in the ANOVA table
b) Test at 5% level of significance, whether fertilizers differ significantly.

11. In a single model, $y_{ij} = u + T_i + e_{ij}$ show that

$$\sum_{i=1}^{a}\sum_{j=1}^{n}(y_{ij}-\bar{y}_{..})^2 = n\sum_{i=1}^{a}(\bar{y}_i-\bar{y}_{..})^2 + \sum_{i=1}^{a}\sum_{j=1}^{n}(y_{ij}-\bar{y}_i)^2$$

12. The results of 2^2 experiments with 3 replications are presented below. Estimate the main effects, interaction effects, SSA, SSB and SSAB. Which effects appear to be large?

Treatment Combination	Replication I	II	III
(1)	22	30	25
a	32	42	29
b	35	33	50
ab	55	45	46

13. Write short notes on **any two**:
(a) Sampling and non sampling errors.
(b) Probability proportion to size sampling.
(c) Factorial experiments.