Tribhuvan University
Institute of Science and Technology
2078
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Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (STA 210)
(Statistics II)
(NEW COURSE)

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

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

Group A

Attempt any Two questions: [2×10=20]

1. There are three brands of computers namely Dell, Lenovo and HP. The following are the lifetime of 15 computers in years.

Serial number	Computer brand	Life time in years
1	Dell	15
2	Lenovo	10
3	HP	9
4	Dell	12
5	Lenovo	6
6	HP	7
7	Dell	4
8	Lenovo	8
9	HP	13
10	Dell	11
11	HP	5
12	Lenovo	7
13	Dell	3
14	HP	5
15	Lenovo	4

$H = 0.286$, accept H₀

Apply appropriate statistical test to identify whether the average life time (in years) is significantly different across three brands of computers at 5% level of significance. You can again tabulate the data initially in the required format for statistical analysis.

2. Explain the sampling distribution of mean with reference to some numerical example. Illustrate the practical implications of Central Limit Theorem (CLT) in inferential statistics?

3. A study was conducted among IT officers working in different IT Centers in Kathmandu valley, one of the objectives of the study was to quantify the effect of age and working hour per day on Computer Vision Syndrome (CVS). The CVS was measured in a continuum measurement scale varying from 0 to 50. Few parts of the data were taken randomly from the surveyed data and provided in the following table for the statistical analysis.

Respondents' ID	001	007	125	231	99	299	145
Scales of CVS	6	7	5	11	3	29.0	28
Age of respondents(in years)	24	26	30	41	47	50	52
Working hour(per day)	4	5	6	8	3	6	7

$= 21.53, \; 0.55, \; 2.31$

Recognize which one is dependent variable? Assuming that the relationship between CVS, age and working hour is linear. Fit a multiple linear regression model to address the objective of the study and interpret the model appropriately.

Group B

[8×5=40]

Attempt any Eight questions:

4. The following are the details of working hours in class room per week of male and female faculty working in the area of Computer Science and Information Technology of Tribhuvan University.

1

	Male faculty	Female faculty	
Sample size	60	30	3.98
Average working hour per week	12	9	2.3, reject
Standard deviation of working hour per week	4	3	

Apply independent t-test to examine whether the average working hour in class room per week is significantly different between male and female faculty, at 1% level of significance. State also null and alternative hypothesis appropriately.

5. A survey was conducted among 70 students studying B.Sc. CSIT in some colleges randomly. Among them 50 students secured more than 80% marks in Statistics. Compute 99% and 95% confidence interval for the population proportion of students who secured more than 80% marks in the subject Statistics, and comment on the results.
53-5.75.3   60 8, 11.97

6. In location 1, there are 250 corona positive cases out of 460 persons and in location 2, 250 positive cases reported out of 650 persons. Can it be concluded that the proportion of corona positive cases is higher in location 1 compared to location 2? Test at 10% level of significance. *5.214, reject*

7. Previous literature has reported that the average age of B.Sc. CSIT enrolling students in Tribhuvan University is 22 years. A researcher has doubts on this information and he feels that the average age to be less than 22 years. In order to examine this, the following sample data were collected randomly from the enrolling students of CSIT.

Age in years	20	19	22	23	19	20	21	20	19	20

4.021, reject

Set up null and alternative hypothesis and test whether the researcher doubt will be justified. Use 5% level of significance. Assume that the parent population from which samples are drawn, is normally distributed.

8. Apply Mann-Whitney U test for examining the following knowledge score on IT among two groups of IT workers at 5% level of significance?

Group A:	5	8	2	7	6
Group B:	9	12	4	6	

U₀=8.5 reject U=1 accept H₀

9. A survey was conducted to see the association between job opportunity status (Yes vs. No) of IT workers and gender. The survey has reported the following details.

Gender	Job opportunity status of IT workers	
	Yes	No
Male	70	35
Female	40	90

3 0.062 reject

Do the information provide sufficient evidence to conclude that gender is associated with job opportunity status of IT workers? Use Chi-square test at 5% level of significance.

10. State the mathematical model for Statistical analysis of m x m LSD for one observation per experimental unit. Also prepare a dummy ANOVA table for this.

11. Define Markov chain and introduce its basic notations. Also explain the characteristics of a Markov chain.

12. Write short notes on the following:
   I. Rationale of using non-parametric statistical test
   II. Estimation of minimum sample size for the given proportion

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Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (CSc. 208)
(Computer Architecture)
(NEW COURSE)

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: (2×10=20)

1. Differentiate between hardwired and microprogrammed control unit. Describe with example of microprogram sequencer used in microprogrammed control unit.

2. Explain the various types of addressing modes and compare them algorithm, advantages and disadvantages.

3. Explain the non-restoring division algorithm with flow chart, and hardware implementation diagram. Divide 10/3 using restoring division.

Short Answer Questions:
Attempt any Eight questions: (8×5=40)

4. Explain the bus interconnection scheme with diagram.

5. What do you mean by instruction format? Explain with an example.

6. Explain the data transfer instruction with example.

7. Explain the symbolic microinstructions with example.

8. Explain an instruction pipeline with suitable examples.

9. Explain the Booth Multiplication algorithm with example.

10. What are the advantages and disadvantages of direct mapping and associative mapping between cache and main memory?

11. Differentiate between Input-output processor with Direct memory access.

12. Draw a three dimensional hypercube and explain with example.

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

Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (CSc. 209)
(Computer Graphics)
(NEW COURSE)

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

[2×10=20]

Attempt any Two questions:

1. Define orthographic, parallel and perspective projections. Consider a region defined by the position vector $P = \begin{bmatrix} 1 & 1 & 2 & 1 \\ 2 & 1 & 2 & 1 \\ 2 & 2 & 2 & 1 \\ 1 & 2 & 2 & 1 \end{bmatrix}$, relative to global XYZ axis system. It is rotated by +30° about X-axis and passing through point (1.5, 1.5, 1.5). Find the final position of the region. [3 + 7]

2. What is the method to recognize boundary point and interior point in solid modeling? Describe how BSP recursively subdivided a space into convex sets. [4 + 6]

3. List some significances of virtual reality. Differentiate between virtual reality and augmented reality with example. Demonstrate how a polygon can be created using OpenGL. [2 + 4 + 4]

Section B

[8 × 5 = 40]

Attempt any Eight questions:

4. Discuss the strength and weakness of the human visual system. Describe Spline representation for the curve. [2 + 3]

5. Plot the I^{st} octant of a circle centered at origin, having the radius 10 units. [5]

6. Define fractal. Explain the Bezier curve and B-Spline curve. [1 + 4]

7. Find the new co – ordinate of the triangle ABC, with co-ordinates A(0, 0) , B(1, 1) and C(5, 2) after it has been magnified to twice of its size. [5]

8. What is the task of polygon table? Why we have to remove hidden surface? Explain with any one methodology? [2 + 3]

9. Define intensity attenuation. Distinguish between Gouraud shading and Phong shading model. [2 + 3]

10. What is the advantage of real time rendering over offline rendering? Discuss the limitation of Z-Buffer algorithm. [2.5 + 2.5]

11. Describe the requirement for line clipping. Explain the scan line polygon filling algorithm. [1 + 4]

12. What is quadric surface? Compare between diffuse reflection and specular reflection. [2 + 3]

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Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (CSc. 206)
(Data Structure and Algorithms)
(NEW COURSE)

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:

(2×10=20)

1. Define queue. What are different applications of queue? Explain queue operations with example.
(1+2+7)

2. Explain circular linked list with example. How do you implement linked list operation in singly linked list? Explain.
(4+6)

3. What is binary search tree? Write a program to implement insertion and deletion algorithms in binary search tree.
(2+8)

Short Answer Questions:
Attempt any Eight questions:

(8×5=40)

4. How do you find compexity of algorithms? Explain (5)

5. Evaluate the expression ABCD − × + using stack where A = 5, B = 4, C = 3 and D = 7. (5)

6. What is priority que? Why do we need this type of queue? (2+3)

7. Write a recursive program to find nth fibonacci number. (5)

8. Explain array implementation of lists. (5)

9. Hand test selection sort with array of numbers 4, 71, 32, 19, 61, 2, -5 in descending order. (5)

10. Write a program to implement sequential search algorithm. (5)

11. What is graph traversal? Explain. (5)

12. Write short notes on:
    a. Divide and conquer sorting
    b. AVL tree
    (2 × 2.5 = 5)

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Bachelor Level / Second Year/ Third Semester/ Science   Full Marks: 60
Computer Science and Information Technology (CSc. 207)   Pass Marks: 24
(Numerical Method)   Time: 3 hours.
(NEW COURSE)

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: (2×10=20)

1. How can Horner's rule be used to evaluate the $f(x)$ and $f(x)$ of a polynomial at given point? Explain. Write an algorithm and program to calculate a real root of a polynomial using Horner's rule.

2. What is matrix factorization? How can it be used to solve system of linear equations? Factorize the given matrix A and solve the system of equations $Ax = b$ for given b using L and U matrices.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 8 & 11 \\ 3 & 22 & 36 \end{bmatrix} \text{ and } b = \begin{matrix} 4 \\ 12 \\ 28 \end{matrix}$$

3. What is higher order differential equation? How can you solve the higher order differential equation? Explain. Solve the following differential equation for $1 \le x \le 2$, taking $h = 0.25$.

$$\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} + 5y = 0, \text{ with } y(1) = 1 \text{ and } y'(1) = 2$$

Section B

Attempt any EIGHT questions: (8×5=40)

4. How the half-interval method can estimate a root of non-linear equation? Find a real root of following equation using half-interval method correct up to two decimal places
$$x^2 - e^{-x} - x = 1$$

5. Calculate a real root of the given equation using fixed point iteration correct up to 3 significant figures.
$$2x^3 - 2x = 5$$

6. What is Newton's interpolation? Obtain the divided difference table from the following data set and estimate the $f(x)$ at $x = 2$ and $x = 5$.

x	3.2	2.7	1.0	4.8	5.6
f(x)	22.0	17.8	14.2	38.3	51.7

7. What is linear regression? Fit the linear function to the following data

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
f(x)	2.0	2.6	3.9	6.0	9.3	15	20.6	30.4

8. What are the problems with polynomial interpolation for large number of data set? How such problems are addressed? Explain with example.

9. Evaluate the following integration using Romberg integration.

$$\int_0^1 \frac{\sin^2 x}{x} dx$$

10. Solve the following set of linear equations using Gauss Jordan method.

$$x_2 + 2x_3 + 3x_4 = 9$$
$$7x_1 + 6x_2 + 5x_3 + 4x_4 = 33$$
$$8x_1 + 9x_2 + x_4 = 27$$
$$2x_1 + 5x_2 + 4x_3 + 3x_4 = 23$$

11. Solve the following differential equation for $1 \le x \le 2$, taking $h = 0.25$ using Heun's method.

$$y'(x) + x^2 y = 3x, \text{ with } y(1) = 1$$

12. Consider a metallic plate of size 90 cm by 90 cm. The two adjacent sides of the plate are maintained at temperature of 100°C and remaining two adjacent sides are held at 200°C. Calculate the steady state temperature at interior points assuming a grid size of 30 cm by 30 cm.