



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 far as practicable.
The figures in the margin indicate full marks.

Attempt any Two questions:

Section A

(2×10=20)

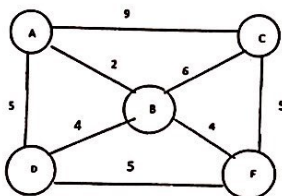
1. Why do we need to balance the binary search tree? Justify with an example. Create an AVL tree from the data 24, 12, 8, 15, 35, 30, 57, 40, 45, 78. (3+7)
2. How recursive algorithm use stack to store intermediate results? Illustrate with an example. Convert the infix expression $A+B - (C*D/E+F) - G*H$ into postfix expression using stack. (5+5)
3. How do you insert and delete a node at k^{th} position of the doubly linked list? Describe the process of implementing stack and queue using linked list. (5+5)

Attempt any Eight questions:

Section B

(8×5=40)

4. Sort the numbers 82, 73, 12, 39, 26, 88, 2, 9, 60 and 41 using shell sort. (5)
5. Why do we need asymptotic notation? Describe about Big oh notation with its curve. (1+4)
6. Define a queue. Explain about enqueue and dequeue operation in circular queue. (1+4)
7. Write a program to implement binary search. (5)
8. Find the MST of following graph using Prim's algorithm (5)



9. Assume you have to store the data $\{0, 1, 2, 4, 5, 7\}$ into a hash table of size 5, with hash function $H(x) = x \% 5$. Apply linear probing and double hashing as collision resolution techniques. (5)
10. In which case, the position of pivot element in quick sort is always either in first or last position. Create a max heap from the numbers $\{10, 12, 53, 34, 23, 77, 59, 66, 5, 8\}$. (2+3)
11. Evaluate the postfix expression $574-*8/4+$ using stack. (5)
12. Write short notes on:
 - a. Priority Queue (2.5+2.5)
 - b. Breadth First Traversal of a graph.

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Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (CSc. 207)
(Numerical Method)
(NEW COURSE)

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

Candidates are required to give their answers in their own words as far as practicable.
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Section A

Attempt any TWO questions:

(2×10=20)

1. How secant method can approximate the root of a non-linear equation? Explain with necessary derivation. Estimate a real root of following equation using secant method. Assume error precision of 0.01.

$$x^3 + 2x - \cos(x) = 4$$

2. How spline interpolation differs with the Lagrange's interpolation? Estimate the value of $f(0)$ and $f(4)$ using cubic spline interpolation from the following data.

x	-1	1	3	5
$f(x)$	-10	-2	14	86

3. What is pivoting? Why is it necessary? Write an algorithm and program to solve the set of n linear equations using Gaussian elimination method.

Section B

Attempt any EIGHT questions:

(8×5=40)

4. Calculate a real root of the following function using bisection method correct up to 3 significant figures.

$$x^2 - e^{-x} = 3$$

5. What is fixed point iteration method? How can it converge to the root of a non-linear equation? Also explain the diverging cases with suitable examples.

6. Write down program for solving ordinary differential equation using Heun's method.

7. Fit the quadratic function for the data given below using least square method.

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	2.7	4	5.8	8.3	11.2	15	19

8. Estimate the integral value of following function from $x = 1.2$ to $x = 2.4$ using Simpson's 1/3 rule.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
$f(x)$	1.53	2.25	3.18	4.32	5.67	7.23	8.98	10.94	13.08

- ✕ 9. What is Gaussian integration formula? Evaluate the following integration using Gaussian integration three ordinate formula.

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

10. Solve the following set of equations using Gauss Seidel method.

$$x + 2y + 3z = 4$$

$$6x + 4y + 5z = 16$$

$$5x + 2y + 3z = 12$$

- ✕ 11. Solve the following differential equation for $0 \leq x \leq 1$, taking $h = 0.5$ using Runge Kutta 4th order method.

$$y'(x) + y = 3x, \text{ with } y(0) = 2$$

- ✕ 12. Solve the Poisson's equation $\nabla^2 f = 3x^2y$ over the square domain $0 \leq x \leq 3, 0 \leq y \leq 3$ with $f = 0$ on the boundary and $h = 1$.

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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 far as practicable.
The figures in the margin indicate full marks.*

Section A

Attempt any Two questions.

(2×10=20)

- Unit 9
1. What is Cache memory? Explain the mapping process. Differentiate between direct mapping and associate mapping. (2+3+5)
 2. Describe micro-programmed control unit. Explain different types of addressing modes with example. (4+6)
 3. Differentiate between floating point representation and fixed point representation. Divide 23 by 9 using restoring division algorithm. (3+7)

Section B

Attempt any Eight questions.

(8×5=40)

4. What are different methods for representing signed numbers? Represent (-71) in those formats.
5. Explain Direct Memory Access with suitable diagram.
6. Explain the data transfer and manipulation instruction with example.
7. Explain common bus system for basic computer.
8. Explain the binary adder-subtractor circuit with suitable diagram.
9. What do you mean by Register Transfer Language? Explain the use of Register Transfer Language control function.
10. What do you mean by sequencer? Explain with microprogram sequencer.
11. Write the program for following statement by using three, single, zero address instructions.
$$X = (A * B + C - D) / (E + F * G)$$
12. Write short notes on (Any TWO)
 - a. CISC
 - b. Overlapped Register
 - c. Pipelining Hazards

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

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

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

Section A

Attempt any Two questions:

(2×10=20)

1. Explain the working details of Mid-Point Circle Algorithm? Trace the points along the line path having two end points (6, 9) and (2,3) using Bresenham's line drawing algorithm. (5+5)
2. Differentiate between object space and image space method of hidden surface removal. Describe the Z-buffer hidden surface removal algorithm. (5+5)
3. Write the algorithm for Cohen-Sutherland Line clipping. Clip the polygon A (100,150), B (200,250) and C (300,200) with clipping window defined by the coordinates (100,300), (300,300) and (200,100) using Sutherland Hodgeman Polygon Clipping Algorithm. (4+6)

Section B

Attempt any Eight questions:

(8×5 = 40)

4. Reflect a line segment having end points (9,3) and (12,10) about a line $Y = 7$. Draw initial and final result graph as well. (5)
5. Differentiate between Raster and Vector graphics method. (5)
6. Explain about parametric curve. Describe the properties of Bezier curve. (2+3)
7. What are blobby objects? How it is represented? Explain the wireframe representation of 3D objects. (1+1+3)
8. Calculate the total memory required to store a 8 minute video in a SVGA system with 24 bit true color and 25 fps. (5)
9. Find the composite transformation matrix for reflection about a line $y = mx + c$. (5)
10. What is polygon table? Explain the use of this method in 3D object representation. (1+4)
11. Define the term "Rendering" in computer Graphics. Explain Phong Shading Method with its advantage and disadvantage. (1+4)
12. Write short notes on (Any TWO) (2.5+2.5)
 - a. BSP Tree
 - b. Virtual Reality
 - c. Intensity Attenuation

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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 far 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. What are the required conditions for error variable in multiple regression analysis? The Internal Revenue Service (IRS) is trying to estimate the monthly amount of unpaid taxes discovered by its auditing division. The IRS estimated this figure on the basis of field auditing labor hours and numbers of hours of its computers are used. The table given below presents these data for the last ten months

Month	(X ₁) Field Audit Labor Hours in 100	(X ₂) Computer Hours in 100	(Y) Actual Unpaid Taxes Discovered million of dollars
Jan	45	16	29
Feb	42	14	24
Mar	44	15	27
April	45	13	25
May	43	13	26
June	46	14	28
Jul	44	16	30
Aug	45	16	28
Sept	44	15	28
Oct	43	15	27

Given: $\sum YX_1 = 12005$, $\sum YX_2 = 4013$, $\sum X_1X_2 = 6485$, $\sum Y^2 = 7428$, $\sum X_1^2 = 19461$, $\sum X_2^2 = 2173$.

- i. Develop the estimating equation best describing these data.
 - ii. Interpret the value of regression coefficients.
 - iii. Estimate the actual unpaid tax for field audit labor hours is 4200 and computer hours is 1600 hours.
2. ii) What do you understand by "Design of an Experiment"? Physicians depend the laboratory test results when managing the medical problems such as diabetes or epilepsy. In a uniformity test glucose tolerance, three different laboratories were each sent $n_i = 5$ identical blood samples from a person who had drunk 50 mg. of glucose dissolved in water. The laboratory results (mg./dl) are listed here:

Lab 1	Lab2	Lab3
12.1	9.3	10.0
11.7	11.1	10.5
10.9	10.7	10.1
10.2	10.9	11.0
10.6	9.0	10.4

Do data indicate a difference in the average readings for the three laboratories? Use $\alpha = .05$.

3. Define Type I and Type II error in testing of hypothesis. A psychologist wishes to verify that a certain drug increases the reaction time to given stimulus. The following reaction times (in tenth of seconds) were recorded before and after injection of the drug for each of four subjects:

Subject		1	2	3	4
Reaction Time	Before	7	2	12	12
	After	13	3	18	13

Test at the 5% level of significance to determine whether the drug significantly increases reaction time.

Group B**Attempt any Eight questions.****[8×5=40]**

4. The following ANOVA summary table was obtained from a multiple regression model with two independent variables.

Source of Variation	Sum of square	Degree of freedom	Mean sum of square	F-value
Regression	12.62	2	?	?
Error	0.78	12	?	
Total	13.40	14		

- Determine the mean sum of square due to regression, the mean sum of square due to error, and F-value.
- Test the significance of the overall regression model at 5% level of significance.
- Compute coefficient of determination and interpret its value.
- Find standard error of estimate.

5. What do you mean by non parametric test? Write down advantages of non parametric tests over the parametric tests.

6. Bank of Nepal recorded the sex of first 30 customers who appeared last Mon day with notation M M F M M F M F F M M F F M F F M F F M F F M M M F F. At the 0.05 level of significance, test the randomness of this sequence.

7. Social media users use a variety of devices to access social networking; mobile phones are increasingly popular. However, is there a difference in the various age groups in the proportions of social media users who use their mobile phone to access social networking? A study showed the following results for the different age groups.

Use mobile phones to access social networking?	Age		
	18-34	35-64	65+
Yes	60	37	14
No	40	63	86

At the 0.05 level of significance, is there evidence of a difference among the age groups with respect to use of mobile phone for accessing social networking?

8. It is claimed that Samsung and Redmi mobiles are equally popular in Kathmandu. A random sample of 500 people from Kathmandu showed 300 have Samsung mobile. Test the claim at 5% level of significance.

9. An effort to estimate the mean amount per customer for dinner at a major Atlanta restaurant, data were collected for a sample of 49 customers and sample mean is found as \$ 24.80. Assume population standard deviation is \$5.

- Compute standard error of mean.
- Find 95% confidence interval estimate for the population mean.

10. Define Markov chain and describe its characteristics.

11. What are the basic concepts of queuing theory? In a super market, the average arrivals rate of customer is 10 per every 30 minutes following Poisson process. The average time taken by the cashier to list and calculate the customers purchase is 2.5 minutes following exponential distribution. What is the probability that queue length exceeds 6. What is the expected time spent by customer in the system?

12. Write short notes on following.

- Partial and multiple correlation coefficient.
- Properties of good estimator