

বিগত সালের প্রশ্নাবলী



Full Marks: 52.5

Time: 3 Hours

[N.B.: Answer any Six (06) Questions taking at least Three (03) from each part.]

Part-A

1. a) Why data structure is needed? Differentiate between linear and nonlinear data structure. 3
b) Explain linear array representation in memory. 2
c) Simulate the binary search algorithm on the following data: 10, 20, 50, 70, 80, 90, 100, 110 (suppose we search for item 110). 3.75
2. a) For column major order find out the address of the element score [15,3] from a 20X5 matrix array score with base value 100 and w=4. 3
b) How does a pointer array can save memory when stores a variable sized group of data? Discuss with necessary figures. 3.75
c) What is a record? What is the difference between a record and a linear array? 2
3. (a) Explain the representation of linked lists in memory. 3
b) Discuss header linked list. Describe grounded and circular header list. 3
c) Briefly explain two-way linked list. 2.75
4. a) What is stack? What are the operations on stack? Explain with example. 3
b) Convert the following infix expression to its equivalent prefix and postfix expression 3.75
 - (i). A+B*C/D-E+(F/G+H↑K)
 - (ii). (1+2) ↑3/4*5+7-8↑9
c) What is priority queue? Why is it important? 2

Part-B

5. a) Illustrate similar and copies of a tree with examples. 3
b) What is complete binary tree? What is the parent-child relationship? 2
c) For the expression: *+a-bc*-de-/fgh draw the tree and perform inorder and postorder traversal. 3.75
6. a) What is binary search tree? 1.75
b) Suppose the following six numbers are inserted into an empty binary search tree: 33, 50, 45, 52, 12, 10. Show the tree as each number is inserted into a binary search tree. 4
c) Simulate the maxheap algorithm for the following values: 77, 40, 90, 65, 20, 35, 95, 10, 15. 3
7. a) Define the following terms: (i) Degree of a node, (ii) Isolated node, (iii) Path, (iv) Multi Graph. 3.75
b) Consider the following adjacency matrix below:

$$A = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{pmatrix}$$

Now find out A2, A3, A4, B4 and from that make the path matrix and tell whether this graph is strongly connected or not.

8. a) Discuss the linked representation of Graph with example. 3.75
b) Consider the adjacency list of the Graph G in the following table. Draw the graph and find out the path from A to H with minimum number of nodes along that path using Breadth First Search. 5

Node	Adjacency	Node	Adjacency
A	E, G	E	H
B	C	F	A, B
C	F	G	B, C, E
D	C	H	D

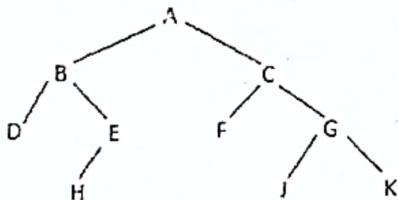
Answer six (06) questions taking three (03) from each part

Part A

1. a) What is data structure? What are the differences between linear and nonlinear data structure? 2.5
 b) Explain the depth-first search technique. → ~~JSTACO ASK~~ 3.5
 c) What do you mean by internal and external sorting? List some names of each type. 2.75
2. a) What is a linked List? Discuss with example. 2
 b) Suppose 20 elements are maintained by array and another 10 are by Linked List. Which method will take longer time to access 9th element? Justify your answer. 2
- Q. 3. (C) Briefly discuss inserting mechanism of an item at the beginning, after a given node and at the end. 4.75
~~JSTACO ASK ZTBZB ZTB~~
3. a) What is polish notation? What are the benefits of polish notation? 2
 b) Convert the following infix expression to its equivalent prefix and postfix expression:
 (i) A*B+(C*D/E)*F+(G↑H)
 (ii) 1*2/3+(4-5↑6)+7-8
 c) Simulate the postfix expression evaluation algorithm using 12, 6, /, 6, 2, +, *, 12, 4, /, - by showing Stack's contents as each element is scanned. 2.75
4. a) What is overflow and underflow? How can you handle them? 3.25
 b) What is a two way list? Why is it important? Explain with schematic diagram. 3.5
 c) What is garbage collection and compaction? 2

Part B

5. a) For column major order find out the address of the element marks[12,3] from a 25X4 matrix array marks with base value 250 and w=8. 2
 b) What is pointer and pointer array? 1.75
 c) How a pointer can save memory space to store a 2D array? 3
 d) What is the difference between Triangular matrix and Tridiagonal matrix? 2
6. a) Define heap, leaf and depth of tree. For 5009 nodes, find out the depth of the tree. 3.75
 b) Discuss the linked representation of binary tree in memory. 2
 c) Simulate the preorder traversal algorithm for the following tree 3



7. a) Define the following graph terms: (i) Adjacent Nodes, (ii) Cycle, (iii) Connected graph, and (iv) Weighted graph. 2
 b) Discuss the sequential Representation of Graph with example. 2.75
 c) Consider the following adjacency matrix below: 4

$$A = \begin{pmatrix} 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \end{pmatrix}$$

Now find out A^2 , A^3 , A^4 , B_4 and from that make the path matrix and tell whether this is strongly connected or not.

8.

- a) What is Directed Graph? Explain.
 b) How many ways a graph G can be traversed? What is the significance of the STATUS field?
 c) Consider the adjacency list of the Graph G in the following table. Find the nodes that are reachable from node C using Depth First Search.

Node	Adjacency	Node	Adjacency
A	G, E	E	C
B	C	F	A, B
C	F	G	B, C, E
D	C	H	D

University of Rajshahi
B.Sc. (Engg.) Part-2 (Odd Semester) Examination-2018
Course: MATH2111 (Matrix and Differential Equation)

Marks: 52.5 Time: 3:00 Hours

[N.B. Answer any Six questions taking Three from each section.]

Section-A

- 1.(a) Define matrix multiplication. Prove that matrix multiplication is associative. 2.75
- (b) Define a symmetric matrix with an example. For any matrix A , prove that AA' and $A'A$ are symmetric. 3
- (c) Define inverse of a matrix. If A and B are invertible matrices then prove that $(AB)^{-1} = B^{-1}A^{-1}$. 3
- 2.(a) For any n -square matrix A , prove that $\text{adj}(\text{adj}(A)) = |A|^{n-2}A$. Hence find $|\text{adj}(\text{adj}(A))|$. 3
- (b) Reduce the matrix $\begin{pmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{pmatrix}$ into echelon form and determine its rank. 2.75
- (c) Find the inverse of $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$, using elementary row operations. 3
- 3.(a) Solve the system of equations: $2x + 3y = 3$, $x - 2y = 5$, $3x + 2y = 7$. 2.75
- (b) Determine the values of k such that the following system in unknowns x, y, z has
 (i) a unique solution, (ii) no solution, (iii) more than one solution:

$$\begin{aligned} kx + y + z &= 1 \\ x + ky + z &= 1 \\ x + y + kz &= 1. \end{aligned}$$
 ✓ 3
- (c) Prove that all eigenvalues of a Hermitian matrix are real. 3
- 4.(a) Define similar matrices. Prove that if two matrices A and B are similar then they have the same eigenvalues. 2.75
- (b) Let $A = \begin{pmatrix} 4 & -3 \\ 2 & -1 \end{pmatrix}$. Find a nonsingular matrix P such that $P^{-1}AP$ is diagonal. 3
- (c) If X_1 and X_2 are eigenvectors of a matrix belonging to distinct eigenvalues λ_1 and λ_2 then prove that X_1 and X_2 are linearly independent. 3

Section-B

- 5.(a) Find the differential equations of all circles which have their centres on x axis and have a given radius. 3
- (b) Solve the differential equation: $\frac{dy}{dx} = x^3 y^3 - xy.$ 2.75
- (c) Prove that the differential equation $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y) dy = 0$ is exact and solve it. 2.75
6. Solve the following differential equations: 3
- (a) $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + y = \sin 2x.$ 3
- (b) $(D^3 - 7D - 6)y = e^{2x} x^2.$ 2.75
- (c) $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4.$
- 7.(a) Solve the differential equation by the method of variation of parameters: 4
- $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x^2 e^x.$
- (b) Solve the differential equation by the method of operator factorization: 4.75
- $[xD^2 + (1-x)D - 2(1+x)]y = e^{-x}(1-6x).$
- 8.(a) Solve the partial differential equations by Charpit's method $z^2 = pqxy.$ 4
- (b) Solve the partial differential equation $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$ by Lagrange's method and hence find its integral surface containing the straight line $x + y = 0, z = 1.$ 4.75

Let $\begin{cases} p = \frac{\partial z}{\partial x} \\ q = \frac{\partial z}{\partial y} \end{cases}$

$$\begin{aligned} & \left(\frac{\partial}{\partial x} + y^2 + z \right) p - \left(\frac{\partial}{\partial y} + x^2 + z \right) q = z(x^2 - y^2) \\ & \left(\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} \right) p - \left(\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} \right) q = x^2 \frac{\partial z}{\partial x} - y^2 \frac{\partial z}{\partial y} \end{aligned}$$

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Roll

University of Rajshahi
 Department of Computer Science and Engineering
 B.Sc.(Engg.) Part-2 (Odd Semester) Examination-2017
 Course: MATH 2111 (Matrix and Differential Equation)

Time: 3 Hours

Marks: 52.5

(Answer any Six of the following questions taking three from each section.)

Section-A

- 1.(a) Define Horizontal matrix, Sub matrix, unit matrix and diagonal matrix with example. 2.75
- (b) Define periodic matrix and idempotent. If A is an idempotent matrix, show that the matrix B = I - A is also idempotent and AB = 0 = BA. 3
- (c) Define nilpotent matrix and orthogonal matrix with example. If A and B be two orthogonal matrices of same order, show that AB is also orthogonal. 3
- 2.(a) Define transposed matrix, symmetric matrix and skew-symmetric matrix. If A is any square matrix, show that $A + A'$ is symmetric matrix. 3
- (b) Define rank of a matrix. Reduce the matrix
- $$\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$$
- to normal form and find its rank.
- (c) If A and B are two $n \times n$ matrices, show that $\text{Adj}(AB) = \text{Adj } B \cdot \text{Adj } A$. 2.75
- 3.(a) Define inverse of a matrix. Find the inverse of 3
- $$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{bmatrix}$$
- (b) Find the solution of the system of equations 2.75
- $$\begin{aligned} x + 2y - 3z &= 1 \\ 2x + 5y - 8z &= 4 \\ 3x + 8y + 3z &= 7 \end{aligned}$$
- using matrix method.
- (c) Determine the value of a so that the following system in unknown x, y and z has (i) no solution, (ii) more than one solution (iii) a unique solution: 3
- $$x + y - z = 1, \quad 2x + 3y + az = 3 \quad \text{and} \quad x + ay + 3z = 2$$
- 4.(a) Show that every matrix is zero of its characteristics polynomial. 4
- (b) Define eigenvalue and eigenvector. Find all eigenvalues and the corresponding eigenvectors of the matrix 4.75
- $$A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$$

Section-B

2.75

- 5.(a) Define order and degree of differential equation. Find the order and degree of the differential equation

$$2 \frac{d^3y}{dx^3} + 3 \left(\frac{d^2y}{dx^2} \right)^4 + \frac{dy}{dx} + y = \sin 4x$$

3

- (b) Define homogeneous ODE. Solve the ODE $(2xy + 3y^2)dx - (2xy + x^2)dy = 0$

3

- (c) Define exact differential equation. Solve $3x(xy - 2) + (x^3 + 2y)dy = 0$

3

2.75

- 6.(a) Define Bernoulli's equation. Solve $\frac{dy}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2$

3+3

- (b) Solve (i) $y + px = p^2 x^4$ (ii) $y = 2px + y^2 p^3$ where $p = \frac{dy}{dx}$

3+3

- 7.(a) Solve (i) $(D^3 - D^2 - 6D)y = 1 + x^2$ (ii) $(D^2 + 4)y = \cos x$

2.75

- (b) Using variation of parameters to find the general solution $4y'' - 4y' - 8y = 8e^{-t}$

8.(a)

- Define regular singular point. Find the general solution of $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 + 2)y = 0$ in power of x about $x_0 = 0$

5.75

(b)

- Define Laplace transformation. Fine the solution of $f''(t) + 3f'(t) + 2f(t) = 4t$ where $f(0) = f'(0) = 0$ using Laplace transformation.

3

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg.) Part-2 Odd Semester Examination-2016

Course: MATH2111 (Matrix and Differential Equation)

Full Marks: 52.5 Duration: 3(Three) Hours

Answer 06(Six) questions taking any 03(Three) questions from each part.

Part-A

1. (a) Let A and B be matrices of order $m \times n$ and $n \times p$ respectively. Prove that $(AB)' = B'A'$. 3
 (b) Define symmetric matrix and skew symmetric matrix. Give an example of each kind. Prove 3
 that the diagonal elements of a skew symmetric matrix are all zero.
 (c) Let A and B be n -square non-singular matrices. Prove that AB is non-singular and 2.75
 $(AB)^{-1} = B^{-1}A^{-1}$.

2. (a) For what value of λ , the system of equations fail to have a solution? 3

$$3x - y + \lambda z = 1$$

$$2x + y + z = 2$$

$$x + 2y - \lambda z = -1$$

- (b) State Cayley-Hamilton theorem and verify it for the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$. 3.

- (c) Define linear dependence and linear independence of a set of vectors. Determine whether or 2.75
 not the vectors [1,2,3], [2,3,4], [3,5,7] are linearly dependent.

3. (a) Apply Cramer's rule to solve the equations: 4

$$x + y + z = 1, x + 2y + z = 2, x + y + 2z = 0$$

- (b) Determine the values of a and b so that the system of equations 4.75

$$x + 2y + z = 1, 3x + y + 2z = b, ax - y + 4z = b^2$$

- has (i) a unique solution, (ii) no solution and (iii) many solutions.

4. (a) For any square matrix A, define $\text{adj}(A)$. Prove that $A\text{adj}(A) = |A|I$. 3

- (b) Find the adjoint and inverse of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$. 3

- (c) Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$ to echelon form and find its rank. 2.75

Part-B

5. (a) Define *degree* and *order*. Find the differential equation of the family of circles 3
 $x^2 + y^2 + 2gx + 2fy + c = 0$.
- (b) Identify and solve $(x^2 + y^2)dx - 2xydy = 0$. 3
- (c) Solve by the variation of parameters: $y'' + y = \cos^2(x)$ 2.75

6. Solve the following differential equations:

2.75

(a) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = xe^{-x}$.

3

(b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x \cos(x).$

3

(c) $\frac{d^2y}{dx^2} + a^2y = x \cos(ax).$

7. Define regular singular points. Find the general solution of $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ by series method.
Test the convergency of the series.

8.75

8. (a) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $u(x, 0) = 3\sin(2\pi x)$, $u(0, t) = 0$, $u(1, t) = 0$ where $0 < x < 1$, $t > 0$ by
Laplace transformation.

4.75

(b) Write down Helmholtz's equation and solve it.

4

University of Rajshahi
Department of Computer Science & Engineering
B.Sc. (Engg.) Part-II Odd Semester Examination 2015
Course: MATH-2111 (Matrix and Differential Equation)
Full Marks: 52.5 Duration: 3(Three) Hours
Answer 6 (Six) questions taking any 3(Three) from each part

Part-A

1. a) Define matrix multiplication. Prove that matrix multiplication is associative. 3
b) Prove that every square matrix can be expressed uniquely as a sum of a symmetric and a skew symmetric matrix. 3
c) If A and B are n -square matrices then prove that A and B commute if and only if $A \cdot kI$ and $B \cdot kI$ commute for scalar k. 2.75

2. a) For any square matrix A and B, prove that $\text{adj}(AB) = \text{adj}(B)\text{adj}(A)$. 3
b) Find the inverse of $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$, using elementary row operations. 3
c) Define linear dependence and independence of a set of vectors. Determine whether or not the following vectors are linearly dependent. $x_1 = [1, 2, -3, 4]$, $x_2 = [3, -1, 2, 1]$, $x_3 = [1, -5, 8, -7]$ 2.75

3. a) Determine the value of k such that the system in unknowns x, y, z has (i) a unique solution
(ii) no solution, (iii) more than one solution 3
$$\begin{aligned} x + y + kz &= 2 \\ 3x + 4y + 2z &= k \\ 2x + 3y - z &= 1 \end{aligned}$$
b) Reduce the matrix $A = \begin{pmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{pmatrix}$ into echelon form and determine its rank. 2.75
c) Define an eigenvalue and associated vector of a square matrix. Find eigenvalues and associated eigenvectors of the matrix $A = \begin{pmatrix} 1 & 2 \\ 3 & 2 \end{pmatrix}$. 3

4. a) If x_1 and x_2 are eigenvectors of a matrix A belonging to m eigenvalue λ then prove that any linear combination $c_1x_1 + c_2x_2$ of x_1 and x_2 is also an eigenvector of A belonging to the eigenvalue λ provided $c_1x_1 + c_2x_2 \neq 0$. 3
b) If A is an n -square matrix. Prove that A and A' have the same eigenvalues. 2.75
c) Let $A = \begin{pmatrix} 4 & -3 \\ 2 & -1 \end{pmatrix}$. Find a nonsingular matrix P such that $P^{-1}AP$ is diagonal. 3

Part-B

5. a) Define variable separable equation. Find an explicit solution of the initial value problem $x^2 \frac{dy}{dx} = y - xy$, $y(-1) = -1$ by separating variables. 3
b) Find the general solution of the differential equation $y' + 3x^2y = x^2$. Give the largest interval over which the solution is defined. Is there any transient term in the general solution? 3
c) Solve the equation by using an appropriate substitution $x \frac{dy}{dx} + y = \frac{1}{y^2}$. 2.75

6. Solve the following differential equations:
a) $y'' + 4y' + 4y = 2x + 6$ 3
b) $y'' - y = x^2 e^x + 5$ 3
c) $y'' - y' - 12y = e^{4x}$ 2.75

PART-B

3

- 5.(a) Define an idempotent matrix. Prove that the matrix

$$A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$$

is idempotent.

3

- (b) Define a Skew-Hermitian matrix. Prove that every complex square matrix can be uniquely expressed as a sum of a Hermitian and a Skew-Hermitian matrices.

2.75

- (c) Prove that $(AB)' = B'A'$

3

- 6.(a) Prove that $A^{-1} = \frac{1}{|A|} (adj A)$

2.75

Define rank of matrix. Find the rank of $A = \begin{bmatrix} 1 & 5 & 9 \\ 4 & 8 & 12 \\ 7 & 11 & 15 \end{bmatrix}$

3

- (c) Find the inverse of $A = \begin{bmatrix} 2 & -4 & -2 \\ 4 & 6 & 2 \\ 0 & 10 & -4 \end{bmatrix}$

- 7.(a) Reduce $A = \begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}$ to the normal form.

3

- (b) For what values of λ the equations

3

$x + y + z = 1, x + 2y + 4z = \lambda$ and $x + 4y + 10z = \lambda^2$ has a solution and solve them completely.

- (c) Solve the systems of equations

2.75

$x + y + z = 6, x - y + z = 2$ and $2x + y - z = 1$ by Krammer's rule/matrix method.

- 8.(a) Determine the eigen values and corresponding eigen vectors of the matrix

4.75

$$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

- (b) State and Prove Cayley-Hamilton theorem.

4

b) One hundred fifty computer graduates are interviewed and are classified according to their result and job satisfaction. The number of graduates in different classes are shown below:

Result	Job Satisfaction	
	Yes	No
Good	22	58
Not Good	20	50
Total	42	108
		150

Do you think that the graduates with good result are satisfied with their job?



[N.B. Answer any Four questions taking Two from each section.]

Section-A

1. a) Define chi-square (χ^2) variate and write down its pdf. 2.75
- b) Show that χ^2 distribution tends to normal distribution for large degrees of freedom. 4
- c) Write down some important properties of χ^2 distribution. 2

2. a) Define F-statistic. Write down the p.d.f. of F-statistic. 2
- b) If F follows F-statistic on (n_1, n_2) degrees of freedom and show that the statistics $\left(1 + \frac{n_1}{n_2} F\right)^{-1}$ has beta distribution. 5
- c) State 2 (two) main applications of F-statistic. 1.75

3. a) What are the methods of point estimation? 1
- b) Define estimate and estimator with examples. 1.75
- c) Let x_1, x_2, \dots, x_n be a random sample from a poisson distribution with pdf given by 6

$$f(x|\lambda) = \frac{e^{-\lambda}\lambda^x}{x!}; \quad x=0, 1, 2, \dots$$

Find the maximum likelihood estimator of λ . Show that the estimator is unbiased.

Section -B

4. a) What do you mean by statistical test of hypothesis? Define with examples (i) null hypothesis (ii) critical region and (iii) level of significance. 3
- b) What is BCR? When does a test become MP test? 1.75
- c) A bulb manufacturing company claims that the average longevity of their bulb is 3.65 years with a standard deviation of 0.16 years. A random sample of 36 bulbs gave a mean longevity of 4.45 years. Does the sample mean justify the claim of the manufacturer? [Use 5% level of significance]. 4

5. a) What do you mean by the power of a test? 1.75
- b) Describe how you will test the following hypothesis $H_0: \rho_1 = \rho_2 = \dots = \rho_k$ ($k > 2$). 3
- c) A set of 8 correlation coefficients and the corresponding sample sizes are given below. Test the homogeneity of these coefficients. 4

γ	0.231	0.464	0.539	0.357	0.628	0.136	0.204	0.461
n	10	12	8	15	18	11	10	7

6. a) What is contingency table? For a 2×2 contingency table 5.75

a	b
c	d

, show that $\chi^2 = \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$, Where $N = a + b + c + d$.

Ans?

~~Ans~~ σ

Discuss acceptance

[N.B. Figures in the margin indicate full marks. Answer FOUR questions taking TWO from each section.]

Part-A

- | | |
|--|--|
| <p>1. (a) Define chi-square (χ^2) variate and its p.d.f. 02
 (b) By using moment generating function (MGF) find β_1 and β_2.
 (c) Find the mode of χ^2-distribution. Mention some important properties and application of χ^2-distribution.</p> <p>2. (a) Define Student's t statistics. Formulate its sampling distribution. 1+3
 (b) Show that Student's t distribution reduces to the standard normal distribution for large degrees of freedom. 4.75</p> <p>3. (a) Define point estimator. What are the criteria of good estimator? 2.25
 (b) What do you mean by sufficient statistic? Let $x_1, x_2 \dots x_n$ be a random sample from a poison variate with parameter 'μ' then show that \bar{x} is a sufficient static for 'μ'. 2.5
 (c) Let $x_1, x_2 \dots x_n$ be a random sample of size 'n' from normal distribution with p.d.f is 4.5</p> | |
|--|--|

Part-B
Answer any TWO questions.

4. (a) Distinguish between Type 1 and Type 2 errors. Define: (i) Power of a test, (ii) Level of significance and (iii) Degree of freedom. Describe the procedure for Testing of Hypothesis. 1.75

(b) The coefficient of correlation obtained from a random sample of 20 pairs is 0.50. Test the population correlation coefficient ($\rho=0$) at 5% level of significance. [$t_{0.05,18} = 2.10$]. +2
+2
03

5. (a) When do you use independent samples t-test? 1+4

Researchers are interested in the mean level of some enzyme in a certain population. They take a sample of 10 individuals, determine the level of enzyme in each and compute a sample mean 22. It is known that the variable of interest is approximately normally distributed with a variance of 45. Can you conclude that the mean enzyme level in this population is different from 25 at the 5% level of significance? [$Z_{0.05} = 1.96$]. 1

(b) For a simple random sample of adults, IQ scores are normally distributed with a mean of 100 and a standard deviation of 15. A simple random sample of 13 statistics professors yields a standard deviation of $s=7.2$. Assume that IQ scores of statistics professors are normally distributed and use a 0.05 significance level to test the claim that $\sigma = 15$. [The tabulated value χ^2 with d.f. 12 at 5% level of significance are 4.404 and 23.337]. 3.75

6. (a) Distinguish between parametric and non-parametric statistical tests. Discuss the advantages and disadvantages of non-parametric test. 2.5

(b) Derive sign test, stating clearly the assumptions made for small sample case. 3.5

(c) Use the sign test to see whether there is a difference between the number of days required to collect an account receivable before and after a new collection policy. Use the 0.05 significance level. 2.7

Before: 33 36 41 32 39 47 34 29 32 34 40 42

After : 35 29 38 34 37 47 36 32 30 34 41 38

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Engg.) Part-2 Odd Semester Examination-2016
Course: STAT2111 (Theory of Statistics)
Full Marks: 35 Duration: 2(Two) Hours

Answer any 04(Four) questions taking 02(Two) questions from each part.

Part - A

1. a) Define Chi-square (χ^2) distribution. Show that χ^2 -distribution tends to normal distribution for large degrees of freedom. 0.75+3
- b) State and prove additive property of χ^2 -distribution. If x has density function $f(x) = e^{-x}, x > 0$. Then show that $2x$ follows χ^2 -distribution with 2-degrees of freedom. 2.5+2.5
2. a) Define F variate. Find the mode of F distribution. If X has F distribution with m and n degrees of freedom, show that $1/X$ has also F distribution with n and m degrees of freedom. Mention some important properties of F distribution. 8.75
3. a) Define point estimation with example. What are the methods of point estimation? 2+1
- b) What is MLE? State and prove the invariance property of MLE. Let x_1, x_2, \dots, x_n be a random sample from $f(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x}$, $x = 0, 1, 2, \dots, n$. Find the MLE of p . 1+2.75 +2

Part - B

4. a) What do you mean by statistical hypothesis? Distinguish between simple and composite hypothesis. Let a random sample of size n is drawn from a normal population with mean μ and known variance σ^2 . How would you test the hypothesis that mean is equal to μ_0 ? 1+1.75 +3
- b) The average IQ of university female students in Bangladesh is suspected to be more than the average 110 for all students. A random sample of 64 female students yielded a sample average IQ of 115.5 and standard deviation of 20. Can you conclude that the average score of the female students is really more than 110? $[Z_{0.05}=1.64]$ 3
5. a) Define $r \times c$ contingency table. Show that in case of 2×2 contingency table, the test statistics becomes $\chi^2 = \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$, also mention Yate's correction for continuity. 1+3 +1.75 → **Q**
- b) In a psychological test, 70 out of 100 boys came out successful while 60 out of 100 girls of the same age group as the boys passed the test. Do the data provide any evidence of difference in respect of abilities between the genders? 3 **Q**
6. a) What do you mean by non-parametric test? Discuss it's importance. Describe the testing procedure of the run test. 1+1.75 +3
- b) The following sequence is purported to be a set of random integers from 0 to 99. Use the run's test to test the hypothesis of the randomness at $\alpha=0.05$ significance level. The sequence is 3

28, 4, 23, 98, 44, 10, 6, 25, 54, 81, 12, 6, 4, 33, 67, 55, 71, 66, 22, 18, 49, 85

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-II (Odd Semester) Examination-2015
STAT-2111(Theory of Statistics)

Full Marks: 35

Time: 2 Hours

[Answer any six (04) questions taking two (02) questions from each part]

Part-A

1. (a) Define Sampling Distribution with examples. Mention the names of sampling distributions which are frequently used. 2+2
- (b) Define χ^2 -distribution. Find moment generating function of χ^2 -distribution. Also find mean and variance of χ^2 -distribution. 0.75+2+2
2. (a) State and prove t-distribution. Show that the odd ordered moments of t-distribution is zero. Write down the properties of t-distribution. 2+2+1.75
- (b) Show that t-distribution tends to normal distribution if the degrees of freedom tend to infinity. 3
3. (a) What are the desirable criteria of a good estimator? 3
- (b) Let (x_1, x_2, \dots, x_n) be a random sample from a Poisson distribution with p.d.f. given by 5.75

$$f(x|\lambda) = \frac{e^{-\lambda} \lambda^x}{x!}; \quad x = 0, 1, 2, \dots$$

Find the maximum likelihood estimator of λ . Show that the estimator is unbiased.

Part-B

4. (a) What do you mean by a statistical hypothesis? Describe different steps for testing statistical hypothesis. Write down the procedure to test the significance of regression coefficient. 1+2.75+1
- (b) A random sample of 10 persons is selected as follows: 5, 2, 0, 4, 16, 14, 10, 11, 6, 8. Do you think that the average schooling year of the persons in population is 5? (Tabulated value at 5% with 9 d.f. is 2.26) 4
5. (a) Define Type I error, Type II error, Level of significance and Most powerful test. 3
- (b) Suppose k random samples are drawn from normal population with mean $\mu_1, \mu_2, \dots, \mu_k$ and common variance σ^2 . Describe the procedure to test that the means are equal. 5.75
6. (a) What is contingency table? What is form of χ^2 test statistic in case of a 2×2 contingency table? 4
- (b) For given information in the following table, test at level of significance 0.05 that whether level of education affects the job performance. [$\chi^2_{0.05,4} = 13.3$] 4.75

Job Performance	Level of Education			
	Below primary	College	University	
Excellent	10	40	10	60
Good	30	30	20	80
Fair	10	30	20	60
	50	100	50	200

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Engg) Part-2 Odd Semester Examination 2014
Course: STAT-2111 (Theory of Statistics)
Full Marks: 35 Duration: 2(Two) Hours

Answer 04(Four) questions taking any 02(Two) questions from each section in separate answer script

Section - A

1. a) Define Chi-square statistic. Derive its sampling distribution. 8.75
 b) State some uses of t-distribution. Describe how would you test the equality of variances of two normal populations.
2. a) Distinguish between MVB estimator and MV estimator. Show that MVB unbiased estimator is also sufficient. 8.75
 b) Find the MVB unbiased estimator of variance of a normal population with mean $\mu=0$. Also show that this estimator is also sufficient.
3. a) Define likelihood function. Describe the method of maximum likelihood. 3.75
 b) Let (x_1, x_2, \dots, x_n) be a random sample from a normal distribution with p.d.f. given by 5

$$f(x|\mu, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}; -\infty < x < \infty, -\infty < \mu < \infty, \sigma^2 \geq 0$$
 Find the maximum likelihood estimator of μ and σ^2 .

Section - B

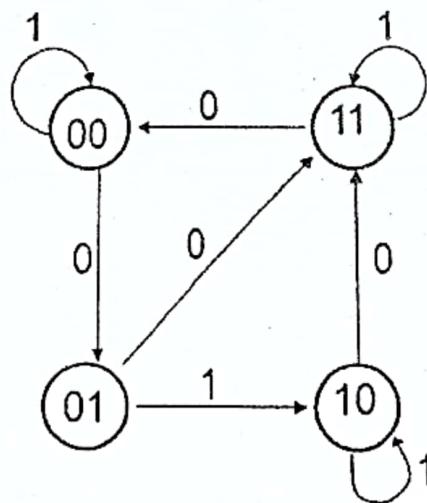
4. a) Define simple hypothesis and critical region. Let x_1, x_2, \dots, x_n and y_1, y_2, \dots, y_m be two random samples drawn from two normal populations $N(\mu_i, \sigma^2)$, $i=1,2$ respectively. If σ^2 is unknown, how would you test null hypothesis that $H_0: \mu_1 = \mu_2$ 8.75
 b) Sample mean weight of 20 CSE students is 50kg and 10 ICE students is 45kg. if the sample variances of weights are 25 and 16, test whether the mean weights of CSE students is greater than the mean weights of ICE students. (Use $t_{0.05,28}=1.64$)
5. a) Define type I error and type II error. Describe the procedure of testing the hypothesis that population proportion is equal to a specified value p_0 . 5.75
 b) A nutritionist claims that 80 percent of the pre-school children in a certain country have protein-deficient diet. A sample survey reveals that it is true for 244 children out of 300. Is the nutritionist justified in his claim? Use a significant level of 0.01 [$Z_{0.01} = 2.33$] 3
6. a) Describe the procedure of Fisher's exact test for testing the independence of two binary variables. 4
 b) For given information in the following table, test at level of significance 0.05 that whether class attendance affects the examination score. 4.75

Class attendance	Examination score	
	A+	Less than A+
Less than 80%	3	6
80% and above	7	4

[N.B. Answer any Six questions taking Three from each section.]

Section-A

1. a) Convert 01010010 (BCD) to Binary. You have a BCD number of two digit decimal values. Now, design a BCD-to-binary converter with 4-bit parallel adder. Draw the logic circuit and explain its operation. *→ input BCD output Binary* 5
- b) Design a BCD to Excess-3 code converter and draw its logic diagram. 3.75
2. a) Why carry-look-ahead adder is faster than regular adder – explain with diagram. 3
- b) Distinguish between 1's complement and 2's complement system. Why these circuits are necessary? 2.75
- c) Design a logic circuit that has four inputs, A B, C and D and whose output will be high only when a majority of inputs are high. 3
3. a) Define decoder and demultiplexer. How decoder can be used as a demultiplexer? 2.25
- b) Define Multiplexer. Implement the logic function $F(A, B, C, D) = \sum m(1, 3, 4, 7, 11, 13, 15)$ using 8x1 MUX. 4
- c) Implement the logic function $F(A, B, C) = \sum m(1, 3, 4, 7)$ using a 3-to-8 line decoder with active low output. 2.5
4. a) What is parity bit? Implement a 4-bit even parity generator circuit and discuss the operation of the circuit with example. 2.75
- b) Define state table and state diagram with example. 2
- c) From the following state diagram, design the sequential circuit using JK flip-flops. 4



Section -B

5. a) Define asynchronous and synchronous counter. Write the advantages of synchronous counter over asynchronous counter. 2.25
b) Construct a binary counter that will convert a 64-kHz pulse signal into a 8-kHz square wave. 2
c) Draw the logic diagram of a Mod-8 synchronous up/down counter. Explain its operation with timing diagram. 4.5
6. a) Define Excitation table. Write the excitation table of SR, JK, D and T flip flop. 3
b) Design a counter with JK flip flop that will count the sequence 0,1,5,4, 3, 2, 0. 5.75
7. a) Discuss FPGA architecture in brief. Distinguish between PLA and PAL in terms of design architecture. 3
b) Implement the Boolean function using PAL 3
- $$Y_1 = \sum m(1,2,4,7)$$
- $$Y_2 = \sum m(3,6)$$
- c) Determine the size of the PROM required to implement a dual 8-to-1 multiplexer with common selection inputs 2.75
8. a) What is VHDL? Briefly describe the salient features of VHDL and Verilog. 2.75
b) Explain an 8-to-1 line Multiplexer module in Verilog HDL. 3
- c) Write a VHDL code to implement XOR operation. 3

[N.B. Answer SIX questions taking THREE from each Section.]

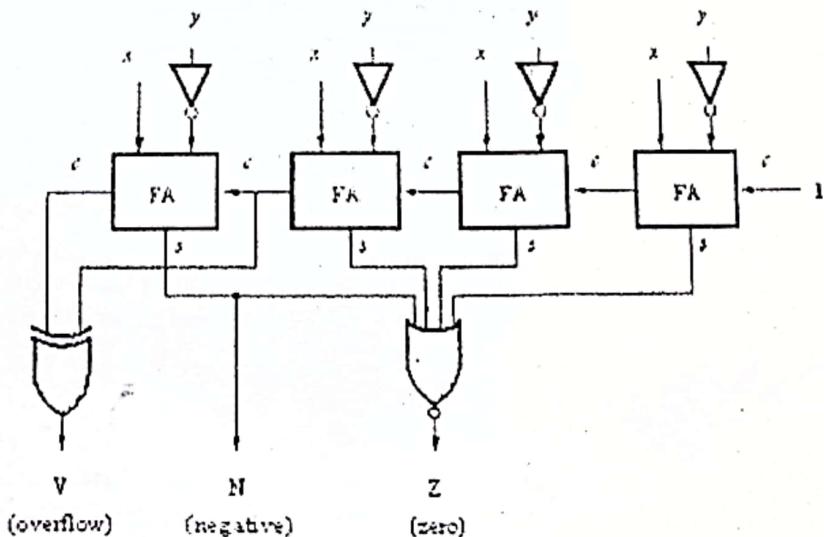
Part A

1. (a) Represent $(-200)_{10}$ and $(200)_{10}$ using sign-magnitude, 1's complement and 2's complement binary form. 2
- (b) Represent $(275)_{10}$ and $(641)_{10}$ in BCD and then perform BCD addition. Check your result by converting back to decimal. 2
- (c) Construct a BCD adder to add two 4-bit BCD code groups using 4-bit parallel adders and discuss its operation with suitable examples. 4.75

2. (a) Design a combinational logic circuit to compare two 4-bit binary numbers A and B and to generate the outputs $A < B$, $A = B$ and $A > B$. 3
- (b) Design a combinational circuit to convert BCD code to 7-segment code. 3.75
- (c) Design a combinational logic using suitable multiplexer to realize the following boolean expression: $Y = AD + B'C + BCD$. 2

3. (a) What is priority encoder? Design a 4-line to 2-line priority encoder with active HIGH inputs and outputs with priority assigned to the higher order data input lines. 4.75
- (b) Implement a full-adder circuit using a 3-to-8 decoder. 4

4. (a) What is code converter? Draw the combinational logic circuit for binary to gray code conversion. 1.75
- (b) Design and explain a 2-bit binary multiplier combinational logic circuit. 4
- (c) In computer computations it is often necessary to compare numbers. Two four-bit signed numbers, $X = x_3x_2x_1x_0$ and $Y = y_3y_2y_1y_0$, can be compared by using the subtractor circuit in Figure, which performs the operation $X - Y$. The three outputs denote the following: $Z = 1$ if the result is 0, otherwise $Z = 0$; $N = 1$ if the result is negative, otherwise $N = 0$; $V = 1$ if arithmetic overflow occurs, otherwise $V = 0$. Show how Z , N , and V can be used to determine the cases $X = Y$, $X < Y$, $X \leq Y$, $X > Y$ and $X \geq Y$. 3



Part B

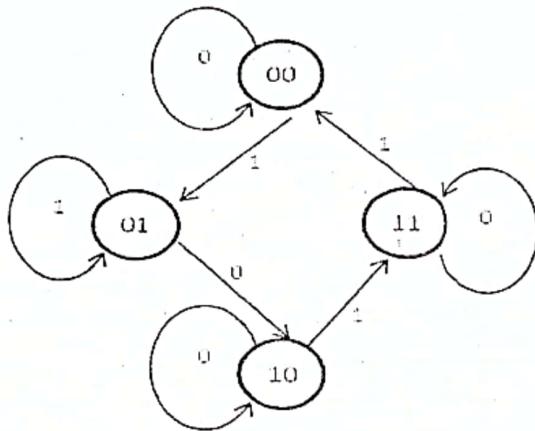
- 5.(a) What is shift register? Design a 4-bit right shift register with parallel load of 3 data.
- (b) What is counter? Differentiate between asynchronous and synchronous counter. 1.75
List the applications of counter.
- (c) Draw the truth table and design a logic diagram of a MOD-10 ripple counter. 4
Explain its operation with timing diagram.
- 6.(a) Design a synchronous counter with JK flip-flop that will count the sequence as 4
0, 2, 4, 6, and repeat.
- (b) Design a MOD-8 synchronous up/down counter and explain its operation with 4
timing diagram.
- (c) What is presetable counters? 0.75
- 7.(a) Design a magnetic core RAM using 2x4 decoder (consider 2-bits input and 2- 4
bits output). Discuss the read/write operation.
- (b) Distinguish between PLA and PAL in terms of design architecture. 1.75
- (c) Define the different hardware of FPGA. Draw the basic FPGA architecture. 3
Give an example.
- 8.(a) What is a hardware description language? What are the requirements of a good 3
HDL?
- (b) Briefly describe the salient features of VHDL and Verilog. 4
- (c) What are the advantages of using JAVA HDL over Verilog? 1.75

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Engg.) Part-2 Odd Semester Examination-2016
Course: CSE2111 (Digital System Design)
Full Marks: 52.5 Duration: 3(Three) Hours

Answer 06(Six) questions taking any 03(Three) questions from each part.

Part-A

- | | |
|---|------|
| 1.(a) Design a 4-bit binary adder circuit with necessary figures. | 2 |
| (b) What do you mean by the terms 'carry generate' and 'carry propagate'? Define those terms with a full adder circuit and necessary equations. | 2.75 |
| (c) Define lookahead carry-generator. Design a 4-bit carry-lookahead adder. | 4 |
| 2.(a) Draw a 2-input AND gate and a 2-input OR gate using Transistor-Transistor logic | 2.75 |
| (b) There are Four switches to control a water pump. The water pump is turned on for the following conditions (i) if switch 1 is turned OFF but both switch 2 and 3 are turned ON, or, (ii) if switch-4 is turned ON but both switch 2 and 3 are turned OFF. Draw the truth table, derive the switching functions, minimize the switching functions by using K-map and draw the logic-gate diagram (circuit). | 4 |
| (c) What are the differences between '7400' and '74LS00'? | 2 |
| 3.(a) Design a clocked sequential circuit that counts from 00 to 11 with JK flip-flops whose state diagram is given below: | 4 |



- | | |
|---|------|
| (b) Define latch and flip-flop. Design a clocked master-slave JK flip-flop. | 3 |
| (c) Define state reduction problem. What is the benefit by considering don't care terms in designing a sequential circuit? | 1.75 |
| 4.(a) Design the sequential circuit using register and ROM whose next state and outputs are defined by the following equations:
$A_1(t+1)=\Sigma(4,6)$
$A_2(t+1)=\Sigma(1,3,5,7)$
$y(A_1, A_2, x)=\Sigma(3,7)$ | 4 |
| (b) Design a 2-input serial adder using a sequential logic procedure. | 3 |
| (c) Discuss the difference between serial and parallel modes of operation in a register. | 1.75 |

Part-B

- 5.(a) Draw the logic diagram of a 4-bit Ripple counter and explain its operation. 3
(b) What do you mean by negative-edge triggered FF, positive edge triggered FF and level triggered FF. Explain with diagrams. 2
(c) Draw the logic diagram of a 4-bit Johnson counter and explain its operation. 3.75
- 6.(a) Design an integrated circuit memory using 2×4 decoder (consider 2-bit input and 2-bit output). 4
(b) A combinational circuits is defined by the following functions 4.75
 $F_1(A,B,C)=\Sigma(3,4,6,7)$
 $F_2(A,B,C)=\Sigma(0,2,5,8)$
Implement the circuit with a PLA having 3 inputs, 4 product terms and 2 outputs.
- 7.(a) Describe the abstraction levels of Verilog HDL. 3
(b) Write the input-output connection rules of Verilog HDL with example. 2.75
(c) What is the difference between the following two lines of Verilog code? 3
i. $\#5 a=5;$
ii. $a=\#5 b;$
- 8.(a) Write Verilog HDL programs including the design and stimulus blocks for 4.75 +4
(i) 4-1 multiplexer,
(ii) 4-bit full adder.

University of Rajshahi
Department of Computer Science & Engineering
B.Sc. (Engg.) Part-II Odd Semester Examination 2015
Course: CSE-2111 (Digital System Design)
Full Marks: 52.5 Duration: 3(Three) Hours
Answer 6(Six) questions taking any 3(Three) from each part

Part-A

1. a) Why combinational logic circuit is needed? Design a BCD to Excess-4 code converter and draw its logic diagram. 4
b) Why carry-lookahead adder is faster than carry propagation adder. Draw the logic diagram of a 4-bit lookahead carry generator. Construct a 4-bit carry-lookahead adder with a lookahead carry generator. 4.75
2. a) What is the difference between a decoder and a de-multiplexer? Implement a full adder circuit with a decoder and two OR gate. 4
b) Define multiplexer. Implement $F(A,B,C,D) = \sum(1,2,4,8,9,15)$ with a 8×1 MUX. 4.75
3. Consider a synchronous sequential binary logic circuit with one input A and one output Z . Suppose A denotes single bit binary number and the input sequence is divided per every three clock cycle. Here, each division is called an *interval*. We would like to design a sequential circuit which outputs 1 at the last clock period of the interval if and only if the interval contains one or more '1's. Table-1 illustrates an example of the action. 2

Clock	C	1	2	3	4	5	6
Input	A	0	0	0	1	0	1
Output	Z	0	0	0	0	0	1

Table- 1

- a) Draw the state transition diagram for the circuit. 2
b) Draw the state transition table for the circuit. 2.75
c) Draw the Karnaugh map for the circuit.
d) Design the synchronous sequential circuit and draw it. You can only use the symbols for AND, OR, NOT, D flip-flop and JK flip-flop.

4. a) Distinguish between flip-flop and latch. Explain clocked SR flip-flop with logic diagram, function table and characteristics equation. 4
b) Complete the diagram of the sequential circuit whose sequence is given below: 4.75

State	a	a	b	c	d	e	f	f	g	f	g
Input	0	1	0	1	0	1	1	0	1	0	0
Output	0	0	0	0	0	1	1	0	1	0	0

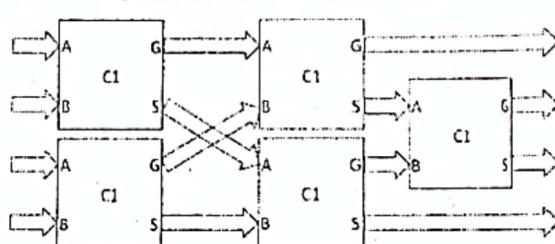
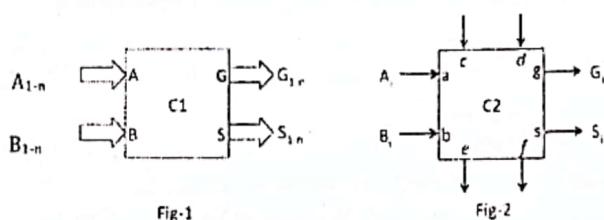
Draw the logic diagram using SR flipflops.

M

Part-B

4.25
4.5

5. a) What is shift register? Design a 4-bit bidirectional shift register with parallel load.
 b) What is ripple counter? Draw the logic diagram of a BCD ripple counter with timing diagram.
6. A circuit C1 shown in Fig-1 accepts n-bit unsigned binary numbers A and B as input and produce G and S as output, where G is the greater and S is the smaller between A and B respectively. When $A=B$, we have $G=S=A=B$. Fig-2 shows a circuit C2 processes numbers of one binary digit. Suppose that cascading n units of circuit C2 implement a circuit C1. The inputs c and d of circuit C2 represent that $A < B$ and $A > B$ respectively for more significant digits than processed by the circuit. The outputs e and f represent that $A < B$ and $A > B$ hold respectively including the digits being processed. G_i and S_i respectively represent ith bit of greater and smaller number.



- a) Construct a truth table for circuit C2. Note that '1' represents *true* and '0' represents *false*. 2.5
 b) Draw a circuit diagram of C2 by using only AND, OR and NOT gate. 2.5
 c) Draw a block diagram of circuit C1 for comparing two 4-bit binary numbers by using four C2 circuit blocks. 1
 d) As shown in Fig-3, four input numbers are sorted by connecting several units of circuit C1. Following Fig-3, show an example circuit for sorting three inputs. 2.75
7. a) Distinguish between SRAM and DRAM. Briefly explain the internal organization of a 64x4 RAM. 4.25
 b) What are the major differences between CPLDs and FPGAs? Discuss FPGA architecture in brief. 4.5
8. a) State port connection rules in Verilog HDL. 2.75
 b) Explain min, max and typ delays in the gate-level design with respect to Verilog HDL. 3
 c) Describe a 8-to-1 line Multiplexer module in Verilog HDL. 3

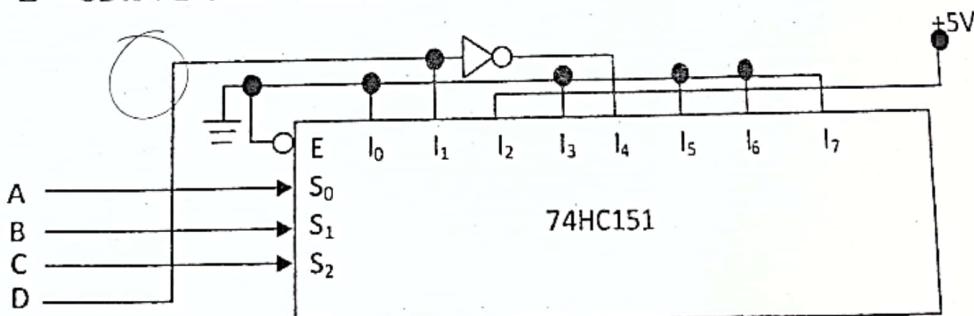
Department of Computer Science & Engineering
B.Sc. Engineering Part-2, odd Semester Examination 2014

Course: CSE2111 (Digital System Design)
Marks: 52.5
Time: 3 hours

(Answer SIX questions taking THREE from each part)

PART-A

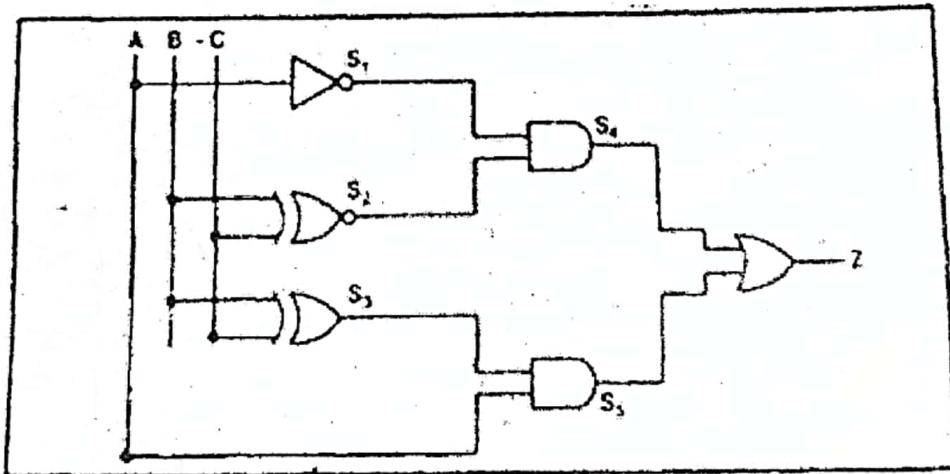
1. a) Define code converter? Design 3 bit Gray Code to binary converter and explain the 4.25 operation.
b) Design an 8-bit magnitude comparator using 74HC85 4-bit magnitude comparator and 4.5 hence describe the operation of the following eight-bit comparison
A7....A0=10101111 and B7....B0=10101001.
2. a) Design a 4-bit binary parallel adder/subtractor circuit and explain the operation with an 5.5 example.
b) There are two types of adder, one is ripple carry and other is carry look-ahead. What 3.25 will be the good design of 32-bit adder? Explain your answer.
3. a) Design a binary multiplier of two numbers A and B (two bit each), C=AxB. Explain its 4.5 operation.
b) Explain an application of magnitude comparator with a digital circuit. 4.25
4. a) Design a 1-line-to-8 line demultiplexer and discuss the operation of the circuit. 4.25
b) From the following figure
Set up a truth table showing the output Z for the 16 possible combinations of input variables.
Write the sum of product expression for Z and simplify it to verify
 $Z = \overline{C} \overline{B} \overline{A} + D \overline{C} \overline{B} A + \overline{D} C \overline{B} \overline{A}$



PART-B

5. a) Define asynchronous and synchronous counter. Discuss the problems of asynchronous counter? 3
 b) What is MOD number of a counter? Show how to wire the 74LS293 asynchronous counter IC as a MOD-10 counter and explain its operation. 5.75
6. a) Define excitation table. Write the excitation table of JK flip flop and D flip flop. 3
 b) Design a counter with JK flip flop that will count the sequence 0,1,3,7,5,2,0. 5.75
7. a) A certain memory stores $8 \text{ k} \times 16$ bit words. How many data input lines, data output lines and address lines does it have? What is its capacity in bytes? 3
 b) Define PAL and PLA. Implement the Boolean function using PAL. 5.75
- $$Y_1 = \Sigma m (1, 3, 5, 7)$$

$$Y_2 = \Sigma m (2, 4).$$
8. a) What is VHDL? What are the three levels of architecture description in VHDL? Briefly discuss. 4.75
 b) Write a VHDL code for the circuit diagram given below: 4



University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-2 (Odd Semester) Examination-2018
Course: ACCO2111 (Industrial Management and Accountancy)
Marks: 35 Time: 2:00 Hours

[N.B. Answer any Four questions taking Two from each section.]

Section-A

1. (a) Define business. 1.75
 (b) What are the important features of business? 5
 (c) Mention the different types of business entities. 2

2. (a) Name the elements of business environment. 3.75
 (b) Discuss the types of industries with examples 5

3. (a) Name the general principles proposed by Fayol. 3.75
 (b) Discuss Maslow's hierarchy of needs. 5

Section-B

4. (a) What is accounting? Make a discussion on the elements of financial statements. 4.75
 (b) Who are the users of accounting information? Discuss. 4

5. On January 1, 2018 Mr. Karim established a travel agency. The following transactions were completed during the month.
 Jan. 1, Invested cash to start the agency Tk. 50,000;
 Jan. 2, Paid cash for office rent Tk. 6000;
 Jan. 5, Purchased office equipment for Tk. 20,000 cash and Tk. 5000 on account;
 Jan. 10, Paid cash for office supplies Tk. 3000;
 Jan. 20, Service performed for cash Tk. 28000 and on account Tk. 7000;
 Jan. 28, Received Tk. 7000 for service performed ~~on account~~.
 Jan. 31, Paid salary Tk. 8000.

Required: (a) Prepare journal entries to record the above transaction. 3
 (b) Post the journal entries to the accounts in the ledger (use T account). 3.75
 (c) Prepare Trial Balance. 2

6. The trial balance columns of the worksheet for Auritra Roofing at March 31, 2018, are as follows. 8.75

Account Titles	Dr.	Cr.
Cash	4,500	
Account receivable	3,200	
Supplies	2,000	
Equipment	11,000	
Accumulated depreciation-Equipment		1,250
Account payable		2,500
Unearned service revenue		550
Owner's capital		12,900
Owner's drawing	1,100	
Service revenue		6,300
Salaries and wages expense	1,300	
Miscellaneous expense	400	
	<u>23,500</u>	<u>23,500</u>

CONFIDENTIAL

Other data:

- i) A physical count reveals only Tk. 480 of roofing supplies on hand.
- ii) Depreciation for March is Tk. 250.
- iii) Unearned revenue amounted to Tk. 260 at March 31.
- iv) Accrued salaries are Tk. 700.

Instruction: Enter the trial balance on a worksheet and complete the worksheet.

[N.B. Figures in the margin indicate full marks. Answer FOUR questions taking TWO from each section including question no. 6 which is compulsory.]

Part-A
 Answer any TWO questions.

- | | |
|---|------|
| 1. (a) What is sole proprietorship business? | 02 |
| (b) Explain the features of sole proprietorship business. | 03 |
| (c) What are the causes of survival of sole proprietorship business side by side with large organization? <i>Sole proprietorship business advantage</i> | 3.75 |
| <i>Ans.</i> | |
| 2. (a) Define motivation. | 03 |
| (b) What are the different types of financial and non-financial incentives provided within the industries of our country? | 5.75 |
| 3. (a) What do you understand by management? | 03 |
| (b) Discuss the basic function of management. | 5.75 |

Part-B
 Answer any TWO questions.

- | | |
|---|-----|
| 4. (a) What is the basic accounting equation? | 02 |
| (b) Identify and describe the steps in the accounting cycle. | 2.5 |
| (c) Define the terms assets, liabilities, and owner's equity. | 03 |
| 5. (a) Define direct materials and indirect materials. | 02 |
| (b) Define variable cost and fixed cost. | 02 |
| (c) Square company has a unit selling price of Tk. 20, variable costs per unit of Tk. 12, and fixed costs of Tk. 80,000. Compute the break-even point in units and in Taka. Compute the sales required in units to earn net income of Tk. 1,20,000. | 3.5 |
| 6. On January 1, 2016 Mr. Karim established a travel agency. The following transactions were completed during the month: | 10 |

January 1	Invested cash to start the agency Tk. 75,000;
January 3	Paid cash for office rent for one month Tk. 5,000;
January 6	Purchased office equipment for Tk. 20,000 cash and Tk. 6,000 on account;
January 10	Incurred advertising cost on account Tk. 4,000;
January 15	Paid cash for office supplies Tk. 3,000;
January 20	Service performed for cash Tk. 22,000 and on account Tk. 3000
January 25	Paid accounts payable due in January 10;
January 30	Paid salary Tk. 8,000;
January 31	Received Tk. 2,000 for service performed on account

Required: (a) Prepare journal entries to record the above transaction.
 (b) Post the journal entries to the accounts in the ledger. (Use T account) and prepare Trial balance.

University of Rajshahi,
Department of Computer Science and Engineering
B. Sc. (Engg.) Part-2 Odd Semester Examination-2016
Course: ACCO2111 (Industrial Management and Accountancy)

Full Marks: 35 Duration: 2(Two) Hours

N.B. Figures in the margin indicate full marks. Answer any 04(Four) questions taking 02(Two) from each part including question no. 6, which is compulsory.

Part - A

- | | |
|--|------|
| 1. a) Define business environment. | 2 |
| b) What are the elements of business environment? | 2.5 |
| c) Discuss the internal environment of a business. | 4.25 |
|
2. a) Define industry. | 2.75 |
| b) Discuss the various types of industries with example. | 6 |
|
3. a) What do you understand by management? * | 3 |
| b) Discuss the basic function of management. * | 5.75 |

Part - B

- | | |
|---|-----|
| 4. a) Define accounting. * | 2 |
| b) Who are the users of accounting information? * | 2 |
| c) State the rules of debit and credit as applied to (i) asset accounts (ii) liability accounts (iii) revenue accounts (iv) expense accounts and (v) capital account. | 3.5 |
|
5. a) Define direct cost and indirect cost. | 2 |
| b) Differentiate between fixed cost and variable cost. | 2 |
| c) Beximco Company has a unit selling price of Tk. 400, variable costs per unit of Tk. 260, and fixed costs of Tk. 210,000. Compute the break-even point in units and in Taka. Compute the sales required in Taka to earn net income of Tk. 200,200. | 3.5 |
|
6. Mr. Karim owns and manages a computer repair service, which had the following balances on December 31, 2014 (the end of its fiscal year): Cash Tk. 12,000; A/R Tk. 13,000; Parts Inventory Tk. 10,000; Shop Equipment Tk. 36,000; A/P Tk. 21,000 and Capital Tk. 50,000. | 10 |

During the year 2015 following summary transactions were completed:

- Additional repair parts inventory acquired on account Tk. 4,000;
- Miscellaneous expenses paid in cash Tk. 2,000;
- Cash collected from customer in payment of A/R Tk. 12,000;
- Cash paid to creditors for accounts payable due Tk. 15,000;
- Repair parts used during the year Tk. 8,000;
- Repair services performed during the year: for cash Tk. 7,000 and on account Tk. 9,000;
- Salary paid in cash Tk. 3,000;

Required:

- Prepare journal entries to record the above transaction.
- Enter the opening balances in the accounts and post the journal entries to the accounts in the ledger. (Use T account) and prepare Trial balance.

Analytic Determination of Debit & credit.

RQ

University of Rajshahi
 Department of Computer Science and Engineering
 B.Sc. (Engg.) Part-2 Odd Semester Examination-2015
 Course: ACCO2111 (Industrial Management and Accountancy)
 Full Marks: 35 Time: 2 Hours

[N.B. Figures in the margin indicate full marks. Answer any Four questions taking two from each part]

Part-A

- | | |
|---|------|
| 1. (a) Define business. | 2 |
| (b) What are the important features of businesses? | 5 |
| (c) Mention the different types of business entities. | 1.75 |
| 2. (a) What do you understand by management? | 3 |
| (b) Discuss the basic functions of management in brief. | 5.75 |
| 3. (a) Define work environment. What makes a successful safety and healthsystems? | 4.75 |
| (b) What strategy does influence on the success of IT industry? | 4 |

Part-B

- | | |
|--|------|
| 4. (a) Define accounting. | 2 |
| (b) "The terms debit and credit mean increase and decrease respectively". Do you agree? Explain. // no. logic and explain determination of debit & credit | 4 |
| (c) What are the elements of financial statements? | 2.75 |
| 5. (a) What are the major components of product cost and period cost? | 2 |
| (b) Define variable cost and fixed cost. Give example of each type. | 2.75 |
| (c) Vargo Video produces a high-end, progressive-scan DVD player/recorder with up to 160-hour recording capacity and MP3 playback capability. Relevant data for the DVD players sold by this company in June, 2015 are as follows: | 4 |

Unit selling price of DVD player	Tk. 500
Unit variable costs	300
Total monthly fixed costs	2,00,000
Units sold	1,600

target profit of 25000
or profit =
25000 / 1600 = 15.625

Required: Calculate BEP in units and profit for June 2015.

6. (a) State the advantages of using Journal. 2.75
 (b) "Abid Computers" opened a software firm on April 1, 2014. During the first month of operations, the following transactions occurred: 6

- April 1. Invested Taka 300,000 cash and Furniture Taka 50,000 in the business.
- 3. Paid office rent for the month Taka 10,000 cash.
- 5. Purchased computer accessories for Taka 250,000. Paying Taka 100,000 in Cash and Taka 150,000 in Credits.
- 10. For advertising the opening of the software firm, give advertisement in News Paper Taka 5,000.
- 20. Withdraw Taka 20,000 cash for personal use.
- 25. Cash receipts for software sale for the month were Taka 2,50,000.
- 30. Paid salary for software engineer of Taka 1,00,000.

Instruction:

Journalize the April Transactions.

University of Rajshahi
 Department of Computer Science & Engineering
 B. Sc. Engineering Part-II Odd Semester Exam-2014
 Course: ACCO-2111 (Industrial Management and Accountancy)
 Marks: 35, Time-2 hours

Answer Four (4) questions taking three (3) from each part

Part A

- | | | |
|------|--|------|
| 1.a) | Define management. State the nature of management. | 6 |
| b) | What is meant by technical skill? | 2.75 |
| 2.a) | Define Motivation. Why is it essential in an organization? | 4.75 |
| b) | Critically evaluate Maslow's need hierarchy theory. | 4 |
| 3.a) | What are the features of business? | 3.75 |
| b) | Mention the different types of business entities. | 5 |

Part B

- | | | |
|------|---|------|
| 4.a) | Who are the users of accounting information? | 2 |
| b) | On January 1, 2012 Mr. Abdullah established a travel Agency. The following transactions were completed during the month: | 6.75 |
| | • January 1: Invested cash to start the agency, Tk. 20,00,000; | |
| | • January 5: Paid cash for April office rent, Tk. 25,000; | |
| | • January 7: Purchased office equipment for Tk. 17,500 cash, and Tk. 4,000 on account; | |
| | January 10: Incurred advertising costs on account Tk. 16,000; | |
| | January 15: Paid cash for office supplies Tk. 10,000; | |
| | January 20: Earned Tk. 60,000 for service rendered, Tk. 20,000 cash is received from customers and the balance of Tk. 40,000 is billed to customers on account; | |
| | January 22: Paid Accounts Payable due in January 10; | |
| | January 25: Withdrew Tk. 50,000 for personal use; | |
| | January 26: Paid employees' salaries Tk. 70,000; | |
| | January 30: Received Tk. 32,000 in cash from customers who have previously been billed in transaction dated 20. | |

Instruction: Prepare a tabular analysis of the transactions showing the following column headings:
Cash, Accounts Receivable, Office Equipment, Supplies, Accounts Payable, Abdullah's Capital.

- | | | |
|----|---|------|
| 5) | Mrs. Kent is a licensed CPA. During the first month of operation of her business, the following events and transactions occurred: | 8.75 |
| | May 1 Kent invested Tk. 50,000 cash. | |
| | 2 hired a receptionist at a salary of Tk. 4,000 per month. | |
| | 4 Purchased Tk. 5,000 of supplies on account. | |
| | 7 Paid office rent of Tk. 1,500 cash for the month. | |
| | 10 Completed a tax assignment and billed client Tk. 4,100 for services provided. | |
| | 12 Received Tk. 5,000 advance on a management consulting engagement. | |
| | 17 Received cash of Tk. 2,400 for services completed for H. Arnold co. | |
| | 30 Paid receptionist Tk. 4,000 salary for the month. | |

Journalize the transactions.

- | | | |
|------|---|------|
| 6.a) | What is a trial balance? | 2 |
| b) | Mr. Khan has a sole proprietorship merchandising enterprise titled Khan & co. Following are the ledger account balance of his enterprise on 31 st December 2013. | 6.75 |

Account's Title	Debit
Cash	26,125
Accounts receivable	36,000
Notes receivable	26,000
Allowance for doubtful Accounts	593
Inventory	62,500
Office Supplies	320
Land	79,780
Building	98,560
Accumulated depreciation-Building	19,712
Office furniture	45,540
Accumulated depreciation- Office furniture	11,385
Accounts Payable	35,584
Notes Payable	15,889
Purchases	88,475
Purchase return and allowances	10,577
Repair and maintenance	5,840
Mr. Khan, Capital	2,90,850
Mr. Khan, drawing	8,780
Sales	1,45,030
Sales return and allowances	2,225
Office salaries	22,520
Sales salaries	20,530
Advertisizing Expenses	5,750
Travel Expenses	450
Prepaid Insurance	850
Interest Revenue	950
Miscellaneous expenses	325

Required:

Prepare a trial balance as on December 31, 2013.

① Isomorphic

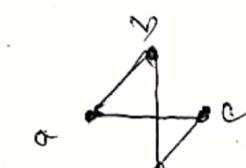
② planer

③ একটি Graph কে দুটি পথের walk 270 ও walk 245 কোথা walk 245

④ Linked Representation.

⑤

How many walks
there form a to d in the
Graph G?



How many walks of length 4 are
there from a to d in the

Graph G?

University of Rajshahi
 Department of Computer Science and Engineering
 B.Sc. (Engg.) Part-2 (Odd Semester) Examination-2018
 Course: CSE 2131 (Discrete Mathematics)
 Marks: 52.5 Time: 3:00 Hours

[N.B. Answer Six questions taking at least Three from each Section.]

Section A

- | | | |
|---|--|------|
| 1.(a) | What are contradiction and tautology? Explain with example. | 2.75 |
| (b) | Show that $(p \rightarrow r) \vee (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ using logical equivalence. | 2 |
| (c) | Express the following statements using the propositions as below:

p : The message is scanned for viruses
q : The message was sent from an unknown system together with logical connectives (including negations): | 4 |
| <ul style="list-style-type: none"> i) The message is scanned for viruses whenever the message was sent from an unknown system. ii) The message was sent from an unknown system but it was not scanned for viruses. iii) It is necessary to scan the message for viruses whenever it was sent from an unknown system. iv) When a message is not sent from an unknown system it is not scanned for viruses. | | |
| 2.(a) | State the rules of <u>inferences</u> for propositional logic. | 2.75 |
| (b) | Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q$, $Q \rightarrow R$, $P \rightarrow M$ and $\neg M$. | 3 |
| (c) | Show that the hypothesis, "It is not sunny this afternoon and it is colder than yesterday", "We will go swimming only if it is sunny", "If we do not go swimming, then we will take a canoe trip" and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion " <u>We will be home by sunset</u> ". | 3 |
| 3.(a) | Define Disjunctive Normal Form and Conjunctive Normal Form. | 2 |
| (b) | Show that the premises "A student in this class has not read the book", and "Everyone in this class passed the first exam" imply the conclusion "Someone who passed the first exam has not read the book" | 3 |
| (c) | Write the negation of the statements i) $(\exists x)(\forall y) p(x, y)$ ii) $\forall y (x^2 > x)$ and $\exists x (x^2 = 2)$. | 2 |
| (d) | Let $P(x, y)$ denote the statement $x = y + 3$. What are the truth values of the Proposition $P(1, 2)$ and $P(3, 0)$. | 1.75 |
| 4.(a) | Prove DeMorgan's law for set intersection, $(A \cap B)' = A' \cup B'$. | 2 |
| (b) | Suppose A is the set of distinct letters in the word elephant, B is the set of distinct letters in the word sycophant, C is the set of distinct letters in the word fantastic, and D is the set of distinct letters in the word student. The universe U is the set of 26 lowercase letters of the English alphabet. Find: | 3 |
| <ul style="list-style-type: none"> i) $A \cup B$ ii) $A \cap C$ iii) $A \cap (C \cup D)$ | | |

① $\neg \exists x \vee y P(x, y) \equiv \forall x \exists y \neg P(x, y)$

(c) $A = \{1, 2, 3, 4, 5\}; B = \{6, 7, 8, 9, 10\}; D = \{7, 8, 9, 10\};$

$C = \{a, b, c, d, e\} f: A \rightarrow B,$

$f = \{(1, 7), (2, 6), (3, 9), (4, 7), (5, 10)\}$

$g = \{(6, b), (7, a), (8, d), (9, c), (10, b)\}$

(i) Is f a function? Why or why not? (ii) Is f injective (that is, one-to-one)?
 Why or why not? (iii) Is f surjective (that is, onto)? Why or why not? (iv) Is g a function? Why or why not?

Section B

5.(a) Define the properties of relation with suitable example. 2

(b) Let R be the relation represented by the matrix: 3

$$M_R = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

Find the matrix representing:

i) R^{-1} , ii) \bar{R} and iii) R^2

(c) Let R_1 and R_2 be relations on a set A represented by the matrices 3.75

$$M_{R_1} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \wedge M_{R_2} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Find the matrices that represent (i) $R_1 \circ R_2$ (ii) $R_2 \circ R_1$



6.(a) Draw the Hasse diagram representing the partial ordering $\{(a, b) \mid a \text{ divides } b\}$ on set $\{1, 2, 3, 4, 6, 8, 12\}$. 3

(b) Use Warshall's Algorithm to find the transitive closures of the relation $R = \{(1, 1), (1, 4), (2, 1), (2, 3), (3, 1), (3, 2), (3, 4), (4, 2)\}$ on set $\{1, 2, 3, 4\}$. 4

(c) Let R be the relation on the set of real numbers such that xRy if and only if x and y are real numbers that differ by less than 1, that is $|x - y| < 1$. Show that R is not an equivalence relation. 1.75

7.(a) Define regular graph and a complete graph. What is meant by isomorphism of graphs? 2.75

(b) Draw the complete graph K_5 with vertices A, B, C, D, E. Draw all complete subgraph of K_5 with 4 vertices. Are the sub graphs bipartite, explain why or why not? 4

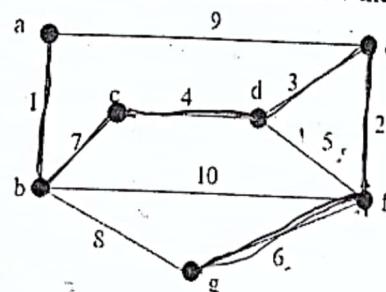
(c) Explain Euler paths and circuits in a graph with example. 2

8.(a) Draw a binary tree to represent the following mathematical expression: 1

$$(a - b) / (c * (d - e))$$

(b) Write down the vertex sequence for the pre-order and also the post-order traversal of the tree (to be created) in (a). 2

(c) Use Kruskal's algorithm to find a minimal spanning tree for the following graph, where the numbers represent the weight of the corresponding edges. What is the total weight of the minimal spanning tree? Also draw the minimal spanning tree. 5.75

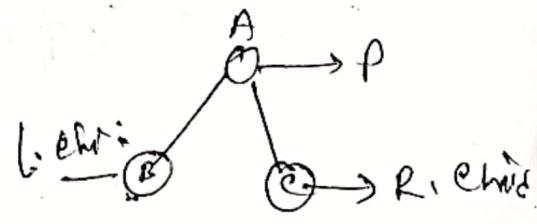


PRE = PLR

post = LRP

Inorder = LPR.

| p = parent
 | l = left child
 | r = right child



University of Rajshahi
 Department of Computer Science and Engineering
 B.Sc.(Engg.) Part-2 (Odd Semester) Examination-2017
 Course: CSE-2131 (Discrete Mathematics)

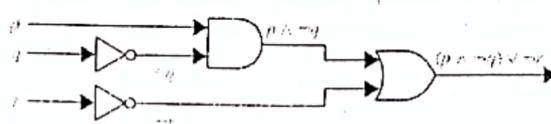
Full Marks: 52.5

Time: 3 Hours

(Answer any Six of the following questions taking three from each section.)

Part-A

- 1.(a) Construct the truth table of the compound proposition $(p \vee \neg q) \rightarrow (p \wedge q)$. 2
- (b) How can this English sentence be translated into a logical expression?
"You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old." 2
- (c) Determine the output for the combinatorial circuit in the following Figure. If the value of p, q and r are T, T and F respectively. 3.25



A combinatorial circuit

- (d) Build a digital circuit that produces the output $(p \vee \neg r) \wedge (\neg p \vee (q \vee \neg r))$ when given input bits p, q , and r . 2
- 2.(a) Define Universal quantification and Existential quantification with example. 2
- (b) Show that $[\neg p \wedge (p \vee q)] \rightarrow q$ is a tautology. 1.75
- (c) Express the statements "If somebody is female and is a parent, then this person is someone's mother" as a logical expression. 2
- (d) Express the following statement using logical connectives:

- i) The automated reply cannot be sent when the file system is full. ~~P~~ \rightarrow 79³
- ii) you cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old. ~~P~~ q $\neg r$ $= (q \wedge \neg r) \rightarrow$
- iii) you can access the internet from campus only if you are a computer science major or you are not a freshman. ~~P~~ C B $\rightarrow (C \vee \neg D) \rightarrow$

- 3.(a) What do you mean by rules of inference? Define Modus ponens and Modus tollens rules of inference with example? 3

- (b) Show that the hypotheses H1, H2, and H3 lead to the conclusion C, where H1: "If you send me an e-mail message, then I will finish writing the program.", H2: "If you do not send me an e-mail message, then I will go to sleep early.", H3: "If I go to sleep early, then I will wake up feeling refreshed.", C: "If I do not finish writing the program, then I will wake up feeling refreshed." 3

- (c) What do you mean by proof by contradiction? Prove the theorem "If $3n+2$ is odd, then n is odd" by using proof by contradiction. 2.75

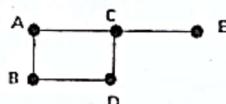
- 4.(a) Define binary relation with example. How many different relations can we define on a set A with n elements? 2

- (b) Let $A = \{1, 2, 3, 4\}$ and R be the relation on A where $(a, b) \in R$ if and only if $a > b$. Represent the relation in arrow diagram, zero-one matrix and graph. 3

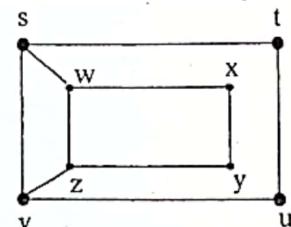
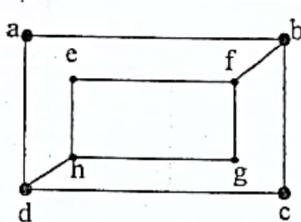
- (c) Define when a relation R on a set A is called symmetric, antisymmetric and asymmetric. Are the following relations on $\{1, 2, 3, 4\}$ symmetric, antisymmetric and asymmetric:
 i) $R = \{(1, 1), (1, 2), (2, 1), (3, 3), (4, 4)\}$ ii) $\{(1, 1)\}$ iii) $\{(1, 3), (3, 2), (2, 1)\}$
 iv) $R = \{(4, 4), (3, 3), (1, 4)\}$

Part-B

- 5.(a) What is the closure of a relation? Find the reflexive, symmetric and transitive closure of the relation $R = \{(1, 3), (1, 4), (2, 1), (3, 2)\}$ on the set $A = \{1, 2, 3, 4\}$. 4.75
 (b) Define totally ordered set with example. Is $(Z^+, |)$ a totally ordered poset? Why? 2
 Here ' $|$ ' means the 'divides by' relation.
 (c) Define lattice. Is the poset $(Z^+, |)$ a lattice? Explain it. 2
- 6.(a) Define n -Cube graph with example. Draw the Q_3 graph. 1.5
 (b) Define bipartite graph with example. Is C_6 graph bipartite? Justify your answer. 2.5
 (c) Represent the graph shown below by adjacency matrix and linked representation. 2

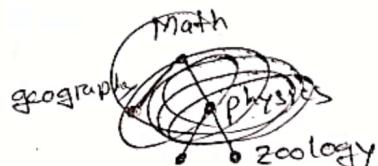
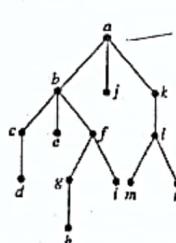


- (d) Define isomorphism of graphs. Are the graphs shown below are isomorphic? Explain. 2.75



- 7.(a) What is planar graph? Is Q_3 planar? Justify your answer with figure. 3
 (b) Define Hamilton circuit and Euler circuit. How do they differ from each other? 3
 (c) What do you know about chromatic number of a graph? What is the chromatic number of the graph $K_{3,4}$. Explain with diagram. 2.75

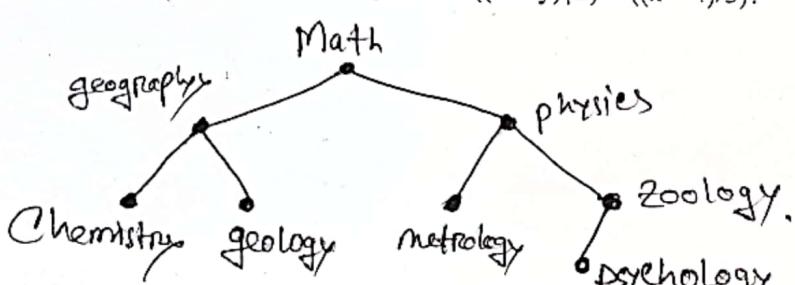
- 8.(a) Find the level of each vertex in the rooted tree shown in the following Figure. What is the height of this tree? 2



- (b) Form a binary search tree for the words mathematics, physics, geography, zoology, meteorology, geology, psychology, and chemistry (using alphabetical order). 2.25

- (c) Use Huffman coding to encode the following symbols with the frequencies listed: A: 0.08, B: 0.10, C: 0.12, D: 0.15, E: 0.20, F: 0.35. What is the average number of bits used to encode a character? 2.25

- (d) What is the ordered rooted tree that represents the expression $((x + y) \uparrow 2) + ((x - 4)/3)$? 2.25



University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Engg.) Part-2 Odd Semester Examination-2016
Course: CSE2131 (Discrete Mathematics)
Full Marks: 52.5 Duration: 3(Three) Hours

Answer 06(Six) questions taking any 03(Three) questions from each part.

Part-A

- | | |
|---|------|
| 1. (a) What do you mean by propositional logic? | 1.75 |
| (b) How can this English sentence be translated into a logical expression? "You can access the Internet from campus only if you are a Computer Science major or you are not a freshman." | 4 |
| (c) Show that the following two sentences are logically equivalent.
(i) "It is not the case that roses are red and violets are blue".
(ii) "Roses are not red, or violets are not blue". | 3 |
| 2. (a) Define ' <i>Propositional Function</i> '. | 1.75 |
| (b) Let $P(x)$ denote the statement " $x > 3$ ". What are the truth values of the quantifications $\exists x P(x)$ and $\forall x P(x)$, where the domain consists of all real numbers? | 4 |
| (c) Negate each of the following statements:
(i) $\exists x \forall y P(x, y)$; (ii) $\forall x \exists y P(x, y)$; (iii) $\exists y \exists x \forall z P(x, y, z)$; | 3 |
| 3. (a) There are 6 people in a room; each of them shakes hands with other. If no one shakes hands with any other person more than once, how many handshakes take place? | 2 |
| (b) A group of 30 people have been trained as astronauts to go on the first mission to Mars. How many ways are there to select a crew of six people to go on this mission (assuming that all crew members have the same job)? | 3.75 |
| (c) Find the minimum number of students in a class to be sure that three of them are born in the same month. | 3 |
| 4. (a) Write down the properties of binary relations. | 2.5 |
| (b) What do you mean by closure of the relation? Let the relation R on a set $\{1, 2, 3\}$ is represented by the following matrix. Find R^* . | 4.25 |
| (c) Define ' <i>Equivalence Relation</i> ' with example. | 2 |

Part-B

- | | |
|--|------|
| 5. (a) Define ' <i>Poset</i> ' and ' <i>Lattice</i> '. | 2 |
| (b) Give a direct proof of the theorem, "If n is an odd integer, then n^2 is odd". | 2.5 |
| (c) The following defines a grammar G : | 4.25 |

$$V = \{A, B, S, a, b\}, T = \{a, b\}, \\ P = \{S \rightarrow AB, A \rightarrow Aa, B \rightarrow Bb, A \rightarrow a, B \rightarrow b\}.$$

Write the production in abbreviated form. Using production rules obtain $w = a^2b^4$.

6. (a) Define 'Pseudograph' and 'Multigraph' with example. What is the difference between them? 3
 (b) State the "Handshaking Theorem" with example. 2
 (c) How adjacency matrix is used to represent a graph? Discuss with example. Draw a graph 3.75
 with the following adjacency matrix.

$$\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

7. (a) What do you mean by 'Isomorphic' and 'Homomorphic' Graphs? Give examples. 1.5
 (b) Define 'Distance', 'Diameter', 'Cutpoints' and 'Bridge' with proper diagram. 4
 (c) Define 'Minimum Spanning Tree'. Find a minimum spanning tree of the weighted graph G 3.25
 in Fig-7c.

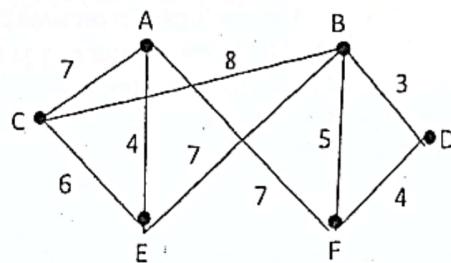


Fig-7c

8. (a) Define 'Planar Graph'. What do you mean by 'Map' and 'Dual Map'? 3.5
 (b) Define 'Spanning Tree' with example. Use BFS to find a spanning tree for the graph shown 5.25
 in Fig-8b choosing the root vertex as 'e'. Write the step and draw the spanning tree.

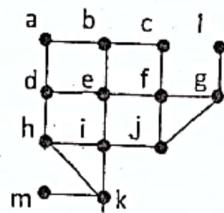


Fig-8b

515

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-II (Odd Semester) Examination-2015
CSE-2131 (Discrete Mathematics)

Time: 3 Hours

Full Marks: 52.5

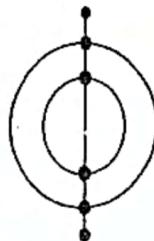
[Answer any six (06) questions taking three questions from each part]

Part-A

- | | | |
|----|---|------|
| 1. | (a) Define 'Proposition'. Consider the following sentences and determine which one is proposition or not. | 2.75 |
| | (i) What time is it? } not p | |
| | (ii) Read this carefully. | |
| | (iii) $x + 1 = 2$ | |
| | (iv) $x + y = z$. } not p | |
| | (b) How can this English sentence be translated into a logical expression? "You cannot ride the roller coaster if you are less than 4 feet tall unless you are older than 16 years old". | 3 |
| | (c) Show that the following two sentences are logically equivalence. "It is not the case that roses are red and violets are blue". "Roses are not red, or violets are not blue". | 3 |
| 2. | (a) Define 'Tautology' and 'Contradiction'.
(b) Let $Q(x)$ denote the statement " $x = x + 1$ ". What is the truth value of the quantification $\exists x Q(x)$ where the domain consists of all real numbers? → false
(c) What are rules of inference? Show that the following argument is valid. If today is Tuesday, I have a test in Mathematics or Economics. If my Economics professor is sick, I will not have a test in Economics. Today is Tuesday and my Economics professor is sick. Therefore, I have a test in Mathematics. | 3.75 |
| 3. | (a) Define 'Set' and 'Symmetric difference of sets'.
(b) In a class of 80 students, 50 students know English, 55 students know French and 46 students know German language, 37 students know English and French, 28 students know French and German, 25 students know English and German, 7 students know none of the languages. How many students know all the 3 languages?
(c) How many seven-letter words can be formed using the letters of the word "BENZENE"? | 3.75 |
| 4. | (a) What do you mean by 'Relation'? Explain the properties of relation.
(b) Suppose R_1 the relation $\{(1, 2), (2, 3), (3, 3), (2, 4), (3, 1)\}$ from $\{1, 2, 3\}$ to $\{1, 2, 3, 4\}$ and R_2 the relation $\{(1, 2), (2, 3), (3, 1), (3, 3), (4, 2)\}$ from $\{1, 2, 3, 4\}$ to $\{1, 2, 3\}$. Determine the adjacency matrix of R_1 and R_2 .
(c) Suppose $R = \{(1, 2), (2, 2), (2, 3), (5, 4)\}$ is a relation on $S = \{1, 2, 3, 4, 5\}$. What is the reflexive and symmetric closure of R ?
(d) What is on-to function? | 0.75 |

Part-B

5. (a) Define 'Partial order' and 'Partially ordered set'. 2
 (b) Let $A = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$ be ordered by the relation " x divides y ". Draw a Hasse diagram of A . Find out the maximal, first and last element(s) of A . 3.75
 (c) Define 'Lattice' and 'Bounded Lattice'. 3
6. (a) Count the number of vertices (V), the number of edges (E), and the number of regions (R) of the following map and verify Euler's formula. Also find out the degree of the outside region. 3

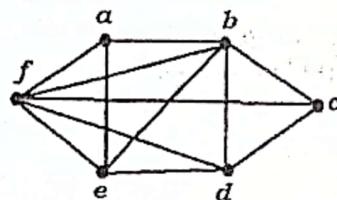


- (b) What are the differences between tree and graph? 2
 (c) Let A, B, C, D, E, F, G, H be eight data items with the following assigned weights: 3.75

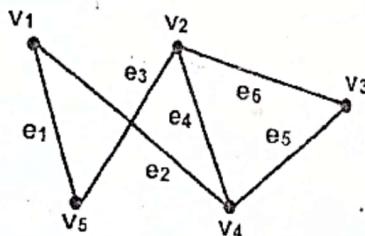
Data item	A	B	C	D	E	F	G	H
Weight	22	5	11	19	2	11	25	5

Construct a 2 tree with a minimum weighted path length P using the above data as external nodes

7. (a) Define bipartite graph with example. Is the following graph bipartite? Explain why or why not. 3



- (b) Define incidence matrix with example. Represent the following the graph using an incidence matrix. 3



- (c) Explain Hamilton path and Hamilton circuit in a graph with example. 2.75
8. (a) Define operation on a nonempty set. 1.75
 (b) Consider the set of positive integers, N . Determine whether addition, multiplication, subtraction and division are operations on N . 2
 (c) Define 'Semigroup', 'Group' and 'Ring'. 3
 (d) Define 'Grammar' and 'Language'. 2

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. Engineering Part-II Odd Semester, Examination-2014
Course: CSE 2131 (Discrete Mathematics)
Full Marks: 52.5 **Time: 3 Hours**

Answer six (06) questions taking three (03) from each part

PART-A

- | | | |
|--------|--|------|
| 1. (a) | Define converse, contrapositive and inverse of a conditional statement $p \rightarrow q$.
What are the converse, contrapositive and inverse of the conditional statement "The home town wins whenever it is raining."? | 3.75 |
| (b) | What is tautology? Determine whether $[\neg q \wedge (p \rightarrow q)] \rightarrow \neg q$ is a tautology or not. | 3 |
| (c) | Show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent by developing a series of logical equivalence. | 2 |
| 2. (a) | Let $P(x)$ denote the statement " $x > 3$ ". What is the truth value of the quantification $\exists x P(x)$, where the domain consists of all real numbers? | 1.75 |
| (b) | Let $Q(x,y)$ denote " $x+y=0$ ". What are the truth values of the quantifications $\forall x \exists y Q(x,y)$ and $\exists y \forall x Q(x,y)$, where the domain for all variables consists of all real numbers? | 3 |
| (c) | Define argument and conclusion. Using rules of inference show that the hypotheses "It is not sunny this afternoon and it is colder than yesterday", "we will go swimming only if it is sunny", "If we do not go swimming, then we will take a canoe trip", and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "we will be home by sunset." | 4 |
| 3. (a) | Define set and symmetric difference of sets. | 2 |
| (b) | What is proof by contraposition? Prove that "if n is an integer and $3n+2$ is odd, then n is odd" by using proof by contraposition. | 3.75 |
| (c) | Prove that $(A \cup B) \setminus (A \cap B) = (A \setminus B) \cup (B \setminus A)$ | 3 |
| 4. (a) | Define relation. Describe various types of relations. | 2.75 |
| (b) | Let $A=\{1,2,3\}$, $B=\{a,b,c\}$, and $C=\{x,y,z\}$. Consider the following relations R and S from A to B and from B to C , respectively, $R=\{(1,b), (2,a), (2,c)\}$ and $S=\{(a,y), (b,x), (c,y), (c,z)\}$ | 3 |
| | i) Find the composition relation $R \circ S$. | |
| | ii) Find the matrices M_R , M_S , and $M_{R \circ S}$ of the respective relations R , S and $R \circ S$, and compare $M_{R \circ S}$ to the product $M_R M_S$. | |
| (c) | Consider a set $A=\{a,b,c\}$ and the relation R on A defined by $R=\{(a,a), (a,b), (b,c), (c,c)\}$. Find i) reflexive (R) ii) symmetric (R) and iii) transitive (R) | 3 |

PART-B

- 5.(a) Define Isomorphic and Homeomorphic graph with example. 3
 (b) Define Hamilton circuit and Euler circuit. How do they differ from each other? 2.75
 (c) What is a planar graph? Is the complete graph with four vertices K_4 a planar graph? Explain your answer.

- 6.(a) How adjacency matrix is used to represent a graph? Explain with example. 4.75
 Draw the graph G corresponding to each adjacency matrix:

$$\text{i) } A = \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \quad \text{ii) } B = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

- (b) State and prove the Euler's formula for any connected map with V vertices, E edges and R regions. 4

7. (a) Define complete and Extended binary trees. 2
 (b) Represent the graph in fig-7b below in computer memory by adjacency matrix and linked representation. 3

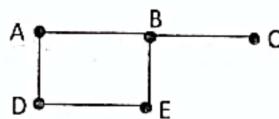


Fig- 7b

- { (c) What is the difference between tree and graph. 1.75
 (d) Consider the algebraic expression $E = (2x + y) * (5a - b)$
 i) Draw the tree T which corresponds to the expression E
 ii) Find the preorder of T 2

8. (a) A bakery makes only 4 kinds of cookies: apple, banana, carrot and dates. Find the number of ways a person can buy 8 of the cookies. 3.75
 (b) Define graph and multigraph. 1
 (c) Define Distance and Diameter with example. 1.5
 (d) Find a minimal spanning tree of the following weighted graph G : 2.5

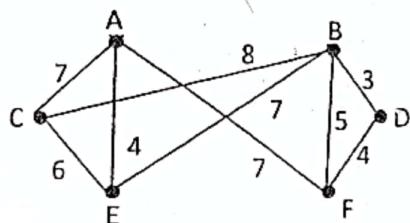


Fig: Graph G

Compet