

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Engg.) Part-2 (Odd Semester) Examination-2020

Course: MATH2111 (Matrices and Differential Equations)

Full Marks: 52.5

Time: 3 Hours

[Answer six questions taking any three from each section]

Section A

1. a) Define the inverse of a matrix. Find the inverse of 3.00

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

- b) Define an involutory matrix. If a matrix A is involutory, then what is the 2.00 inverse of A?

- c) Define the transpose of a matrix. Prove that
- $(AB)^t = B^t A^t$
- . When a matrix is 3.75 called symmetric?

2. a) What is the adjoint of a matrix? Find the adjoint of 3.00

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

- b) If A is non-singular, then show that
- $\text{adj}(\text{adj } A) = |A|^{n-2} \cdot A$
- 3.00

- c) Prove that the adjoint of a symmetric matrix is itself symmetric. 2.75

3. a) Define the rank of a matrix. Find the rank of the matrix: 3.00

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \\ 3 & 6 & 10 \end{bmatrix}$$

- b) Reduce the matrix: 3.00

$$A = \begin{bmatrix} 1 & 2 & -2 & 3 & 1 \\ 1 & 3 & -2 & 3 & 0 \\ 2 & 4 & -3 & 6 & 4 \\ 1 & 1 & -1 & 4 & 6 \end{bmatrix}$$

to its canonical form, find its rank and then reduce to its normal form.

- c) Solve the following equations by Crammer's rule 2.75

$$x + y + z = 6$$

$$x - y + z = 2$$

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

4. a) Define eigenvalues and eigenvectors of an
- n
- square matrix. What is meant by 4.75 characteristic polynomial of an
- n
- square matrix? Find the characteristic roots and characteristic vectors of the following matrix:

$$\begin{bmatrix} -3 & 1 & -1 \\ -7 & 5 & -1 \\ -6 & 6 & -2 \end{bmatrix}$$

- b) Define null space and nullity of a matrix. State Cayley-Hamilton theorem. Use 4.00 the mentioned theorem to find the inverse of the matrix given below:

$$\begin{bmatrix} 2 & 2 & 3 \\ 1 & -1 & 0 \\ -1 & 2 & 1 \end{bmatrix}$$

Section B

5. a) Define ordinary differential equations. Solve the homogeneous differential equation $\frac{dy}{dx} = \frac{3y^2 - x^2}{2xy}$. 2.75
- b) Define Bernoulli differential equations. Identify the differential equation $\frac{dy}{dx} + \frac{3y}{x} = 6x^2$ and solve it. 3.00
- c) The population x of a certain city satisfies the logistic law $\frac{dx}{dt} - \frac{1}{100}x = -\frac{1}{10^8}x^2$, where time t is measured in years. Find the population of the city at any time. 3.00
6. a) Define initial value problems. A circuit has in series a constant electromotive force of 40 V, a resistor of 10Ω , and an inductor of 0.2 H. Find the current at time $t > 0$ if the initial current is zero. 2.75
- b) Define Clairaut's equation. Find a one-parameter family of solutions of the equation $y = px + p^2$, where $p \equiv \frac{dy}{dx}$. Find singular solution, if exists, of the given equation which is not a member of the one-parameter family of solutions. 3.00
- a) Use the method of undetermined coefficients to solve the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 2e^x - 10\sin x$. 3.00
- a) Define Riccati's equation. State under what conditions, Riccati's equation reduces to a linear and Bernoulli's equation? Solve: $\frac{dy}{dx} + y = xy^3$. 3.00
- b) Solve $(D^2 + 4)y = x^2e^{2x}$ by operator method. 2.75
- c) Define regular singular point and examine the regular singular point of $x^2y'' - xy' + 8(x^2 - 1)y = 0$. 3.00
8. a) Convert the differential equation $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ with the initial conditions $y(0) = 1, y'(0) = 0$ into an integral equation. Finally, identify your obtained integral equation. 2.75
- b) An LTIC system is in zero state. Its response $y(t)$ is described by the differential equation $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = \frac{df}{dt} + f(t)$. Find the response of the system if the input is given by $f(t) = 3e^{-5t}u(t)$. 2.00
- c) Solve the following one-dimensional heat equation by the method of separation of variables. 4.00
- $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 < x < 1, t \geq 0$
 subject to the initial profile
 i) $u(x, 0) = 1, 0 < x < 1$ and the Dirichlet boundary conditions
 ii) $u(0, t) = 0, t \geq 0$ and
 iii) $u(1, t) = 0, t \geq 0$.

Section A

1. (a) Define diagonal matrix, identity matrix, scalar matrix and skew symmetric matrix with examples. 2.75
 (b) Define periodic matrix. Write the period of an idempotent matrix. If $AB=A$ and $BA=B$, show that A and B are idempotent. 3
 (c) Show that every square matrix with complex elements can be uniquely expressed as the sum of a Hermitian and a skew Hermitian matrices. 3
2. (a) Define inverse of a matrix. If A and B are non-singular matrices, show that $(AB)^{-1} = B^{-1}A^{-1}$. 2.75
 (b) Show that $A^{-1} = \frac{\text{adj } A}{|A|}$ and hence find the inverse of $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{bmatrix}$. 3
 (c) If A and B are matrices of order $n \times n$, show that $\text{adj } (AB) = (\text{adj } B)(\text{adj } A)$. 3
3. (a) Define rank of matrices. Reduce $\begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 5 \\ -1 & -2 & 6 & -7 \end{bmatrix}$ to the canonical form and find its rank. 2.75
 (b) Define normal forms of a matrix. Reduce the matrix $A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ to normal form and find its rank. 3
 (c) Determine the value of a so that the following system in unknowns x, y and z has
 (i) no solution, (ii) more than one solution, (iii) a unique solution:
 $x+y-z=1, 2x+3y+az=3, x+ay+3z=2$. 3
4. (a) Find the solutions of the system of equations:

$$\begin{aligned} x_1+x_2+x_3+x_4 &= 0 \\ x_1+3x_2+2x_3+4x_4 &= 0 \\ 2x_1+x_3-x_4 &= 0 \end{aligned}$$
 2.75
 (b) Define characteristic roots. If μ_1, \dots, μ_n are the characteristic roots of the n -square matrix A , prove that $\mu_1-\lambda, \dots, \mu_n-\lambda$ are the roots of the characteristic equation of $A-\lambda I_n$. 3
 (c) Find eigen values and eigen vectors of $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$, and an invertible matrix P such that $P^{-1}AP$ is diagonal. 3

Section B

5. (a) Define differential equations, its order and its degree with example. 2.75
 (b) Form the differential equation of the circle represented by $y^2 - 2ay + x^2 = a^2$, a being arbitrary constant. Also, identify the differential equation. 3
 (c) What is first order exact differential equation? Solve $(2x \cos y + 3x^2 y)dx + (x^3 - x^2 \sin y - y)dy = 0$, $y(0) = 2$. 3
6. (a) Define homogeneous ODE. Solve the DE $(x^3 + y^2 \sqrt{x^2 + y^2})dx - xy \sqrt{x^2 + y^2} dy = 0$. 3
 (b) Define Bernoulli differential equation. Solve the DE $\frac{dy}{dx} + y = xy^3$. 3
 (c) $y + px = x^4 p^2$, where $p \equiv \frac{dy}{dx}$. 3 2.75
7. (a) Solve $y'' - 6y' + 25 = 0$, $y(0) = -3$, $y'(0) = -1$. 2.75
 (b) Solve $(D^4 + 2D^3 - 3D^2)y = 3e^{2x} + 4 \sin x$ by operator method. 3
 (c) Find a series solution of $2xy'' - xy' + (x-5)y = 0$ in some interval $0 < x < R$ using the method of Frobenius. 3
8. (a) Solve $p \cos(x+y) + q \sin(x-y) = z$ by Lagrange method. 3.75
 (b) Eliminate a, b from $z = (x^2 + a)(y^2 + b)$. 2
 (c) Apply Charpit's method to solve $p = (qy + z)^2$. 2

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

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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
- $2x + 3y = 3$
- 3.(a) Solve the system of equations: $x - 2y = 5$ 2.75
 $3x + 2y = 7$.
- (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:

$$\begin{aligned} kx + y + z &= 1 \\ x + ky + z &= 1 \\ x + y + kz &= 1. \end{aligned}$$
- (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 3 given radius.

Solve the differential equation: $\frac{dy}{dx} = x^3 y^3 - xy.$ 3

Prove that the differential equation $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$ is 2.75 exact and solve it.

6. Solve the following differential equations:

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

(b) $(D^3 - 7D - 6)y = e^{2x} x^2.$ 3

(c) $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4.$ 2.75

- 7.(a) Solve the differential equation by the method of variation of parameters: 4

$$x^2 \frac{d^3y}{dx^3} + x \frac{dy}{dx} - y = x^2 e^x.$$

- (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 $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$ 4.75
by Lagrange's method and hence find its integral surface containing the straight line
 $x + y = 0, z = 1.$

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. 3
- (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

~~5(b)~~

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

3

Define exact differential equation. Solve $3x(xy - 2) \overset{dx}{\cancel{+}} (x^3 + 2y)dy = 0$

6(a)

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

2.75

(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) $(D^2 + 4)y = \cos x$

3+3

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

2.75

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. Find 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 that the diagonal elements of a skew symmetric matrix are all zero. 3
 (c) Let A and B be n -square non-singular matrices. Prove that AB is non-singular and $(AB)^{-1} = B^{-1}A^{-1}$. 2.75

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

$$\begin{aligned} 3x - y + \lambda z &= 1 \\ 2x + y + z &= 2 \\ x + 2y - \lambda z &= -1 \end{aligned}$$

- (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 not the vectors $[1, 2, 3]$, $[2, 3, 4]$, $[3, 5, 7]$ are linearly dependent. 2.75

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 $x + 2y + z = 1$, $3x + y + 2z = b$, $ax - y + 4z = b^2$ has (i) a unique solution, (ii) no solution and (iii) many solutions. 4.75

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 $x^2 + y^2 + 2gx + 2fy + c = 0$. 3
- (b) Identify and solve $(x^2 + y^2)dx - 2xydy = 0$. (3) Exam
- Ans* Solve by the variation of parameters: $y'' + y = \cos^2(x)$ 2.75

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

2.75

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. (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 $A-kI$ and $B-kI$ 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) $y'' - y' - 12y = e^{4x}$ 3
 2.75

7. a) Use annihilator operator to solve $y'' - y' - 12y = e^{4x}$ 3
b) By variation of parameters solve the equation $2y'' + 2y' - 8y = 2e^{-2x} - e^{-x}$ 3
c) Solve the Cauchy-Euler equation $3x^2y'' + 6xy' + y = 0$ 2.75
8. a) Solve the IVP using Laplace transform $y'' - 3y' + 2y = e^{-4t}, y(0) = 1, y'(0) = 5$ 4
b) Find the series solution of $y'' + \cos x y = 0$ 4.75

Marks: 35

[Answer any four (04) questions taking two (02) from each section]

Section-A

- 1.a) What do you mean by simple random sampling? Illustrate with an example. 2.75
- b) Suppose we select a random sample of size n from a population and have independent random variables X_1, X_2, \dots, X_n . Do those random variables have the same distribution? Explain. 2
- c) Suppose that of six students, the first student has \$1, the second student has \$2, the third student has \$3, the fourth student has \$4, the fifth student has \$5, and the sixth student has \$6. Consider the 1, 2, 3, 4, 5, 6 dollars as the population. A sample of two students is selected. What is the probability that the sample mean is equal to \$3.5? Write down every step of your calculation. 4
- 2.b) Write some names of statistics that can be used as estimator of the population. 1
- b) What are the criteria for a good estimator? 1
- c) Is 'sample mean' a good estimator in terms of unbiasedness? Explain. 4
- d) Is 'median' a consistent estimator? Explain with example. 2.75
- 3.a) Define F-distribution with degrees of freedom n_1 and n_2 and point out its uses? 4
- b) Discuss the relationship among F, t and χ^2 distribution. 4.75

Section-B

4. a) What do you mean by tests of good-ness of fit? 2
- b) Suppose a coin is tested 60 times with the results given in the following Table 4.75

| Event | n_i |
|-------|-------|
| Heads | 32 |
| Tails | 28 |

Is this a fair coin? The null hypothesis is

$$H_0: n_i = np_i$$

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where n_i is the number of observed frequencies and np_i is the expected frequencies in which p_i are the theoretical probabilities. Given that, $\alpha = 5\%$.

- c) Which statistical test is suitable to test equality of variances? Explain. 2
5. a) Define (i) null hypothesis (ii) critical region. 3
- b) Describe how you would test the hypothesis $H_0: \sigma_1^2 = \sigma_2^2$. 3
- c) The estimates of variances from two random samples of sizes 7 and 16 are 5.6 and 7.0 respectively. Test whether the samples could have arisen from populations with the same sample variance. 2.75

- 6.a) In what circumstances we need to perform non-parametric test? 2
- b) A particular shoe store believes that the median foot size of teenage boys is 10.25 inches. To test this hypothesis, the foot size of each of a random sample of 50 boys was determined. Suppose that 36 boys had sizes in excess of 10.25 inches. Does this disprove the hypothesis that the median size is 10.25? Use sign test to solve this problem. 4.75
- c) Discuss the purposes of run test and rank-sum test. 2

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University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-II, Even Semester, Examination-2019
Course: STAT 2111 (Theory of Statistics)
Full Marks: 35, Time: 2 hours

[Answer any four questions taking two from each section]

Section-A

1. (a) What do you mean by sampling distribution? Write down the probability density function of Chi-square distribution with n degree of freedom (d.f). 2.75
(b) If X has a Chi-square distribution with $nd.f$, find the MGF of Chi-square distribution. 4
(c) Write down important uses of Chi-square distribution. 2
2. (a) What is likelihood function? 2
(b) What are the principles of maximum likelihood estimation method? 3
(c) Find maximum likelihood estimator of parameters when n samples are drawn from Normal distribution? 3.75
3. (a) Define statistic, estimator and estimate with example. 2.75
(b) Describe three properties of a good estimator, in short. 3
(c) Show that sample average \bar{x} is an unbiased estimator of population mean, but sample variance $s^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$ is a biased estimator of population variance. 3

Section-B

4. (a) Distinguish between:
i) Null hypothesis and alternative hypothesis
ii) Type I error and Type II error 3
(b) How does a t-test differ from a normal test? 2
(c) A sample of 900 items taken from population with standard deviation 2.61 cms. The mean of the sample is 3.4 cms. Test whether the sample come from the population with mean 3.25 cms. To be noted $\Pr\{Z < -1.73\} = \Pr\{Z > 1.73\} = 0.089$. 3.75
5. (a) What is critical region? How the alternative hypothesis affects in computing critical region? 2.75
(b) Describe different steps for testing a hypothesis of equality of two proportions. 3
(c) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. Among the respondents, 200 men and 325 women were in favor of the proposal. Test the hypothesis that proportions of men and women in favor of the proposal are same. To be noted $\Pr\{Z < -1.269\} = \Pr\{Z > 1.269\} = 1.02$. 3

6. (a) What is a contingency table? How does it differ from a correction table? 2
- (b) What is the null hypothesis in a test of independence? Define the expression for the value of Chi-square in $a \times c$ contingency table. 2
- (c) Two sample polls of votes for two candidates A and B for a public office are taken, one from among the residents of rural areas. The results are given in the adjoining table. Examine whether the nature of the area is related to voting preference in the election. 4.75

| Area | Votes for | | Total |
|-------|-----------|-----|-------|
| | A | B | |
| Rural | 620 | 380 | 1000 |
| Urban | 550 | 450 | 1000 |
| Total | 1170 | 830 | 2000 |

[Value of the cumulative distribution function of Chi-square at 10.09 with 1 d.f is 0.0015]

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-2 (Odd Semester) Examination-2018
Course: STAT2111 (Theory of Statistics)
Marks: 35 Time: 2:00 Hours

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

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 University of Rajshahi.

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 $N = a + b + c + d$.

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 | | Total |
|----------|------------------|-----|-------|
| | Yes | No | |
| Good | 22 | 58 | 80 |
| Not Good | 20 | 50 | 70 |
| Total | 42 | 108 | 150 |

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

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: 3

| Result | Job Satisfaction | | Total |
|----------|------------------|-----|-------|
| | Yes | No | |
| Good | 22 | 58 | 80 |
| Not Good | 20 | 50 | 70 |
| Total | 42 | 108 | 150 |

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

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

| Part-A | | Property of Seminar Libra Dept. of Computer Science Engineering University of Rajshahi. |
|---------------------------|--|--|
| Answer any TWO questions. | | |
| 1. | (a) Define chi-square (χ^2) variate and its p.d.f. (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. | 02 |
| 2. | (a) Define Student's t statistics. Formulate its sampling distribution. (b) Show that Student's t distribution reduces to the standard normal distribution for large degrees of freedom. | 1+3 4.75 |
| 3. | (a) Define point estimator. What are the criteria of good estimator? (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 '. (c) Let $x_1, x_2 \dots x_n$ be a random sample of size 'n' from normal distribution with p.d.f is $f(x, \mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2} \quad -\infty < x < \infty, -\infty < \mu < \infty, \sigma^2 > 0$ Find the MLE of ' μ ' and σ^2 . | 2.25 2.5 4.5 |
| 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. (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. [$t_{0.05,18} = 2.10$]. | 1.75 +2 +2 03 |
| 5. | (a) When do you use independent samples t-test? 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? [$Z_{0.05} = 1.96$]. (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]. | 1+4 3.75 |
| 6. | (a) Distinguish between parametric and non-parametric statistical tests. Discuss the advantages and disadvantages of non-parametric test. (b) Derive sign test, stating clearly the assumptions made for small sample case. (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. 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 | 2.5 3.5 2.75 |

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
- 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
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 (06) 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 |
| Good | 30 | 30 | 20 |
| Fair | 10 | 30 | 20 |

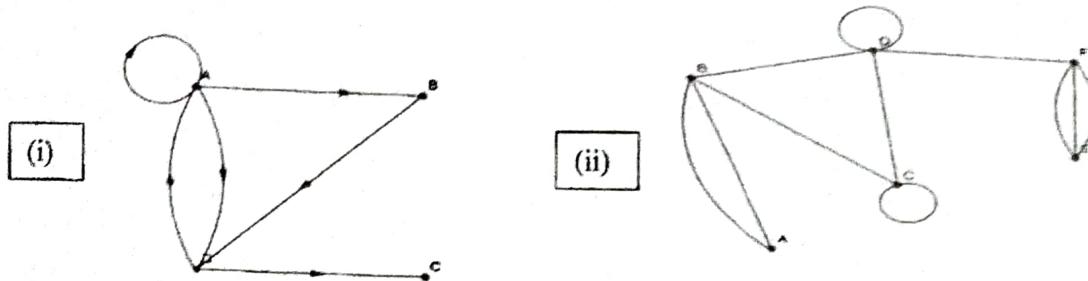
[N.B. Answer any Six of the following questions taking three from each section]

Section-A

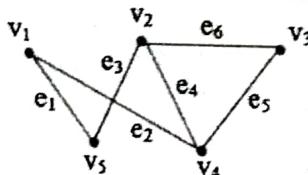
- 1.(a) Define Proposition with example. Consider the following sentences and determine which one is proposition or not. 2.25
- (i) Colombo is the capital of Pakistan. ✓ (ii) $2 + 3 = 5$ ✓ (iii) $x + 2 = 11$ N
 (iv) $x + y = y + x$, for every pair of real numbers x and y .
- (b) What are the "contrapositive", "converse" and "inverse" of the conditional statement: "The home team wins whenever it is raining"? 2
- (c) Show that $(p \rightarrow q) \leftrightarrow (\neg p \vee q)$ is a tautology. 2.25
- (d) Translate the following sentence into logical expression: "You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old." 2.25
- 2.(a) Express the statement "Every student in this class has studied calculus" using predicates and quantifiers. 1.75
- (b) Let $Q(x, y)$ denote the statement " $x + y = 0$." What are the truth values of the quantification $\forall x \exists y Q(x, y)$ and $\exists y \forall x Q(x, y)$ where the universe of discourse for the variables are the set of real number? Explain. 3
- (c) Let $M(x, y)$ be " x has sent y an e-mail message" and $T(x, y)$ be " x has telephoned y " where the universe of discourse is the set of all students in your class. Use quantifiers to express each of the following statements. (Assume all e-mail messages that were sent are received.) 4
- (i) Every student in your class has sent e-mail message to Kamal.
 (ii) No one in your class has telephoned Nondini.
 (iii) Everyone in class has either telephoned Arup or sent him an e-mail message.
 (iv) There is someone in your class who has either sent an e-mail message or telephoned everyone else in your class.
- 3.(a) What do you mean by rules of inference? What rules of inference are used in the following famous argument? "All men are mortal. Socrates is a man. Therefore, Socrates is mortal." 2.75
- (b) Show that the hypotheses H_1 , H_2 , and H_3 lead to the conclusion C , where
 H_1 : "If you send me an e-mail message, then I will finish writing the program."
 H_2 : "If you do not send me e-mail message, then I will go to sleep early."
 H_3 : "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) Suppose the domain of the propositional function $P(x, y)$ consists of pairs x and y , where x is 1, 2, or 3 and y is 1, 2, or 3. Write out these propositions using disjunctions and conjunctions. 3
- i) $\exists x P(x, 3)$, ii) $\forall y P(1, y)$, iii) $\exists y \neg P(2, y)$ and iv) $\forall x \neg P(x, 2)$.
- 4.(a) Define composite function. Find $f \circ g$ and $g \circ f$, where $f(x) = x^2 + 1$ and $g(x) = x + 2$ are functions from \mathbb{R} to \mathbb{R} . 3
- (b) Suppose that the universal set is $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. 3
- (i) Express the bit strings of the sets $A = \{2, 4, 7\}$ and $B = \{1, 3, 6, 9\}$.
 (ii) Find the value of $A - B$ and $A \oplus B$ using bit strings.
- (c) What is the bit string corresponding to the symmetric difference of two sets? Suppose that the universal set is $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Express each of these sets with bit strings where the i^{th} bit in the string is 1 if i is in the set and 0 otherwise : i) $\{3, 4, 5\}$ and ii) $\{1, 3, 6, 10\}$. 2.75

Section-B

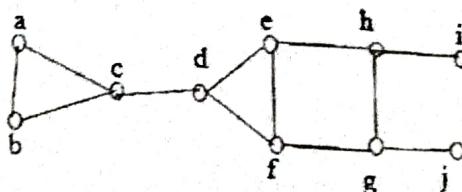
- 5.(a) Define binary relation with example. Explain the properties of relation. 3
- (b) Let $A = \{1, 2, 3, 4\}$ and R be the relation on A where $(a, b) \in R$ if and only if $a > b$. Represent the relation in arrow diagram, zero-one matrix and graph. 3
- (c) How many reflexive relations are there on a set with n elements? Explain. 2.75
- 6.(a) What is lattice? Show that every totally ordered set is a lattice. 2
- (b) Find the greatest lower bound and the least upper bound of the sets $\{3, 9, 12\}$ and $\{1, 2, 4, 5, 10\}$, if they exist, in the poset $(\mathbb{Z}^+, |)$. 2.75
- (c) Use Warshall's Algorithm to find the transitive closures of the relation $R = \{(1,2), (1,3), (1,4), (2,3), (2,4), (3,4)\}$ on $\{1, 2, 3, 4\}$ 4
- 7.(a) Define 'Pseudograph' and 'Multigraph' with example. Write the differences between them. 2.75
- (b) Find the adjacency matrix of the given graphs: 3



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



- 8.(a) Explain Euler path with example. Discuss the necessary and sufficient condition to have a Euler path in a graph. 3
- (b) What is full m-ary tree? When a rooted m-ary tree is called balanced? 1.75
- (c) Define spanning tree with example. Use DFS to find a spanning tree for the following graph choosing the root a. Write the step and draw the spanning tree. 4



University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engineering (CSE) 2nd Year Odd Semester 2019
Course: CSE 2131 (Discrete Mathematics)

Time: 3 Hrs. Full Marks: 52.5

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

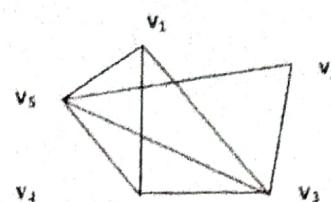
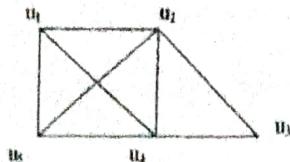
Section A

- 1.(a) Define proposition and predicate calculus with example. 1.75
- (b) Give the converse, inverse and contrapositive of the implication "If it is raining then I get wet". 2
- (c) Check whether $((P \rightarrow Q) \rightarrow R) \vee \neg P$ is a tautology. 2
- (d) Show that $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \not\rightarrow R$. [Use only Laws] 3
- 2.(a) Find the disjunctive and conjunctive normal form for $P \wedge (P \rightarrow Q)$. 3
- (b) Give reasons for each step needed to show that the following argument is valid, using rules of inference: $[P \wedge (P \rightarrow Q) \wedge (S \wedge R) \wedge (R \rightarrow \neg Q)] \rightarrow (S \vee T)$. 3
- (c) Let $p(x, y)$, $q(x, y)$ and $r(x, y)$ represent open statements, with replacements for the variables x, y chosen from some prescribed universe. Write the negation mentioning the rules used: $\forall x \exists y [(p(x, y) \wedge q(x, y)) \rightarrow r(x, y)]$. 2.75
- 3.(a) Prove the theorem "If $3n+2$ is odd, then n is odd" by using appropriate proof method. 2.75
- (b) Define composite function. Find $f \circ g$ and $g \circ f$ where $f(x) = 2x + 3$ and $g(x) = 3x + 2$ are functions from \mathbb{R} to \mathbb{R} . 3
- (c) The bit strings for the sets $\{1, 2, 3, 4, 5\}$ and $\{1, 3, 5, 7, 9\}$ are 1111100000 and 1010101010 respectively. Use bit strings to find the union and intersection of these sets. 3
- 4.(a) Define complement of a set and power set. 3
- (b) Give a proof using set laws: (i) $A - (B \cup C) = (A - B) \cap (A - C)$ (ii) $(A - B) \cup (A - C) = A \cap (B \cap C)$ 3
- (c) If $A = \{1, 2, 3, 4\}$ give an example of a relation R on set A which is i) Reflexive and symmetric, but not transitive ii) symmetric and transitive, but not reflexive. 2.75

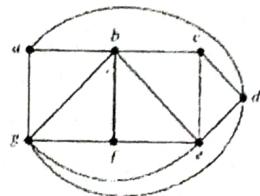
Section B

- 5.(a) Explain inverse of a relation, with suitable example. 1
- (b) Given $R = \{(x, y) : x + 3y = 12\}$; i) Write R as a set of ordered pairs ii) Find domain, range, inverse of R iii) Find $R \circ R$. 4
- (c) $A = \{a, b, c\}$, $R = \{(a, a), (a, b), (b, c), (c, c)\}$, find reflexive, symmetric and transitive closure. 3.75
- 6.(a) What is Hasse diagram? Draw the Hasse diagram for the poset $(\{1, 2, 3, 4, 6, 8, 12\}, |)$. 3
- (b) Define lattice. Determine whether the posets $(\{1, 2, 3, 4, 5\}, |)$ and $(\{1, 2, 4, 8, 16\}, |)$ are lattices. 3
- (c) Answer the following questions concerning the poset $(\{3, 5, 9, 15, 24, 45\}, |)$. Find: i) the maximal element ii) the minimal element iii) the least upper bound of $\{3, 5\}$, if it exists. iii) The greatest lower bound of $\{15, 45\}$, if it exists. 2.75

- 7.(a) Define Bipartite Graph and complete bipartite graph with example. 2
 (b) Examine whether the following pair of graphs are isomorphic. If not isomorphic, give the 2 reasons.



- (c) Define Eulerian graph and Hamiltonian graph. Give an example of a graph which is 3 Eulerian but not Hamiltonian and vice versa.
 (d) Show that the complete bipartite graph $K_{n,n}$ has the Hamiltonian cycle. 1.75
- 8.(a) What is the prefix form for $((x + y) \uparrow 2) + ((x - 4) / 3)$? what is the value of the postfix 4 expression $7 \ 2 \ 3 \ * \ - \ 4 \uparrow \ 9 \ 3 \ / \ +$?
 (b) What is the difference between graph and tree? Prove that a tree with n vertices has $(n-1)$ 2.75 edges.
 (c) Find a spanning tree for the graph shown by removing edges in simple circuits. 2



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: 4
- p : The message is scanned for viruses
- q : The message was sent from an unknown system together with logical connectives (including negations):
- The message is scanned for viruses whenever the message was sent from an unknown system.
 - The message was sent from an unknown system but it was not scanned for viruses.
 - It is necessary to scan the message for viruses whenever it was sent from an unknown system.
 - When a message is not sent from an unknown system it is not scanned for viruses.
- 2.(a) State the rules of inferences 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 "We will be home by sunset". 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
- $A \cup B$
 - $A \cap C$
 - $A \cap (C \cup D)$

- (c) $A = \{1, 2, 3, 4, 5\}; B = \{6, 7, 8, 9, 10\}; D = \{7, 8, 9, 10\};$ 3.75
 $C = \{a, b, c, d, e\} f: A \rightarrow B,$
 $f = \{(1, 7), (2, 6), (3, 9), (4, 7), (5, 10)\}$
 $g = \{(6, b), (7, a), (8, d), (9, c), (10, b)\}$

- (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:

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

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) $R_2 \circ R_1$

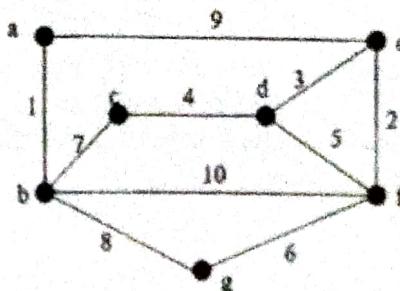
- 6.(a) Draw the Hasse diagram representing the partial ordering $\{(a, b) \mid a \text{ divides } b\}$ on set $\{1, 2, 3, 4, 6, 8, 12\}$. 3
 (b) Use Warshall's Algorithm to find the transitive closures of the relation $R = \{(1, 1), (1, 4), (2, 1), (2, 3), (3, 1), (3, 2), (3, 4), (4, 2)\}$ on set $\{1, 2, 3, 4\}$. 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 sub graph 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



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

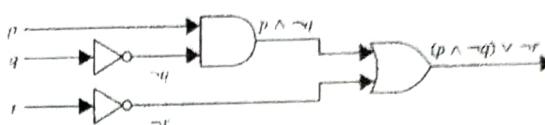
Time: 3 Hours

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

Part-A

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- 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." 1.5
- (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: 3
- i) The automated reply cannot be sent when the file system is full.
 - ii) you cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old.
 - iii) you can access the internet from campus only if you are a computer science major or you are not a freshman.
- 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

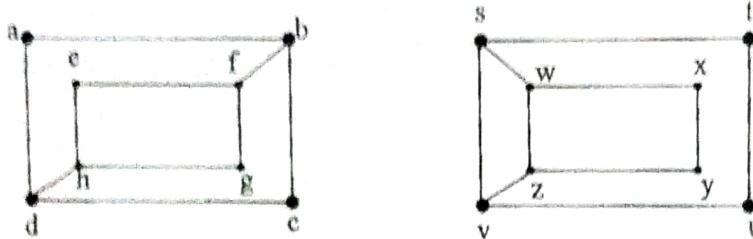
- (e) Define when a relation R on a set A is called symmetric, antisymmetric and asymmetric. Are the following relations on $\{1, 2, 3, 4\}$ symmetric, antisymmetric and asymmetric? 3.75
- (i) $R = \{(1, 1), (1, 2), (2, 1), (3, 3), (4, 4)\}$ (ii) $\{(1, 1)\}$ (iii) $\{(1, 3), (3, 2), (2, 1)\}$
 (iv) $R = \{(4, 4), (3, 3), (1, 4)\}$

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 $(\mathbb{Z}^+, |)$ a totally ordered poset? Why? 2
 Here ' $|$ ' means the 'divides by' relation.
- (c) Define lattice. Is the poset $(\mathbb{Z}^+, |)$ 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

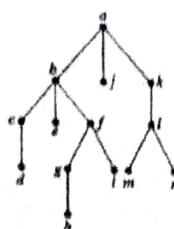


- (d) Define isomorphism of graphs. Are the graphs shown below are isomorphic? Explain. 2.75



- 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



A Rooted Tree.

- (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

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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 'Propositional Function'. (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? (c) Negate each of the following statements: (i) $\exists x \forall y P(x, y)$; (ii) $\forall x \exists y P(x, y)$; (iii) $\exists y \exists x \forall z P(x, y, z)$ | 1.75 |
| 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? (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)? (c) Find the minimum number of students in a class to be sure that three of them are born in the same month. | 2 |
| 4. (a) Write down the properties of binary relations. (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^* . $M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$ (c) Define 'Equivalence Relation' with example. | 2.5 |
| | 4.25 |
| | 2 |

Part-B

- | | |
|---|------|
| 5. (a) Define 'Poset' and 'Lattice'. (b) Give a direct proof of the theorem, "If n is an odd integer, then n^2 is odd". (c) The following defines a grammar G : | 2 |
| | 2.5 |
| | 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 with the following adjacency matrix. 3.75

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

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 in Fig-7c. 3.25

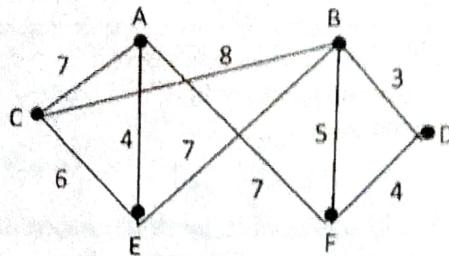


Fig-7c

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 in Fig-8b choosing the root vertex as 'e'. Write the step and draw the spanning tree. 5.25

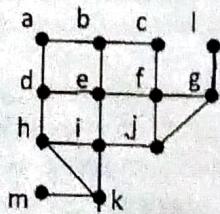


Fig-8b

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

Full Marks: 52.5

Time: 3 Hours

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

Part-A

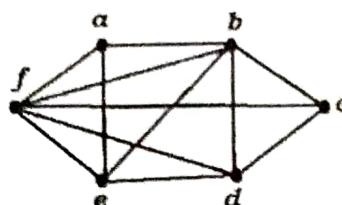
- | | |
|---|------|
| 1. (a) Define 'Proposition'. Consider the following sentences and determine which one is proposition or not. | 2.75 |
| (i) What time is it? | |
| (ii) Read this carefully. | |
| (iii) $x + 1 = 2$ | |
| (iv) $x + y = z$. | |
| (b) How can this English sentence be translated into 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'. | 2 |
| (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? | 3 |
| (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'. | 2 |
| (b) In a class of 80 students, 50 students know English, 55 students know French and 45 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? | 3.75 |
| (c) How many seven-letter words can be formed using the letters of the word "BENZENE"? | 3 |
| 4. (a) What do you mean by 'Relation'? Explain the properties of relation. | 3 |
| (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 . | 3 |
| (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 ? | 2 |
| (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 3.75
 Hasse diagram of A. Find out the maximal, first and last element(s) of A.
 (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 3
 of the outside region.



- (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, 2
 multiplication, subtraction and division are operations on N.
 (c) Define 'Semigroup', 'Group' and 'Ring'. 3
 (d) Define 'Grammar' and 'Language'. 2

Shawda
University of Rajshahi
Computer Science and Engineering
B.Sc. (Engg.) Part-2 Odd Semester Examination, 2020
Course: ACCO-2111 (Industrial Management and Accountancy)
Full Marks- 35 Time- 2 hours

(Answer **Four** questions taking any **Two** Questions from each section)

Section A

- | | |
|----|--|
| 1. | a) What is partnership? 2 |
| | b) What are the main features of a partnership business? Discuss. 3 |
| | c) Distinguish between a company and a partnership firm. 3.75 |
| 2. | a) What is meant by company form of organization? 2 |
| | b) Discuss the features of a company form of organization. 4 |
| | c) Distinguish between public and private companies. 2.75 |
| 3. | a) Define Motivation. Why is it essential in an organization? 4.75 |
| | b) Critically evaluate Maslow's need hierarchy theory. 4 |

Section B

- | | |
|----|--|
| 4. | a) What is meant by accounting equation? 2.75 |
|----|--|

- b) Following are the transactions of DSolution that took place during a financial year 2020-2021. Show the effect of each transaction on the accounting equation.

Transaction A: Mr. Abdur Rahim, owner of the firm, deposits Tk. 25,000 in a bank account in the name of DSolution.

Transaction B: DSolution paid Tk. 20,000 for the purchase of land as a future building site.

Transaction C: DSolutions purchased supplies for Tk. 1350 and agreed to pay the supplier in the near future.

Transaction D: DSolutions received cash of Tk. 7,500 for providing services to customers.

Transaction E: DSolutions paid the following expenses during the year: wages, Tk. 2,125; rent, Tk. 800; utilities, Tk. 450; and miscellaneous, Tk. 275.

Transaction F: Mr. Abdur Rahim had the cost of supplies on hand at the end of the month was Tk. 550.

- | | |
|----|---|
| 5. | a) What is T account? 2 |
| | b) What do you mean by accounting cycle? 2.75 |
| | c) The unadjusted trial balance of BIG Leaf Co. at December 31, 2020, the end of the current year, is shown below. The data needed to determine year-end adjustments are as follows. 4 |
- i. Supplies on hand at December 31 are Tk 1,500.

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- ii. Insurance premiums expired during the year are Tk. 2,500.
- iii. Depreciation of equipment during the year is 4,700.
- iv. Wages accrued but not paid during the year are Tk. 750.

Required:

- A. Journalize the adjustment entries.
- ~~B. Prepare an adjusted trial balance.~~

6. a) Define break-even chart. 2.75
- b) Ideal Company Limited produces a product selling at Tk. 50 per unit. 6
Variable cost per unit is Tk.20. Annual fixed cost is Tk. 1,60,000.
Estimated sales for the period are 35,000 units.

Required:

- i. The break-even point in units and taka.
- ii. The contribution margin and contribution margin ratio.
- iii. The margin of safety and margin of safety ratio.
- iv. The estimated profit for the period.
- v. The sales volume in units if the company earns a profit of
Tk.1,80,000.

Full Marks: 35

[Answer four questions taking any two from each section.]

Section A

- | | | |
|----|--|----------------|
| 1. | (a) Define Business. (b) What do you mean by 'Extractive Industry'? (c) How commerce can help to eliminate the barriers for conducting a business perfectly in Bangladesh? | 2 2 4.75 |
| 2. | (a) What is sole proprietorship form of business? (b) What are advantages and disadvantages sole proprietorship form of business? (c) State the basic features of Joint Stock Company. | 1.75 4 3 |
| 3. | (a) Define Management. (b) Discuss in brief the functions of Management. (c) Discuss the role of a manager in an organization that suggested by Henry Mintzberg. | 1.75 3 4 |

Section B

- | | | |
|--|---|-----------|
| 4. | (a) Who are the users of accounting information? (b) Max Services was started on March 1, 2019. A summary transaction is presented below: 1. Invest Tk. 1,00,000 to start business. 2. Purchase equipment for Tk. 30,000 in cash. 3. Purchase supplies on account Tk. 7500. 4. Office rent paid Tk. 5,000 5. Received Tk. 25,000 in cash from customers for service provided. 6. Salary paid to staff Tk. 12,000 7. Provide services to customers Tk. 15,000 on account. 8. Utility bills paid Tk. 3,500 9. Mr. Max withdraw Tk. 5,000 for personal use | 2 6.75 |
| <p>Required: Prepare tabular analysis of the above transactions.</p> | | |
| 5. | (a) What is trial balance? (b) On December 31, 2018, the following trial balance is prepared for 'Ahmed and Sons'. Due to some mistakes the trial balance does not balance. | 1 7.75 |

| Account Heading | Ref. | Debit | Credit |
|------------------------------------|------|----------|----------|
| Capital | | | 2,50,000 |
| Cash | | 2,32,425 | |
| Accounts Receivable | | | 20,000 |
| Accounts Payable | | 10,855 | |
| Unearned Revenue | | 1,250 | |
| Supplies | | 1,875 | |
| Prepaid Insurance | | | 620 |
| Office Equipment | | 30,650 | |
| Accumulated depreciation-equipment | | 5,270 | |
| Drawing | | | 1,200 |
| Service revenue | | | 35,125 |
| Salaries expenses | | 12,415 | |
| Rent expenses | | 3,600 | |
| Utilities expenses | | 2,715 | |
| Investment in securities | | | 11,000 |
| Notes payable | | 13,500 | |
| Interest revenue | | 500 | |

Required: (i) Find out the mistakes and prepare a correct trial balance.

(ii) Prepare an income statement an Owner's equity statement and a Balance sheet from the trial balance prepared in requirement (i).

6. (a) What is break-even point? 1.75
(b) Star Company Limited produces a product selling at Tk. 30 per unit. Variable cost per unit is Tk. 18. Annual fixed cost is Tk. 1,50,000. Estimated sales for the period are 25,000 units. 7

You are required to calculate:

- (i) Break even point in units and taka.
- (ii) The contribution margin and contribution margin ration.
- (iii) The margin of safety.
- (iv) The estimated profit for the period.
- (v) The sales volume in units, if the company wants to earn profit of Tk. 1,50,000.

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. (b) What are the important features of business? (c) Mention the different types of business entities. | 1.75 5 2 |
| 2. | (a) Name the elements of business environment. (b) Discuss the types of industries with examples | 3.75 5 |
| 3. | (a) Name the general principles proposed by Fayol. (b) Discuss Maslow's hierarchy of needs. | 3.75 5 |

Section-B

- | | | |
|----|--|----------------|
| 4. | (a) What is accounting? Make a discussion on the elements of financial statements. (b) Who are the users of accounting information? Discuss. | 4.75 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. (b) Post the journal entries to the accounts in the ledger (use T account). (c) Prepare Trial Balance. | 3 3.75 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> |

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.

University of Rajshahi
 Department of Computer Science and Engineering
 B.Sc. (Engg.) Part-2 Odd Semester Examination-2017
 Course Code: **ACCO2111**
 Course Title: **Industrial Management and Accountancy**
 Full Marks: 35 Time: 2 Hours

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

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- 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? | 3.75 |
| 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 3.75 |
| (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:

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

Required:

- a) Prepare journal entries to record the above transaction.
- b) 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.

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. | 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 |

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.