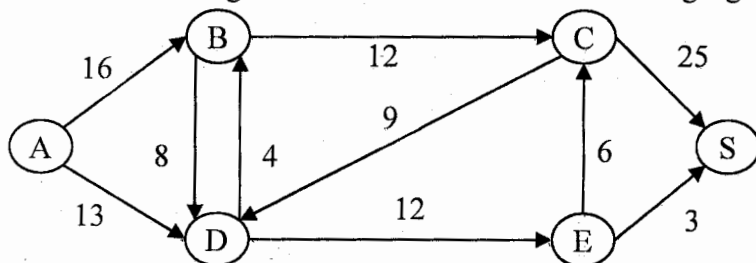


- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the immediate right column of the questions indicate full marks.
 iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is an algorithm? What are the basic criteria that an algorithm must satisfy? (10) [CO1]
- b) Write down the differences between Ford-Fulkerson and Edmond-Karp algorithms. (18) [CO3]
 Apply Ford-Fulkerson algorithm for the network in following figure.



Source = A
Sink = S

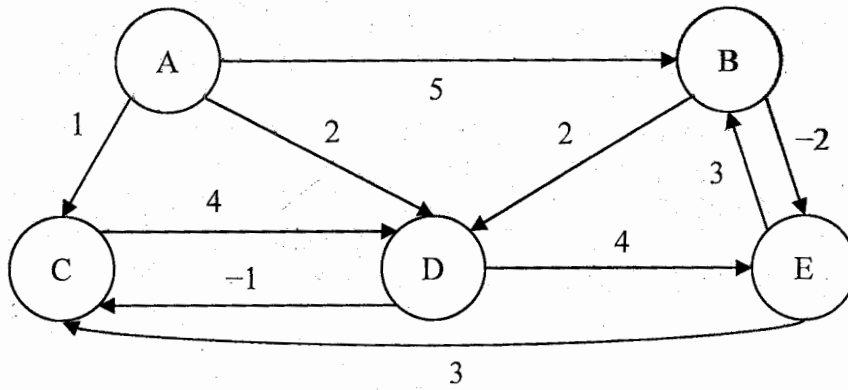
- c) Define NP-hard and NP-complete problems using examples. (07) [CO1]
2. a) What are the main types of mathematical proofs for algorithm correctness, and explain each type with example? (10) [CO1]
- b) The following algorithm multiplies two matrices a and b , where a is an $m \times n$ matrix and b is an $n \times p$ matrix. Under what conditions, it is profitable to interchange the two outermost *for* loops? (07) [CO1]

```

Algorithm Mult(a, b, c, m, n, p) {
  for i := 1 to m do
    for j := 1 to p do {
      c[i, j] := 0;
      for k := 1 to n do
        c[i, j] := c[i, j] + a[i, k] * b[k, j];
    }
}
```

- c) How can you identify errors in the implementation of any algorithm and prove the correctness of binary search using a proof by contradiction? (10) [CO1]
- d) Explain whether every NP problem is also in P, and discuss the significance of the P vs NP question with examples. (08) [CO1]
3. a) Given $T(n) = 2T(n/2) + n/\log(n)$, explain why the master theorem cannot be applied. (05) [CO1]
- b) Compare the efficiency of SStraightEval and NStraightEval algorithms using the following polynomial: $A(x) = 5x^4 - 3x^3 + 4x^2 - 9x + 1$, evaluated at $x = 2$. (12) [CO1]
- c) Explain the concept of the adversary technique and the decision tree model with examples. (10) [CO4]
- d) Explain reduction in algorithm analysis and information-theoretic arguments in lower bound theory with examples. (08) [CO4]
4. a) Given the data points $(x_0, y_0) = (1, 1)$, $(x_1, y_1) = (2, 4)$, and $(x_2, y_2) = (3, 9)$: (08) [CO1]
 Construct the Lagrange interpolation polynomial $P(x)$ that passes through these points. Use the polynomial $P(x)$ to estimate the value of y when $x = 2.5$.
- b) In what ways, the straightforward method is more efficient than the Horner algorithm for polynomial evaluation? Explain with proper examples. (10) [CO2]
- c) Let the roll number R is 107001. The sparse polynomial is generated using the digits of the roll number: $P(x) = C_k \cdot x^k + C_{k-1} \cdot x^{k-1} + \dots + C_1 \cdot x + C$, where $k =$ highest power of x , derived from the sum of the digits of R modulo 5, plus 3 (to ensure a minimum degree of 3) = (sum of digits of R mod 3). Coefficient $C_i =$ Alternating digits of the roll number, starting from the least significant digit. (07) [CO2]
 Using Horner's method, evaluate the sparse polynomial $P(x)$ at $x = 2$, simplifying the computation by identifying and skipping terms with zero coefficients (sparse polynomial optimization).

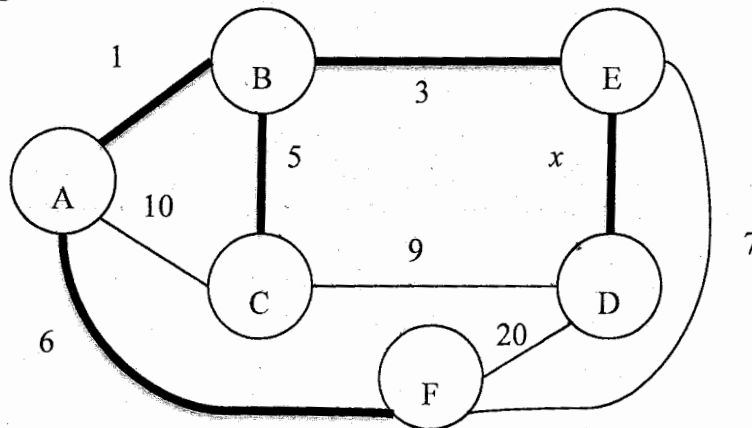
- d) Find the shortest path from the following graph by using **Bellman-Ford algorithm**. (10) [CO2]
Consider A is the source node.



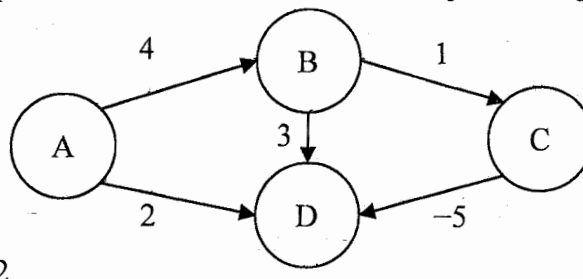
SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Given the sentence "Set a task and ask a team to act". Represent it using Huffman (15) [CO4] encoding. Show the complete process of constructing the Huffman tree step by step.
b) For the following graph, the bold edges form minimum spanning tree (MST). What can (12) [CO3] you tell about the range of values for X ? If, $X = 5$, then use Kruskal's algorithm to compute the MST. Write down the edges of the MST in the order they are added using Kruskal's algorithm.



- c) Is Robin-Karp algorithm a Las Vegas or Monte Carlo algorithm? Justify your answer (08) [CO2] with reasoning about its behavior and correctness.
6. a) Find the shortest path between all pair of nodes using Johnson's algorithm in the (15) [CO3] following graph. Explain how the Bellman-Ford and Dijkstra's algorithm are applied.



- b) Write the implicit and explicit constraints of the N-Queen problem. Write a pseudo-code (12) [CO3] to determine the number of ways to place $(n - 3)$ queens on an $n \times n$ chessboard such that no two queens attack each other.
c) Why do we use approximation algorithms even though they may not always produce the (08) [CO3] exact answer? Explain the scenarios where approximation algorithms are beneficial.
7. a) Given the coin denominations $\{1, 2, 3, 5\}$. Use the top-down approach of Dynamic (15) [CO4] programming to find the minimum number of coins required to make a sum of 14. Show the recursive process with memorization.
b) Develop a parallel algorithm for merge-sort. Show how the divide-and-conquer approach (12) [CO2] can be parallelized and explain how the algorithm performs with multiple processors.
c) How do you determine if a problem can be solved using dynamic programming? List the (08) [CO2] key characteristics a problem must have and explain each with examples.
8. a) Write down the best big-oh (O) characterization for each of the following running time (12) [CO1] estimates of different algorithms.
(i) $1000n^2 + 16n + 2^n$, (ii) $\log(n) + 10000$, (iii) $2^{20} + 3^7$.
b) What are the differences between branch-and-bound and backtracking paradigm? (13) [CO2]
c) Write down the control abstraction for greedy method. (10) [CO2]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 2nd Term Examination, 2023
Department of Computer Science and Engineering
HUM 2207

Economics and Accounting

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates the course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. Suppose, the market demand and market supply for commodity X is given by the following (35) [CO1] equations:

$$Q_{dx} = 132 - 8P_x$$
$$Q_{sx} = 6 + 4P_x$$

- i) Find equilibrium price (P_x) and quantity (Q_x),
ii) What is the equilibrium P_x and Q_x if per unit tax $t = 4.5$ is applied on X ?
iii) Elucidate on the factors that determine supplied quantity,
iv) Why does the demand curve slope move downward?
v) Identify some exceptions to law of demand with example.
2. a) Define Cross-price and Income-elasticity of demand. (05) [CO2]
b) List the determinants that govern the size of the price-elasticity of demand. (10) [CO2]
c) Suppose the demand for Ali's cement is given by the following equation: (20) [CO4]
$$Q_x = 20,000 - 5000P_x + 5I + 500P_c$$

Assume, the initial values of P_x , I , and P_c are \$5, \$10,000 and \$6 respectively.
Using the above information.
i) determine what effect an increased price would have on total revenue,
ii) evaluate how sale of the cement would change during a period of rising income,
iii) assess the probable impact if competing producer would raise their price.
* In the equation, P_x = price charged for Ali's cement;
 P_c = price charged for competing producer's cement;
 I = income per capita.
3. a) Explain the concept of Economics, Microeconomics, and Macroeconomics. (10) [CO1]
b) What are the factors of production? Mention the main functions of an entrepreneur. (07) [CO1]
c) "A rational producer will always produce in stage-2" – analyze the statement. (18) [CO3]
4. a) Define market. Show the differences between Monopolistic competition and monopoly. (07) [CO4]
b) What is short-run? For a given price, explain how do the perfect competitive firm (18) [CO2] choose the level of output that maximize profit.
c) Define normal profit. At what stage, a firm should shut-down in perfect competition? (10) [CO3]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Why is accounting called the language of business? (10) [CO1]
b) What do you mean by accounting cycle? Discuss in brief each stage of the cycle. (10) [CO1]
c) Explain the fundamental Accounting equation. Explain the influence of two (05) [CO3] transactions on the accounting equation.
d) Explain the main features of the Double Entry System of accounting. (10) [CO2]
6. a) "Accounting is the decision-making tools" – explain. (05) [CO1]
b) Kazi Firoz is a lawyer practicing in Dhaka Judge Court. He starts a sole proprietorship (30) [CO1] law firm in the name of Kazi Legal Services. During the first month of operation, April 2023, Kazi engages in the following transactions: (20)
April 1 Kazi invested tk 200,000 of personal cash to start the business. +
April 2 purchase office supplies on account at a cost of tk 2,000. (10)
April 3 purchase furniture paying tk 60,000 in cash.
April 4 deals a case for one client and receives cash of tk 6,000.
April 5 paid tk 1,000 on the account payable transaction *April 2*.
April 6 electricity paid in cash tk 500.
April 7 pays tk 1,000 from personal funds for a personal trip to Rajshahi.
April 8 Kazi withdraws cash of tk 2,500 for personal use.

- i) Prepare journal,
- ii) Prepare Tabular Summary and show the effects on accounting equation.

7. a) Discuss the limitations of the trial balance. (05) [CO2]
 b) From the following transactions of M/S Karim & Sons, you are required to prepare (30) [CO2]
 necessary ledger accounts:

2024

January 1 M/S Karim & Sons invested tk 200,000 cash to start the business.

January 2 cash deposited into bank tk 50,000.

January 3 office supplies purchase in cash tk 4,000.

January 4 furniture purchase for office use by cheque tk 20,000.

January 5 advertisement bill received but not yet paid tk 5,000.

January 6 advertisement bill paid by cheque transaction January 5.

M/S Karim & Sons uses the chart of accounts: Cash – 101, Capital – 301, Bank – 110,
 Supplies – 120, Furniture – 130, Advertisement expense – 201, Accounts payable – 305.

8. National Graphics Company was organized on January 1, 2023 by S. D. Rubel. At the (35) [CO3]
 end of the first 6 months of operations, the trial balance contained the following accounts:

Accounts' Titles	Debit (taka)	Credit (taka)
Cash	19,000	
Accounts receivable	28,000	
Equipment	90,000	
Insurance expense	3,600	
Salaries expense	60,000	
Supplies expense	5,400	
Advertisement expense	3,800	
Rent expense	3,000	
Utilities expense	3,400	
Notes payable		34,000
Accounts payable		18,000
S. D. Rubel, Capital		50,000
Graphic revenue		1,04,200
Consulting revenue		10,000
	2,16,200	2,16,200

Additional data:

- a) Supplies on hand at 30 June 2023 tk 3,000.
- b) Depreciation charged on equipment for 6 months tk 2,000.
- c) Graphic revenue earned but unbilled at June 30 tk 4,000.
- d) Consulting fees are credited to revenue when received. At June 30, Consulting fees of tk 2,000 are unearned.

Instructions:

- i) Prepare a statement of comprehensive income for 6 months, the period ended June 30, 2023,
- ii) Prepare a statement of owner's equity, and
- iii) Prepare a statement of financial position as on June 30, 2023.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 2nd Year 2nd Term Examination, 2023
 Department of Computer Science and Engineering
 MATH 2207

Complex Variable, Vector Analysis and Statistics

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the immediate right column of the questions indicate full marks.
 iii) The rightmost column indicates the course outcomes.
 iv) z – table, t – table, χ^2 – table, and graph paper will be provided if required.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) The frequency distributions are given below: (19) [CO3]

Class interval	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85	85 – 95
Frequency	12	16	22	7	8	3

Calculate the first four raw moments about O (origin) from the above table. Also find the coefficient of skewness, CoV, mean and comment on the result.

- b) Out of every 500 jobs at a computing center, 60 are of class 1, 30 are of class 2, and 10 are of class 3. A sample of 30 jobs is taken with replacement. (8) [CO3]
- i) Find the probability that the sample will contain 10 jobs of each class.
 - ii) Find the probability that the sample will contain exactly 20 jobs of class 1.
 - iii) Find the probability that the sample will contain at most 2 jobs of class 3.
- c) A service provider company, P, has three units: A, B, and C. Unit A has 25 workers, unit B has 15 workers, and unit C has 10 workers. Each worker provides good service 50% of the time. (8) [CO4]
- i) If a customer received a good service, what is the probability that it came from unit B?
 - ii) If a customer received a service from unit B, what is the probability that it was good?
 - iii) If a customer received a service, what is the probability that it was good?

2. a) When three fair coins are flipped, let the random variable X be defined as 2 times the number of the upper face of the head minus 5. Now, express the probability distribution of the random variable corresponding to these flipped coins. Subsequently, determine the mean and variance. Additionally, calculate the Probability $p(X < 1)$ and identify the actual number of heads for the values of $X < 1$. (09) [CO3]

b)
$$F(x) = \begin{cases} kx/8 & \text{if } 1 \leq x \leq 16 \\ 0 & \text{otherwise} \end{cases} \quad (15) [CO3]$$

Determine the value of 'k' that makes ' $F(X)$ ' a valid probability distribution function (PDF) [Note: not probability density function (pdf)]. After finding 'k', calculate the mean, standard deviation, and $p(0 < X < 20)$. Additionally, create graphical representations of both the pdf (probability density function) and PDF on a graph paper.

- c) Define Poisson process with necessary properties. An observer counts the number of wrong signals for each 5-minute time interval. (11) [CO3]

Possible number of wrong signals within 5 min	0	1	2	3	4	≥ 5
Number of observations	2	5	4	0	2	0

- i) Find the probability that 10 wrong signals observed within half an hour.
- ii) Find the probability that 10 wrong signals observed within the duration 11.00 – 11.30 am or 5.00 – 5.30 pm.

3. a) What is the value of k for which the following table represent a probability distribution? (15) [CO3]

x	-1	0	2	3	4
$T(x)$	$2k$	$5k$	0.2	0	0.1

Then, find first four raw moments (measured from origin). Then find first three central moments. Also find mean and variance of the distribution.

- b) List the necessary assumptions of the Bernoulli distribution. An automatic traffic control system monitors video download speeds for under-speeding. Based on a previous analysis, the probability of a video being under-speeded is 0.10. In a specific time-frame, four videos are investigated. Calculate the probability for the following scenarios: (10) [CO1]
- i) Green light: No under-speeded video observed.
 - ii) Red light: All videos are under-speeded.
 - iii) Yellow light: At least one, but not all videos are under-speeded.

- c) The grade on a quiz were 0, 1, 2, ..., 10 points, depending on the number answered correctly (10) [CO4]
 out of 30 questions. The mean grade was 6.50 and the standard deviation was 1.1. Express with appropriate assumptions to determine following probabilities, and then determine:
- The percentage of student scoring 7.0 point.
 - The maximum grade of the lowest 10% of the class.
 - The minimum grade of the highest 10% of the class.
4. a) Given $A = \begin{bmatrix} 3 & 2 \\ -1 & 2 \end{bmatrix}$ express matrix A as a linear combination of elementary matrices. (17) [CO4]
- Identify each of the elementary matrices obtained above, specifying whether they represent scaling, shear, rotation, or another transformation.
 - Sequentially apply the left multiplication of the elementary matrices (derived from matrix A) on the geometric object $ABCD$ whose corner points are $A(0, 0)$ to $B(4, 0)$, $C(2, 4)$ and $D(0, 2)$. Draw initial and all the modified figures of the given object $ABCD$. If the order of the elementary matrices obtained from A is interchanged, and if you apply the transformations again to $ABCD$, do you obtain the same result as before? justify your answer.
 - Additionally, apply the left multiplication of A directly on the object $ABCD$. Draw the figure after the transformation is applied to $ABCD$.
- b) The space curve is given by $x = 3 \cos t$, $y = 3 \sin t$, $z = 4t$. Find (i) the unite tangent \vec{T} , (18) [CO2]
 (ii) the principal normal \vec{N} , curvature k , and radius of curvature ρ , (iii) the binormal \vec{B} , (iv)
 The coordinate plane containing \vec{N} and \vec{B} (Normal plane) at $t = \pi/2$.

SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Prove that the modulus of the difference of two complex numbers is greater than or equal to (08) [CO2]
 the difference of their moduli.
- b) Express $\frac{1+2i}{1-3i}$ in the polar form. (06) [CO3]
- c) Define the following singularities with example: (i) Pole, (ii) Essential Singularity, (10) [CO1]
 (iii) Removable Singularity and (iv) Isolated Singularity.
- d) If $f(z)$ is analytic at z_0 , prove that it must be continuous at z_0 . Give an example to show that (11) [CO2]
 the converse is not necessarily true.
6. a) Define harmonic function. (02) [CO1]
- b) Write down the necessary and sufficient conditions for a function to be analytic. (08) [CO2]
- c) Prove that $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic. Find v , such that (13) [CO3]
 $f(z) = u + iv$ is analytic, where v is harmonic conjugate.
- d) Evaluate $\oint_c \frac{z-1}{(z+1)^2(z-2)} dz$ where c is the circle $|z - i| = 2$. (12) [CO3]
7. a) Point out physical outcomes of a gradient of scalar point function and a divergence of vector (05) [CO1]
 point function.
- b) Apply appropriate vector differential operator, (16) [CO4]
- Find the angle between the two surfaces $S1: xyz = 1$ and $S2: x^2 + y^2 + z^2 = 3$ at $(1, 1, 1)$.
 - Find the tangential plane of the surface $S2$ at the point $(1, 1, 2)$.
 - Also find the maximum rate of change of heat of the level surface of temperature given by $S1$ and the directional derivation of $S1$ along $\hat{i} + \hat{j}$ direction.
- c) Test the types of vector field F by using vector differential operator ∇ , where (14) [CO3]
 $F = GM\vec{r}/r^2$, G and M are constants and \vec{r} is position vector. Hence, find the scalar potential Φ of the vector field such that Φ at $(1, 1, 1)$ is 3.
8. a) If $\vec{F} = (2x + y)\vec{i} + (3y - x)\vec{j}$, evaluate $\oint_c \vec{F} \cdot d\vec{r}$, where c is the curve in the xy -plane (10) [CO2]
 consisting of the straight lines from $(0, 0)$ to $(2, 0)$, and then to $(3, 2)$.
- b) Evaluate $\iint_s \vec{A} \cdot \vec{n} ds$, where $\vec{A} = 18z\vec{i} - 12\vec{j} + 3y\vec{k}$ and s is that part of the plane (12) [CO2]
 $2x + 3y + 6z = 12$ which is located in the first octant.
- c) State Green's theorem. Verify Green's theorem in the plane for $\oint_c (xy + y^2) dx + x^2 dy$, (13) [CO4]
 where c is the closed curve of the region bounded by $y = x$ and $y = x^2$.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 2nd Year 2nd Term Examination, 2023
 Department of Computer Science and Engineering
 CSE 2209
 Theory of Computation

TIME: 3 hours

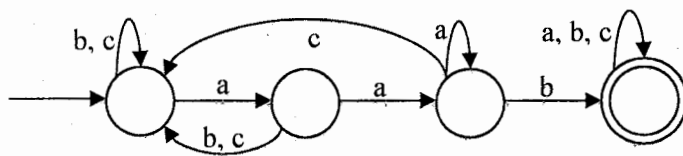
FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the immediate right column of the questions indicate full marks.
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SECTION A

(Answer **ANY THREE** questions from this section in Script A)

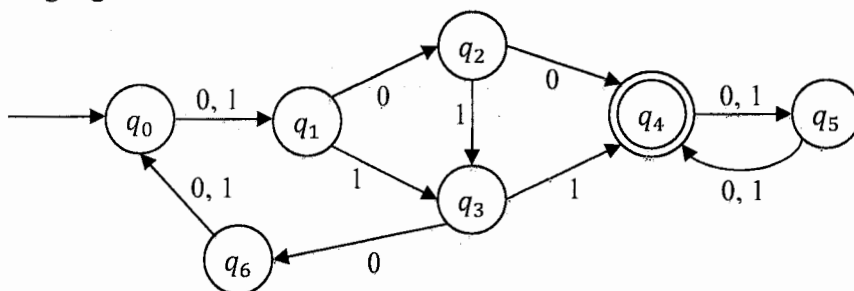
1. a) Explain finite automata for a word “donkey”. What does a DFA do on reading an input string? (08) [CO1]
 b) Build DFAs for the following language by describing the steps and transition tables (12) [CO2] where $w \in \{a, b\}^*$.
 i) $L = \{w | w \text{ is a string where } |w| \cong 1 \pmod 3\}$.
 ii) $L = \{w | w \text{ is a binary string that has even number of 1s and 0s}\}$.
 c) Use the following language and prove the Kleene theorem: $L = \{w | w \text{ ends with } 101\}$. (15) [CO4]
2. a) Explain the relationship between regular expressions and finite automata with example(s). (05) [CO1]
 b) What is $\epsilon\text{-CLOSE}(q_0)$ where q_0 means a state? Design ϵ -NFA for $L = \{w | w \text{ is empty, or if non-empty will end with } 111, \text{ or } 100, \text{ or if non-empty will start with } 101\}$ and convert it to DFA. (20) [CO4]
 c) Prove that “If $L = L(A)$ for some DFA A , then there is a regular expression R such that $L = L(R)$ ”. (10) [CO2]
3. a) Build a regular expression for the following DFA. (07) [CO2]



- b) Prove whether $L = \{a^n b^{n+m} c^{m+i} d^i | n, m, i \geq 1\}$ is regular or not using pumping lemma. (13) [CO3]
- c) Find the equivalent DFA of the generated DFA from the following transition table. (15) [CO4]

	0	1
→ A	B	C
B	A	D
* C	E	F
* D	E	F
* E	E	F
F	F	F

4. a) Describe the membership problem. If L and M are regular languages then prove $L - M$ is also regular. (10) [CO3]
- b) What are the approaches to test finiteness of a language? Determine whether the following language of DFA is finite or infinite? (10) [CO2]



- c) What is an “error state”? Explain with example(s). (05) [CO1]
- d) Construct an NFA and convert it to DFA using lazy creation process for the given example: $L = \{w | w \text{ contains a substring } 1001\}$. (10) [CO3]

SECTION B

(Answer ANY THREE questions from this section in Script B)

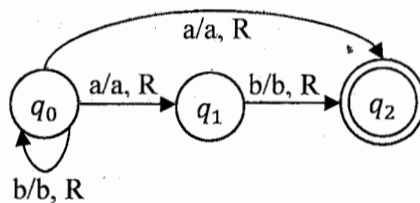
5. a) Give a context free grammar (CFG) for the language L with regular expression (25) [CO3] $(a(ab)^*a(a + \epsilon))$. Convert your CFG in Chomsky normal form.
 b) Is it decidable to determine whether the intersection of 2 context free languages (CFLs) (10) [CO1] is empty? Explain your answer with examples.

6. a) In your library, you must ensure that the number of fiction books is never same as the number of non-fiction books and the number of non-fiction is never same as the number of science-fiction books. Verify these conditions for a shelf arrangement by designing pushdown automata (PDA). (12) [CO2]
 b) Show the language with words $a^n b^m c^p$ is not context free for $n > 0, m = 2n$ and $p = m + n$. (06) [CO4]
 c) You are asked to build a system which have valid passwords as a set of words over the alphabet $\{a, b\}$ containing the same number of occurrences of a and b . Create a CFG to check the password. (07) [CO2]
 d) Explain the required format for production rules in CFG generating a regular language (10) [CO1] with an example.

7. a) Show that the language $L = \{a^i b^j c^k \mid j > i + k\}$ cannot be written in the form (10) [CO4] $L = L_1 L_2 L_3$ where L_1, L_2, L_3 are subsets of $\{a\}^*, \{b\}^*$, and $\{c\}^*$.
 b) Show the CFG with following productions is ambiguous. (10) [CO3]

$$S \rightarrow a \mid Sa \mid bSS \mid SSb \mid SbS$$

 c) Analyze whether the given Turing machine accepts all the strings for the language (15) [CO2] $L = \{\text{strings containing "ab" or ending with "ba"}\}$. If not, propose necessary modifications to the machine to ensure it accepts all strings form L .



8. a) Differentiate between pumping lemma for regular language and CFL. (05) [CO4]
 b) Design a Turing machine that accepts 2 integers and produces their subtraction as (18) [CO2] output. Demonstrate for the following examples.
 Input1 : 1 0000 1 00 1
 Output1 : P 00
 Input2 : 1 000 1 000000 1
 Output2 : N 000

[Here P and N represent positive and negative, and number of 0's defines input integer and 1 defines separator.]

- c) Given a language $L = \{0^n 1^n \mid n \geq 1\}$, define the substitution function such that (12) [CO3] $S(0) = \{a^n b^m \mid m \leq n\}$ and $S(1) = \{ab, abc\}$. Generate CFG for both original language L and the output language after substitution applied to L .

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 2nd Year 2nd Term Examination, 2023
 Department of Computer Science and Engineering
 ECE 2213
 Digital Electronics

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the immediate right column of the questions indicate full marks.
 iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is digital electronics? Why is the study of digital electronics important for the CSE (10) [CO1] undergraduate students?
- b) Define self-complementary code. "Excess-3 code is a self-complementary code"— (10) [CO1] justify the statement.
- c) Determine the prime-implicants of the following function by using Tabulator method. (15) [CO1]

$$F(w, x, y, z) = \sum (1, 4, 6, 7, 8, 9, 10, 11, 15)$$

2. a) Define and classify comparator. Give example of each type. (10) [CO2]
- b) Briefly explain the operating procedure of inverting comparator with necessary diagrams. (12) [CO2]
- c) Design a noninverting comparator that will compare a sinusoidal input $v = 6 \sin wt$ with a reference voltage of 4 volt. (13) [CO2]

3. a) Define the following terms: (i) fanout, (ii) propagation delay, and (iii) noise margin. (06) [CO1]
- b) Compare TTL, ECL and IIL considering propagation delay, power consumption, noise immunity and speed. (11) [CO1]
- c) Implement the following Boolean function using 8:1 and also using 4:1 multiplexer. (18) [CO1]

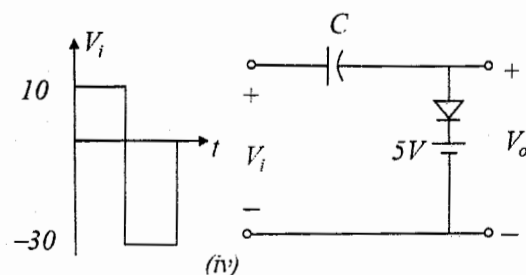
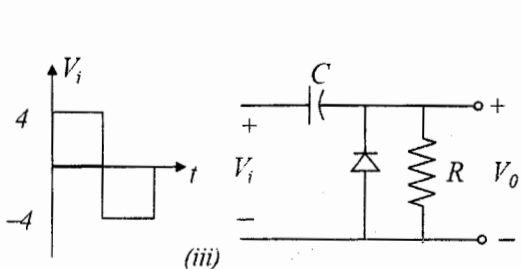
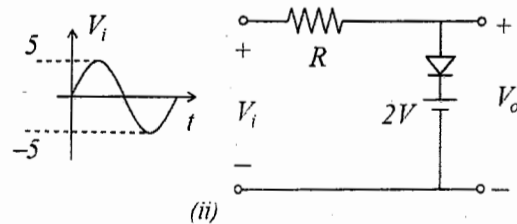
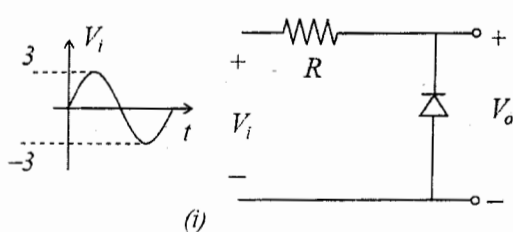
$$F(A, B, C, D) = \sum m(0, 1, 2, 4, 6, 9, 12, 14)$$

4. a) Write down the characteristics table and excitation table of RS, JK, D and T flip-flop. (11) [CO1]
- b) What do you mean by state table, state diagram, and state equations? (09) (06) [CO1]
- c) Define PLA. Describe its basic structure including the significance of the programmable AND and OR planes. (15) [CO1]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Draw the output of the following circuits. (28) [CO4]



- b) Show that transistor can be operated as a switch. (07) [CO4]
6. a) Explain the difference between various types of multivibrator. (10) [CO2]
- b) With a neat sketch, explain, the working principle of an astable multivibrator. (14) [CO2]
- c) What is pulse transformer? Write down the differences between pulse transformer and power transformer. (11) [CO2]

7. a) Describe the operating principle of Schmitt trigger. (11) [CO3]
b) Design an inverting Schmitt trigger for $V_{UT} = 2V$, $V_{LT} = -2V$ and $V_{sat} = 12V$. (12) [CO3]
c) Show with necessary diagram, how UJT relaxation oscillator can be used as a voltage sweep. (12) [CO3]
8. a) Explain the operating principle of VTVM. (08) [CO4]
b) Write down the applications of Digital Multimeter (DMM). Also describe the parts of a DMM. (07) [CO4]
c) A Q meter has a series coil of inductance (L) valued $10\mu H$, resistance R of the coil is 25Ω and resonant frequency of the circuit is $1MHz$. Calculate the factor of the circuit. (10) [CO4]
d) Prove that $E_c = QE$ for a Q meter, where the symbols have their usual meanings. (10) [CO4]