

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. Engineering Examination-2019

Course Code: CSE251

Course Title: Algorithm Design and Analysis

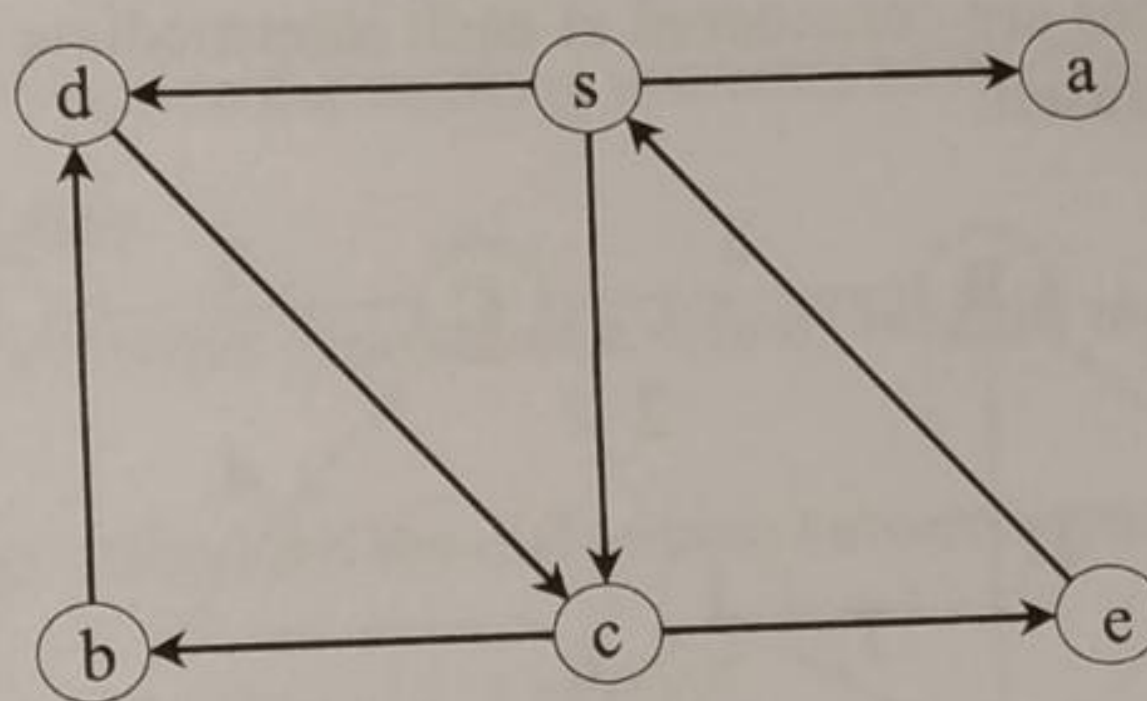
Total Marks: 60

Time: 3 (Three) Hours

N.B.: Answer **SIX** questions out of the following **EIGHT** questions.

1. a) How does counting sort work? Describe with some examples. 5
b) Build matrix of LCS for the following input and write the pseudocode for printing the LCS (i) PBCWEDEUY (ii) KXBWDUYL 5
2. a) Write down the comparison between counting sort and radix sort. 2
b) Write down the Huffman code algorithm and describe with an example. 3
c) What is merge sort? Give an example problem and show the steps. Compute the run time of merge sort. 5
3. a) Describe the process building max-priority queue using heapify. Build a priority queue using heapify for the inputs = {12, 11, 5, 8, 3, 2, 10, 4}. 5
b) Give the visited node order for each type of graph search, starting with s, given the following adjacency lists and accompanying figure: 5

$adj(s) = [a, c, d],$
 $adj(a) = [],$
 $adj(c) = [e, b],$
 $adj(b) = [d],$
 $adj(d) = [c],$
 $adj(e) = [s]$



(i) Breadth First Search (ii) Depth First Search

4. a) Compute the worst case, best case and average case running time of quick sort. 3
b) What are back edge, forward edge, cross edge and tree edge? Explain with examples. 3
c) What is connected component? Write down the algorithm for finding connected components. 4
5. a) What is single source shortest path? Write down the Dijkstra algorithm for finding shortest path. 5
b) What is the problem with Dijkstra algorithm and how Bellman ford algorithm overcomes the problem? 2.5
c) What is flow network and residual network? Explain with examples. 2.5

6. a) Determine maximum flow over the flow network in the figure-1(a).

5

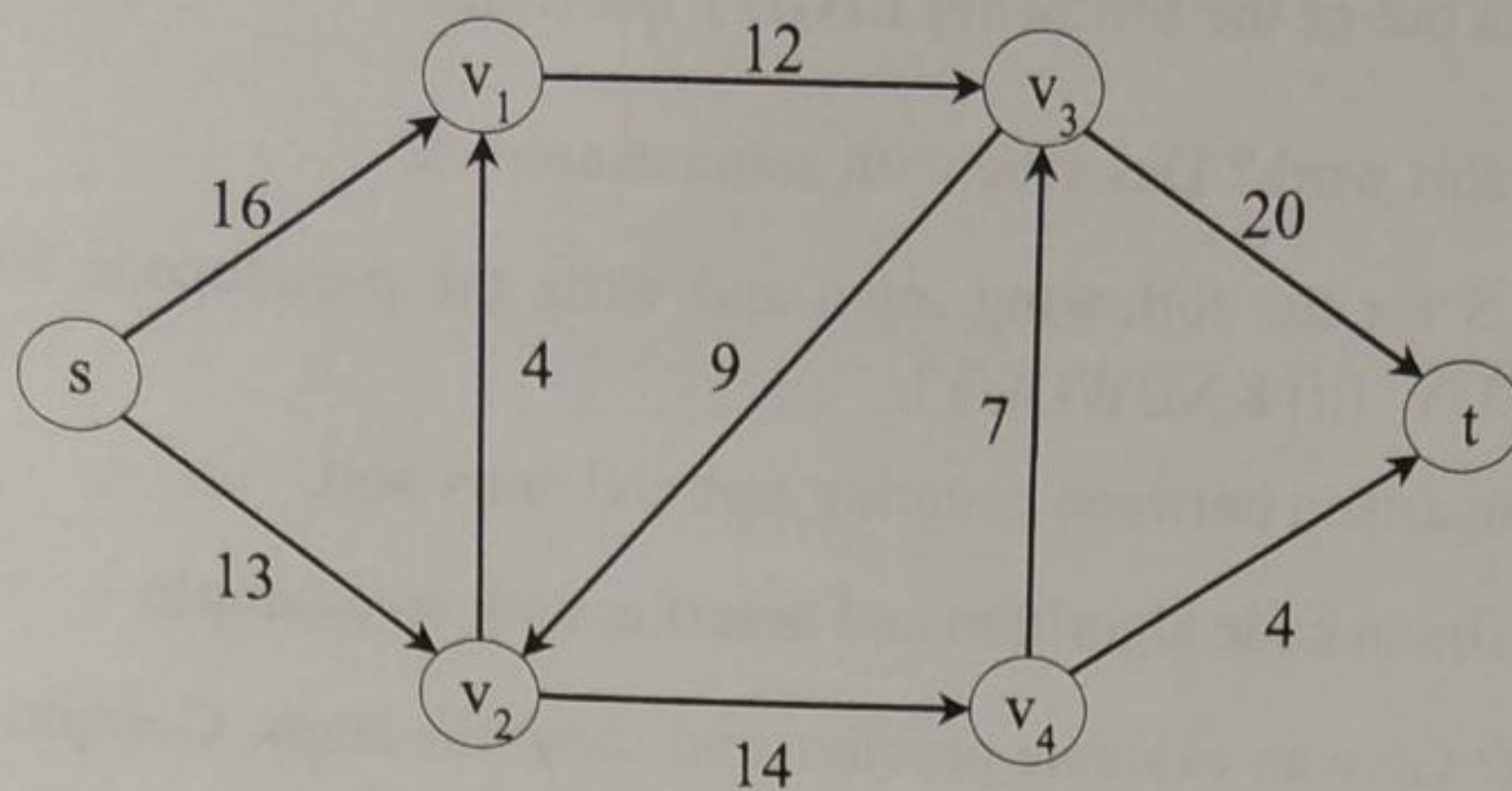
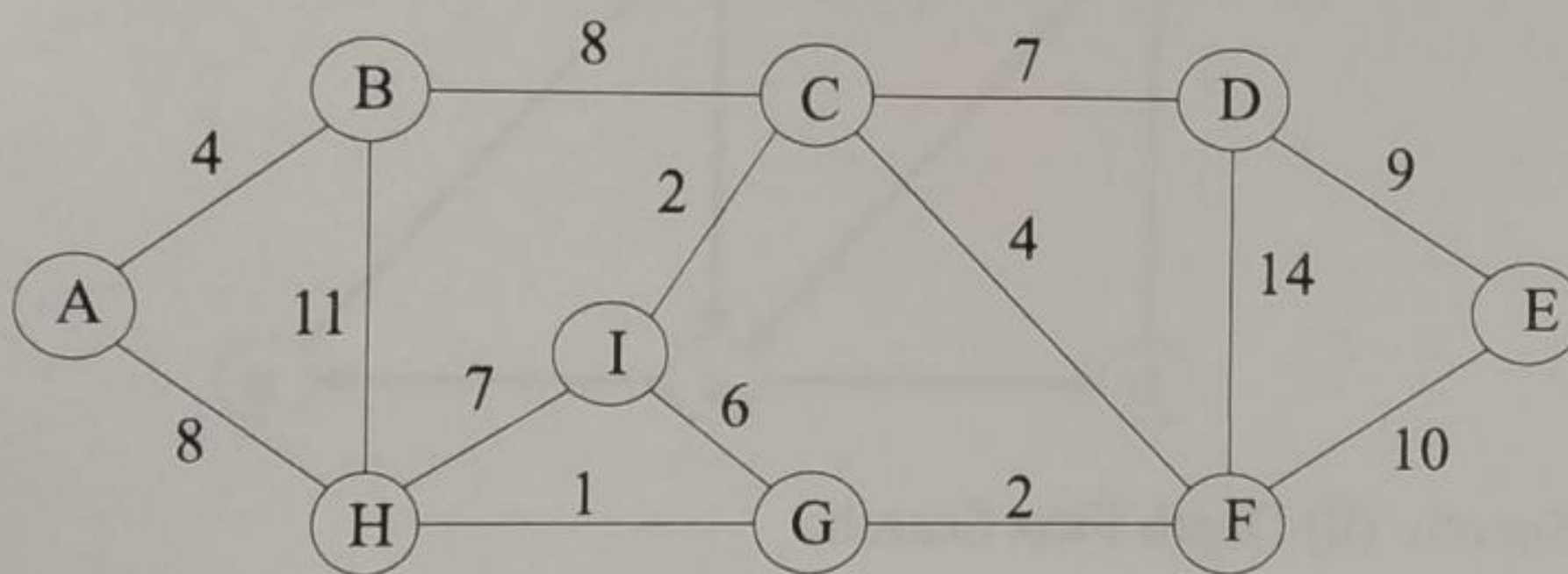


Figure-1(a)

- b) Write short note on (i) average bound (ii) upper bound and (iii) lower bound run time. 2
- c) What is tree? What are the properties of a tree? 3
7. a) We want to find the minimum spanning tree of the given graph. Run Kruskal's algorithm. Show which edges are considered at each intermediate state and indicate whether an edge is accepted or refused. 4



- b) What are the comparisons of Kruskal's and Prim's algorithms? 2
- c) What is graph? How are graphs implemented in computer? Show an example of implementations. 4
8. a) What are the major characteristics of NP, NP hard and NP complete problems? Explain with example. 2
- b) Write down the relaxation algorithm of vertex cover problem and show an example. 4
- c) Write down the pseudocode of Insertion sort and calculate the running time of the algorithm. 4

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering
2nd Year 2nd Semester B.Sc. Engineering Examination-2019

Course Title: Introduction to Digital Systems
Full Marks: 60

Course Code: CSE253
Time: 3 hours

N.B.

- i) Answer any **SIX (6)** from the following **EIGHT (8)** questions.
- ii) All questions are of equal values.

- Q.1 (a) Design OR and AND gates using diodes only. 5
(b) Implement full adder using multiplexer and describe its operations. 5
- Q.2 (a) Design the combinatorial circuit of Binary to Excess-3 code converters. 4
(b) Define Fan out, Power dissipation, Propagation delay and Noise margin. 4
(c) Write the applications of TTL circuits. 2
- Q.3 (a) What do you mean by combinatorial logic circuit? Design and explain NAND and NOR gate using CMOS. 7
(b) Write down fan-in and fan-out of a standard TTL IC. 3
- Q.4 (a) What is flip-flop? Design and explain the working principle of JK flip-flop. 4
(b) Write the applications of flip-flop. 2
(c) What is shift register? Draw the block diagram of a 4(four) bit shift register. 4
- Q.5 (a) What do you mean by counter? What are the differences between synchronous and asynchronous counter? 5
(b) Design a counter which can count binary 1111 to 0000. 5
- Q.6 (a) What is wave shaping? Draw and explain positive diode clipping circuit. 5
(b) What is clamper circuit? Explain working principle of negative clamper. 5
- Q.7 (a) Describe potential timing problem in FF circuits. 3
(b) Explain the working principle of astable and bistable multi-vibrator. 7
- Q.8 Write the short notes (any two) 5+5
1) Achmitt trigger
2) PLA's A/D converter
3) Monostable multi-vibrator

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. Engineering Examination-2019

Course Code: CSE255

Course Title: Theory of Computing

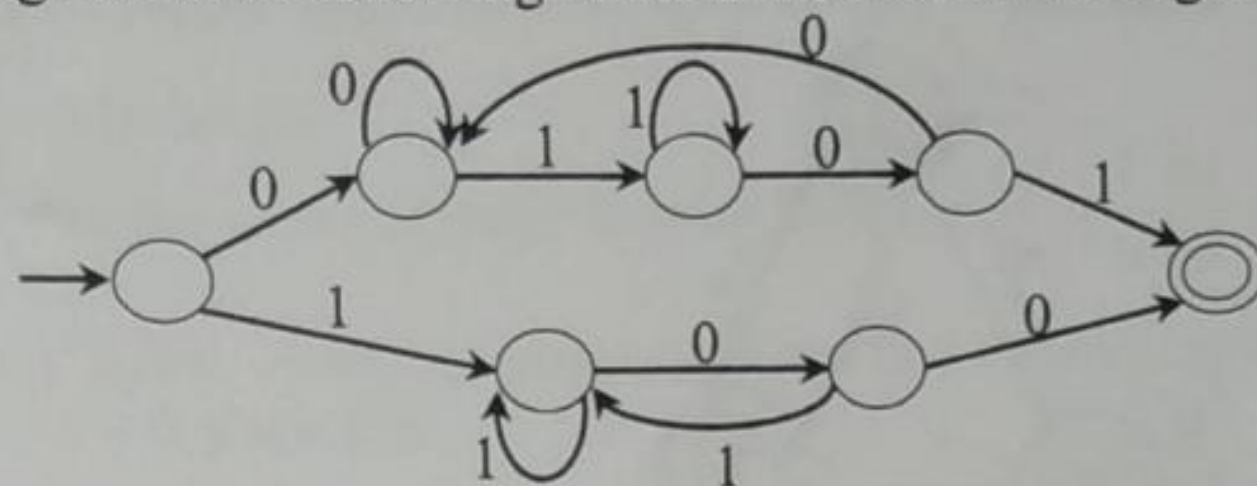
Total Marks: 60

Time: 3 (Three) Hours

N.B.: Answer SIX questions out of the following EIGHT questions.

1. a) Design a DFA over $\Sigma = \{1, 2, 3\}$ that recognizes the language A which is the set of numbers where the sum of the digits in a number is a multiple of 5. Explain how the DFA works. 4

- b) What language does the following Finite State Machine recognize? 3



- c) What are the differences between DFA and NFA? Give examples. 3

2. a) Consider a context free grammar as follows: 4

$S \rightarrow ASB \mid SC \mid BS$

$A \rightarrow aBC \mid \epsilon$

$B \rightarrow b \mid Ac \mid \epsilon$

$C \rightarrow c$

Convert it to CNF grammar.

- b) Consider the following context free Grammar G: 3

$S \rightarrow XRX \mid R$

$R \rightarrow aTb \mid bTa$

$T \rightarrow XTX \mid X \mid \epsilon$

$X \rightarrow a \mid b$

Now answer all the following questions:

(i) What are the variables of G?

(ii) What are the terminals of G?

(iii) Which is the start variable of G?

(iv) Check whether G generates the string 'aaaabbb' and if it does, also draw the parse tree.

- c) Construct a push down automaton that accepts the language $L = \{w : w \in \{a, b\}^* \text{ and the length of } w \text{ is odd with middle symbol 'b'}\}$. Such strings are: aba, babab, aabab etc. 3

3. a) Prove that class of regular languages is closed under 'star' operation. 3

- b) Compute Regular Expressions for the following languages: 4

(i) $L = \{w \mid w \text{ begins with a 1 and ends with a 0}\}$.

(ii) $L = \{w \mid w \text{ has length at least 3 and its third symbol is a 0}\}$.

(iii) $L = \{w \mid w \text{ contains an even number of 0's or exactly two 1's}\}$.

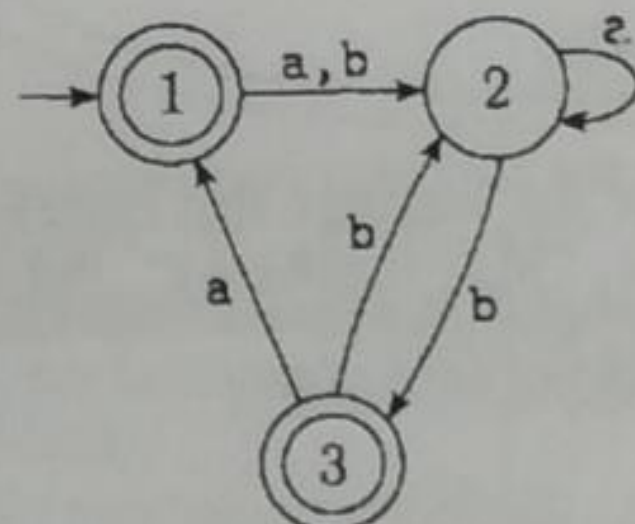
(iv) $L = \{w \mid w \text{ is any string except 11 and 111}\}$.

(v) $L = \{w \mid w \text{ contains at least two 0's and at most one 1}\}$.

- c) What is ambiguity? Give an example of an ambiguous context free grammar and explain it. 3

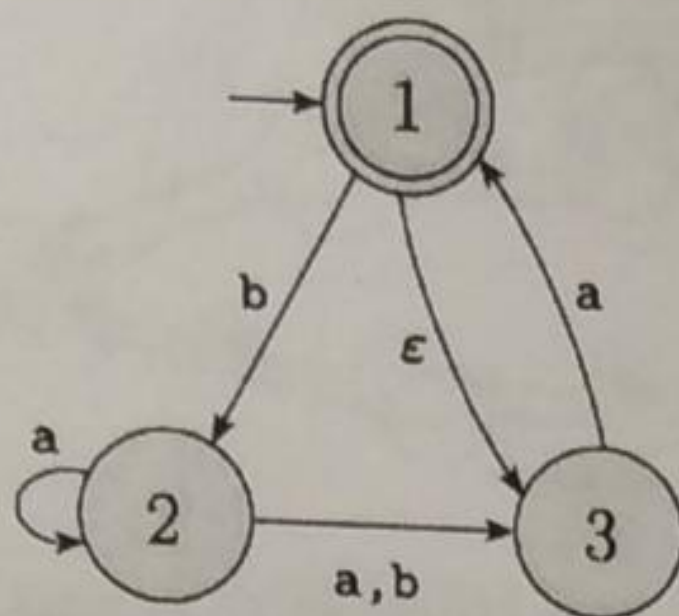
4. a) Construct the state diagram of a push down automaton that recognizes the following language: $L = \{a^i b^j c^k : i + j = k\}$. 3

- b) Convert the following DFA into Regular expression. 4

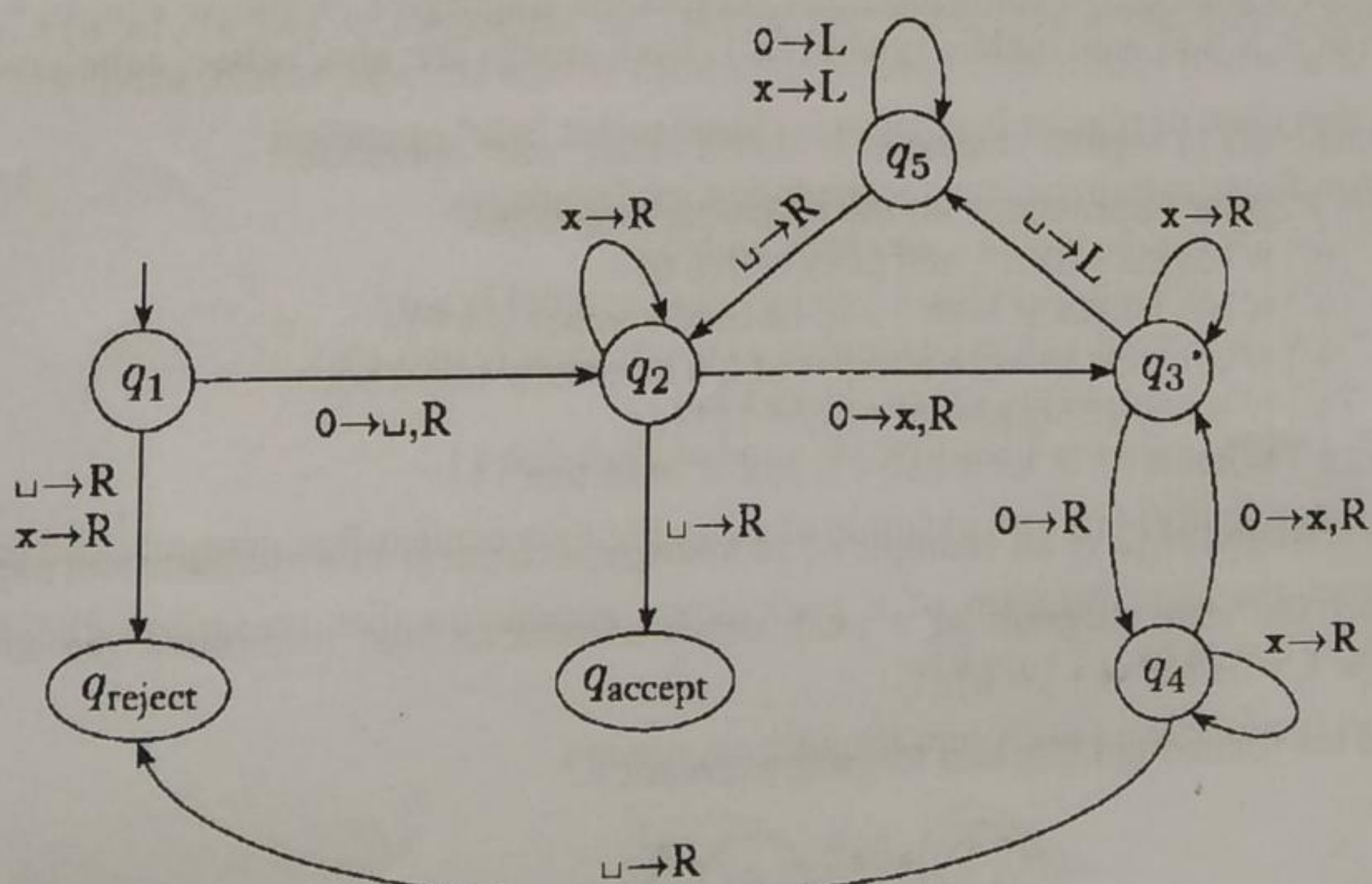


- c) Prove that for any pushdown automaton P, there exists a context free grammar G such that $L(P) = L(G)$. 3

- Total
5. a) Prove that every multi-tape Turing machine has an equivalent single-tape Turing machine. 4
- b) Build a Turing machine to recognize the language $L = \{a^n b^n c^n \mid n > 0\}$. 4
- c) Answer the following questions about Turing machine and explain your reasoning: 2
- Can a Turing machine's head ever be in the same location in two successive steps?
 - Let $C_1 = uvwq_i xy$ and $C_2 = uvq_j rxy$ be two successive steps. Are they valid for a Turing machine?
6. a) Convert the following NFA into equivalent DFA. 6



- b) Suppose the PDA $P = (\{p, q, r, s\}, \{0, 1\}, \{0, 1, \$\}, \delta, p, \{s\})$ has the following transition function: 4
- $\delta(p, \epsilon, \epsilon) = \{(q, \$)\}$
 - $\delta(q, 0, \epsilon) = \{(q, 0)\}$
 - $\delta(q, 1, \epsilon) = \{(q, 1)\}$
 - $\delta(q, \epsilon, \epsilon) = \{(r, \epsilon)\}$
 - $\delta(r, 0, 0) = \{(r, \epsilon)\}$
 - $\delta(r, 1, 1) = \{(r, \epsilon)\}$
 - $\delta(r, \epsilon, \$) = \{(s, \epsilon)\}$
- Draw the state diagram for this PDA.
7. a) Consider the language $A = \{\langle G \rangle \mid G \text{ is a connected undirected graph}\}$. Show that how a Turing machine can decide A. 4
- b) Draw the state diagram for a PDA P that can recognize whether there is any syntax error in an arithmetic expression. For example: P accepts $((a+b)/b-a)$, $((a*b)-a)/b$ and rejects $a+(b-a)$, $((a-b)*b/)$. 4
- c) Construct a DFA for the language which contains the numbers divisible by 2. Input $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. You must use only two states. 2
8. a) Show the steps when the following Turing machine runs on the input '00000'. 5



- b) Design a context free grammar G for the language that contains the conditional statement used in programming language e.g. $\text{"if}(a \geq b \& \& a < c)\text{"}$, $\text{"if}(a < b \parallel b = c)\text{"}$. For simplicity consider the input $\Sigma = \{\text{if}, (,), >, <, =, \&, |, a, b, c\}$. 5
- Using G, show the parse tree for the above two strings.

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 Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. Engineering Examination-2019

Course Code: MAT255

Course Title: Complex Variables and Laplace Transformation

Total Marks: 60

Time: 3 (Three) Hours

N.B.: Answer SIX questions out of the following EIGHT questions.

1. a) Define complex number. Is complex number algebra? Explain why or why not. 3
 b) For any complex number z_1, z_2, \dots, z_n prove that $|z_1 + z_2| \leq |z_1| + |z_2|$. 3
 c) Explain with an example single and multiple valued functions. If $\lim_{z \rightarrow z_0} f(z)$ exists, then prove that it must be unique. 4
2. a) Show that Cauchy-Riemann equations in polar form are $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$. 5
 b) Show that $u = e^{-x}(x \sin y - y \cos y)$ is harmonic. Then find the conjugate harmonic function v such that $f(z) = u + iv$ is analytic. 5
3. a) Verify the Cauchy's theorem for the function $3z^2 + iz - 4$ if C is the square with vertices at $1 \pm i, -1 \pm i$. 5
 b) State and Prove Green's Theorem in the plane. 5
4. a) State Taylor theorem. Expand $f(z) = \sin z$ in a Taylor series about $z = \frac{\pi}{4}$. 4
 b) State and prove residue theorem. 3
 c) Show that $\oint_c \frac{e^z}{z^2 + 1} dz = 2\pi i \sin t$, where c is the circle $|z| = 3$ and $t > 0$. 3
5. a) Show that $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2 + 1)^2 (x^2 + 2x + 2)} = \frac{7\pi}{50}$. 6
 b) State Laurent's theorem. Find the Laurent series of $f(z) = \frac{1}{(z+1)(z+2)}$ at $z = -2$. 4
6. a) Define Laplace Transform. State and prove second shifting property of Laplace Transform. 5
 b) Find the Laplace transform of the functions $F(t) = \begin{cases} \sin t; 0 < t < \pi \\ 0; \pi < t < 2\pi \end{cases}$. 5
7. a) Find the Laplace Transform of (i) $e^{3t}(2\cos 5t - 3\sin 5t)$ (ii) $(5e^{-3t} - 3)^2$. 4
 b) State convolution theorem. Evaluate $\mathcal{L}^{-1} \left\{ \frac{1}{s^2(s^2 + 4)} \right\}$, using convolution theorem. 6
8. a) Define inverse Laplace transform with examples. Evaluate $\mathcal{L}^{-1} \left\{ \frac{3s+7}{s^2 - 2s - 3} \right\}$. 5
 b) State first shifting property of Inverse Laplace Transform. Solve the differential equation $Y''(t) + Y(t) = t$, when $Y(0) = 1, Y'(0) = -2$. 5

Course Title: Industrial Management and Accountancy
Full Marks: 60

Course Code: ACC255
Time: 3 hours

N.B.

- i) Answer any **SIX (6)** from the following **EIGHT (8)** questions.
ii) All parts of a question must be answered sequentially.
ii) The figures in the right margin indicate the marks for each question.

- Q.1 (a) Why accounting is considered as an Information Systems? 4
(b) What are the branches of Accounting? 3
(c) Explain the Extended Equation of Accounting. 3

Q.2 Mr. Farid opened a law office on January 1, 2017. The transaction of first month, are as follows:

- January 1. Mr. Farid brings \$11,000 cash in the law practice as investment
January 2. Paid \$800 for advertisement to Universe Ltd.
January 5. Purchased a computer on account \$3,000.
January 9. Provided legal services to clients for cash \$1,500
January 15. Borrowed \$700 cash from a bank on a note payable.
January 16. Performed legal services for client and billed \$2,000.
January 27. Paid monthly salaries expense \$500, utilities bill \$300, and Rent \$100.
January 28. Mr. Farid takes \$1,000 cash for personal use.

Instructions:

- (a) Prepare a tabular analysis of the transactions, using the following column. 6
headings: Cash, Accounts Receivable, Equipment, Notes payable, Accounts Payable, Mr. Farid's Capital, Mr. Farid's Drawing, Revenues, and Expenses.
(b) Prepare the income statement. 2
(c) Prepare the balance sheet at January 31. 2
- Q.3 (a) What is the debit/credit effect of an unearned service revenue adjusting entry? 3
(b) The ledger of H. Co. on March 31, 2012 includes the following selected accounts before adjustments: 7

Name of accounts	Debit Taka	Credit Taka
Prepaid Insurance	3,600	
Office Supplies	2,800	
Office Equipment	25,000	
Accumulated Depreciation-Equipment		8,400
Unearned Rent Revenue		9,900
Notes Payable		20,000
Rent Revenue		60,000
Interest expenses	-0-	
Wages expenses	14,000	

An analysis of the accounts shows the following:

- (i) Insurance expires at the rate of Tk. 100.
(ii) Supplies on hand total Tk.800.
(iii) The office equipment depreciates Tk. 200 a month.
(iv) $\frac{2}{5}$ Of the unearned rent revenue was earned in March.
(v) Service provided Tk. 1,000 but not recorded and unbilled.
(vi) Interest of Tk. 500 is accrued on the notes payable.

Instruction: Prepare the adjusting entries at March 31, assuming that adjusting entries are made quarterly.

Q.4 Mr. Solaiman opened a new business named Solaiman Trading. During the first month of the operation of his business, the following events and transactions occurred.
April 1 Invested \$50,000 cash.

- 1 Place an order for purchasing equipments of \$3,400.
2 Paid utilities for the month \$2,000.
3 Purchased supplies on account from Care company \$3,000.
10 Provided dental services and billed \$6,100.
11 Received \$2,000 cash advance for service to be provided by the next month.

- 20 Received \$3,100 cash for services completed and delivered.
 30 Paid \$3,400 for purchasing equipment as per the order.
 30 Paid \$2,600 to Care Company for accounts payable due.
- (a) Journalize the transactions. 5
 (b) Post to the ledger accounts. Prepare the following account- 5
 Cash, Capital, Salary Expense, Service Revenue, Accounts Payable
- Q.5 (a) What is account? 2
 (b) Write about GAAP. 2
 (c) Prepare a Trial Balance from the following information. 6

Brooklyn Inc.
 For the Month Ended March 31, 2017

Cash	4,500
Accounts Receivables	3,200
Supplies	2,000
Equipment	9,750
Accounts Payable	2,500
Unearned Service Revenue	750
Owner's Capital	12,900
Owner's Drawing	1,100
Service Revenue	6,300
Salaries and Wages Expense	1,300
Miscellaneous Expense	400
Interest	100
Tax	100
Depreciation- Equipment	200
Reserve Fund	5,000
Rent Expense	1,800
Furniture	2,500
Depreciation- Furniture	500

- Q.6 (a) Define Business, commerce and industry. 3
 (b) Why sole proprietorship is more popular than other business organizations? 3
 (c) Discuss the procedures for the termination of partnership. 4
- Q.7 (a) What is business? What factors to be considered for starting a new business? 5
 (b) Write about the Fayol's Fourteen Principles of Management? 5
- Q.8 The trial balance columns of the worksheet for Mariana Car Servicing Ltd. at March 31, 2018 are as follows. 10

Mariana Car Servicing Ltd. Worksheet
 For the Month Ended March 31, 2018

Accounts Titles	Dr.	Cr.
Cash	4,500	
Accounts Receivable	3,200	
Supplies	2,000	
Equipment	11,000	
Accumulated Depreciation-Equipment		1,250
Accounts Payable		2,500
Unearned Revenue		550
Capital		12,900
Drawing	1,100	
Service Revenue		6,300
Salaries Expense	1,300	
Miscellaneous Expense	400	
	23,500	23,500

Other data:

1. A physical count reveals only \$650 of supplies on hand.
2. Depreciation for March is \$250.
3. Unearned revenue amounted to \$170 at March 31.
4. Accrued salaries are \$600.

Instructions:

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

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Course Title: Cyber and Intellectual Property Law
Full Marks: 60

Course Code: LAW255
Time: 3 hours

N.B.

- i) Answer any **SIX (6)** from the following **EIGHT (8)** questions.
- ii) All questions are of equal values.

- Q.1 (a) What is intellectual property rights?
(b) Describe different treaties and conventions which deal with intellectual property right. 10
- Q.2 (a) What is patent?
(b) State different grounds for revocation of patent. 10
- Q.3 Discuss the constitution, jurisdiction and power of cyber appellate tribunal. Is the decision of cyber appellate tribunal final? 10
- Q.4 (a) Describe various types of cyber crime.
(b) Critically analyze the scope of Information and Communication Technology Act, 2006. 10
- Q.5 (a) What are the criteria for registration of design.
(b) State the procedure for registration of design. 10
- Q.6 What is trademark? What is the importance of trademark? Elaborate the registration procedure of trademark. 10
- Q.7 What are the criteria of patentability? Answer with references to *Diamond vs Chakrabarty* (1980) 10
- Q.8 Write short Notes on (Any three) 10
- a) Passing off
 - b) Digital Signature
 - c) Deceptive similarity
 - d) Infringement of Copyright