

**Bangabandhu Sheikh Mujibur Rahman Science and Technology University**  
**Department of Computer Science & Engineering**  
**2<sup>nd</sup> Year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016**

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

**Course No: LAW 254**  
**Time: 3 hours**

**N.B.**

- i) Answer **SIX** questions, taking any **THREE** from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

**SECTION-A**

1. (a) What is E-governance? What are the purposes of E-governance? Discuss. 5  
(b) State the barrier of E-governance in Bangladesh. 5
2. (a) What do you mean by legal recognition of digital signature? Discuss. 5  
(b) What is meant by online contract? Discuss the evidentiary value of online contracts? 5
3. (a) What is Macro, Trojan horse, Worm, Memory residential and Hox virus? Discuss. 5  
(b) Briefly discuss the methods, advantages and disadvantages of E-learning? 5
4. (a) How cyber crimes originated? Discover the methods of prevention of cyber crimes. 4  
(b) Define broadcasting and harmful interference. Abdullah causes annoyance to Sajia over phone to make a relation with her. He repeatedly does it. He sends obscene message to Sajia which goes against the modesty of her. Are those activities crime? Discuss with relevant section. 6

**SECTION-B**

5. (a) What is intellectual property? How does it differ from other kinds of property? 5  
(b) Write the object of intellectual property law. Which remedies are available in case of violation of intellectual property right? Discuss. 5
6. (a) Define the term "Copyright". What rights are protected under copyright? Discuss. 5  
(b) Write the grounds and exceptions of infringement of copyright. State the remedies in these issues. 5
7. (a) What are the characteristics of good trademarks? Which marks are not registrable? 5  
(b) What are the process to register a trade mark? Explain elaborately. 5
8. (a) What is patent right? What are the conditions of patentability? Discuss briefly. 5  
(b) Which discover cannot consider as subject matter of patent right? What would be the procedure of application of patent under "Patent and Design Act, 2001"? 5

# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of Computer Science & Engineering

### 2<sup>nd</sup> Year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016

Course Title: Numerical Analysis and Concrete Mathematics  
Full Marks: 60

Course No: CSE262  
Time: 3 hours

#### N.B.

- i) Answer SIX questions, taking any THREE from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

#### SECTION-A

1. (a) What are the reasons for occurring errors in numerical analysis? 3  
(b) Illustrate truncation, rounding-off and algorithmic error. 3  
(c) Using Bisection method, find a positive root of the equation:  $\cos x - 1.3x = 0$ . 4
2. (a) Describe the approach of False position method for finding roots. 3  
(b) Find the root of the following equation using bisection method:  $x^2 - 4x - 10 = 0$ . 5  
(c) Write down the difference between Bisection method and False position method. 2
3. (a) What do you mean by interpolation and interpolation polynomials? Also describe about regression. 1+1  
(b) What do you mean by Linear interpolation? How does Lagrange interpolation differ from linear interpolation? 1+1  
(c) Using Lagrange interpolation find the value of  $f(x)$  for the point  $x = 3.5$  according to the tabular value: 6

x	1	2	3	4	5
$f(x)$	1	1.4142	1.7321	2	2.2361

4. (a) What do you mean by Least Square regression? Give description about it. 2  
(b) Write down the formula for calculating a and b in this equation  $y = a + bx$ . 2  
(c) Apply Least square regression to find the value of y for  $x = 8$ : 6

x	1	2	3	4	5	6	7
y	3	4	4	5	8	9	10

#### SECTION-B

5. (a) Write down the approach of Gauss Elimination method for finding the inverse of a  $3 \times 3$  matrix. 4  
(b) Find the inverse of the following matrix using gauss Elimination method: 6
$$\begin{matrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{matrix}$$
6. (a) What do you mean by Numerical Integration? 1  
(b) Describe the General Quadrature formula for numerical integration. 3  
(c) Evaluate  $\int_0^{10} \frac{dx}{1+x^2}$  by using 3\*2
  - (i) Trapezoidal rule
  - (ii) Simpsons 1/3 rule
  - (iii) Simpsons 3/8 rule
7. (a) Describe the Euler's method for differential equation to derive the formula: 3
$$y_{m+1} = y_m + hf(x_m, y_m)$$
  
(b) What is Runge-Kutta method? Write down its first order and third order derivations. 1+2
  
(c) Given that  $y' = x^2 - y$ ,  $y(0) = 1$ , find  $y(0.1)$ ,  $y(0.2)$  using Runge-Kutta methods of
  - (i) Second Order
$$k_1 = hf(x_0, y_0)$$

$$k_2 = hf(x_0 + h, y_0 + k_1)$$

$$k = \frac{1}{2}(k_1 + k_2)$$

$$y_1 = y_0 + k$$
8. (a) Why Weddle's rule gives better result in numerical integration? 4  
(b) By means Newton's dividend difference formula, find the values of  $f(8)$  and  $f(15)$  from the following table: 6

X:	4	5	7	10	11	13
$f(X)$ :	48	100	294	900	1210	2028

# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of Computer Science & Engineering

2<sup>nd</sup> Year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016

Course Title: Digital Logic Design

Full Marks: 60

Course No: CSE 252

Time: 3 hours

### N.B.

- i) Answer **SIX** questions, taking any **THREE** from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

### SECTION-A

1. (a) What is Karnaugh map? Give an example of two and three variables map. 1+2  
(b) Simplify the Boolean function:  $F = x'yz + x'yz' + xy'z' + xy'z$ . 2  
(c) Simplify the following Boolean function in (a) sum of products and (b) product of sums. 5  
$$F(A, B, C, D) = \sum(0, 1, 2, 5, 8, 9, 10)$$
 with proper gate implementation.
2. (a) Implement the function  $F(x, y, z) = \sum(0, 6)$  with NAND gates. 3  
(b) What is Don't care condition? Explain it with an example. 1+1  
(c) Simplify the Boolean function:  $F(w, x, y, z) = \sum(1, 3, 7, 11, 15)$  and the don't care conditions: 5  
$$d(w, x, y, z) = \sum(0, 2, 5)$$
.
3. (a) What is a combinational logic circuit? Draw its block diagram. 1+1  
(b) Write down the design procedures of combinational circuits. 2  
(c) What is code conversion? Design a BCD-to-7-segment code converter. 1+5
4. (a) What is Universal gate? Implement NOT, AND and OR gates by NAND gates. 1+2  
(b) Suppose you are in a class room where there are eight windows. Your teacher gives you an assignment to open and close the window one after another and so forth. How can you design a digital circuit for this problem? 4  
(c) Analyze the gate diagram truth table for the following expressions: 3  
$$T_1 = (CD)', T_2 = (BC)', T_3 = (B'T_1)', T_4 = (AT_3)', F = (T_2T_4)'$$

### SECTION-B

5. (a) What is Multiplexer? Explain a 4-to-1 line multiplexer. 1+3  
(b) What is ROM? Design a  $32 \times 4$  ROM. 1+3  
(c) What is Encoder? Give an example. 2
6. (a) Explain sequential circuit with corresponding block diagram. 2  
(b) Explain D Flip-Flop in details with proper logic diagram, characteristic table and equations. 5  
(c) Design a synchronous counter using J-K flip-flop to count the following sequence: 3  
$$0 \rightarrow 2 \rightarrow 4 \rightarrow 5 \rightarrow 1 \rightarrow 7 \rightarrow 6$$
7. (a) What is Decoder? Explain a 3-to-8 line decoder. 1+3  
(b) Implement a full adder circuit with a decoder and two OR gates where the combinational circuit in sum of minterms are:  $S(x, y, z) = \sum(1, 2, 4, 7)$  and  $C(x, y, z) = \sum(3, 5, 6, 7)$ . 3  
(c) Draw the Karnaugh map for the corresponding expression for Sum of products (SOP): 3  
$$A \oplus B \oplus C \oplus D$$
8. (a) Why are Master-Slave J-K flip-flops used? Explain with example. 3  
(b) What do you mean by sequential circuit? Explain Moore and Mealy model. 4  
(c) Draw the odd-parity generation table and its figure. 3

# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of computer Science & Engineering

2<sup>nd</sup> year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016

Course Name: Design and Analysis of Algorithms

Full Marks: 60

Course No.: CSE 250

Times: 3 Hours

## N.B.:

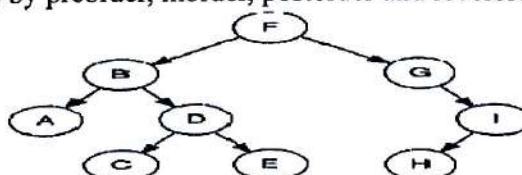
- Answer SIX questions, taking any THREE from each section.
- All questions are of equal values.
- Use separate answer script for each section.

## SECTION-A

- a) What do you mean by algorithm? What are the criteria an algorithm must satisfy? 1+2  
b) Write about best, average and worst case analysis with proper example. 4  
c) What is asymptotic notation? Explain it with proper example. 3
- a) Distinguish between up-recursive and down-recursive with an example. 2  
b) Consider the recurrence equation: 
$$\begin{aligned} T(N) &= 1 && \text{for } N = 1 \\ T(N) &= 2T(N-1) + 1 && \text{for } N \geq 2 \end{aligned}$$
 Solve the recurrence equation by unfolding method.  
c) Find the complexity of the given recurrence equation using master theorem: 4  
$$T(n) = 2T(n/2) + n \log n.$$
- a) What do you know about optimal binary search tree? 2  
b) Use Radix sort algorithm to sort the following data set. 4  
329, 457, 657, 839, 436, 720, 35  
c) Define Knapsack problem. Find an optimal solution to the Knapsack instance n=7, m=15, 4  
 $w=[2,3,5,7,1,4,1]$ , and  $p=[10,5,15,7,6,18,3]$  using greedy method.
- a) Find out the optimal solutions using matrix chain multiplication. Where dimension of matrixes are: 5  
$$\begin{aligned} A1 &= 10 \times 100 \\ A2 &= 100 \times 5 \\ A3 &= 5 \times 50 \\ A4 &= 50 \times 1 \end{aligned}$$
  
b) Write down the algorithm of the quick sort. 5

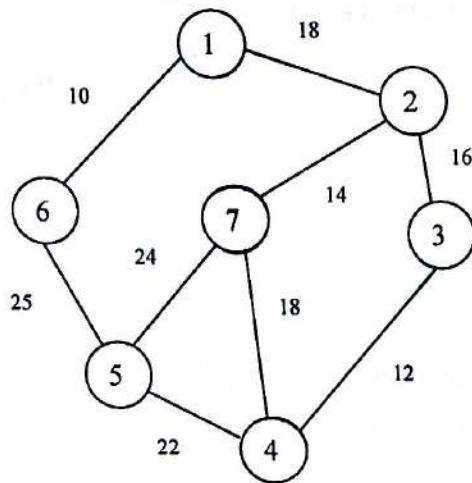
## SECTION-B

- a) Explain some real world applications of greedy algorithm. 3  
b) How will you calculate longest common subsequence? 3  
c) Traverse the following tree by preorder, inorder, postorder and levelorder. 4

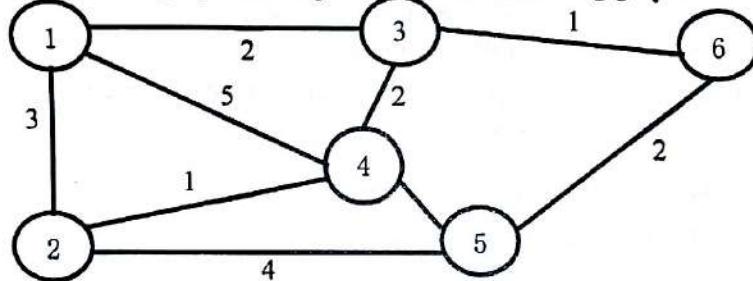


6. a) What are the four steps to develop a dynamic programming?  
b) Find MST with minimum cost from the following graph using Prim's and Kruskal's algorithm:

7



7. a) What is a Minimum Spanning Tree? 1  
b) Find out the shortest path using dijkstra's algorithm for the following graph: 5



- c) How will you find the closest pair of points? 4
8. a) Define: NP problem, NP-hard problem. 2  
b) Discuss about branch and bound. 4  
c) What are the rules followed in 15-puzzle problem? 4

olc

# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of Computer Science & Engineering

2<sup>nd</sup> Year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016

Course Title: Automata Theory

Course No: CSE 260

Full Marks: 60

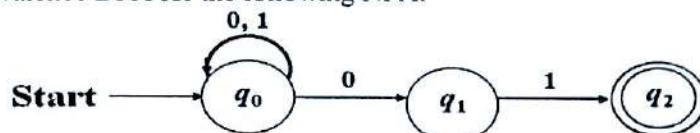
Time: 3 hours

N.B.

- i) Answer SIX questions, taking any THREE from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

### SECTION-A

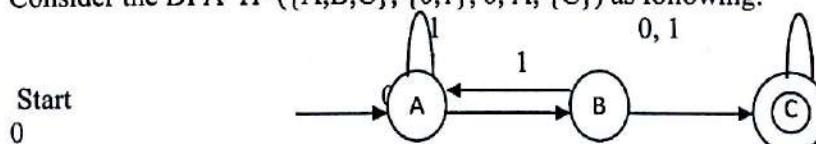
1. (a) What is Finite Automata? Write down its types. 1+1  
(b) Give the definition of DFA and NFA addressing their tuples. 2+2  
(c) Show the differences of DFA and NFA. 4
2. (a) How does a DFA process strings? 2  
(b) Draw the transition diagram for the DFA that accepts the language  $L = \{x01y \mid x \text{ and } y \text{ are any strings of 0's and 1's}\}$  3  
(c) Design an NFA accepting the following language  $L = \{ w \mid w \in \{0, 1\}^* \text{ and second last position is 1} \}$  so that you can test this string  $x = 01010$ . 5
3. (a) What do mean by the equivalence of DFA and NFA? 2  
(b) Construct the equivalence DFA for the following NFA. 6



- (c) Draw the diagram for the Finite Automata to recognize the key word "then". 2
4. (a) Describe the simple notations for DFA's with examples. 3  
(b) Draw the DFA from the following transition table that accepts the strings over the binary alphabet and show the sequence of moves made for processing the input string 011101. 4

$\delta$	0	1
$\rightarrow q_0$	$q_1$	$q_1$
$q_1$	$q_4$	$q_2$
$*q_2$	$q_3$	$q_3$
$q_3$	$q_2$	$q_2$
$q_4$	$q_4$	$q_4$

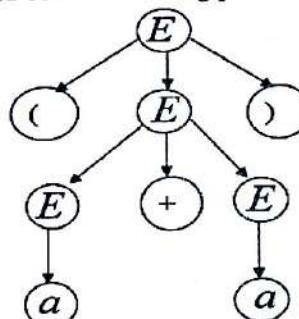
- (c) Consider the DFA  $H = (\{A, B, C\}, \{0, 1\}, \delta, A, \{C\})$  as following: 3



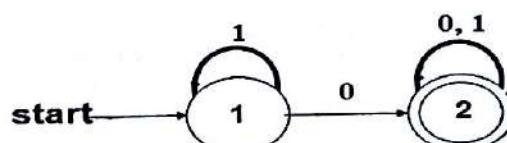
From the above DFA  $H$ , construct the transition table and show that the string 1101110001010 are accepted by this DFA  $H$ .

## SECTION-B

5. (a) Write down the RE to represent the string **Computernetwork** CN and 2  
**csebsmrstu@bsmrstu.edu.**
- (b) What are the uses of  $\epsilon$ -transitions? Write down an  $\epsilon$  - NFA that can accept the decimal numbers 1+3 like 2.15, 0.125, +1.4, -0.501.
- (c) Define CFG through its tuples. Write down the CFG for palindrome over the alphabet {0, 1}. 1+3
6. (a) What is recursive inference in CFG? Show the recursive inference of arrival in this  $(x + y1) * y$  1+2 through its grammar.
- (b) What do you mean by left most (lm) and right most (rm) derivation? Write down the rm 2+3 derivation for  $a^*(a+b1)$  using the following grammar:
- $$\begin{aligned} E &\rightarrow E+E \mid E^*E \mid (E) \mid I \\ I &\rightarrow L \mid ID \mid IL \\ D &\rightarrow 1 \\ L &\rightarrow a \mid b \end{aligned}$$
- (c) Represent the string "the man sleeps" according to its grammar. 2
7. (a) What is parse tree? What is the yield of the following parse tree? 1+1



- (b) What do you mean by Ambiguity in CFG? Write down the two ambiguous derivations for the 4 expression  $a+a^*a$  which is constructed from this grammar shown below:
- $$E \rightarrow E+E \mid E^*E \mid (E) \mid a$$
- (c) Remove the ambiguity from the following CFG: 4
- $$\begin{aligned} E &\rightarrow E+E \\ E &\rightarrow E^*E \\ E &\rightarrow (E) \\ E &\rightarrow b \end{aligned}$$
- Also draw its unique derivation.
8. (a) What is Regular Expression (RE)? Write down some applications of RE. 2
- (b) How can you build a Language L from RE through Basis and Induction rules? 3
- (c) Convert the following DFA to RE. 5



# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of computer Science & Engineering

2<sup>nd</sup> year 2<sup>nd</sup> Semester B.Sc. Engineering Final Examination-2016

Course Name: Linear Algebra

Course No.: MAT 256

Full Marks: 60

Times: 3 Hours

N.B.:

i. Answer SIX questions, taking any THREE from each section.

ii. All questions are of equal values.

iii. Use separate answer script for each section.

### SECTION-A

1. a. Prove that  $W$  is a subspace of vector space  $V(F)$  if and only if  $W$  is non empty and  $\forall \alpha, \beta \in F$  and  $\forall u, v \in W \Rightarrow \alpha u + \beta v \in W$ .  
b. Define vector space with example. Let  $W = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a + b + c + d = 0 \right\}$ . If  $V = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} : a, b, c, d \in R \right\}$ , then show that  $W$  is a subspace of  $V(R)$ .
2. a. Define linear combination of a vector in a vector space. Express the vector  $v = (1, 2, 6)$  as a linear combination of the vectors  $v_1 = (2, 1, 0)$ ,  $v_2 = (1, -1, 2)$ ,  $v_3 = (0, 3, -4)$ .  
b. For which values of  $\lambda$  the following set of vectors are linearly dependent:  
 $v_1 = \left( \lambda, -\frac{1}{2}, -\frac{1}{2} \right)$ ,  $v_2 = \left( -\frac{1}{2}, \lambda, -\frac{1}{2} \right)$ ,  $v_3 = \left( -\frac{1}{2}, -\frac{1}{2}, \lambda \right)$
3. a. Define basis of a vector space. Show that the set of vectors  $(1, 2, 3, 4), (2, 1, -1, 3), (3, 3, 2, 7), (1, -1, -1, -1)$  do not form basis of  $R^4$ .  
b. Find the basis and dimension of the sub space  $W$  generated by the polynomial  $\{t^3 - 2t^2 + 4t + 1, 2t^3 - 3t^2 + 9t - 1, t^3 + 6t - 5, 2t^3 - 5t^2 + 7t + 5\}$ .
4. a. Define linear transformation of a vector space. Show that the mapping  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$  defined by  $T(x, y, z) = (2x + y + z, 3x + y + 4z)$  is a linear transformation.  
b. Let  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^4$  be a linear transformation, where  $T(x, y, z) = (x + y + z, x + 2y - 3z, 2x + 3y - 2z, 3x + 4y - z)$ , then find the Basis and dimension of (i)  $\text{Im } T$  and (ii)  $\text{Ker } T$ .

### SECTION-B

5. a. Define eigen values and eigen vectors of a square matrix.  
b. Find the eigen values and corresponding eigen vectors of the following matrix:  
$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$$

Also find the matrix  $P$  that diagonalizes the matrix  $A$  and determine  $P^{-1}AP$ .

6. a. Define Dual Basis. Let  $B = \{(1, -1, 3), (0, 1, -1), (0, 3, -2)\}$  be a basis of the vector space  $\mathbb{R}^3$  over the real field  $\mathbb{R}$ . Find the dual basis of  $B$ .  
b. Let  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  be a linear operator define by  $T(x, y, z) = (2x - 3y + 4z, 5x - y - 2z, 4x + 7y)$ . Find the matrix of  $T$  in the basis  $\{f_1 = (1, 1, 1), f_2 = (1, 1, 0), f_3 = (1, 0, 0)\}$
7. a. What do you mean by bilinear form? Let  $x = (x_1, x_2)$  and  $y = (y_1, y_2)$  be in  $\mathbb{R}^2$ . Show that  $f(x_1, x_2) = 2x_1y_2 - 3x_2y_1$  is a bilinear form on  $\mathbb{R}^2$ .  
b. Prove that the quadratic form  $q(x_1, x_2, x_3) = x_1^2 + 2x_2^2 + 2x_3^2 - 2x_1x_2 - 2x_2x_3 + x_3x_1$  is positive definite.
8. a. Define inner product space. If  $\{v_1, v_2, \dots, v_n\}$  is an orthonormal basis for an inner product space  $V$  and  $u$  is any vector in  $V$ , then prove that  $u = \langle u, v_1 \rangle v_1 + \langle u, v_2 \rangle v_2 + \dots + \langle u, v_n \rangle v_n$ .  
b. Use the Gram-Schmidt orthogonalization process to transform the basis  $\{v_1, v_2, v_3\}$  of  $\mathbb{R}^3$  into an orthonormal basis, where  $v_1 = (3, 0, 4)$ ,  $v_2 = (-1, 0, 7)$ ,  $v_3 = (2, 9, 11)$  and also verify the result.