

Bangabandhu Sheikh Mujibur Rahman Science and Technology University  
 Department of Computer Science and Engineering  
 2<sup>nd</sup> Year 2<sup>nd</sup> Semester BSc Engineering Examination-2015

Course No: CSE150/CSE210 (Equivalent CSE252)

Course Title: Digital Logic Design

Full Marks: 70

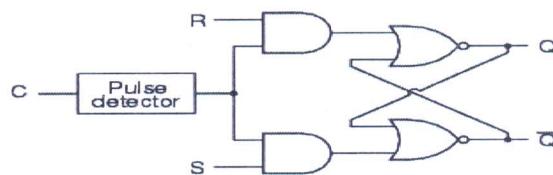
Times: 4 Hours

**N.B.**

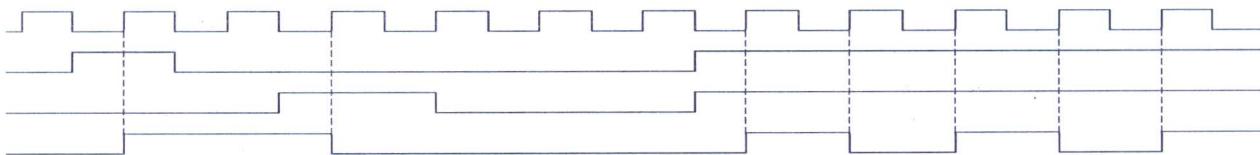
- i. Answer **SIX** questions, taking any **THREE** from each section.
- ii. All questions are equal values.
- iii. Use **separate answer script** for each section

### SECTION-A

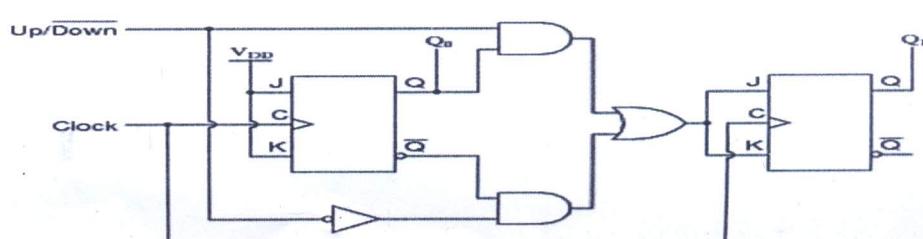
- |  |      |
|--|------|
| 1. a) Why Master-Slave J-K Flip-Flop are used. Explain with example.   | 3.67 |
| b) True or false. Explain your answer  | 4    |
| i. A J-K flip-flop can be used as an S-C flip flop, but an S-C flip flop cannot be used as a J-K flip flop.                                |      |
| ii. The CLK input will affect the FF output only when the active transition of the control input occurs.                                   |      |
| iii. The $\overline{SET}$ input can never be used to make $Q = 0$ .  |      |
| iv. A FF that has an $F_{MAX}$ rating of 25 MHz can be reliably triggered by any CLK pulse waveform with a frequency below 25 MHz.         |      |
| c) Describe NGT, PGT, HLT and LLT Clocked pulse with their symbol used in IC.  | 4    |
| 2. a) How serial data can be converted to parallel data using shift register.  | 4.67 |
| b) Explain 7-segment display.  | 3    |
| c) Determine the output frequency for a frequency division circuit that contains 12 flip-flops with an input clock frequency of 20.48 MHz. | 3    |
| 3. a) Is there any problem in this SR Flip-Flop? Explain.  | 4    |



- b) If first one is CLK second and Third are inputs, Forth is output which type of Flip-Flop this should be. 3



- c) Why asynchronous counter is not suitable for time critical operation. Explain your answer. 3.67
4. a) Write down working principle of NAND Latch with truth table. 4
- b) Explain this circuit.



## SECTION-B

5. a) A certain J-K flip-flop has  $t_{pd} = 12\text{ns}$ . What is the largest MOD counter that can be constructed from these FFs and still operate up to 10 MHz? ( $\text{pd} = \text{propagation delay}$ )
- b) Design synchronous counter of the following state diagram. 6
- 
- ```

graph TD
    S000((000)) --> S011((011))
    S011 --> S010((010))
    S010 --> S111((111))
    S111 --> S100((100))
    S100 --> S000
  
```
- c) Let you are in a shop there are five camera and one monitor you have to capture one photo in each second and have to sent it to monitor. Give a suitable digital circuit for this problem. 3
6. a) Draw the diagram for a MOD 16 down counter. If the counter is initially in the 0110 state, what state will it be in after 37 clock pulses? 3.67
- b) Suppose you are in a class room there are eight windows in this room. Your teacher gives you an assignment to open and close window one after another and so forth. How you efficiently design a digital circuit for this problem. 4
- c) How you convert Digital signal to analog signal. 3
7. a) Draw and explain Analog to digital conversion process. 4
- b) Which type of FF is best suited for synchronous transfer because it requires the fewest interconnections from one FF to the other? Explain your answer. 3
- c) If MSB of an 8 bit DAC give 6 volt. Calculate the voltage of "10101010". 3.67
8. a) Draw truth table of this circuit. 3
-

Course no: CSE262

Course Title: Numerical Analysis and Concrete Mathematics

Full Marks: 70

Times: 3 Hours

**N.B.**

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

**SECTION-A**

1. a) Find a real root of the equation  $f(x) = x^3 - x - 1 = 0$ , by using bisection method. 5  
 b) Find a real root of the equation  $x^3 + x^2 + x + 7 = 0$ , by using false-position method. 6.67
2. a) Find a real root, correct to three decimal places, of the equation  $2x - 3 = \cos x$  lying in the interval  $[\frac{3}{2}, \frac{\pi}{2}]$ , by using iteration method. 6.67  
 b)  $f(x) = x^3 - 2x + 2$  solve this using Newton-Rapson method. 5
3. a) Solve this using Gauss Elimination method. 5
- $$\begin{aligned} 2x + y - z &= 8 \\ -3x - y + 2z &= -11 \\ -3x + y + 2z &= -3 \end{aligned}$$
- b) Solve the following system by using Gauss-Seidel method 6.67
- $$\begin{aligned} 10x_1 - 2x_2 - x_3 - x_4 &= 3 \\ -2x_1 + 10x_2 - x_3 - x_4 &= 15 \\ -x_1 - x_2 + 10x_3 - 2x_4 &= 27 \\ -x_1 - x_2 - 2x_3 + 10x_4 &= -9 \end{aligned}$$
4. a) What do you mean by numerical method of solving any problem? 4  
 b) Describe different type of error occurred in numerical calculation. 3.67  
 c) Why numerical method can give result when analytical method can't. 4

**SECTION-B**

5. a) Establish the Trapezoidal rule. 5  
 b) Evaluate (i)  $\int_{-2}^2 \frac{x}{5+2x} dx$  and (ii)  $\int_1^3 \frac{1}{x} dx$ , using the trapezoidal rule with five ordinates. 6.67
6. a) Derive the Simpson's  $\frac{1}{3}$  formula. 5  
 b) Using Simpson's  $\frac{1}{3}$  rule with  $h=1$ , evaluate the integral  $I = \int_3^7 x^2 \log x dx$ . 6.67
7. a) Derive the second order Runge-Kutta formula. 6.67  
 b) If  $\frac{dy}{dx} = y - x$  where  $y(0) = 2$ , then find  $y(0.1)$  and  $y(0.2)$  correct to four decimal places. 5
8. a) Describe recurrence with proper example. 4  
 b) What do you mean by prime factor of a number? Calculate prime factor of 142. 4  
 c) Write down condition of divisibility of a number by 7 and 9. 3.67

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- b) Solve the following system by using Gauss-Seidel method 6.67
- $$\begin{array}{l} 10x_1 - 2x_2 - x_3 - x_4 = 3 \\ -2x_1 + 10x_2 - x_3 - x_4 = 15 \\ -x_1 - x_2 + 10x_3 - 2x_4 = 27 \\ -x_1 - x_2 - 2x_3 + 10x_4 = -9 \end{array}$$
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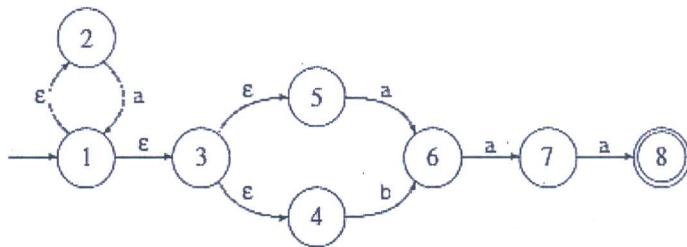
**Section A**

- |   |                                                                                                                                                                                  |      |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1 | a. Define finite automata (FA). How can an FA be represented?                                                                                                                    | 1+3  |
|   | b. Differentiate between non-deterministic and deterministic finite automata.                                                                                                    | 3    |
|   | c. How can FA be applied to a pattern finding software?                                                                                                                          | 2.67 |
|   | d. Design a NFA to accept the set of strings that either begin or end (or both) with 11.                                                                                         | 2    |
| 2 | a. What can be the possible states and inputs to an FA for the functions of an automatic door which opens automatically when a person approaches to its front side? Draw the FA. | 3    |
|   | b. What is a transition diagram?                                                                                                                                                 | 2    |
|   | c. Draw a transition diagram to accept the word “MUMMY”.                                                                                                                         | 5    |
|   | d. Design the regular expression for all strings containing at least two 1's.                                                                                                    | 1.67 |
| 3 | a. What are the two formal proof methods? Describe in short.                                                                                                                     | 2.67 |
|   | b. Use both formal proof methods to prove <b><i>if</i> <math>x \geq 4</math>, <i>then</i> <math>2^x \geq x^2</math></b> .                                                        | 6    |
|   | c. Define: Theorem, Lemma and Corollary.                                                                                                                                         | 3    |
| 4 | a. Write True or False for the following regular expressions                                                                                                                     | 5    |
|   | i. $r \epsilon = r$                                                                                                                                                              |      |
|   | ii. $r^+ = \epsilon r rr rrr\ldots\ldots$                                                                                                                                        |      |
|   | iii. $r(s t) = rs rt$                                                                                                                                                            |      |
|   | iv. $a b c\ldots z = A B C\ldots Z$                                                                                                                                              |      |
|   | v. $0 1 2 \ldots 9 = [0-9]$                                                                                                                                                      |      |
|   | b. Provide examples of prefix, suffix, substring, and subsequence for the string – “library”                                                                                     | 3.67 |
|   | c. For the regular expression $ab^* b^*c$ show the validity for each inputstring of the following<br>abc, abb, bcc, bcb, bbb, bbbc                                               | 3    |

**Section B**

- |   |                                                                          |      |
|---|--------------------------------------------------------------------------|------|
| 5 | a. What will be the regular expression for recognizing unsigned numbers? | 3    |
|   | b. Draw the transition diagram to recognize unsigned numbers.            | 3.67 |
|   | c. Convert the regular expression $ab^* b^*c$ to NFA. Show Each step.    | 5    |

- 6 a. Convert the NFA in the figure to DFA.



- 7 a. What are the benefits of a grammar? 2.67  
 b. What is Context Free Grammar and what are its components? 2  
 c. What is ambiguous grammar? Consider the grammar 7  
 $S = aS \mid aSbS \mid \epsilon$

This grammar is ambiguous. Show in particular that the string aaab has two:

- (i) Parse tree.
- (ii) Leftmost derivations.
- (iii) Rightmost derivations.

- 8 a. Consider the grammar on the right. 3+1.67  
 Show the steps of parsing (int) for the grammar.  
 What are the terminals here?
- b. What is a Turing Machine? What the types of Turing Machines? 2.5  
 c. Describe: Halting Problem, Decision Problem and Undecidable Problem 4.5

|                                               |
|-----------------------------------------------|
| $E \rightarrow T \mid T + E$                  |
| $T = \text{int} \mid \text{int} * T \mid (E)$ |

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2<sup>nd</sup> Year 2<sup>nd</sup> Semester B.Sc. Engineering Examination-2015

Course No.:LAW254

Course Name: Cyber and Intellectual Property Law

Full Marks: 70

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) Write down types of Cyber Law.                                                                                                                 | 3.67 |
| b) Why cyber law is needed.                                                                                                                          | 4    |
| c) Write down history of cyber law.                                                                                                                  | 4    |
| 2. a) Describe strength and limitation of ICT ACT 2006.                                                                                              | 4    |
| b) Why cyber law is essential for ICT professionals? Explain.                                                                                        | 3.67 |
| What are the strength of ICT Act 2006? Describe briefly.<br><i>what is hacking? How does ICT ACT 2006 deal with hacking.</i>                         | 4    |
| 3. a) Define intellectual property. Give a list of subject matters which are protected by intellectual property rights according to WIPO convention. | 4    |
| b) What do you mean by Secured Electronic record and Secured digital signature?                                                                      | 3.67 |
| c) Write down process of "Crime investigation, judgment and punishment" under ICT ACT 2006.                                                          | 4    |
| 4. a) Can a digital signature certificate issued by foreign certifying authority be valid in Bangladesh? Explain.                                    | 5    |
| b) Write down duties of a subscriber.                                                                                                                | 3    |
| c) Write about attribution, acknowledgement and dispute of Electronic record.                                                                        | 3.67 |

**SECTION-B**

- |                                                                                                                                                |      |
|------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 5. a) What is the importance of introducing intellectual property law? Why different countries have laws to protect intellectual property.     | 4    |
| b) Write about online payment system and its law.                                                                                              | 4    |
| c) Differentiate between copyrighting software and patenting software.                                                                         | 3.67 |
| 6. a) Who is controller of certifying authority? Write about his duties and responsibilities.                                                  | 5.67 |
| b) Write about cyber vandalism, hacking and spreading of viruses with their definition, section of ICT act 2006, types of penalty and example. | 6    |
| 7. a) What is a trademark? Why should trademarks need to be protected? What happens when trademark is illegally copied?                        | 6    |
| b) What do you mean by unsolicited email, email abuse and invasion of privacy?                                                                 | 5.67 |
| 8. a) What are the requirements of patentability? Define briefly.                                                                              | 3.67 |
| b) Why are patent necessary? How can a patent be obtained worldwide?                                                                           | 4    |
| c) What are major functions performed by the trademarks? What kinds of trademarks can be registered?                                           | 4    |

Course No: MAT256

Course Title: Linear Algebra

Full Marks: 70

Times: 4 Hours

**N.B.**

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

**Section A**

1. (a) Define system of linear equations. Solve the following system of linear equation's by the Gauss-Jordan elimination method.

$$x + y + 2z = 9$$

5

$$2x + 4y - 3z = 1$$

$$3x + 6y - 5z = 0$$

- (b) Determine the values of  $\lambda$  and  $\mu$  such that the following system of linear equation's has (i) no solution (ii) more than one solution (iii) a unique solution.

$$x + y + z = 6$$

6.67

$$x + 2y + 3z = 10$$

$$x + 2y + \lambda z = \mu$$

2. (a) What do you mean by subspace of a vector space? Prove that  $W$  is a subspace of a vector space  $V(F)$  if and only if  $0 \in W$  or  $W \neq \emptyset$  and for all  $\alpha, \beta \in F$  and for all  $u, v \in W \Rightarrow \alpha u + \beta v \in W$ .

5

- (b) Let  $V(R)$  be a vector space of  $n \times n$  matrices and let  $S$  and  $T$  are two subspaces of  $V(R)$  such that  $S = \{A: A' = A\}$  and  $T = \{A: A' = -A\}$ . Then prove that  $V(R) = S \oplus T$

6.67

3. (a) Define Group and Ring with example.

3

- (b) Define Sum and Direct Sum of two subspaces.

2

- (c) Let  $V_1$  and  $V_2$  be two subspaces of  $V$  then prove that

6.67

$$V = V_1 \oplus V_2 \text{ iff } V = V_1 + V_2 \text{ and } V_1 \cap V_2 = \{0\}.$$

4. (a) Define linearly independence and dependence.

2

- (a) Show that the vector  $v = (3, 9, -4, -2)$  is a linear combination of the vectors

4

$$v_1 = (1, -2, 0, 3), v_2 = (2, 3, -1, 0) \text{ and } v_3 = (2, -1, 2, 1).$$

- (b) Show that the vectors  $(1, 1, -1), (1, 0, 2)$  and  $(1, 1, 1)$  in  $R^3$  are linearly independent.

5.67

**Section B**

5. (a) Define linear transformation. Show that the mapping

3.67

$$T: R^3 \rightarrow R^3 \text{ defined by } T(x, y, z) = (x, y, 0)$$

is a linear transformation.

- (b) Define Kernel and image of linear transformation.

4

- (c) Let  $T: R^3 \rightarrow R^3$  be a linear transformation defined as follows:

4

$$(i) T(x, y, z) = (x - y, y - x, x - z), \text{ Then find } \text{Ker } T \text{ and } \text{Im } T.$$

6. (a) Define Singular and Non-singular linear transformation. 2
- (b) Let  $T:V \rightarrow V$  be a linear operator and  $\{e_1, e_2, \dots, e_n\}$  be a basis of  $V$ , then show that  $[T]_e[v]_e = [T(v)]_e, \forall v \in V$ . 5.67
- (c) Find the standard matrix for the linear transformation  $T: R^3 \rightarrow R^3$  defined by  $T(x, y, z) = (x - 2y, 2x + y)$ . 4
7. (a) Define inner product space. 2
- (b) Show that the following function defines an inner product on  $R^2$ , where  $u = (u_1, u_2)$  and  $v = (v_1, v_2)$ .  
 $\langle u, v \rangle = u_1 v_1 + 2v_2 u_2$  4
- (c) State and prove Cauchy-Schwartz inequality. 5.67
8. (a) What do you mean by matrix polynomial? State and prove Cayley-Hamilton theorem. 5.67
- (b) Find the Eigen values and associated Eigen vectors if the matrix  $A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$  in 6  
the field  $R$ . Also find an invertible matrix  $P$  such that  $P^{-1}AP$  is diagonal.

Course No. : CSE 250

Full Marks: 70

Course Name: Design and Analysis of Algorithms

Times: 4 Hours

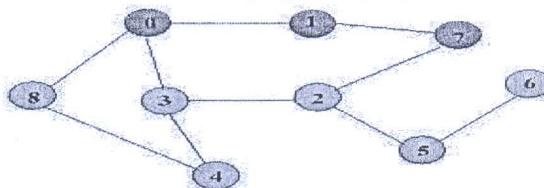
**N.B.:**

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- ii. All questions are of equal values
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**Section-A**

1. (a) For each of the following statements, say whether it is True or False. If it is True, give a brief explanation; if it is False, give a simple counter example. 6
- (i) In a depth first search of a directed graph, if there are no back edges, then there are no cycles.
  - (ii) Adding one edge to a DAG always creates cycle.
  - (iii) If we add a directed edge to a directed graph with S strongly connected components, the number of strongly connected components in the new graph can equal any number between 1 & S but cannot exceed S.
  - (iv) Suppose all edge weights are different. Then the shortest path from A to B is unique.
- (b) For a graph, the total number of in-degree plus the total number of out-degree is even. 2  
Why?
- (c) What is in-degree and out-degree of a vertex? Give an algorithm to calculate the out-degree of all vertices of a graph where the graph is given as adjacency matrix. 3.67  
Determine the time complexity of your program.
2. a) Answer True or False with proper justification 3
- (i) Bellman-Ford shortest path algorithm is an example of greedy algorithm.
  - (ii) Consider a graph  $G = (V, E)$ , with negative weight edges. We can solve all pairs shortest paths (with negative cycle detection) on  $G$  in  $O(|V|^3)$  time.
  - (b) Why topological sort needed? Give practical example of topological sort. 2
  - (c) What is bridge? How can it be detected? 2
  - (d) Proof that if a graph,  $G$  is undirected, a DFS produces only tree and back edges. 3
  - (e) Can tree edges form cycles? Why or why not? 1.67
3. (a) Consider the following matrix which corresponds to the initialized distance matrix of the all-pairs-shortest path algorithm: 5
- $$\begin{pmatrix} 0 & 2 & 4 & 3 \\ 3 & 0 & \infty & 3 \\ 5 & \infty & 0 & 3 \\ \infty & 1 & 4 & 0 \end{pmatrix}$$
- Draw the corresponding graph and execute one iteration of Floyd-Warshall algorithm.
- (b) What is the property of bipartite graph? How can we detect it? 3
- (c) What do you mean by Complexity of an algorithm? Describe  $\Theta(n), O(n), \Omega(n)$  and  $\omega(n)$  with proper example? 3.67
4. (a) Write and describe Primes algorithm with example. 5
- (b) Express the function  $n^3 - 100n^2 - 100n + 3$  in terms of  $\theta$ -notation. 2.67
- (c) Define the following terms 4
- (i) Monotonically increasing and decreasing
  - (ii) Strictly increasing and decreasing
  - (iii) Polylogarithmically bounded
  - (iv) Articulation Point

5. (a) What is Huffman Coding? Give a Huffman code for this string. Write down both the tree and the actual binary encoding for the first 5 characters of the string.  
**AACABAABAAAABAACACAACBAACBAACA**
- (b) Describe DFS and BFS traversal of the graph step by step starting from 4.

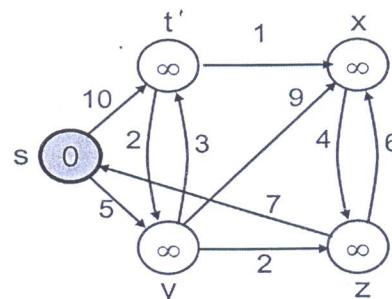


- (c) What will be the running time for undirected graph to detect cycle? 1.67
6. (a) Describe how matrix chain multiplication can be solved by dynamic programming? 4  
(b) Describe Dijkstra's algorithm for the figure 5(b) where start node 2. 3  
(c) Suppose you are given an array of n numbers and it is required to calculate their sum. 4.67  
Write a divide and conquer algorithm to solve this problem. Analyze the time complexity of your algorithm.

7. (a) Suppose you are given the denominations of coins (say,  $C_1 < C_2 < \dots < C_k$ , all  $C_i$ 's are integers and an integer X, and you want to find the smallest set of coins of the denominations that sum up to X. For example, if  $k=6$ ,  $C_1 = 1$ ,  $C_2 = 5$ ,  $C_3 = 10$ ,  $C_4 = 25$  and  $C_5 = 100$ ,  $C_6 = 200$ . The best way to split value  $X = 367$  would be with 8 coins as: 5  
 $367 = 200+100+25+25+10+5+1+1$

Design a dynamic programming algorithm that for a given coin system and a value of X, finds the minimum number of coins that sum to X.

- (b) Describe an algorithm for the following graph. Is your algorithm able to handle negative cycle? If not, how can you handle negative cycle? 5



- (c) Write a sudo code for printing the shortest path for dijkstra's algorithm 1.67
8. (a) When a greedy method is used to solve a problem? What are the elements of greedy strategy? 3.67  
(b) Here are a set of start and finish times 4

| $i$   | 1 | 2 | 3 | 4 | 5 | 6 | 7  | 8  | 9  | 10 | 11 |
|-------|---|---|---|---|---|---|----|----|----|----|----|
| $s_i$ | 1 | 3 | 0 | 5 | 3 | 5 | 6  | 8  | 8  | 2  | 12 |
| $f_i$ | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

What is the maximum number of activities that can be completed? Explain.

- (c) What is Network Flow? Calculate maximum network flow for the following graph. 4

