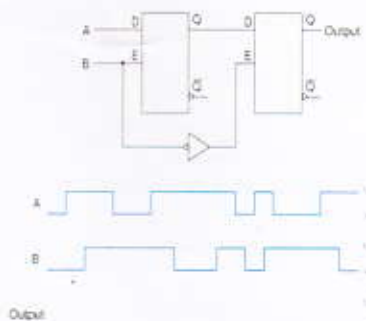


Begum Rokeya University, Rangpur  
Department of Computer Science and Engineering  
2<sup>nd</sup> Year 1<sup>st</sup> Semester Final Examination-2018  
Course Code: CSE 2101 Course Title: Digital Logic Design

**N.B**

- a) Answer any **five** questions.  
b) 1 to 7 all questions have **equal marks**.  
c) All parts of each question must be answered **consecutively**.

1. a) A private jet employs a system for monitoring the rpm, pressure, and temperature values of its engines using sensors that operate as follows:  
S sensor output=1 only when speed>4800rpm  
P sensor output=1 only when pressure>220 psi  
T sensor output=1 only when temperature>220 F  
As a system engineer now you design a ctrl circuit that presents a cockpit warning light for  $(T=1 \text{ AND } (P=1 \text{ OR } S=0))$ . At first you design the circuit using primary gets, and then change this circuit to one using all NAND gates. 5
- b) Convert the -19.365 AND 16.342 decimal numbers to their 2's complement representations. 2
- c) Explain the significance of DeMorgan's theorem in digital systems. 3
2. a) Explain SOP and POS expression using suitable examples. 3
- b) A university needs to have a alert sound to signal quitting time. The horn should be activated when either of following condition is meet-  
a) After 11PM and the day is not any special day.  
b) Country issues Hurricane signal no 8-10.  
c) After 9 PM when day is weekend.  
As a project work now you design a simple logic circuit that will control the horn. 4
- c) Implement the circuit of problem 2(b) using all NAND gates. 3
3. a) Determine the final output states over time for the following circuit, built from D-type gated latches: 2

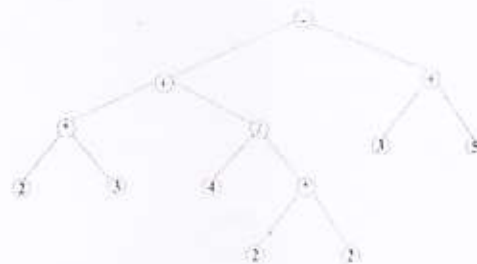


- b) What is meant by the term edge-triggered? 1
- c) Define the setup time and hold time requirements of a clocked flipflop. 2
- d) Explain the internal circuitry of the edge-triggered S-R flip-flop and J-K flip flop. 5

- |    |      |  |   |
|----|------|--|---|
| 4. | a)   | Explain Octets with a suitable simplification example  | 2 |
|    | b)   | Use a K-Map to simplify $y = C(ABD + D) + ABC + D$ .   | 3 |
|    | c)   | Describe and design a parity generator and checker.  | 2 |
|    | d)   | Using an example you show that the Latch remembers the last input that was activated, and it will not change states until the opposite input is activated.   | 3 |
| 5. | a)   | What is race-around condition? How does it set eliminate is a Master-Slave J-K flip-flops.   | 5 |
|    | b)   | Show how to wire a 74LS293 as a MOD-10 counter.  | 3 |
|    | c)   | How many logic devices are required for a MOD-64 parallel counter?   | 2 |
| 6. | a)   | Design MOD-60 counter using JK flip-flops. Explain how this circuit works.   | 4 |
|    | b)   | Describe a cascading BCD adder to add two three-digit decimal numbers.   | 4 |
|    | c)   | What is the difference between the counting sequence of an up counter and down counter?  | 2 |
| 7. | a)   | A 4-bit binary number is represented as $A_3A_2A_1A_0$ , where $A_3, A_2, A_1$ , and $A_0$ represent the individual bits and $A_0$ is equal to LSB. Design a logic circuit that will produce a HIGH output whenever the binary number is greater than 0010 and less than 1000. | 4 |
|    | b)   | Define the following terms:  | 6 |
|    | i)   | Enable circuit   |   |
|    | ii)  | Don't care condition   |   |
|    | iii) | Ripple counter   |   |

[Answer any five questions of the following. Each question carries a total of 10 marks]

1. (a) What are the linear and non-linear data structures? Name a data structure that is appropriate for implementing the *priority queue* ADT. (3)
- (b) Briefly explain max-heap and min-heap. (3)
- (c) Write a C/C++ procedure that counts the leaves of a binary tree. [You can write pseudo-code] (4)
2. (a) Give the prefix, infix and postfix expressions corresponding to the tree in the figure below. What is the value of expression represented by this tree? (4)



- (b) How is an array different from a linked list? (1)
- (c) Define *complexity* of an algorithm. Given a collection of algorithms that runs on  $O(1)$ ,  $O(n \log n)$ ,  $O(n)$ ,  $O(n^2)$ ,  $O(\log n)$ ,  $O(n!)$ , order the algorithms from slowest to fastest. (2)
- (d) For each of the following Algorithms, find the complexity of the algorithm using big O notation. You must justify your answer with 1-2 lines of explanation. (3)
  - (i) 

```
for( i = 1; i < n; i *= 2)
    for(j = 1; j < n; j++)
        { some statements; }
```
  - (ii) An algorithm that determines all possible paths between  $n$  cities.
3. (a) Explain the path compression technique in the disjoint-set data structure. (3)
- (b) Suppose you are given two polynomials. Represent the polynomials in a suitable data structure and write a C/C++ procedure to add two polynomials. (3)
- (c) What is the definition of the *prefix function* that is used by the KMP string-matching algorithm? Show the KMP *prefix function* for pattern **aabaabcaab**. (4)
4. (a) Determine if the following array represent a *binary heap*. Illustrate your answer. (2)

	0	1	2	3	4	5	6	7	8	9	10	11
B =	1	8	27	10	45	83	91	31	12	52	51	



- (b) Recall that in a binary tree, a node may have 0, 1, or 2 children. In the following questions about binary trees, the height of a tree is the length (number of edges) of the longest path. A tree consisting of just one node has height 0. (4)
- (i) What is the maximum number of nodes in a binary tree of height  $d$ ?
  - (ii) What is the minimum number of nodes in a binary tree of height  $d$ ?
  - (iii) What is the maximum height of a binary tree containing  $n$  nodes?
  - (iv) What is the minimum height of a binary tree containing  $n$  nodes?
- (c) Construct a *binary search tree* whose post-order traversal is as follows: (4)
- {1, 7, 5, 50, 40, 10}. Illustrate your process as you construct. (2)

5. (a) Define *spanning tree* and *minimum spanning tree*. (3)

(b) Consider the following tree:



How many ways we can traverse the tree? Write the traversal paths.

- (c) For each of the following applications, indicate which data structure would be most suitable and give a brief justification for your choice. (5)
- (i) Chess board – an  $8 \times 8$  board used for a game of chess. Each square on the board is either empty or contains a chess piece.
  - (ii) Given a set of numbers. You have to add them all. For each addition operation the cost will be summation of two numbers. Minimize the total cost.
  - (iii) Given a set of English words and their meaning in a Bangla language. Now for each word of the English language what will be its meaning in Bangla.
6. (a) What is hashing? Give the characteristics of a hash function? (3)
- (b) Consider the following problem: (5)
- You are given an array of  $N$  integers,  $\text{arr}[0], \text{arr}[1], \dots, \text{arr}[(N-1)]$ . And you are given a list of ranges. For each range,  $(l, r)$  you have to find the minimum value between range  $\text{arr}[l], \text{arr}[l+1], \text{arr}[l+2], \dots, \text{arr}[r]$ . The length of array and number of queries could be at most  $10^5$ . Write pseudo-code for your algorithm.
- (c) Write a recursive procedure to compute  $n^{\text{th}}$  Fibonacci number. (2)
7. (a) Why a QUEUE needs to maintain two pointers in its operation. Represent how a queue insert an element in it. (3)
- (b) What is Priority Queue(PQ)? Describe at least one example where we can use PQ. (4)
- (c) Write a recursive algorithm that can calculate factorial of an integer  $n$ . (3)

**Department of Computer Science & Engineering**

**Begum Rokeya University, Rangpur**

**2<sup>nd</sup> Year 1<sup>st</sup> Semester(Session 2016-17) Final Examination – 2018**

**Course Code: SOC 2123**

**Course Title: Bangladesh Studies and Sociology**

**Total Marks: 50**

**Exam Duration: 3 Hours**

**N.B**

- a) Answer any **five** questions.
- b) All questions have **equal** marks.
- c) All parts of each question must be answered **consecutively**.

- |   |  |    |
|---|--|----|
| 1 | Write an essay on the historical background of Bangladesh.   | 10 |
| 2 | Write an account on the political condition of Bangladesh.   | 10 |
| 3 | What are the socioeconomic impacts of globalization on human life? Briefly discuss it in context of Bangladesh.  | 10 |
| 4 | What do you understand by educational development? Discuss.  | 10 |
| 5 | Write an essay on the empowerment of women in Bangladesh.  | 10 |
| 6 | What do you mean by patron-client relationship? Do you think this relationship is becoming intricate in terms of national politics of Bangladesh? Discuss. | 10 |
| 7 | Write an essay on the Digital Version of Bangladesh.   | 10 |

**Begum Rokeya University, Rangpur**  
**Department of Computer Science and Engineering**  
2<sup>nd</sup> Year 1<sup>st</sup> Semester B.Sc. (Engg.) Final Examination-2018  
Session: 2016-2017  
Course Code: CHM 2124  
Course Title: Chemistry

Time: 03 Hours

Marks: 50

(Answer any **five** of the following. All questions must be answered sequentially. Marks are indicated at right margin)

1.
  - a) Write the postulates of Bohr theory of hydrogen atom. 4
  - b) Mention the important observations of  $\alpha$  - particle scattering experiment. What conclusions could be derived from those observations? 4
  - c) State Aufbau Principle. 2
2.
  - a) State and explain Le Chatelier principle. 4
  - b) What is equilibrium constant? Describe the factors that influence the equilibrium constant of a factor. 4
  - c) Distinguish between order and molecularity of a reaction. 2
3.
  - a) What is coordination bond? Explain that coordination bond is a special type of covalent bond. 4
  - b) State and explain valence bond theory. 4
  - c) Write down the general characteristics of transition element. 2
4.
  - a) What is electron affinity? Write down the increasing order of electron affinity of halogens and explain the order. 4
  - b) What do you mean by hybridization? Explain that the bond angle of  $NH_3$  is shorter than that of  $CH_4$ . 4
  - c) What is hydrogen bond? How is it formed? 2
5.
  - a) Explain Langmuir adsorption isotherms. 4
  - b) Discuss the stability of colloids. 4
  - c) What are the differences between emulsion and gel? 2
6.
  - a) State and explain Debye-Huckel limiting law for electrolytic solution. 4
  - b) What is electrochemical cell? Distinguish between electrochemical and electrolytic cell. 4
  - c) What are reference electrodes? 2
7.
  - a) Distinguish between physical adsorption and chemisorption. 3
  - b) What is electrolyte and equivalent conductance. 3
  - c) What are 'Faraday's laws' of electrolysis? Discuss their importance. 4



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 2<sup>nd</sup> Year 1<sup>st</sup> Semester B.Sc. (Engg.) Final Examination-2018  
 Session: 2016-2017  
 Course Code: STA 2125  
 Course Title: Statistics

Time: 03 Hours

Marks: 50

(Answer any **five** of the following. All questions must be answered sequentially. Marks are indicated at right margin)

1. a) Describe the different measures of central tendency and mention their necessity in real life data. 4
- b) Prove that algebraic sum of deviations of a set of values from their mean is always zero, i.e  $\sum_{i=1}^n (x_i - \bar{x}) = 0$  3
- c) Calculate the missing frequency from the following data you are given that mean is 50. 3

Marks	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
No. of Students	5	?	30	12	8

2. a) What is dispersion? Discuss the various measures of dispersion with appropriate examples. 4
- b) The following table gives the distribution of weekly wages of 600 workers in a factory: 6

Weekly Wages (in BDT)	No. of Workers	Weekly Wages (in BDT)	No. of Workers
375- 450	200	600-675	80
450-525	205	675-750	30
525-600	65	750-825	20

Find mean and variance of the above data.

3. a) What is statistics? Define the following term with example: Sample, Population, Statistic, Qualitative variable. 5
- b) From the following data of travelling allowance of sales men. Calculate mean of the data 5

Travelling allowance in BDT (per day)	No. of Salesmen	Travelling allowance in BDT (per day)	No. of Salesmen
110-115	4	135-140	90
115-120	10	140-145	52
120-125	26	145-150	33
125-130	49	150-155	17
130-135	72	155-160	7

4. a) What is skewness and kurtosis? Define the shape characteristics of a distribution using the measures of skewness and kurtosis. 4
- b) Find the variance of the series  $a, a + d, a + 2d, \dots, a + 2^{nd}$ . 3
- c) Find two numbers whose arithmetic mean is 6 and variance is 16. 3

P.T.O.

5. a) What is probability? Assume that on an average two telephone number out of sixteen is busy. 5  
What is the probability if eight randomly selected telephone numbers are called
  - i) Not more than 3 will be busy?
  - ii) At least 3 will be busy?
- b) In a ceramic company 400 plates are defected on an average. If the plates are packed in 5  
boxes of 100. What is the probability that any given box of items will contain:
  - i) No defective
  - ii) Less than 3 defective
  - iii) More than three defective
6. a) State and prove Bayes theorem. 6
- b) The record of city zoo show that 40% of animals in the zoo are foreign born and that only 4  
55% of these survive the first 6 months. On the other hand, of the 60% locally born animals, 70% survive the first 6 months. Suppose that a newborn animal is randomly selected.
  - i) What is the probability that it is foreign born and will not survive the first 6 months?
  - ii) What is the probability that it will survive the first 6 months?
7. a) Define normal distribution. Mention some properties of normal distribution. Also mention 5  
the necessity of normal distribution in real life examples.
- b) The time required by a bank cashier to deal with customer has been observed to be normally 5  
distributed with mean 24 seconds and a standard deviation of 10 seconds. Find the probability that a customer arriving at random will have to wait:
  - i) Between 20 to 28 seconds
  - ii) Less than 20 seconds
  - iii) More than 30 seconds



**Begum Rokeya University, Rangpur**  
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 2<sup>nd</sup> Year 1<sup>st</sup> Semester B.Sc. (Engg.) Final Examination-2018  
 Session: 2016-2017  
 Course Code: MAT 2127  
 Course Title: Matrix and Differential Equation

Time: 03 Hours

Marks: 50

(Answer any **five** of the following. All questions must be answered sequentially. Marks are indicated at right margin)

1. a) Define rank of a matrix. Find the rank of the matrix  $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 8 \\ 4 & 10 & 18 \end{pmatrix}$ . 5  
 b) If A and B are two  $n \times n$  matrices then  $\text{adj}(AB) = (\text{adj } B)(\text{adj } A)$  5
2. a) Define inverse of a matrix. Find the inverse  $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$ . 5  
 b) Find the non-singular matrices I and Q such that PAQ is the normal or diagonal form where  $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$  5
3. a) Prove that the rank of the product of two matrices cannot exceed the rank of either matrix. 5  
 b) Investigate for what values of k, the system of equations 5  
 $kx + y + z = 1$   
 $x + ky + z = 1$   
 $x + y + kz = 1$   
 Will have (i) no solution (ii) a unique solution and (iii) infinitely many solutions
4. a) State and prove Cayley- Hamilton theorem. 5  
 b) Find the Eigen value and Eigen vectors for the matrix  $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$  5
5. a) Define linear and non-linear differential equation and what is solution and its classification. 5  
 b) Show that every function f defined by  $f(x) = (x^3 + c)e^{-3x}$ . Where c is an arbitrary constant 5  
 is a solution of the differential equation  $\frac{dy}{dx} + 3y = 3x^2e^{-3x}$
6. a) Define a first order linear differential equation. Show that the transformation  $v = y^{1-n}$  5  
 reduces the Bernoulli equation  $\frac{dy}{dx} + p(x)y = Q(x)y^n$  to a linear equation in v.  
 b) Solve:  $(2xy^4e^y + 2xy^3 + y)dx = (x^2y^4e^y - x^2y^2 - 3x)dy = 0$  5
7. a) Find the orthogonal trajectories of the family of parabolas  $y = cx^2$ . 5  
 b) Find the family of oblique trajectories that intersect the family of straight lines  $y = cx$  at angle  $45^\circ$ . 5