

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science and Engineering

2nd Year 1st Semester Final B.Sc. Engineering Examination-2021

Course Code: CSE203

Total Marks: 60

Course Title: Digital Logic Design

Time: 3 (Three) Hours

N.B.:

- i. Answer SIX questions taking any THREE from each section.
- ii. All parts of a question must be answered sequentially.

Section-A

1. a) What is Karnaugh map? Give an example of two and three variables map. 2
b) Simplify the Boolean function: $F = x'yz + x'yz' + xy'z' + xy'z$. 3
c) Simplify the following Boolean function in (a) sum of products and (b) product of sums. $F(A, B, C, D) = \sum(0, 1, 2, 5, 8, 9, 10)$ with proper gate implementation. 5
2. a) What is Universal gate? Implement NOT, AND and OR gates by NAND gate. 3
b) What is propagation delay? Explain propagation delay with figure. 3
c) Simplify the Boolean function: $F(w, x, y, z) = \sum(1, 3, 7, 11, 15)$ and the don't care conditions: $d(w, x, y, z) = \sum(0, 2, 5)$. 4
3. a) Explain design procedure for combinational circuit and difference between combinational circuit and sequential circuit. 5
b) What is code conversion? Design a BCD-to-8421 code converter. 5
4. a) Design a combinational circuit using a ROM. The circuit accepts a 3-bit number and generates an output binary number equal to the square of the input number. 5
b) A combinational circuit is defined by the functions $F_1(A, B, C) = \sum(3, 5, 6, 7)$ and $F_2(A, B, C) = \sum(0, 2, 4, 7)$. Implement the circuit with a PLA having three inputs, four product terms and two outputs. 5

Section-B

5. a) Design a D flip-flop from clocked S-R flip-flop. Write the uses of D flip-flop. 4
b) Using 10's complement, subtract 73542 – 3421. 4
c) What is a clock in a digital system? Give example. 2
6. a) Explain sequential circuit with corresponding block diagram. 3
b) Simplify the following Boolean function by first finding the essential prime implicants: $F(A, B, C, D) = \sum(0, 2, 3, 5, 7, 8, 10, 11, 14, 15)$. 7
7. a) Implement a full adder circuit with a decoder and two OR gates where the combinational circuit in sum of minterms are: $S(x, y, z) = \sum(1, 2, 5, 7)$ and $C(x, y, z) = \sum(3, 4, 6, 7)$. 5
b) Implement the following function with a multiplexer:
$$F(A, B, C, D) = \sum(0, 2, 5, 7, 8, 9, 14) \quad 5$$
8. a) What is Decoder? Explain a 3-to-8 line decoder. 4
b) Design a logic circuit of 4-bit magnitude comparator. 4
c) Draw the odd-parity generation table and its figure. 2

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2nd Year 1st Semester Final B.Sc. Engineering Examination-2021

Course Code: STA205

Total Marks: 60

N.B.:

- i. Answer **SIX** questions taking any **THREE** from each section.
- ii. All parts of a question must be answered sequentially.

Section-A

1. a) What is Statistics? Write down its uses in computer science and limitations. 4
b) Define Variable. What are the different types of variables known to you? Give examples of each type. 4
c) What are the different sources of primary data and secondary data? 2
2. a) What are the different Measures of Central Tendency? Write down the uses of Arithmetic, Geometric and Harmonic mean. 3
b) What are the advantages and disadvantages of median and mode? 3
c) Consider the following data: 4

Class Int.	100-125	125-150	150-175	175-200	200-225	225-250	250-275
Freq.	3	2	4	5	3	2	2

3. i. Calculate AM, GM, HM and show that $AM > GM > HM$.
ii. Find Median and Mode of the data set.
a) What do you understand by measure of dispersion with example? What are the various methods of measuring dispersion? Write down the important properties of variance. 5
b) The following data give the numbers of pieces of junk mail received by 20 families during the past month. 5
20 22 40 35 23 32 38 25 29 23 41 33 28 21 29 19 14 31 39 36
Find the range, variance, standard deviation and co-efficient of variation.
4. a) What is Probability? Explain the classical and empirical approaches of defining probability. 2
b) Explain the terms with example – a) Sample space, b) Mutually exclusive events, c) Equally Likely events, d) Conditional Probability 4
c) Write down the additive and multiplicative law of probability. In a class of 120 students, 60 are studying English, 50 are studying French and 20 are studying both subjects. If a student is randomly selected from the class, what is the probability that he is studying English if it is given that he is studying French? 4

Section-B

5. a) What do you mean by Probability distribution? Define Binomial distribution. In a course, the probability of getting A grade is 0.20. Five students sit for the exam. Now find the probability that (i) Two of them will get A grade, (ii) None will get A grade and (iii) At least two of them will get A grade. 5

- b) Define Poisson distribution. Give some examples where Poisson distribution can be applied. If 2% fuses produced by a company are usually found defective then what is the probability that in a box of 200 fuses there will be (i) No defective fuse, (ii) 1 defective fuse and (iii) 2 defective fuses? 5
6. a) What is correlation analysis? Define regression analysis with examples. Distinguish between correlation analysis and regression analysis. 4
- b) The following table gives information on the number of megapixels and the prices of nine randomly selected point-and-shoot digital cameras that were available on BestBuy.com on July 22, 2009. 6
- | Megapixels | 10.3 | 10.2 | 7.0 | 9.1 | 10.0 | 12.1 | 8.0 | 5.0 | 14.7 |
|------------|---|------|-----|-----|------|------|-----|-----|------|
| Price(\$) | 130 | 150 | 62 | 160 | 200 | 280 | 125 | 60 | 400 |
| i. | Find the correlation coefficient and interpret the result. | | | | | | | | |
| ii. | Find the regression equation $\hat{y} = a + bx$ where x is the number of megapixels and y is the price. | | | | | | | | |
7. a) Define the Skewness and Kurtosis of a graph. Explain the terms – Positively skewed and Negatively skewed curve. 4
- b) What are the different types of Kurtosis and how to detect them? Provide related graphs. 3
- c) The first four central moments of a distribution are 0, 4, 0 and 37.6. Find the co-efficient of skewness and kurtosis and comment on the shape characteristics of the distribution. 3
8. a) Define stochastic process. Specify different types of stochastic process with some real life examples. Identify the type of stochastic process for the following systems with justification. 5
- i. Number of students waiting for the bus per hour of a day.
 - ii. Waiting time of customers.
 - iii. Number of calls at a phone set at any time during the day.
- b) What do you mean by queuing process? Write down the different elements of queuing model. Explain the different characteristics of M/M/1 queuing model with infinite capacity. 5

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Course Code: MAT205

Total Marks: 60

N.B.:

Course Title: Vector, Matrix and Fourier Analysis
Time: 3 (Three) Hours

- i. Answer SIX questions taking any THREE from each section.
- ii. All parts of a question must be answered sequentially.

Section-A

1. a) Define unit vector. Determine a unit vector perpendicular to the plane of $A = 2i - 6j - 3k$ and $B = 4i + 3j - k$. 5
 b) A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction $i - 3j + 2k$. 5
2. a) Interpret gradient, divergence and curl physically. 3
 b) Prove that $\nabla \times (\nabla \times \vec{A}) = -\nabla^2 \vec{A} + \nabla(\nabla \cdot \vec{A})$. 3
 c) Find the directional derivation of $\varphi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction $2\hat{i} - 3\hat{j} + 6\hat{k}$. 4
3. a) Define line integrals, surface integrals and volume integrals. If $F = 3xyi - y^2 j$, evaluate $\int_C F \cdot dr$ where C is the curve in the xy plane, $y = 2x^2$, from $(0, 0)$ to $(1, 2)$. 6
 b) Let $F = 2xzi - xj + y^2 k$. Evaluate $\iiint_V F dV$ where V is the region bounded by the surfaces $x = 0$, $y = 0$, $y = 6$, $z = x^2$, $z = 4$. 4
4. a) State and prove Green's theorem in the plane. 6
 b) Using divergence theorem, evaluate $\iint_S F \cdot n dS$, where $F = 4xzi - y^2 j + yzk$ and S is the surface of the cube bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$, $z = 1$. 4

Section-B

5. a) Define symmetric matrix, idempotent matrix and normal matrix with example. Show that the matrix $A = \begin{pmatrix} 1 & i \\ -i & -1 \end{pmatrix}$ is unitary. 6
 b) Show that, every square matrix can be uniquely expressed as the sum of a symmetric matrix and a skew-symmetric matrix. 4
6. a) Find the inverse of the matrix 4

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 3 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$
 using row operation.
 b) Define Rank of a matrix. Determine the rank of the matrix A by reducing it to the normal form 6
 Where $A = \begin{pmatrix} 2 & -1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 3 & 11 & 6 \end{pmatrix}$.

5

7. a) Define half range Fourier sine and cosine series.
 Find the Fourier series of the periodic function x^2 with period $2l$ on the interval $[-l, l]$.

5

b) Prove that $\int_0^\infty \frac{x \sin mx}{x^2 + 1} dx = \frac{\pi}{2} e^{-m}$, $m > 0$.

4

8. a) Find the Fourier transform of $f(x) = e^{-|x|}$ where x belongs to $(-\infty, \infty)$.
 b) Use finite Fourier transforms to solve

6

$$\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}; \quad U(0, t) = 0; U(\pi, t) = 0; U(x, 0) = 2x \text{ where } 0 < x < \pi, t > 0.$$

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Course Code: CSE205

Total Marks: 60

N.B.:

- i. Answer SIX questions taking any THREE from each section.
- ii. All parts of a question must be answered sequentially.

Course Title: Java Technology
Time: 3 (Three) Hours

1. a) What do you mean by container and component in java? Give some example of container and component class in java. 3
- b) Explain class and objects in java. 3
- c) What happens if the static modifier is not included in the main method signature in Java? 4
What is the component used for compiling, debugging and executing java programs?
2. a) Write 2 (two) different ways to convert an int value to a String. Write a Java program that takes N integers from command line and prints the maximum and the minimum of them. 4
- b) Write short notes on the following with example:
 - 1) super and static keyword
 - 2) class and object 3
- c) Differentiate between the following two statements:
i) int []c, x ii) int c[], x 3

Write Java code to create the following array in Java.

0			
1	2		
3	4	5	
6	7	8	9

3. a) What is garbage collector? Explain it's working with examples. 4
- b) In computer science, a Queue is a FIFO (first in, first out) data structure. Objects inserted first into a queue are the first objects removed from the queue. One way to design a queue data structure is to build it as a chain of node objects (like a linked list). Now write a java program to implement above FIFO with the use of all the methods. 4
- c) When we say "a class is final" or "a method is final" what does that mean? Show example codes to make a class and a method final. 2
4. a) What is an abstract class? Write the restrictions imposed on an abstract class. Point out and fix the problems in the following code snippet. 4

```
final class X{  
    final void show(){  
        System.out.println("Printed from a method");  
    }  
}  
class Y extends X{  
    void show(){  
        System.out.println("In subclass method");  
    }  
}  
interface interface1 {  
    default void f1(){  
    }  
    void f2();  
}  
interface interface2 {  
    void f3();  
    void f4();  
}  
abstract class class1 implements interface1 {  
    abstract void f5();  
    final void f6(){  
    }  
}  
class myclass extends class1 implements interface2 {  
    // your code  
}
```

Write minimum code for **myclass** for successful compilation. You can't define **myclass** as abstract. 2

- c) Briefly explain the differences between class and instance variable with examples.

Section-B

4

5. a) Consider a **MyStack** class implemented with array and with the following functions:
- void push(Object ob)** - this method pushes an Object ob into the stack
 - Object pop()** - this method pops an Object from the stack
 - Object top()** - this method returns the Object in the top of the stack without modifying the stack
 - boolean isEmpty()** - this method returns true if the stack is empty, otherwise false.

MyStack class has the following instance variables:

final int CAPACITY = 100 - capacity of the stack
Object [] s - the array to hold the stack
int top - the top of the stack

Here are the restrictions:

1. In **MyStack**, **pop()** and **top()** cannot be performed if the stack is empty. In that case it will trigger **StackEmptyException** with the message 'Stack is Empty'.
2. In **MyStack**, **push()** cannot be performed if the stack is full. In that case it will trigger **StackFullException** with the message 'Stack is full'.

Write Java code for the custom exceptions mentioned above. You also need to write the **MyStack** class to trigger these exceptions when needed.

4

- b) Write about network programming in java with proper examples 2
- c) Describe java socket.

2

6. a) Write two different ways to create Threads in Java with short code examples. Which one is better and why? What is the difference between synchronized method and synchronized statement? 4

b)

```
class Product {
    private String name;
    private double price;
    Product (String name, double price) {
        this.name = name;
        this.price = price;
    }
    public String getName () {
        return this.name;
    }
    public double getPrice () {
        return this.price;
    }
}
```

Write Java code for the following:

- 1) Define an **ArrayList** named **myProducts** that can store a list of **Product**.
- 2) Generate 5 Product with 'A' to 'E'. and random prices and add them to **myProducts**.
The following code generates random integers between 0 to 500
Random r = new Random(); r.nextInt(500);
- 3) Add a new Product with name 'F' and price 1000 at index 1 of **myProducts**
- 4) Sort **myProducts** based on **Product's** price in ascending order.

2

- c) Write the differences between **ArrayList** and **HashMap** with examples.

2

7. a) What is Iterator? Describe the methods of Iterator interface in Java. Suppose you have a **LinkedList** of string objects. Now using iterator you have to find out maximum length string object. 4

b) With Java threads, it is very easy to parallelize computations. Suppose you are in a job interview and the interviewer asks you to write Java code to find out summation of 1 to 10000000. You can't use any simple equation; you can only use loops. But you are asked to divide the work equally among 10 different threads. Write complete Java code to compute the summation of 1 to 10000000 by dividing the work equally among 10 different threads. The main thread will wait for the 10 threads to finish and will only print the final summation.

4

- c) Briefly describe the methods that Java uses for inter thread communication.

2

8. a) Suppose consider a file named List.txt is formatted so that each line has the following format: 6

Gender FirstName LastName Status

Gender will be either an "F" or a "M" and Status will be either "Good" or "Bad".
An example List.txt file would be formatted as follows:

M Jack Frost Bad
F CindyLou Who Good
M Rudolph Rednose-Reindeer Good

Now generate ShoppingList.txt file should be formatted such that each line has "lastName, firstName toyName" where toyName will be as following.

- toyName will be "Coal" if the status of the child is "Bad"
- toyName will be "Pony" if the gender of the child is "F" and the status of the child is "Good"
- toyName will be "Bicycle" if the gender of the child is "M" and the status of the child is "Good"

In addition, the last three lines of the file should print the number of coals, bicycles, and ponies to buy. An example resulting ShoppingList.txt file for the above List.txt should be:

Frost, Jack Coal
Who, CindyLou Pony
Rednose – Reindeer, Rudolph Bicycle
Coals: 1
Bicycles: 1
Ponies: 1

In order to do this you should create a complete class called **ToyHelper** which will read List.txt and produce ShoppingList.txt. Do not make any assumptions about the length of the list, but you can assume that it is formatted correctly. If the List.txt file does not exist, you should catch any exception that might be thrown.

- b) Differentiate between: 4
- 1) Checked and Unchecked exceptions
 - 2) Byte based and Character based stream

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Department of Computer Science and Engineering

2nd Year 1st Semester Final B.Sc. Engineering Examination-2021

Course Title: Data Structure
Time: 3 (Three) Hours

Course Code: CSE201

Total Marks: 60

N.B.:

- i. Answer SIX questions taking any THREE from each section.
- ii. All parts of a question must be answered sequentially.

Section-A

- | | | |
|----|---|-----|
| 1. | a) Define Data Structure. Why do we need to know about different types of data structures in the computer engineering field? | 1+2 |
| b) | "All the logics behind control structures could be used in a single solution with their usual characteristics." Do you agree? Defend yourself using an example. | 2 |
| c) | Write down an algorithm for searching an element in an unsorted array. Deduce number of comparisons required in the best, worst and average cases. | 1+2 |
| d) | What do you mean by the complexity of an algorithm? Discuss briefly the time-space tradeoff of algorithms. | 2 |
| 2. | a) Let array A: 32, 66, 51, 27, 85, 23, 13. Apply bubble sort algorithm to sort the array. | 3 |
| b) | What is binary tree? Construct a binary search tree for the following numbers:
40, 60, 55, 22, 66, 11, 50 | 3 |
| c) | Derive the complexity of linear search algorithm. | 2 |
| d) | Write down the differences between Breadth-First-Search (BFS) and Depth-First-Search (DFS) with a suitable example. | 2 |
| 3. | a) Distinguish between stack and queue. | 2 |
| b) | Convert the following postfix expression into its equivalent infix expression and then evaluate it:
12, 7, 3, -, /, 2, 1, 5, +, *, + | 3+2 |
| c) | Consider the following queue where QUEUE is allocated 6 memory cells:
FRONT=2, REAR=4 QUEUE: __, A, C, D __, __
Describe the queue including FRONT and REAR, as the following operations take place: <ol style="list-style-type: none">i. K, L, M are added to the queueii. Two letters are deleted andiii. R is added to the queue | 3 |
| 4. | a) What are the advantages of linked list over array? | 2 |
| b) | Write algorithms for PUSH and POP operations of stack using array. | 3 |
| c) | What is chaining? How does it help in hashing? Give example. | 3 |
| d) | Write a program to generate Fibonacci series using recursion. | 2 |

Section-B

- | | | |
|----|--|---|
| 5. | a) What is linked list? Describe the representation of linked list in memory. | 3 |
| b) | Write down the algorithm of searching a linked list when the list is unsorted. | 3 |
| c) | What are the applications of data structures? Give examples. | 4 |

- 1
6. a) Define queue. 3
- b) Construct an expression tree for the expression: $E = (x + y - z) / (5a * 3b / 6c)$. 3
- c) Build a heap from the following list of numbers: 40, 30, 70, 23, 54, 50, 21, 44, 55, 77. 3
- d) Consider the following list of numbers: 23, 14, 10, 17, 24, 11, 18, 10, 32, 14, 6, 22, 15, 25. Using binary search tree, delete the duplicate numbers and find the exact number of comparisons. 4+3
7. a) Consider the following list of letters is inserted into an empty binary search tree:
 J, R, D, G, T, E, M, H, P, A, F, Q
 i. Find the final tree T (show each step separately) and
 ii. Describe the tree after the node R is deleted 3
- b) Suppose inorder and preorder traversals of a binary tree are as follows:
 Inorder: D B H E A I F J C G
 Preorder: A B D E H C F I J G
 Draw the binary tree. 1+2
8. a) What is connected graph? Describe the linked representation of graph. 3
- b) Suppose S is the following list of 14 alphabetic characters: DATASTRUCTURES. Use the Quick sort algorithm to find the final position of character E. 4
- c) What is graph? Discuss about the shortest path algorithm with example. 4