University of Dhaka

Department of Computer Science and Engineering

Second Year B. Sc.(Honors.)

Incourse Examination

CSE 2101: Data Structures and Algorithms

Total Marks: 40 **Time: 1.5 Hours**

1. Distinguish among O, Ω and Θ-notation. Order the following terms in ascending order. 6

   O(n), O(100), O(n logn), O(log n), $O(n^2)$.

2. For a given integer K, write a procedure which delete the Kth element from a doubly linked list. Your procedure should cover all the cases i) delete first element, ii) delete last element and iii) delete any element other than first and last element. In case of unavailability of the data, it will print a message. 10

3. Write a procedure to calculate the Greatest Common Divisor (GCD) for a given two numbers. You have to write two versions – i) a recursive function, and ii) a function with stack (explicitly). 10

4. i) Write a pseudo code to insert an element in a Binary Search Tree (BST). Using this pseudo code, construct a BST with following data. 10

   50, 33, 44, 22, 77, 35, 60, 40

   ii) Write a pseudo code to delete an element in a BST. Using this pseudo code delete element a) 33, b) 80 and c) 77. You have to show the tree after each deletion.

5. Prove that the lower bound of the height of a binary tree with N is $\log_2(N+1) - 1$. 4

University of Dhaka
Dept. of Computer Science and Engineering
2nd Year 1st Semester, 2021 Midterm Examination
CSE-2102: Object Oriented Programming

Total Marks: 30 **Date: 9-3-2022** **Time: 1 hour 20 minutes**

1) Is there anything wrong with the following Java program? If yes, explain. If not, what will be the output of the program? [5]

```
public class MyClass {
    public static void main(String[] args) {
        Box myBox;
        myBox.width = 30;
        myBox.height = 50;
        System.out.println("myBox's area is " + myBox.area());
    }
}
```

2) The following code creates one array and one string object. How many references to those objects exist after the code executes? Is either object eligible for garbage collection after the code executes? [5]

```
String[] persons = new String[10];
String person_name = "Muhammad Abdullah";
persons[0] = person_name;
person_name = null;
```

3) How can a Java program destroy an object that it creates? [5]

4) Consider the following two classes:

```
public class MyClass {
    public void method_1(int i)              {    }
    public static void method_2(int i){      }
    public static void method_3(int i){      }
}
public class YourClass extends MyClass {
    public void method_1(int i)              {    }
    public void method_2(int i)              {    }
    public static void method_3(int i){      }
}
```

Briefly explain, for each of the three methods, whether overriding occurs or not and why. [5]

5) The `IntStack` interface along with two classes that implement it are as follows:

```
// Define an integer stack interface.
interface IntStack {
  void push(int item); // store an item
  int pop(); // retrieve an item
}

// An implementation of IntStack that uses fixed storage.
class FixedStack implements IntStack {
  private int[] stck;
  private int tos;

  // allocate and initialize stack
  FixedStack(int size) {
    stck = new int[size];
    tos = -1;
  }

  // Push an item onto the stack
  public void push(int item) {
    if(tos==stck.length-1) // use length member
      System.out.println("Stack is full.");
    else
      stck[++tos] = item;
  }

  // Pop an item from the stack
  public int pop() {
    if(tos < 0) {
      System.out.println("Stack underflow.");
      return 0;
    }
    else
      return stck[tos--];
  }
}
```

GED 2104

Marks: 30 Time: 90 m

1.	Briefly describe 5 major river networks of Bangladesh.	6
2.	Discuss about the problems of education system in Bangladesh.	7
3.	Briefly describe the impacts of Madrassa education on our society.	4
4.	Mention the meanings of the seven towers of The National Memorial Monument.	4
5.	Describe about the National Emblem of Bangladesh.	3
6.	What is meant by culture? Write a short note on Bangla Nabobarsho.	5

University of Dhaka

Department of Computer Science and Engineering

2nd Year 1st Semester Incourse Examination 2021

Course Code: MATH-2105 # Course Title: Linear Algebra

Time: 1 hour 30 minutes # Full Marks: 30

1. Determine existence and uniqueness of the solutions to the system [6]

$$3x_2 - 6x_3 + 6x_4 + 4x_5 = -5$$
$$3x_1 - 7x_2 + 8x_3 - 5x_4 + 8x_5 = 9$$
$$3x_1 - 9x_2 + 12x_3 - 9x_4 + 6x_5 = 15$$

2. Reduce the following augmented matrix to *Reduced Echelon* form and represent the reduction steps as a sequence of matrix multiplication. [6]

$$\begin{bmatrix} 1 & -2 & 1 & 3 \\ 0 & 2 & -8 & 8 \\ 5 & 0 & -5 & 10 \end{bmatrix}$$

3. Find an LU factorization of the following matrix if there exists one. [6]

$$\begin{bmatrix} 2 & -4 & 2 \\ 1 & 5 & -4 \\ -6 & -2 & 4 \end{bmatrix}$$

4. Calculate the adjugate and if possible inverse of the following matrix utilizing Cramer's Rule. [6]

$$\begin{bmatrix} 3 & 5 & 4 \\ 1 & 0 & 1 \\ 2 & 1 & 1 \end{bmatrix}$$

5. Let $B=\{b_1, b_2\}$ and $C = \{c_1, c_2\}$ be the bases for $\mathbf{R}^2$. Find the change-of-coordinate matrices from B to C and C to B. [6]

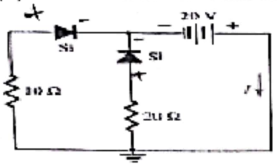
$$b_1 = \begin{bmatrix} -6 \\ -1 \end{bmatrix}, b_2 = \begin{bmatrix} 2 \\ 0 \end{bmatrix}, c_1 = \begin{bmatrix} 2 \\ -1 \end{bmatrix}, c_2 = \begin{bmatrix} 6 \\ -2 \end{bmatrix}$$

2nd Year 1st Sem. In-course Exam 2021, Dept. of CSE, University of Dhaka,
EEE 2103: Electronic Devices and Circuits, Time: 1.5 hour Full Marks: 30

Answer any five Questions

1(a) Explain how minority and majority carriers are produced in n-type semiconductor.

(b) Calculate I in the following circuit. Consider practical Si diode.

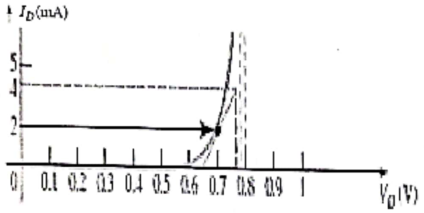


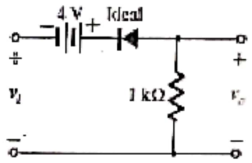
2(a) Determine the diode current at 20°C for a silicon diode with $I_S = 50$ nA and an applied forward bias of 0.6 V.

(b) What is load line and why it is called so? Explain how load line can be drawn on the *I-V* characteristic curve of a *PN*-junction diode.

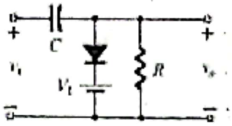
3(a) Determine r_d at an operating point shown by arrow in the following figure (lefthand).

(b) Draw the input and output waveform of the following (right hand) circuit when a sinusoidal input voltage of 10 V amplitude is applied.



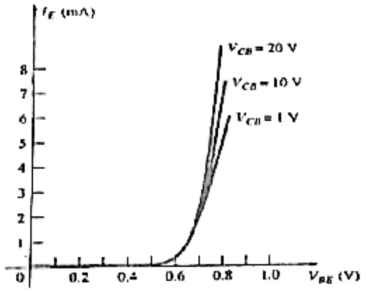


4 (a) Determine v_O for the network given below for sinusoidal input.



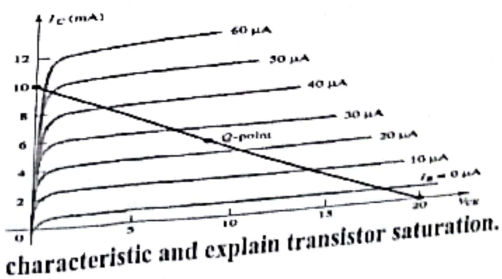
(b) Draw a basic voltage regulator circuit using Zener diode and determine V_L, I_L, I_Z, and I_R. Assume $V_S = 20V$, $R_S = 230\ \Omega$, $R_L = 470\ \Omega$ and $V_Z = 10V$.

5 (a) Figure below indicates which characteristic curve? Explain why does I_E takes different shape for different V_{BE}.



(b) Prove that $\beta = \alpha/(1-\alpha)$, where the symbols carry usual meaning.

6 (a) Given the load line of figure below and the defined Q-point, determine the required values of V_{CC}, R_C, and R_B for a fixed-bias configuration.



(b) Draw the Common base output characteristic and explain transistor saturation.