2nd Year 1st Semester Incourse Exam, 2018 (CSE-2201 Data Structures and Algorithms)

Time: 1 Hour 30 Mins

1. What does the following functions do? Answer briefly. Also mention the complexity of each function. **[6]**

a)
```
int f(int a[], int l, int r){
    if(l == r)return a[l];
    int mid = (l+r)/2;
    int x = f(a, l, mid);
    int y = f(a, mid + 1, r);
    if(x < y) return x;
    else return y;
}
```

b)
```
int f(int a[], int n){
    if(n == 0) return 0;
    int x = f(a, n - 1);
    if(a[n-1]>0)x += a[n-1];
    return x;
}
```

c)
```
int f(int a[], int n){
    if(n == 1)return 1;
    if(a[n-1] <= a[n-2]) return 0;
    else return f(a, n - 1);
}
```

2. Simulate **a)** Merge Sort **b)** Counting Inversion using Merge Sort on the following array: **[4]**
7, 15, 3, 11, 5, 1, 2, 6, 10, 8, 50, 20, 47, 48, 2.

3. Insert the following items in a Binary Search Tree in the order given. Show steps. **[4]**
J, P, E, A, F, G, B, W, Z, L, K, N, M, O.

4. Show the in-order, pre-order and post-order traversal of the tree given in Q.3. **[6]**

5. Given an expression in in-fix notation, give an algorithm to represent it as a binary tree. **[3]**

6. Given an array A and an integer D, find how many pair elements are there, which has a difference greater or equal to D. If A = {1, 5, 7, 2, 9} and D = 3 the answer is 7. Such pairs are (1, 5), (1, 7), (1, 9), (5, 2), (5, 9), (7, 2), (2, 9). Assume, size of the array is around 100,000. Elements of the array can be any integer. Analyze the complexity of your algorithm. **[4]**

7. Given a post-order traversal of a BST, how can you retrieve the original tree? Give an algorithm. **[3]**

University of Dhaka
Department of Computer Science and Engineering
B.Sc. (Hons.) In-course Examination 2018
CSE 2102: Object Oriented Programming

Total Marks: 30 **(Answer any Three (3) of the following Questions)** **Time: 1.15 Hours**

1. a) Define the feasibilities of Implementing *Runnable* Interface and Extending the *Thread class* for creating a thread. [2]
   b) Show the life-cycle of threads using a diagram. [2]
   c) Provide an example code of the following methods of the thread class: suspend(), resume(), join(), and isAlive(). [3]
   d) How encapsulation, inheritance and polymorphism are implemented in JAVA. Show by example. [3]
2. a) Assume that a bank maintains two kinds of accounts for its customers, one called **savings account** and the other **current account**. The savings account provides compound interest (5%) and withdrawal facilities. The current account provides no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge in imposed. [6]
   Create a class Account that stores customer name, account number, type of account and balance. From this Account class derive the classes CurrentAccount and SavingsAccount to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks: [Use only methods to initialize the class members and other tasks.]
   - Initialize all instance variables through constructors. [use super()]
   - Accept deposit from a customer & update the balance [depAmount (...)]
   - Display the balance [showBalance ( )]
   - Compute and deposit interest [computeInterest ( )]
   - Permit withdrawal and update the balance [withdraw (...)]
   - Check for the minimum balance (assume $500), impose penalty (print a message, if necessary) and restrict the withdrawal of balance.

   b) There are three important keywords for Java exception handling: throw, throws, and finally. Provide a valid example that visualizes their usage. [3]
   c) i) Why main method is static? [1]
   ii) Can we overload main() method?
3. a) i) Can an Interface be final? Is there any case when finally will not be executed? [1+
   ii) What is difference between final, finally and finalize? 2]
   b) Suppose there are 6 methods defined as following, void f1(), void f2(), void f3(), void f4(), void f5() and void f6(). There are also three interfaces named as Interface i1, i2 and i3. There is also a class named as Myclass, which needs to be forced to implement all the 6 methods. Write the necessary codes to demonstrate this scenario. There are some constraints as below: [3]
   - Each interface can define at most 2 methods.
   - The class Myclass can only implement 1 interface.

   c) Write a program which creates two threads. The main thread takes an integer number N from the user. Thread 1 starts printing from 1 to N/2 and after every 4 count, the thread goes to sleep for about 3sec. Thread 2 starts printing from N/2+1 to N. [4]
4. a) Write a method "*dumpFile(name)*" in Java that takes the name of a file (a string) as input. Then reads the data of the file, and prints on the console—line by line. The file contains one or more lines of data in the following format: #StudentID#grade#. Here, StudentID is a string with no spaces and grade is a real number ($0 \le grade \le 4$). [5]
   The method returns the average of all the grades input from the file.
   b) Modify the program of 4(a). Generate your own exceptions depending on the following situations. [5]
   - invalidInputRangeException -> When any input number is not in the range of 0-4
   - suspicousOutputException -> If the calculated average is more than 3.9
   - studentFailedException -> If the average is less than 2.0

   You need to maintain the given priority for generating Exception. If you do not find any exception, print the average marks of the student.

2nd Year 1st Sem. In-course Exam 2018, Dept. of CSE, University of Dhaka,

EEE 2103: Electronic Devices and Circuits, Time: 1 hour **Full Marks: 20**

Answer any four of the following questions

1(a) Sketch the atomic structure of silicon and insert an impurity of arsenic and indium. 5

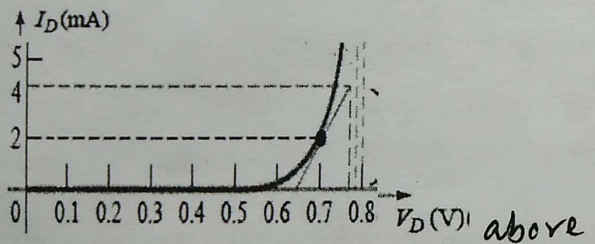
(b) Draw the energy band diagrams of metal, semiconductor and insulator with proper leveling. 5

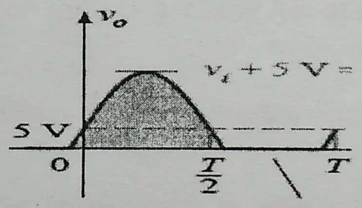
2(a) Draw the schematic diagram of depletion layer in a p-n junction and explain barrier potential. 5

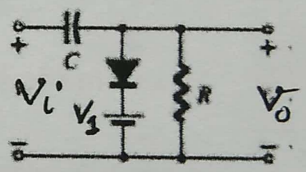
(b) Explain the effects of forward and reverse in p-n junction. (no fig. required) 5

3(a) Describe avalanche and Zener breakdown phenomena in a p-n junction diode. 5

(b) Determine the ac or dynamic resistance resistance of the commercially available diode at a forward voltage of 0.7 volt in the following figure (lefthand). 5







4(a) For the waveform given ~~below~~ above (middle hand), draw the corresponding clipper circuit. 5

(b) Determine v_O for the network given above (right hand) for sinusoidal input. 5

5(a) Explain the current gain phenomena in CE configuration with a numerical example. 5

(b) Explain the advantage of emitter-stabilized bias over fixed-bias of BJT. 5

University of Dhaka

Department of Computer Science and Engineering (CSE)
2nd Year 1st Semester (2017-208) 1st Incourse Test, 2018
Course # GED-2104 (Bangladesh Studies)
March 6, 2018

Full Marks: 10 Time: 50 minutes

Answer any one of the following

1. (a) Define culture. 2

   (b) Mention noteworthy characteristics of Bangladeshi culture with suitable examples. 4

   (c) What challenges does Bangladeshi culture confront at present? 4

2. (a) Reveal some of the dominant reasons for the emergence of Bangladesh in 1971. 6

   (c) Do you think that political reasons supersede socio-economic reasons in this respect? Give arguments for your answer. 4

University of Dhaka

Department of Computer Science and Engineering (CSE)
BSc (Hons.) 2nd Year 1st Semester, 2018
2nd In-course Test (April 24, 2018)
Course # GED-2104 (Bangladesh Studies)

Full Marks: 20 Time: 1:30 hours

Answer any two of the following questions

1) (a) What is meant by a constitution? 3
(b) Mention the salient features of the 1972 Constitution of Bangladesh? 5
(c) Is Bangladesh a secular state in light of her present constitution? 2

2) (a) Illustrate the meaning and concept of democracy. 4
(b) What are the prerequisites for the success of democracy in Bangladesh? Discuss. 6

3) (a) Define foreign policy? 2
(b) What are the main elements of the foreign policy of a country? 4
(c) Delineate the salient features of the foreign policy of Bangladesh. 4

Department of Computer Science and Engineering, University of Dhaka

Midter Examination **Course Title:** Linear Algebra **Course Code:** MATH-1223 **Total Marks - 30**

Answer all of the following questions

1. **[5]** Perform LU factorization of the matrix $A = \begin{bmatrix} 3 & -7 & -2 & 2 \\ -3 & 5 & 1 & 0 \\ 6 & -4 & 0 & -5 \\ -9 & 5 & -5 & 12 \end{bmatrix}$
2. **[3]** Find the basis of the nullspace of the matrix $A = [3 \quad -3 \quad 3 \quad -3]$.
3. **[5]** Find all possible solutions of the following system of linear equations written in matrix form

$$\begin{bmatrix} 1 & 3 & 0 & 2 \\ 0 & 0 & 1 & 4 \\ 1 & 3 & 1 & 6 \end{bmatrix} \begin{bmatrix} u \\ v \\ w \\ x \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 7 \end{bmatrix}$$

4. **[4]** For a matrix $A = \begin{bmatrix} 2 & 1 & 2 & 4 \\ 2 & 1 & 1 & 3 \\ 2 & 1 & 3 & 5 \end{bmatrix}$ the reduced row echelon form is $R = \begin{bmatrix} 1 & 0.5 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$. Find the basis of its
   a. Columnspace
   b. Rowspace
   c. Nullspace
   d. Left-nullspace
5. **[3]** Answer the following questions for a full row rank m by n matrix A (m < n)
   a. What is the form of its reduced row echelon form?
   b. How many solutions are there for Ax=b?
   c. What is the dimension of its nullspace?
6.
   a. **[1]** If $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & -1 \\ 3 & -1 & -4 \\ 4 & 1 & -3 \end{bmatrix}$, what is the dimension of its columnspace? What is the dimension of its nullpace?
   b. **[1]** Write one nonzero vector from the columnspace of the matrix of question **a**
   c. **[1]** If we throw away any one column of the matrix A of question **a**, will the columnspace of the new matrix be a subspace (even may be proper subspace) of that of the original matrix? Explain
   d. **[1]** Does the solutions of Ax=b form a vector space? Explain
   e. **[1]** Does elimination change nullspace of a matrix ? Does it change the columnspace?
   f. **[1]** If the reduced row echelon form of a matrix A is of the form $R = \begin{bmatrix} I & F \\ 0 & 0 \end{bmatrix}$, how may solutions are there for Ax = b?
   g. **[1]** In R^3 can two orthogonal lines be the rowspace and nullspace of a matrix A? Explain.
   h. **[1]** What is the projection matrix P for an invertible matrix A? Prove your answer.
   i. **[1]** Consider the three vectors $\begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$, $\begin{bmatrix} 2 \\ 2 \\ 5 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ 3 \\ 8 \end{bmatrix}$. Can they be the basis of any space? Explain
   j. **[1]** Let, P be the projection matrix of a matrix A. What is the projection of a vector b on the columnspace of A if b is perpendicular to A's columnspace. Prove it.