

Year 2 CSE CAT 1 TRIMESTER II 2021

Time: 1 h 30 min

Q1. The factorial of a given number is given by $n! = n * (n-1)!$ where $n \geq 0$, and $0! = 1$
write a program to find the factorial of any number. (4 Marks)

Q2. Class A is a sub class of class B, class C implements methods defined in D, E to test
functionalities defined in B and C.

class B has a function called `getCelcius` that accepts Fahrenheit and returns temperature
measurement in celcius (float) using formula $\text{Celsius} = 5.0 / 9.0 * (\text{Fahrenheit} - 32)$;

Class A, has a function that prompt user to type the name of patient and temperature in Fahrenheit
and prints the Name and Temperature in Celsius using inherited functions.

E.g., Dear John, Your Temperature in Celsius is 36. where John is a name of patient.

Class C implements `sayGoodBye` function which has one parameter (name of patient) and prints
"Dear John, thank you for coming" where John is a name of patient.

Write java codes for both A, B, C, D and E by catching exceptions where necessary. (put
comments) (12 marks)

Q3. Differentiate checked and unchecked exceptions. (4 marks)

(I) Analysis of Algorithms

(a) Express the following functions in Big O notation.

(i) $f_1 = \binom{n}{5}$
(ii) $f_2 = \binom{n}{n-4}$

(b) What is the time complexity of the following functions ?

(i)

```
public static void f2(int N) {
    int sum = 0;
    for (int i = 1; i <= N; i = i*2) {
        for (int j = 0; j < i; j += 1) {
            sum += 1;
        }
    }
}
```

(ii)

```
public static void f3(int[] a) {
    if (a.length == 0) { return; }
    int N = a.length;
    int[] newA = new int[N-1];
    for (int i = 0; i < newA.length; i += 1) {
        newA[i] = a[i];
    }
    f3(newA);
}
```

(c) Let $T(n) = \frac{1}{2}n^2 + n$. Which of the following are true? (There might be more than one correct answer)

- (A) $T(n) = O(n)$
- (B) $T(n) = \Omega(n)$
- (C) $T(n) = \Theta(n^2)$
- (D) $T(n) = O(n^3)$

(II) Consider the LinkedList class we have used in class :

```
public class LinkedList {
    class Node {
        {
            int item;
            Node next;
            public Node(int data)
            {
                item=data;
            }
        }
        Node head;
        public LinkedList()
        {
            head=null;
        }
        public void insertFront( int data)
```

```
{  
    Node newNode=new Node(data);  
    if (head != null) {  
        newNode.next = head;  
    }  
    head=newNode;  
}  
public void deleteFront()  
{  
    if(head==null)  
        return;  
    else  
    {  
        head=head.next;  
    }  
}  
public void printList()  
{  
    Node current=head;  
    while(current!=null) {  
        System.out.println(current.item);  
        current=current.next;  
    }  
}  
public void insertBack(int data)  
{  
    Node newNode=new Node(data);  
    if(head==null)  
        head=newNode;  
    else  
    {  
        Node current =head;  
        while(current.next!=null)  
            current=current.next;  
        current.next=newNode;  
    }  
}  
public void deleteBack()  
{  
    if(head==null)  
        return;  
    Node previous=head;  
    Node last=head.next;  
    while(last.next!=null) {  
        previous = last;  
        last = last.next;  
    }  
    previous.next=null;  
}  
public boolean Find(int a)  
{  
    if (head==null)  
        return false;  
    Node current=head;  
    while(current!=null&& current.item!=a)  
        current=current.next;  
    if(current==null)  
        return false;  
    else  
}
```

Section A : Answer all questions in this section

- (I) (a) Express the time complexity of the following code in Asymptotic notation

```
public void f2( int N)
{
    for( int i=0; i<N; i *=2){
        for( int j=0; j<i;++j) {
            System.out.println("Hello World!");
        }
    }
}
```

[3 marks]

- (b) Draw the binary search tree that would result from inserting the following elements in the given order. [3 marks]

- (i) Jaques, Sunny, Klaus, Violet, Beatrice, Bertrand, Kit, Lemony
- (ii) Leslie, Ron, Tom, Jerry, Larry, Garry, April, Andy
- (iii) Aaron, Andrew, Chris, Colin, Jason, Leslie, Wesley

- (c) What are the main differences between the List and Set interfaces in the Java Collection Framework? [2 marks]

- (d) The partition routine of Quick Sort is applied once to the list of numbers : 23 13 30 15 29 41 30. What is the order after partition? [3 marks]

- (e) Write a java method that takes a Stack of integers and returns true if the stack does not contain any duplicated element, and returns false otherwise. [5 marks]

```
public void isUninque(Stack<Integer> s)
{
    // your code goes here
    /*the stack should remain unchanged after the
method */
}
```

- (f) Give an example of a real situation that can be modeled as Directed graph. What would be the Nodes and what would be the edges? [2 marks]

- (g) Give a real world situation that can be modeled as an Undirected Graph. What would be the nodes and what would be the edges? [2 marks]

- (h) A Perfectly balanced Binary Tree has 1023 Nodes. What is the height of that tree? [3 marks]

University of Rwanda
 College of Science and Technology
 School of ICT
 Year 2 Computer and Software Engineering
 Data Structures and Algorithms- Test

(I) (a) Given $f(n) = \log(n^2)$ and $g(n) = \log(n) + 5$, Show that $f(n) = \Theta(g(n))$ ✓ [4 marks]

(b) Express the time complexity of the following function in Big O notation [2 marks]

```
public static int mystery(int n)
{
    int r=0;
    for(int i=1;i<n;++i)
        for(int j=i+1;j<=n;++j)
            for(int k=1;k<=j;++k)
                r=r+1;
    return r;
}
```

$$\Theta(n^3)$$

(c) Let $T(n) = 2^{n+1}$. Show that $T(n) = O(2^n)$ ✓ [2 marks]

(d) Let $T(n) = 2^{2n}$. Show that $T(n) \neq O(2^n)$ [2 marks]

(II) Given a Stack of integers, write the definition of a method sum, that returns the sum of the numbers in the stack. The stack should remain unchanged after the function returns. Assume that the pop operation returns the popped item from the stack. You are allowed to create a temporary stack. [10 marks]

```
public static int sum(Stack<Integer> s)
{
    //your code goes here
}
```

(III) (a) Assume that, while implementing Quick Sort, one chooses the median element as the pivot. What will be the time complexity of Quick Sort then? $\Theta(n \log n)$ [3 marks]

(b) Assume the input to Quick Sort is already sorted, and the first element is always chosen as the pivot. What will be the time complexity of Quick Sort under this scenario? $\Theta(n^2)$ [3 marks]

(c) Write the definition of a Java methods that takes two arrays of integers as input and returns an array containing the elements that appear in both arrays. [4 marks]

```
public static int[] intersection(int[] a, int[] b)
{
    //your code goes here.
}
```

$$O(\log n)$$

(IV) (a) What is the time complexity of inserting an item in a perfectly balanced Binary Search Tree? [2 marks]

(b) The following keys are inserted in an initially empty Binary Search Tree. 15 13 22 14 10 11 8 19 24 16 20

(i) Draw the resulting Binary Search Tree [1 mark]

(ii) Is this Tree balanced? [1 mark]

(iii) List the keys as they are visited by INORDER traversal of the Tree [1 mark]

(iv) List the keys as they are visited by PREORDER traversal of the Tree [1 mark]

(v) List the keys as they are visited by POSTORDER traversal of the Tree [1 mark]

(vi) List the keys as they are visited by LEVEL ORDER traversal of the Tree [1 mark]

(vii) Redraw the Tree after deleting the root node [2 mark]

Section B : Answer any two questions in this section

- (II) The following keys are inserted in an initially empty Binary Search Tree:
15 9 11 22 19 23 10 12 8 :

- (a) Draw the resulting Binary Search Tree [2 marks]
- (b) List the keys as they are visited by :
- (i) Preorder traversal [2 mark]
 - (ii) Inorder traversal [2 mark]
 - (iii) Postorder traversal [2 mark]
 - (iv) levelorder traversal [2 mark]
- (c) Delete the key in the root node and reinsert it in the tree, then redraw the resulting Binary Search Tree. [2 marks]
- (d) Is this last BST balanced? [3 marks]

- (III) The following class implements a stack of integers using an Array. Take into consideration the comments and implement the missing methods.

```
public class ArrayStack {  
    int[] items;  
    int maxsize; // maximum number of elements the stack can contain  
    int size; // the number of elements currently on the Stack  
    int top; //keeps track of the top of the stack  
  
    public void Push(int item)  
    {  
        //Push item on the stack,  
        //if the stack is not full [5 marks]  
    }  
    public int Pop()  
    {  
        //remove and return the top element,  
        //if the stack is not empty [5 marks]  
    }  
    public boolean isFull()  
    {  
        return size==maxsize;  
    }  
    public boolean isEmpty()  
    {  
        return top== -1;  
    }  
}
```

```

    }

    public ArrayStack( int b )
    {
        this . maxsize=b;
        items=new int [ maxsize ];
        top=-1;
        size=0;
    }
    public void printStack()
    {
        // prints the elements of the stack
        // without destroying the stack [ 5 marks ]
    }
}

```

- (IV) (a) What is the difference between the Comparable and Comparator interfaces ? [3 marks]
- (b) If you are defining a class whose objects are going to be stored in a HashSet, which methods, should your class override. [3 marks]
- (c) What are the main differences between Iterator and ListIterator in the Java Collection framework? [3 marks]
- (d) For each of the following sets of five functions, order them so that if f_a appears before f_b in your sequence, then $f_a = O(f_b)$. If $f_a = O(f_b)$ and $f_b = O(f_a)$ (meaning f_a and f_b could appear in either order), indicate this by enclosing f_a and f_b in a set with curly braces. For example, if the functions are: $f_1 = n, f_2 = \sqrt{n}, f_3 = n + \sqrt{n}$, the correct answers are $(f_2, \{f_1, f_3\})$ or $(f_2, \{f_3, f_1\})$. [6 marks]

a	b
$f_1 = (\log n)^{2019}$	$f_1 = 2^n$
$f_2 = n^2 \log(n^{2019})$	$f_2 = n^3$
$f_3 = n^3$	$f_3 = \binom{n}{n/2}$
$f_4 = 2.019^n$	$f_4 = n!$
$f_5 = n \log n$	$f_5 = \binom{n}{3}$

(V)

1.



DEPARTMENT OF COMPUTER AND SOFTWARE ENGINEERING

Instruction to Module Leader:

Tick/Highlight the campus where the module is delivered: KIGALI

NOTE: For a common module highlight all the campuses where the module is delivered.

END OF TRIMESTER II EXAMINATIONS - ACADEMIC YEAR 2020 – 2021

YEAR OF STUDY : II GROUPS: CSE & IS

MODULE CODE : ISY2264

MODULE TITLE : COMPUTER NETWORKS

DATE OF EXAM : 22/12/2021

TOTAL DURATION : 02 HOURS

MAXIMUM MARKS : 50

INSTRUCTIONS TO THE STUDENT:

1. This question paper contains FOUR (4) questions.
2. Answer THREE (3) questions only:
 - a. Question ONE (1) from Section A is COMPULSORY.
 - b. Answer ANY TWO (2) questions from Section B.
3. No study material is allowed into the examination hall.
4. Do not forget to write your Registration Number.
5. Write all your answers in the booklet provided.
6. Do not write any answers on this question paper.
7. Start each question on a NEW page.

SECTION A (COMPULSORY QUESTION)

Question 01 (20 marks)

- a) Briefly describe two error correction methods. (4 marks)
- b) Provide one advantage and one dis-advantage of Dynamic Routing. (2 marks)
- c) What are the three main components that make up a network. (3 marks)
- d) Provide three main function of data link layer. (3 marks)
- e) With the help of diagram, describe four features of a nonhierarchical network structure. (4 marks)
- f) Differentiate distance vector routing protocols from link-state routing protocols. (2 marks)
- g) Differentiate a point-to-point connection from a multipoint connection. (2 marks)

SECTION B: ANSWER ANY TWO QUESTIONS

Question 02 (15 marks)

- a) How many subnets and hosts per subnet can you get from the network 192.168.1.0 255.255.255.224? (3 marks)
- b) What is the Subnet Mask corresponding to a shorthand of /11? (3 marks)
- c) You have sub-netted your class C network 200.138.1.0 with a subnet mask of 255.255.255.252. Please list the following: number of networks, number of hosts per network, the full range of the first three networks, and the usable address range from those first three networks. Additionally, identify the broadcast addresses for each network. (6 marks)
- d) Write the IP address 135.1.1.25 mask 255.255.248.0 in CIDR notation. (3 marks)

Question 03 (15 marks)

- a) With help of diagrams, describe three types of guided transmission media. (6 marks)
- b) Differentiate the following error detection methods:
 - i) Vertical Redundancy Check (VRC) from Longitudinal Redundancy Check (LRC) (3 marks)
 - ii) Cyclic Redundancy Check (CRC) from Checksum. (3 marks)
- c) What is the function of SMTP & POP3 protocols? (2 marks)
- d) Give one difference between TCP and UDP transport layer protocols. (1 mark)

Question 04 (15 marks)

- a) What is the difference in terms of functionality between the upper layers and lower layers of the OSI model? (3 marks)
- b) With a help of diagrams, briefly explain three categories of a network. (6 marks)
- c) You have been allocated a class A network address of 29.0.0.0. You need to create at least 20 networks and each network will support a maximum of 160 hosts. Would the following two subnet masks work: 255.255.0.0 and or 255.255.255.0? (4 marks)
- d) Distinguish client/server network model from peer-2-peer (P2P) network model. (2 marks)

*****GOOD LUCK*****



COLLEGE OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND SOFTWARE ENGINEERING

(Huye Campus)

END OF TRIMESTER EXAMINATION -ACADEMIC YEAR 2020-2021

YEAR: 2 TRIMESTER: II GROUP: Computer and Software Engineering

MODULE TITLE: Object Oriented Programming Using Java

MODULE CODE: COE2262

DATE: 20/12/2021

TIME: 2 hours

MAXIMUM MARKS = 50

INSTRUCTIONS

1. This paper contains **FOUR (4)** questions.

2. Answer **THREE (3) Questions only:**

Question ONE (1) from Section "A" is Compulsory and Answer any TWO (2) from Section "B"

3. No written materials allowed.

4. Do not forget to write your Registration Number.

5. Write all your answers in the booklet provided

6. Do not write any answers on this questions paper.

7. Start each question in a **NEW** page

SECTION A: 20 marks

QUESTION 1

- a. Define the following terms (6 marks)
 1. Socket programming
 2. Multithreading
 3. Method overriding
- b. Write a program using nested loops to display the following output. (3 marks)

```
* * * * *
* * * *
* * *
* *
*
```

- c. Specify the errors in the following program and how to fix them and display the output. (6 marks)

```
public class Calculator{
    public static void main(String[] args){
        int a=3,b=7.4;
        int c=add(a,b);
        System.out.println("The sum is "+c);
    }
    public void add(int a, int b){
        return a+b;
    }
}
```

- d. Write a java function to compare two string and return true if they match and false if they don't match. (3 marks)
- e. In inheritance what is the meaning of super key word and how should it be used. (2 marks)

SECTION B (CHOOSE ONLY TWO QUESTIONS)

QUESTION 2

- a. Write a function to swap values of two variables (3 marks)
Hint: int a=5 and int b=6, after swap function a=6 and b=5.
- b. With help of codes, write key steps to connect to database using JDBC (10 marks)
- c. Differentiate Statement from Prepared Statement in JDBC (2 marks)

QUESTION 3

The volume of a pyramid is given by $v=b*h/3$

Where by b is the base area of the pyramid and h is the height of the pyramid.

Base of the pyramid can be any shape, Circle, rectangle, Triangle, pentagon or any other polygon. The shape must have area.

- a. Apply OOP concepts to write a program to calculate the volume of A Cone (Circular Base) as an Example of A pyramid given that the radius of circular base is r .
Minimum required classes: Pyramid, Cone and Circle (10 marks)
- b. Differentiate Interface from Abstract class (5 marks)

QUESTION 4

- a) Write down 4 Servers that can be used to deploy Java web application. (2 marks)
- b) With help of codes explain the three tags used in Java Server Pages (6 marks)
- c) Clearly explain the function of @webServlet annotation in Servlet class (3 marks)
- d) Write all required steps from development to deployment of Java Web application to server of your choice (4 marks)

END



UNIVERSITY of
RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

SCHOOL OF ICT

P.O. Box: 3900 Kigali, Rwanda

DEPARTMENT OF CSE

(HUYE CAMPUS)

YEAR OF STUDY: YEAR 2 CSE

SEMESTER/TRIMESTER: SEMESTER 2

COURSE CODE: COURSE NAME: COE5224: COMPUTER ORGANIZATION

STUDENT REGISTRATION No: _____

DATE: 17/12/2021

TIME: 2 HOURS

MAXIMUM MARKS = 50

INSTRUCTIONS

1. This question paper contains two sections: A and B.
2. Answer all questions in Section A, and choose any two in Section B.
3. No written materials allowed.
4. Do not forget to write your Registration Number.
5. Do not write any answers on this question paper.

COMPUTER ORGANIZATION MAIN EXAM

SECTION A: COMPULSORY (20 marks)

Question 1 [20 marks]

- 1) What is computer organization? [2marks]
- 2) Provide the list of the computer functions. [2marks]
- 3) In fifth computer generation we find the development of true artificial intelligent, what is artificial intelligent? List two factors that make it possible in fifth generation. [2marks]
- 4) Explain two types of registers that are implemented within a cpu. [2mark]
- 5) What are the three basic steps that are needed for the CPU to perform a write operation into a specified memory location? [3marks]
- 6) Convert the following arithmetic expressions from/to infix to/from reverse Polish notation. [2marks]
 - a. $A/[B + C * (D + E)]$
 - b. Abcdef /-+* -
- 5) What are the advantage and disadvantages of using signed magnitude for representation of signed number? [2 marks]
- 6) Why are computer memories organized in a hierarchy not a single type? [2marks]
- 7) What are the two DMA transfer mode? [3marks]

Section B

Question 2:

- 1) What are the basic stages involved during instruction execution cycle? [2marks]
- 2) Sketch and Explain the Top-level Structure of a computer. [7marks]
- 3) What is the difference between von-Neumann and hazard memory architecture? [3marks]
- 4) Assume a processor has enough processing speed. What else do we have to consider in the performance balance? [3marks]

Question 3

1. Explain the main parts of the CPU. [3marks]
2. A computer is implementing byte addressing memory of 16Kbytes and 32 operations. refer to this instruction($A=b-c$), where the CPU is referring to the memory. what will be the length of instruction (Control word length)? [4marks].
3. Perform the following binary operations using: [8marks]
 - a. $5-11 =$ using two's compliment.
 - b. $1010110-101010$
 - c. Represent 15.0625 decimal number using float number representation.
Show it:
 - a. a scientific notation representation
 - b. the significand, exponent, and sign bits, using The IEEE-754 *single precision* floating point (32 bits total)

Question 4

1. Briefly explain the computer internal memories. [3marks]
2. A computer has 32MB of memory. How many bits are needed to address any single word in memory If. [4marks]
 - a. Byte addressable
 - b. 128bytes word addressable
3. What are the functions of I/O interface during input/output operations? [4marks]
4. What are the three different techniques that the processor uses to perform I/O operations. [4 marks]

Good Luck

CIT 3321- Programming Languages and Syntax Directed tools-Exam paper

SECTION: A

COMPULSORY QUESTION

QUESTION 1:

- | | |
|---|-------|
| a) In which area LISP is used? | /2pts |
| b) For which category of people BASIC was designed? | /2pts |
| c) Clarify the notion of scripting language with an example. | /2pts |
| d) What is the role of a Lexical Analyzer? | /2pts |
| e) Give four examples of Finite-state machines (FSM) in Real world | /4pts |
| f) What is a syntax diagram? | /2pts |
| g) Make a comparison of the Top-Down Parsing and the Bottom-Up Parsing aka shift-reduce parsing | /4pts |
| h) Discuss the concept of garbage collector | /2pts |

SECTION: B

OPTIONALY QUESTIONS: ANSWER ANY TWO

QUESTION 2:

/15pts

- | | |
|---|-------|
| a) Using Prolog, create a program with facts about teachers, students and classes; rules about whom is taught by and who is teaching whom. Make queries to list all teachers and their students in their respective classes | /9pts |
| b) With a diagram explain the structure of a compiler | /6pts |

QUESTION 3:

/15pts

- | | |
|--|-------|
| a) Using modular programming in C programming language, create code that simulate a calculator with four operator, +, -, *, /. Split it in order to have each operator in its own module | /9pts |
| b) Explain the classification of errors | /6pts |

QUESTION 4

/15pts

Given the following grammar

E → T + E | T - E | T

T → F * T | F / T | F

F → 0...9 | X...Z | (E)

And the input string: (5-X)-(Y+1).

- | | |
|---|--------|
| a) Using shift-reduce parsing fill in the action table | /10pts |
| b) From the action table build the concrete parse tree. | /1pts |
| c) Enumerate the Disadvantages of Imperative paradigm | /4pts |



DEPARTMENT OF COMPUTER AND SOFTWARE ENGINEERING

END OF SEMESTER EXAMINATION - ACADEMIC YEAR 2010-2021

YEAR: II

SEMESTER: II

GROUP: CSE

MODULE CODE and NAME: COE2261 INTERACTIVE COMPUTER GRAPHICS

DATE:

TIME: 2 hours

MAXIMUM MARKS = 50

INSTRUCTIONS

1. This paper contains FOUR (4) questions.
2. Answer THREE (3) Questions only:
Question ONE (1) from Section "A" is Compulsory and Answer any TWO (2) Questions from Section "B"
3. No written materials allowed.
4. Do not forget to write your Registration number.
5. Write all your answers in the booklet provided
6. Do not write any answers on this questions paper.
7. Start each question in a new page.
8. Materials allowed: Scientific calculators. Smart phones are not allowed.

SECTION A: COMPULSORY QUESTION

Question 1

1. Discuss the following computer animation types (2.5marks)
 - a. Raster Scan (2.5marks)
 - b. Text Clipping (2.5marks)
 - c. Morphing (5marks)
2. Discuss any 5 Computer Graphics applications with examples (2.5marks)
3. Explain the following with one example each (2.5marks)
 - a. Bitmap Graphics (2.5marks)
 - b. Procedural Animation (2.5marks)
 - c. Visible surface detection (2.5marks)
 - d. Frame buffer (2.5marks)

SECTION B: ANSWER ANY TWO QUESTIONS

Question 2

1. Give a mathematical demonstration for Bresenham's line generation algorithm (7marks)
2. Discuss the Line Clipping using Cohen Sutherland Algorithm (8marks)

Question 3

1. How are fractals generated in computer in Computer Graphics? (2marks)
2. Discuss any three 2D-transformation types used in Computer graphics (6marks)
3. Given a line are (2, 3) and (5, 8). Find intermediate points using Bresenham's Line Generation Algorithm. (7marks)

Question 4

1. Write a C program for the DDA line generation algorithm (8marks)
2. Write a C program for the Flood fill 4connected polygon fill algorithm (7marks)