



# **MAASAI MARA UNIVERSITY**

## **UNIVERSITY EXAMINATIONS**

**2019/2020 ACADEMIC YEAR**

**SCHOOL OF SCIENCE AND INFORMATION SCIENCES**

**DEPARTMENT OF COMPUTING AND INFORMATION SCIENCES**

**THIRD YEAR FIRST SEMESTER EXAMINATION**

**(REGULAR)**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

**COURSE CODE: COM-3105**

**COURSE TITLE: OBJECT ORIENTED PROGRAMMING II**

**DATE: 11<sup>TH</sup> DEC, 2019**

**TIME: 8:30- 10:30**

### **INSTRUCTION TO CANDIDATE**

- i. Question ONE in section A is compulsory
- ii. Answer any OTHER Two (2) Questions from section B
- iii. Use diagrams, example and illustration where necessary
- iv. All questions in section B have equal marks

### **QUESTION ONE (30 MARKS)**

a) Define the following terms as used in Object Oriented Programming and with appropriate example demonstrate (syntax) how they are declared in Java

- i. Polymorphism [2 Marks]
- ii. Inheritance [2 Marks]
- iii. Encapsulation [2 Marks]
- iv. Information hiding [2 Marks]

b) Write a program in Java to display today's date in this format:

*12 December 2017*

**[2 marks]**

c) By use of example define and show how constructor is created both *default* and *non- default constructor* in Java, create a class *Emp* with the following *Name, Id, and Salary* of type private with the same instances variables [10 Marks]

d) Write a program that accepts a word and prints out the middle character. The length of the input word is odd. For example, if the input is magnificent, which has 11 characters, you output the sixth character f. You use the division operator /. This operator returns only the quotient. For example, the expression 10/4 would result in 2 (not 2.5).

**[10 marks]**

### **SECTION B ANSWER ANY TWO QUESTION [40 MARKS]**

#### **QUESTION TWO [20 MARKS]**

a) Consider the following property about the bubble sort:

If the last exchange made in some pass occurs at the  $J$ th and  $(J + 1)^{st}$  positions, then all elements from the  $(J + 1)^{st}$  to the  $N$ th positions are in their correct location.

Improve the bubble sort algorithm by incorporating this property. Write a test program to verify the correct implementation of the modified bubble sort algorithm [6 Marks]

- b) Write a loan calculator program that computes both monthly and total payments for a given loan **amount**, **annual interest rate**, and loan period.

The formula for computing the monthly payment is given as

$$\text{Monthly payment} = L \times R / (1 - [1/(1 + R)]^N)$$

[7 Marks]

- c) Write a program that determines the number of days in a given semester. Input to the program is the year, month, and day information of the first and the last days of a semester.

[7 Marks]

### **QUESTION THREE [20 MARKS]**

- a) Write a test program to compare the performances of selection sort, bubble sort, and heapsort algorithms experimentally. Randomly generate 5000 integers, and sort the generated integers by using the three sorting algorithms. For each execution, record the time it took to sort the numbers

### **QUESTION FOUR [20 MARKS]**

- a) Define the term “Array”, show how both one dimension and two dimensional array is declared and created [6 Marks]
- b) Write an **AddressBook** class that manages a collection of Person objects. An **AddressBook** object will allow the programmer to **add, delete, or search** for a **Person object** in the address book.

[7 Marks]

- c) A codon is a triplet of nucleotides that specifies a single amino acid (a protein is a sequence of amino acids). Write a program that extracts codons found in an input DNA (or RNA) sequence and stores them in an ArrayList. For example, if the input is GATTTCGATC, the program stores GAT, TCG, and ATC in an ArrayList. If the length of an input string is not a multiple of 3, then ignore any leftover nucleotides. For example, if the input is GATTTCGA, then store GAT and TCG. Output codons in the list using the “for-each loop”. Repeat the operation until an empty string is entered.

[7 Marks]

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