370

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

SECOND YEAR 1ST SEMESTER EXAMINATIONS

BACHELOR OF SCIENCE IN
Computer Science, information technology, education technology

COURSE CODE:	**BCS 210 / BIT 210**
COURSE TITLE:	**OBJECT-ORIENTED PROGRAMMING**

DATE: 15/12/2022 **TIME: 08:00-10:00AM**

INSTRUCTIONS TO CANDIDATES

THIS IS AN OPEN BOOK EXAMINATION
Answer Question **ONE (1)** and Any **OTHER 2** questions
Ensure your answers/ideas are clearly expressed
All your answers must be clearly numbered
Write in ink. Rough work can be done in pencil and will not be marked. Cross out any rough work. Calculators, phones, tablets, computers not allowed

TIME: 2 Hours 20 Minutes (20 minutes for reading and choosing questions)

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE: COMPULSORY QUESTION [30 MARKS]

(a) Briefly explain why you would prefer to use interfaces rather than abstract classes [2 Marks]

(b) A method **printMin** receives variable-length argument list and returns the minimum double in the list. Write the definition of this method. [3 Marks]

(c) The mathematical constant **e** = **2.7182818285** raised to some value **x** can be estimated using the formulae

$$e^x = \sum_{n=0}^{\infty} \frac{1}{n!} \times x^n$$

where *n* is the number of times you improve the estimation. Using a **do...while** loop, write a Java method that receives a parameter **x**, estimate and return $\mathbf{e^x}$ with accuracy of less or equal to 10^{-4}. *Hint: Given factorial of* **n**, *factorial of* **n + 1** *is given by* $(n + 1)! = (n + 1) \times (n)!$ [5 Marks]

(d) A **Circle** is a 2D shape that has radius, in addition to common attributes of a 2D shape. Any 2D shape has date created, and name.

(i) Write the definition of **Shape2D** class. [3 Marks]

(ii) Write the definition of **Circle** class [2 Marks]

```
public boolean equals(Object o) { if (Circle
   instanceof o) return radius ==
   (Circle)o.radius;
   else
      return this == o;
}
```

(iii) In the **Circle** class, the *equals()* method is overridden as

1
2
3
4
5
6

such that it returns **true** if two **Circle** objects have equal radius. State and explain **TWO** errors in this method. [2 Marks]

(e) Figure 1 shows the structure of an array in memory named **vals.**

34	56	76	12	54	75	48
56	71	90	39			
28	63	48	32	65		
60	83	54				

Figure 1: Structure of an array in memory

(i) Write Java lines of code that could have been used to declare, create and initialize this array. [3 Marks]

(ii) Using a **while** loop, write a method that will receive this array, calculate and return the average of the values in the array. [4 Marks] (f) Marks of a student in 10 subjects are store in an array shown in Figure 2. You

34	56	76	12	54	75	48	56	78	54

Figure 2: Marks of a student in 10 subjects

are required to write a Java program that calculates standard deviation (δ) of this student using the formula

$$\delta = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{n-1}}$$

where

$$\mu = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1 + x_2 + x_3 \cdots + x_n}{n}$$

[6 Marks]

QUESTION TWO **[15 MARKS]**

(a) A Date class is partially define as

such that it adds one to the current date and ensures that the resultant date is valid. [3 Marks]

(b) You can estimate π using the series

$$\pi = 4\left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} \cdots + \frac{(-1)^{i+1}}{2i-1}\right)$$

where i is the number of times you do the approximations. Write a Java program that approximate the value π 800 times and display the approximated value.

[4 Marks]

QUESTION THREE **[15 MARKS]**

(a) Using appropriate methods of **JOptionPane**, write a complete Java program that reads a number from the keyboard, calculates and display the square-root of that number [5 Marks]

(b) The **Cloneable** interface in the **java.lang** package is defined as

```
1 package java.lang; public interface
2 Cloneable {
3 }
```

(i) What name is given to such empty interface? [1 Mark]

(ii) The clone() method in class **Object** is declared as

```
1 protected native Object clone() throws
    CloneNotSupportedException;
```

a. What does the word **native** denote in this method declaration? [1 Mark]

b. Assume a class **Circle** implements **Clonable** interface. Write the overriden method **clone()** as it should appear in class **Circle** such that it can be used in any package. [3 Marks]

(c) Using conditional expressions, write a Java method that generates random integers between two parameters it receives and return the absolute difference between the two numbers. [5 Marks]

QUESTION FOUR **[15 MARKS]**

(a) A **Year** has got twelve months. The months are numbered from 1 to 12. Each month has a name with month 1 being January and month 12 corresponds to December. The names of the months are stored in an array **names** whose structure in memory is shown in Figure 4.

Figure 4: Structure of an array in memory

(i) Write a line of code that initializes the array **names** with names shown in Figure 4 [3 Marks]

(ii) Write the definition of a method that will initialize a month of the year. Month is initialized to a number between 1 and 12 (1 and 12 inclusive) or initialized to a random number between 1 and 12 if the month is out of the specified range. [4 Marks]

(iii) Write the definition of method that returns the number of current month of the year. [2 Marks]

(iv) Write the definition of the method that returns the name that corresponds to the current month of the year. If current month is 1, this function returns

Jan. [Don't use decision making constructs] [2 Marks]

(v) Write definition of a method that returns the name of the next month. [Use decision making constructs sparingly] [2 Marks]

(vi) Write definition of a method that returns the name of the previous month. [Use decision making constructs sparingly] [2 Marks]

(vii) Write definition of a method that adds one to the current month. [2 Marks]

(viii) Write definition of a method that adds number of months it receives as a parameter to the current month. [Re-use the function defined in (vii) above] [3 Marks]
