SEMESTER 2
2019-20

CS162FZ
Introduction to Computer Science 2

Dr. Q. Shahnawaz, Dr. J. Timoney, Dr. M. Huggard

The total time allowed is **3 hours**. This assumes an exam duration of 2 hours with a 1 hour submission time.

By starting the examination you confirm that you have read the instructions in the box below

The exam is Open Book and all answers must be your own work. Collaboration is not permitted. The MIEC's policies on plagiarism will be applied. The MIEC reserves the right to interview students about their submitted works. All scripts will be submitted to Turnitin for plagiarism detection. High similarity scores that are flagged on Turnitin will be subject to University scrutiny.

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Should you have any questions regarding your exam paper during the exam period or if you encounter any technical difficulties you should contact the lecturer at **qureshi.shahnawaz@mu.ie**

If you experience any connectivity issues that prevent you from submitting the exam on time you must inform your lecturer within 24 hours of the final submission time. You must clearly detail the nature of the issue & any contact past this time will not be considered. Late submissions may be reviewed for plagiarism.

Maynooth University
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Time allowed: 2 hours

Answer at least three questions

Your mark will be based on your best ***three*** answers

All questions carry equal marks

Instructions

	Yes	No
Log Books Allowed	☐	☐
Formula Tables Allowed	☐	☐
Other Allowed (*enter details)*	☐	☐

[25 marks]

1 (a) Provide appropriate method headers for the following method descriptions: [5 marks]

i. A static method called *helloSummer* that prints the text "Hello Summer" to the screen.

ii. A static method called *getAverage* that will print out the average of two integer numbers passed in.

iii. A static method called *isSubString* that when passed two strings returns true if the second string contains the first.

iv. A method called *getX* which will return the value of a variable x, of type float, stored in the class.

v. An instance method called *getSalary* which returns the value of a variable salary, 'of type double' defined in a class.

(b) Write a static method named *oddEvenArray* which takes an array of integers. The method will find and print out the number of even and odd integers that are found to be present in the input array of integers. [10 marks]

Assuming you have an array defined in a main method as follows:

int myNumber [ ] = {5, 3, 9, 18, 2, 7, 12, 14}

So your method should print *The count of odd numbers is 4 and count of even numbers is 4.*

(c) Write a recursive method (no loops) that take a String as a parameter and returns an integer. Your recursive method should count the number of lowercase 'x' chars in the String. The program should use a String input by the user to test the method. [10 marks]

[25 marks]

2 (a) Write a **static** Java method that takes a two dimensional array as a parameter. The method should print out the array in reverse order. For example: The two-dimensional array on the left is printed out in reverse order as shown below. [10 marks]

1	2	3
4	5	6
7	8	9

9	8	7
6	5	4
3	2	1

(b) Draw Finite Automata that recognise the following languages. [5 marks]

- L1 = {x | x ∈ {0, 1} *, x contains **exactly four** symbols}.
- L2 = {x | x ∈ {a, b} *, x has any number of a's and b's but x must have a as its **first** symbol and b as its **third}**.
- L3 = {x | x ∈ {a, b}*, x has an even number of a's and b's}.
- L4 = {x | x ∈ {a, b, c} *, x has any number of a's and b's and c's but accepts only input beginning with **at least three** or **four c's}**.
- L5 = {x | x ∈ {a, b, c} *, x has any number of a's and b's and c's **but** x must end with **exactly three a's** or **three b's** or **three c's**}.

(c) Consider each of the following regular expressions. **Which** alphabet inputs for each of the sequences (on the right hand side) are accepted by each of the following regular expressions. [5 marks]

i.	a+b*	a, aa, bb, abba
ii.	[dwb]ay	bay, dway, way, ay
iii.	[Bb]{2,4}	b, Bb, bbb, BBBBB
iv.	p?[qr]*	p, pp, pq, rq
v.	f[ia]xed	fxed, fixed, faxed, fiaxed

(d) Write a Java *myString.matches()* **statement** using a regular expression to recognize each of the following: [5 marks]

i. A *computer science module* which is no more than 5 characters in length and must start with 'CS' followed by exactly three digits.

ii. Exactly any sequence of 6 lowercase alphabetic characters followed by '@mu.ie. For example, qureshi@mu.ie
iii. Any three letter word that ends in 'og'
iv. A *variable name which must start with my* and one uppercase alphabetic character followed by any sequence of lowercase alphanumeric characters for example myVariable7.
v. Find all $ values from $20 to $89 at the **beginning** of a line.

You may assume a variable myString of type String already holds the value that you are required to validate.

[25 marks]

3 (a) Write a sub-class of a class *Bicycle* called *MountainBike*. This class should inherit from *Bicycle* and should include one new attribute called *seatHeight* of type int. You should provide a default constructor which in turn calls the default constructor of *Bicycle* and a getter and setter method for *seatHeight*. [7 marks]

(b) Write a class to represent a Rectangle. This class should include the following: [8 marks]
i. An attribute named *width* of type double.
ii. An attribute named *length* of type double.
iii. A constructor which should set the *width* and *length* attributes to values which are passed to the constructor.
iv. Getter and setter methods for the *width* and *length* attributes.
v. A method to calculate and return the area of the rectangle which is the *width* * *length*.

(c) Write a main method in a new class, and in this method create a Rectangle Object (from part (b)) with a **length of 4** and **width of 6**. Call the method that **calculates the area of this Rectangle and print** this value to the screen. [10 marks]

Also, in your main method, write code to do the following:
- Create an array containing **5 rectangle objects** allowing each object have a **width of 8** and **length of 6** and when it is created.
- Call the getter methods on the **2nd object** in the array of the Rectangle objects to **print** its width and length to the screen.
- Set the length of the **3rd object to be 7** and the width of the **5th object to be 10.**

[25 marks]

4 (a) Write a class to represent an Employee [12 marks]

i. The class should have four attributes to represent an Employee as follows:
- A name
- A job title
- A salary (double)
- A unique employee number

ii. Provide a default constructor to give default values to all attributes **except** the employee number. The employee number should be set to a unique number.

iii. Provide a single constructor that should initialize the name, job title and salary attributes to values passed to the constructor and sets a unique value for their employee number.

iv. Provide any two getter and any two setter methods for attributes.

v. Provide a **printEmployee()** method that prints all the attributes for a Employee.

(b) Write a main class called Records, which uses the above Employee class. In the main method: [13 marks]

i. Declare an array of **6 Employee objects**.

ii. Instantiate each of the Employee objects by obtaining the necessary attribute values from a user through keyboard input. Your solution should make use of the Scanner class and a loop.

iii. Use the appropriate getter methods to print the name and job title of the **fourth Employee** in the array.

iv. The Employee in the **fifth position** of the array has changed salary to the following: 55000.00. Implement this change.

v. Call the **printEmployee()** method to return the attributes for each Employee object.