SEMESTER 1
2020-21

CS161FZ
Introduction to Computer Science 1

Dr. Chunyang Zhang, Dr. J. Timoney, Dr. M. Huggard

Time allowed: 2 hours

Attempt all questions

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

All questions carry equal marks

Instructions

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

General (*enter details)*

1. In Java, the invalid statemen is ( ) **[2 marks]**

   A. String s= “join”+ “was”+ “here”;

   B. String s= “join”+3;

   C. int[] Arr = { 1, 1, 1, 1, 1 };

   D. Int[] Arr = new Arr[5]; Arr = { 1, 1, 1, 1, 1 };

   answer: D

2. When the following statements are implemented, the value of str is ( ) . **[2 marks]**

   String str ="123456789"; str = str.substring(1, 3);

   A. "23 " ; B. "123" ; C. "12" ; D. "234" ;

   answer: A

3. The main() is defined as

   public static void main (String[] args) {

   System.out.print(“Hello”+args[1]) ;}

   When the arguments from command line are given by "people world nation", the result of the program is ( ) . **[2 marks]**

   A. Hello people

   B. Hello world

   C. Hello people world nation

   D. An exception occurred at runtime

   answer: B

4. In the following declarations, ( ) is invalid. **[2 marks]**

   A. float f=1/3; B. int i=1/3;

   C. float f=1*3.0; D. double f=1.0/3;

   answer: C

5. If the follow program segment is implemented, ( ) will occur. **[2 marks]**

```
String s = null; s.concat (" abc");
```

A. ArithmeticException B. NullPointerException
C. IOException D. EOFException

answer: B

6. What is Von Neumann architecture? Briefly describe the functionalities of its four main components. **[5 marks]**

Answer: Input and output devices, memory, CPU (ALU, CU, PC and registers).

7. What is operation system? Give three examples of operation systems. **[5 marks]**

Answer: Operation system is a powerful, and usually large, program that controls and manages the hardware and other software on a computer. Eg. Linux, Windows, MacOS.

8. Discuss the importance of using standard communication protocols for the Internet. **[5 marks]**

Answer: A network protocol includes all the rules and conventions for communication between network devices, including ways devices can identify and make connections with each other. There are also formatting rules that specify how data is packaged into sent and received messages.

9. What is object-oriented programming, and explain the concepts: class, method and object. **[5 marks]**

Answer: Older programming languages like COBOL and C followed the Procedural Programming approach. The program written using these languages used to be a series of step by step instructions. They made use of procedures/subroutines for making the program modular. This programming paradigm focused on logic more than data and the program used to combine both of them together. Modern programming languages like Java, C# etc. follow the Object Oriented approach. In object oriented programming, importance is given to data rather than just writing instructions to complete a task. A

class defines attributes and behavior (methods). An object is a thing or idea that you want to model in your program.

10. Convert $(861.125)_{10}$ to binary, and convert $(11001001101)_2$ to hexadecimal. **[6 marks]**

Answer:$(1101011101.001)_2$; $(64D)_{16}$

11. If declare and initialize four integer variables as a = 4, b= 8, c = 11, compute the expression: result = ++c%a/2 ==0 | b>a*2 & c <3*a; step by step. **[5 marks]**

Answer: result = (c++)%a/2 ==0 | (b>a*2 & c <3*a)= ture.

12. What is the value in the variable *result* and *f* after the following code segment runs: **[5 marks]**

```
int result = 4;
boolean f = (++result < 4) && (result-- < 10);
```

Answer: result = 4; f = false

13. What is the expected output following the execution of the code fragment given below? Please also identify the values for *result1, result2, result3* and *result4*. **[5 marks]**

```
public class StringComparision {

      public static void main(String[] args) {
            String str1 = "CS161FU";
            String str2 = new String("CS161FU");
            String str3 = "cs161FU";
            String str4 = "CS161FU";
            Boolean result1 = str1 ==str2;
            Boolean result2 = str1.equals(str2);
            Boolean result3 = str1.equals(str3);
            Boolean result4 = str1 ==str4;
            Boolean result = (result1 & result2)^(result3 |
result4);
            System.out.println(result);
      }
   }
```

Answer: false;true;false;true;true

14. Please find all errors in following program. **[6 marks]**

```
public class test {
```

```
    public static void main(String[] args) {

        for ( count = 0; count >= 0; count++);
        {
        System.out.println("Count is: " + count );
        }

}
```

Answer: (1) there is no semicolon in the end of condition; (2) a } is missing for the class; (3) int count = 0; (4) infinite loop

15. Write a complete program to print all the Narcissistic numbers between 100 and 1000 exclusive. A three-digits number is call ed as Narcissi number if it equals the sum of the cubes of its digits. For example, $370 = 3^3 + 7^3 + 0^3$, and 370 is a Narcissi number.

Step (1): split each number properly; **[3 marks]**

Step (2): check if it is a Narcissi number; **[5 marks]**

Step (3) : print all the Narcissi numbers in single line with four blank spacing. **[3 marks]**

Answer:

```
public class Narcissistic {
    public static void main(String[] args) {
        int firstdigit = 0;
        int seconddigit = 0;
        int lastdigit = 0;
        for(int i = 100; i < 1000; i++){
          lastdigit = i/100;
          seconddigit = i/10%10;
          firstdigit = i%10;
          if(Math.pow(firstdigit, 3) + Math.pow(seconddigit,
3) + Math.pow(lastdigit, 3) == i ){
            System.out.print(i+"\t");
          }
        }
    }
}
```

16. For any positive integer, write a complete program to check whether it is a prime number. Prime numbers are the positive integers having only two factors, 1 and the integer itself.

(1) Step 1: declare an integer variable, assign its value from keyboard with user prompt message “Please input a positive integer:”; **[4 marks]**

(2) Step 2: identify whether the integer is a prime number. **[5 marks]**

(3) Step 3: print appreciate messages. If the number is 5, print “5 is a prime number”. If the number is 4, print “4 is a prime number”. **[2 marks]**

Answer:

```
import java.util.Scanner;
public class prime {
	public static void main(String[] args) {
		Scanner sc = new Scanner(System.in);
		System.out.print("Please input a positive integer:
");
	      int a = sc.nextInt();
		for(int i =2;i<a;i++) {
		    if (a%i==0) {
			System.out.println(a+" is not a prime
number");
			return;
		    }
		  }
		System.out.println(a+" is a prime number");
	}
}
```

17. Write a complete program that creates two strings *s1* and *s2* reference “Hello World” and “hello world” respectively. The program should:

(1) check if the Strings have the same length. Print an appropriate message; **[2 marks]**

(2) If they are the same length check if the strings are lexicographically the same; **[2 marks]**

(3) get the 6rd character in *s1*; **[2 marks]**

(4) change the case of *s1* and *s2*, one to uppercase and one to lower case; **[2 marks]**

(5) check if *s1* contains the letter 'l'. If it does print a message to display the first position of the letter 'l' in the String. **[3 marks]**

Answer:

```
public class similar
{
      public static void main(String args[])
      {
            String s1 = new String("Hello world"), s2 = new
String("Hello World");
            int len1 = s1.length(), len2 = s2.length();
            if(len1 == len2){
                  System.out.println("The Strings are both of
length " + len1);
                  if(s1.equals(s2)){
                        System.out.println("The Strings are
lexicographically the same");
                  }
                  else{
                        System.out.println("The Strings are not
lexicographically the same");
                  }
            }
            else{
                  System.out.println("The Strings are not the
same length");
            }

         char c1 = s1.charAt(2);
            s1 = s1.toUpperCase();
            s2 = s2.toLowerCase();
            System.out.println("S1: " + s1);
            System.out.println("S2: " + s2);

            if(s1.indexOf('l') != -1){
                  System.out.println("The character e appears at
index: " + s1.indexOf('l'));
            }
      }
}
```

18. Given a matrix $\begin{pmatrix} 8 & 1 & 2 & 2 & 9 \\ 1 & 9 & 4 & 0 & 3 \\ 0 & 3 & 0 & 0 & 7 \end{pmatrix}$, write a complete program to calculate the minimal and maximal elements, mean value and standard deviation, denoted by *min, max, mean and std* respectively. For a matrix a= $\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$, *mean* is the average value of all the elements in the matrix, and $std =$

$\frac{1}{N-1}\sqrt[2]{\sum_{i=1}^{3}\sum_{j=1}^{3}(a_{ij}-mean)^2}$, where N is the number of elements.

(1) Declare and initialize an 2D array with integer type; **[3 marks]**

(2) Compute the *max, min*, *mean* and *std* with proper types; **[5 marks]**

(3) Print the four values to the screen in different lines; **[2 marks]**

Answer:

```
public class matrix {
   public static void main(String[] args) {
   int [][] a =
{{8,1,2,2,9},{1,9,4,0,3},{0,3,0,0,7}};
    int r = a.length, c = a[0].length;
    double mean = 0, std = 0;
    int min = a[0][0], max = a[0][0];
    for(int i=0;i<r;i++)
        for(int j=0;j<c;j++) {
            min = min<a[i][j]? min:a[i][j];
            max = max>a[i][j]? max:a[i][j];
            mean+=a[i][j];
           }
    mean/=(r*c);

    for(int i=0;i<r;i++)
        for(int j=0;j<c;j++)
            std += Math.pow((a[i][j]-mean), 2);

          std = Math.pow(std, 0.5)/(r*c-1);
          System.out.println("Min:"+min);
          System.out.println("Max:"+max);
          System.out.println("mean:"+mean);
          System.out.println("std:"+std);
         }
}
```