CSC 115
Midterm Exam:
Thursday, 9 June 2022

Exam duration: 70 minutes

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Students must check the number of pages in this examination paper before beginning to write, and report any discrepancy immediately.

- We will not answer questions during the exam. If you feel there is an error or ambiguity, write your assumption and answer the question based on that assumption.
- Answer all questions on this exam paper.
- The exam is closed book. No books or notes are permitted.
- **Electronic devices, including calculators, are not permitted.**
- The marks assigned to each part are printed within brackets. Partial marks are available.
- There are fourteen (14) pages in this document, including this cover page.
- Pages 11 and 14 are left blank for scratch work. If you write an answer on that page, clearly indicate this for the grader under the corresponding question.
- Clearly indicate only one answer to be graded. Questions with more than one answer will be given a **zero grade**.
- It is strongly recommended that you read the entire exam through from beginning to end before beginning to answer the questions.

Part 1 (18 marks)
For the following questions, write your final answer in the box provided.
Write **"invalid"** for those with syntax errors.

a) What are the values of the variables a and b after the following code segment has executed?

```
double a = 4.7;
int b = 9;

b = (int) ( a + b / (int) a );
```

a: 4.7

b: 6

b) What are the values of the variables a and b after the following code segment has executed?

```
int a = 2;
int b = 5;

b = b + a++;
```

a: 3

b: 7

c) What is the output of the following program?

```
public class Question {
   public static void main(String[] args) {
         int x = 5;
         int y = 11;
         foo(x, y);
         System.out.println("main:" + x + "," + y);
   }

   public static void foo(int x, int y) {
         int z = x;
         x = y;
         y = z;
         System.out.println("foo:" + x + "," + y);
   }
}
```

Write **only** your final answer in this box:

foo: 11, 5
main: 5, 11

d) Write the code to replace the // comment so that this program will calculate and print the cost of shipping a package of weight 12.7 kgs.

```
public class Question {
   public static void main(String[] args) {
         double numKilograms = 12.7;

         // your code to be inserted here

         System.out.println("shipping cost is $:" + cost);
   }

   public static double calculateShipping(double weightKGs) {
         // method body omitted intentionally
         // do not complete this method
   }
}
```

Write **only** your final answer in this box:

```
double cost = calculateShipping(numKilograms);
```

e) What is the output of the following program?

```
public class Question {
   public static void main(String[] args) {
         int[] data = {4, 8, 1, 7};
         int count = 4;
         foo( data, count );

         System.out.println(data[0]);
         System.out.println(data[3]);
         System.out.println(count);
   }

   public static int foo(int[] array) {
         int count = 0;

         for (int i = 0; i < array.length; i++) {
               if (array[i] > count) {
                     array[i]++;
                     count++;
               }
         }
         return count;
   }
}
```

4 8 1 7

5 7 4

i	if	count
0	✓	0 → 1
1	✓	1 → 2
2	X	2 → X
3	✓	2 → 3
4		

Write **only** your final answer in this box:

Compile Error as foo function is taking one input not two.

f) Consider the following method with correct documentation but that contains a logic error in the implementation.
To answer this question fix the error in the method by crossing out incorrect code and/or adding necessary code to make it correct.

```
/*
 * myMax
 * Purpose: returns the max int value found in the given array
 * Parameters: int[] array
 * Example: if called with array {-9,-7,-2} it will return -2
 * Precondition: array is not null and array is not empty
 * Returns: int - the max integer value
 */
public static int myMax (int[] array) {

    int max = 0;
    for (int i = 0; i < array.length-1; i++) {

        if ( array[i] > array[i+1] ) {

            max = array[i];

        } else {

            max = array[i+1];

        }

    }

    return max;
}
```

{1, 2, 3, 4?

if (array.length != 0) {

i	
0	✓
1	✓
2	
3	

0 > 1
1 > 2
2 > 3

Write an example call to this method that would have demonstrated the error you found:

```
int[] data = {};
int maxNumber = myMax(data);
```

Part 2 (23 marks)

Consider the Student Class written for you and that will be used in the following 4 questions. NOTICE the print statements added that will impact tracing questions.

```
public class Student {
    private static final int MINIMUM_DEGREE_CREDITS = 60;
    private static String institutionName = "UVic";
    private String sid;
    private double gpa;
    private int currentCredits;

    public Student () {
        String sid = "unknown";
        double gpa = 0.0;
        int currentCredits = 0;
        System.out.println("A");
    }

    public Student (String sid, double gpa) {
        this.sid = sid;
        this.gpa = gpa;
        this.currentCredits = 0;
        System.out.println("B");
    }

    public void setSid (String sid) {
        this.sid = sid;
    }

    public String getSid () {
        return sid;
    }

    public void setGpa (double gpa) {
        this.gpa = gpa;
    }

    public double getGpa () {
        return gpa;
    }

    public void setCurrentCredits(int currentCredits){
        this.currentCredits = currentCredits;
    }

    public int getCurrentCredits(){
        return currentCredits;
    }

    public boolean equals(Student other) {
        return this.sid.equals(other.sid);
    }
}
```

a) What is the output of the following program?

```
public class Question {
    public static void main (String[] args) {
        Student s0;
        System.out.println("C");

        Student s1 = new Student("V1234", 8.2);
        Student s2 = new Student("V5678", 7.5);
        s0 = new Student();

        System.out.println("D: " + s0.getSid());
        System.out.println("E: " + s1.getSid());
        System.out.println("F: " + s2.getSid());

        s2 = s0;
        s0.setSid("V8888");
        System.out.println("G: " + s0.getSid());
        System.out.println("H: " + s2.getSid());

        Student[] students = {s1, s2};
        students[1].setSid("V3333");
        System.out.println("J: " + s0.getSid());
        System.out.println("K: " + s1.getSid());
        System.out.println("L: " + s2.getSid());
        System.out.println("M: " + students[1].getSid());
    }
}
```

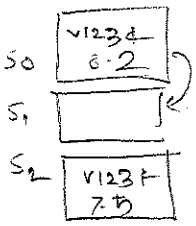
Write only your final answer in this box:

C
B
B
A
D: unknown
E: V1234
F: V5678
G: V8888
H: unknown
J: V888
K: V1234
L: V333
M: V333

b) What is the output of the following program?

```
public class Question {
    public static void main (String[] args) {
        Student s0;
        Student s1 = new Student("V1234", 8.2);
        Student s2 = new Student("V5678", 7.5);
        s0 = s1;
        s2.setSid("V1234");

        System.out.println("W: " + s0 == s1);
        System.out.println("X: " + s2 == s1);
        System.out.println("Y: " + s0.equals(s1));
        System.out.println("Z: " + s2.equals(s1));
    }
}
```



Write only your final answer in this box:

B
B
W: true
X: false
Y: true
Z: true

c) A portion of the Student class from page 6 is copied here for your convenience:

```
public class Student {
    private static final int MINIMUM_DEGREE_CREDITS = 60;
    private static String institutionName = "UVic";
    private String sid;
    private double gpa;
    private int currentCredits;
    // getter/setter methods omitted here for space
}
```

Consider the following documentation for methods to be added to the Student class.
Add an **X** to the box beside the methods that can be defined as static methods. (negative marks for incorrect selections)
Method implementations omitted intentionally - you do not need to implement them.

☐
```
/* setInstitutionName
 * Purpose: sets institutionName to newName
 * Parameters: String newName
 * Returns: nothing
 */
```

☐
```
/* higherGpa
 * Purpose: returns true if s1 has a higher gpa than
 *   this Student, false otherwise
 * Parameters: Student s1
 * Precondition: s1 is not null
 * Returns: boolean
 */
```

☐
```
/* getNumberOfCreditsNeeded
 * Purpose: returns the number of credits Student s1 needs
 *  to reach MINIMUM_DEGREE_CREDITS
 * Parameters: Student s1
 * Precondition: s1 is not null
 * Returns: int
 */
```

☐
```
/* anyHaveSameNumberOfCredits
 * Purpose: returns true if this Student has the same number of
 *  currentCredits as any Student in otherStudents, false otherwise
 * Parameters:  Student[] otherStudents
 * Precondition: otherStudents is not null
 * Returns: boolean
 */
```

☒
```
/* getAllWithSameHireYear
 * Purpose: returns an array of the sids of all Students
 *   in otherStudents that have a gpa higher than the gpa
 *   of the given Student s1
 * Parameters:  Student[] otherStudents, Student s1
 * Precondition: otherStudents and s1 are not null
 * Returns: String[]
 */
```

d) If the Student class was changed and set to implement the following Person interface, what code would you need to add to the Student class?
You do not need to write the code but clearly identify what you would need to add.

```
public interface Person{

    /* getName
     *
     * Purpose: returns the name of this Person
     * Parameters: none
     * Returns: String - the name
     */
    String getName();


    /* setName
     *
     * Purpose: set the name of this Person to given name
     * Parameters: String name
     * Returns: nothing
     */
    void setName(String name);

}
```

Write only your final answer in this box:

```
public class Student implements Person {
    private String name;

    // all aforementioned functions inside the student class

public String getName() {
    return this.name;
}
public void setName(String name) {
    this.name = name;
}
```

Page left blank intentionally for scratch work if needed...
If you write an answer on that page, clearly indicate this for the grader under the corresponding question.

Part 3 (13 marks)

Given the following interface:

```
public interface IntegerList {

    /* extend
     *
     * Purpose: adds the values in the given array
     *   to the end of this IntegerList
     *
     * Parameters: int[] array - values to be added
     *
     * Precondition: array is not null
     *
     * Returns: nothing
     *
     * Example:
     *  If this list contains the following 3 values in this order:
     *  1, 2, 3
     *  after this method is called with the array {7, 9, 8, 5}
     *  this list will contain the following 7 values in this order:
     *  1, 2, 3, 7, 9, 8, 5
     *
     */
    void extend(int[] array);

} // end of IntegerList interface
```

Complete the required method for the `IntegerArrayList` class beginning below.
Write only the required code in the box provided on the following page.
Note: other methods you would expect in a list have been omitted for space.

```
public class IntegerArrayList implements IntegerList {

    private static final int INITIAL_SIZE = 10;

    private int[] data;    // array to hold list values
    private int   count;   // number of values in this list

    public IntegerArrayList() {
        data = new int[INITIAL_SIZE];
        count = 0;
    }
```

```
public void extend (int[] array) {

    if ((array.length) > (data.length - count)) {

        int[] newArr = new int[ data.length + array.length];
        int total = (data.length + array.length);

        for (int i = 0; i < data.length; i++) {

            newArr[i] = data[i];

        }

        int count = 0;
        for (int i = data.length; i < total; i++) {

            newArr[i] = array [count + 1];

        }

        data = newArr;

        count += total;

    }
```

```
} // end of IntegerArrayList class
```

Page left blank intentionally for scratch work if needed...
If you write an answer on that page, clearly indicate this for the grader under the corresponding question.

END OF EXAM