King Saud University

College of Computer and Information Sciences
Computer Science Department

Duration	**3 hours**
Course Code:	CSC 111
Course Title:	Introduction to Programming
Semester:	Spring 2016
Exercises Cover Sheet:	**Final Exam – (Version A)**

Student Name:	
Student ID:	
Student Section No.	

Tick the Relevant	Computer Science B.Sc. Program ABET Student Outcomes	Question No. Relevant Is Hyperlinked	Covering %
√	**a) Apply knowledge of computing and mathematics appropriate to the discipline;**	**1,2,3**	**40%**
	b) Analyze a problem, and identify and define the computing requirements appropriate to its solution		
√	**c) Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;**	**4**	**60%**
	d) Function effectively on teams to accomplish a common goal;		
	e) Understanding of professional, ethical, legal, security, and social issues and responsibilities;		
	f) Communicate effectively with a range of audiences;		
	g) Analyze the local and global impact of computing on individuals, organizations and society;		
	h) Recognition of the need for, and an ability to engage in, continuing professional development;		
	i) Use current techniques, skills, and tools necessary for computing practices.		
	j) Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;		
	k) Apply design and development principles in the construction of software systems of varying complexity;		

Important Notes:

- Cheating is prohibited! Looking at your colleague's paper will get you an F in the course immediately!

- Turn OFF your Phone/s. If you take out your phone for ANY reason, you will get an F in the course immediately!

. Same applies for smart watches.

ملاحظات هامة

. الغش ممنوع! عند النظر إلى ورقة زميلك، سترسب في المادة مباشرة!

. أغلق جوالك / جوالاتك! عند إخراجك للجوال لأي سببٍ كان، سترسب في المادة مباشرة!

. نفس المبدأ يطبق على الساعات الذكية.

Question 1 (8 Marks)

Question	Answer
1	
2	
3	
4	
5	
6.1	
6.2	
6.3	

1. What will be the output of the following segment of program?

```
int i = 1, j = 10;
do
{
   if(i > j)
   {
       break;
   }
   j--;
   i++;
} while (i < 5);
System.out.println("i = " + i + " and j = " + j);
```

A. `i = 6 and j = 5`
B. `i = 5 and j = 6`
C. `i = 6 and j = 4`
D. `i = 5 and j = 5`

2. What will be the output of the program?

```
public class test1
{
      public static void main(String [] args)
         {
            int i = 1;
            do{
                        while ( i < 1 )
                            System.out.print("i is " + i);
                     }while ( ++i > 1 ) ;
          }
}
```

A. `i is 1`
B. `i is 1 i is 1`
C. No output is produced.
D. Compilation error

3. What output will be produced by the following code?

```
int[] anArray = new int[5];

for (int i = 0; i <anArray.length; i++)
    anArray[i] = 2 * i;

for (int j = 0; j <anArray.length; j++)
    System.out.print(anArray[j] + " ");
```

A. `0 2 4 6 8`
B. The code has a compilation error
C. `2 4 6 8 10`
D. The code has a run-time error

4. What output will be produced by the following code?

```
char[] a = new char[3];

for (int i = 0; i <a.length; i++)
      a[i] = 'a';
char[] b = a;
b[2] = 'b';
a[1] = 'c';
System.out.println("a[1] = " + a[1] + ", b[1] = " + b[1]);
System.out.println("a[2] = " + a[2] + ", b[2] = " + b[2]);
```

A.
```
a[1] = c, b[1] = c
a[2] = b, b[2] = b
```

B.
```
a[1] = c, b[1] = a
a[2] = a, b[2] = b
```

C.
```
a[1] = a, b[1] = b
a[2] = a, b[2] = b
```

D. The code has a run-time error

5. What output will be produced by the following code?

```
Class People{
      /**
      Postcondition: Returns the number of people in
      numberOfCouples couples.
      */
      public static int countPeople(int numberOfCouples){
            return 2 * numberOfCouples;
      }
      /**
      Postcondition: Returns the number of children,
      assuming that each couple has 2.3 children.
      */
      public static double countPeople(int numberOfCouples){
            return 2.3 * numberOfCouples;
      }
}

Class TestPeople{
      public static void main(String[] args){
      People p = new People();
      p.countPeople(1000);
}
```

A. The code has a compilation error

B. `2000`

C. `2300`

D. `2.300`

6. Consider the class MyClass:

```
class MyClass
{
      public void service1(char letter)
      {
       System.out.println(letter);
      }
      public int service2 ()
      {
         return 2+3+4;
      }
      public double service3(int i)
      {
        return i + 0.0;
      }
}
```

6.1. Which of the following is a valid statement to invocate service1:

A.
```
MyClass.service1('a');
```

B.
```
MyClass ref = new MyClass();
System.out.println(ref.service1('$'));
```

C.
```
MyClass ref = new MyClass();
ref.service1('$');
```

6.2.Which of the following is a valid statement to invocate service2:

A.
```
MyClass.service2('a');
```

B.
```
System.out.println(MyClass.service2());
```

C.
```
MyClass ref = new MyClass();
System.out.println(ref.service2());
```

6.3. Which of the following is a valid statement to invocate service3:

A.
```
MyClass.service3(-7);
```

B.
```
MyClass ref = new MyClass();
System.out.println(ref.service3(-7));
```

C.
```
int j = MyClass.service3(5));
```

Question 2 (4 Marks):

Show the output of the following programs?

```
public class Test {
      public static void main(String[] args){
      int i = 1;
      while (i < 5) {
      for (int j = i; j > 0; j--)
            System.out.print(j + " ");
            System.out.print("****");
            System.out.println();
            i++;
            }
       }
}
```

Output :

Question 3 (3 marks)

Find 3 errors (there are more than 3) in the following Java code. The errors are both compiler errors and logical errors. For each error, identify the line number and briefly explain what is the error.

```
1 public class Circle {
2     public static final float PI = 3.14F ;
3
4     private double x, y ; /* The center of the circle. */
5     private double r ; /* The radius of the circle. */
6
7     public Circle(double r) {
8           this(0.0,0.0,this.r) ;
9     }
10
11    public Circle(double x, double y, double r) {
12          this.x = x ;
13          this.y = y ;
14          this.r = r ;
15
16    /* Returns the area of the circle. */
17    public double area() {
18          return PI * r * r ;
19    }
20
21    /* Indicates whether a point is on the boundary of the circle.
22    public boolean onCircle(double x1, y1) {
23          static final double EPSILON = 0.01 ; double dx = x1 - x ;
24          double dy = y1 - y ;
25          return (dx*dx + dy*dy - r*r) < EPSILON ;
26    }
27
28    /* Creates a series of concentric circles */
29    public static void main(String[] args) {
30          int i ;
31
32          for( int i=0 ; i < 10 ; i++ )
33                Circle c = Circle(10.0*i) ;
34                System.out.println("r="+c.r+" A="+c.area) ;
35    }
36 }
```

Answer:

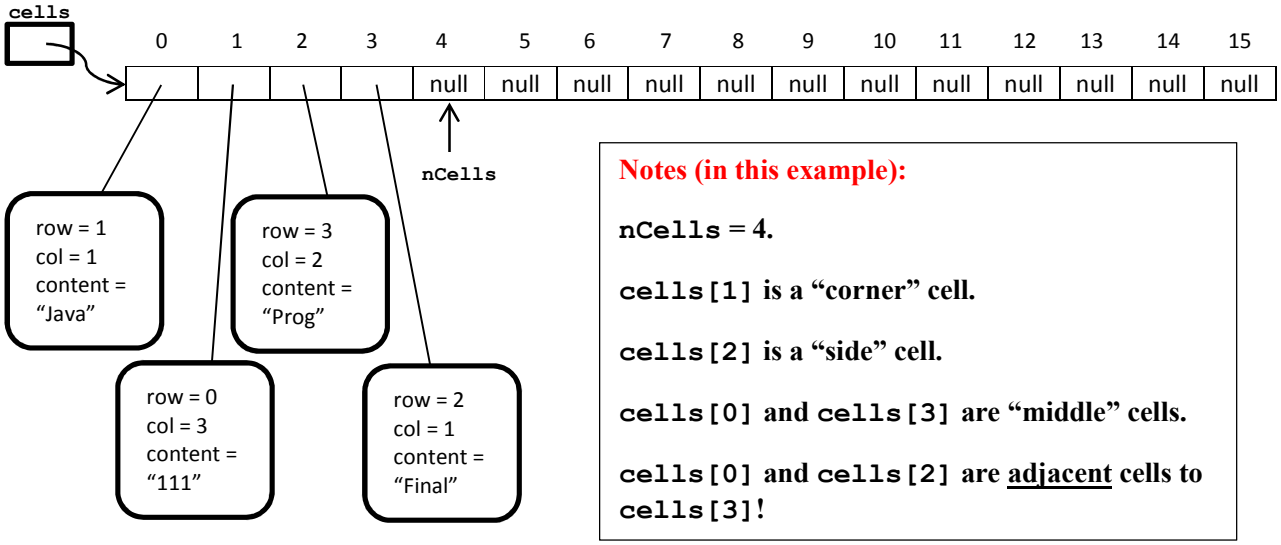
Line Number	What is the error?

Question 4 (25 marks):

Write a program that manages **a spreadsheet**. A spreadsheet contains a fixed number of rows and columns. Your program should allow the user to add a cell, find a cell by its row and column numbers, find if a cell has adjacent cells, and returns the type of the cell (corner, side or middle). The following figure shows a spreadsheet and how it is represented using an array of objects.

	0	1	2	3
0				111
1		Java		
2		Final		
3			Prog	

The spreadsheet above will be represented in the array of objects below:



Notes (in this example):

`nCells` = 4.

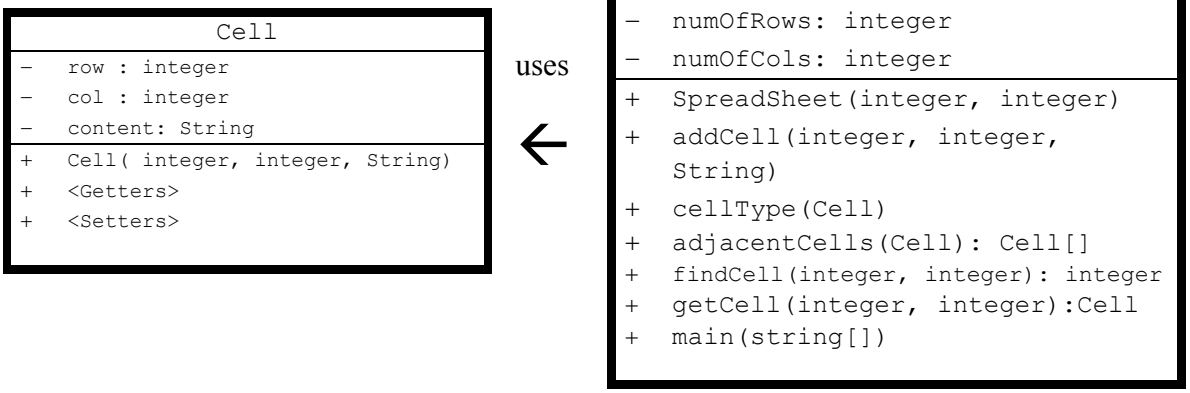
`cells[1]` is a "corner" cell.

`cells[2]` is a "side" cell.

`cells[0]` and `cells[3]` are "middle" cells.

`cells[0]` and `cells[2]` are adjacent cells to `cells[3]`!

UML Diagram



The Class: Cell

(1.5 mark) Develop the class **`Cell`** that represents a single cell in a spreadsheet. It has the attributes: row of type integer, column of type integer, and content of type String. These represent the row and column where the cell is located along with the content of the cell.
The methods of this class are **(all methods are not static)**:

- **(2.5 marks) Cell**: A constructor that receives three parameters row, col, content and initializes new cell with the initial values from these parameters. The first row is row 0 and the first column is column 0. If the value of the row or the column is not valid (negative) then use 0. (*use setter methods to initialize instance variables here and apply the same rules there.*).
- **(1.5 marks) Setter methods** (one for each attribute)
- **(1.5 marks) Getter Methods** (one for each attribute)

Answer :

The Main Class: SpreadSheet

(2 marks) The main class is class **`SpreadSheet`** which is also the class that you are going to use to test your program. This class contains one array of objects `cells` that holds all the cells information. It also contains one integer variable `nCells` that contains the number of cells in the spreadsheet. It also contains two variables `numOfRows` and `numOfCols` that store the number of rows and the number of columns in the spreadsheet. The first row is row 0 and the first column is column 0.
This class contains `main` method as well as other methods.
The methods of this class are **(all methods are not static)**:

- **(2 marks) SpreadSheet**: A constructor that takes two integer parameters which are number of rows and number of columns. It creates the array `cells` and initializes number of cells to zero. *Note: the size of the spreadsheet must have at least one row and one column and the maximum number of cells in the arrays equals to the size of the spreadsheet (number of rows * number of columns)*
- **(3 marks) addCell**: this method receives 3 parameters: `row` of type integer, `col` of type integer, and `content` of type String. Using this info, it creates and adds a new cell if the cell is:
  - Inside the spreadsheet (within the spreadsheet boundaries)
  - Not already added.

  If the cell is not inside the spreadsheet or already added then print error message "`ERROR: the cell cannot be added`". *Use* `findCell` *to check if the cell exists*.
- **(2.5 marks) cellType**: the method receives one parameter `cell` which is an object of type `Cell` that represents one of the cells in the spreadsheet and returns the type of the cell as a String. There are three types of cells:
  - "Corner" which is a cell that is located in a corner of the spreadsheet.
  - "Side" which is a cell that is located on one of the sides of the spreadsheet (first or last row or column) but not in the corner.
  - "Middle" a cell that is not a "corner" or a "side" cell.
- **(2.5 marks) adjacentCells**: the method receives one parameter `cell` which is an object of type Cell that represents one of the cells in the spreadsheet and returns an array of objects `adjCells` that contains all cells in the spreadsheet adjacent to `cell`.
- **(2 marks) findCell**: this method receives 2 parameters: `row` of type integer, `col` of type integer and returns the index of the cell in array `cells` that is located at the specified row and column in the spreadsheet. If there is no cell at the specified location then the method returns -1.
- **(1 mark) getCell**: this method takes two integer parameters `row` and `col` and returns the cell object at the specified row and column or null if it is not found.
- **(3 marks) main:** the main method. It will do the following:
  1. It creates a SpreadSheet object of size 4(rows)*5(columns).
  2. Then, it adds a cell located at row 0, column 0 with content "I love".
  3. Then, it adds a cell located at row 3, column 2 with content "Java :)".
  4. Then, it gets the cell at row 0, column 0 and prints its type.
  5. Finally, it returns the adjacent cells to cell at row 0, column 0.

Answer :

(Bonus Question 3 Marks)

Suppose you have the following class:

```
public class HC {
      private String name;
      private int id;
      public static void main(String[] args) {
            int x = 5;
            double d = -10.0;
            HC h = new HC("Final", 40);
            if(method1(d+1)) // …… Line 1
                  System.out.println("Positive");
            else
                  System.out.println(h.method1());// …… Line 2
            System.out.println(HC.method2('2')); // …… Line 3
}
public HC(String n, int i)
{
            name = n;
            id = i;
}
// … The Rest of the methods are here …
} // end of class
```

Write down a possible heading for the following methods:

A) The method invoked in Line 1:

```
public _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
{
     return d + 10 > 0;
}
```

B) The method invoked in Line 2:

```
public _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
{
     return id;
}
```

C) The method invoked in Line 3:

```
public _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
{
     return (double) c + 1;
}
```

Result					
Question No.	**Relevant Student Outcome**	**SO is Covered by %**	**Full Mark**	**Student Mark**	**Assessor's Feedback**
1	a	15	8		
2	a	15	4		
3	a	10	3		
4	C	60	25		
Bonus Question	N/A	N/A	3		
Totals		100% + 15%	40 + 3		

I certify that the work contained within this assignment is all my own work and referenced where required. **Student Signature:** **Date:**			**Feedback Received:** **Student Signature:** **Date:**	