Name: _____

CS 141: Introduction to (Java) Programming: Exam 2

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1.	(max 14)	3.	(max 21)	5.	(max 9)	7.	(max 16)
2.	(max 10)	4.	(max 14)	6.	(max 16)		
Total:							(max 100)

1. (1 pts each, 16 pts total) **True and False:** Please circle T or F *(Credit is only given if the instructor can clearly tell which answer is circled)*

1) **T** or **F** In an abstract class, not all of the methods are implemented.

2) **T** or **F:** If Electric is a subclass of Vehicle, then it is ok to have the declaration:

```
Electric e = new Vehicle();
```

3) **T** or **F:** An object can be created from an abstract class.

4) **T** or **F:** A do-while loop always executes the loop body at least once.

5) **T** or **F:** Arrays can be used as arguments or return values in methods.

6) **T** or **F:** The size of an ArrayList cannot be changed.

7) **T** or **F:** When declaring a multi-dimensional array, the size of all of the dimensions must be specified.

8) **T** or **F**: The implements keyword is used to specify that a class uses an interface.

9) **T** or **F:** Array parameters are passed (i.e. called) by value.

10) **T** or **F:** Overloading is when methods in a class have the same name but a different list of parameters.

11) **T** or **F:** An example of polymorphism is when an array contains objects of different types but where those types are related through inheritance.

12) **T** or **F:** An exception is an object that is thrown when an error or an unexpected event occurs during runtime.

13) **T** or **F:** A deep copy of an object creates new references but not necessarily new objects.

14) **T** or **F:** An object cannot be created from only an interface.

2. (10 pts) **Looping:** Write a **<u>while-loop</u>** which prints out the even numbers from 200 down to 100. That is, the output should look something like: 200 198 196 194 ... 100.

```
int i = 200;
while (i >= 100) {
     System.out.print(i + " ");
     i=i-2;
}
```

3. (7 pts each, 21 pts total) **1D Arrays:** Write code that:

   a. Declares and creates a 1D array called `vals` consisting of 100 doubles*:*

```
double[] vals = new double[100];
```

b. Implement a **for-loop** that initializes each array element in `vals` to a random number (e.g. use Math.random()) .

```
for (int i=0; i < vals.length; i++) {
    vals[i] = Math.random();
}
```

c. Implement a second for-loop which computes and prints the maximum value of all of the elements in `vals`.

```
double max = vals[0];
for (int i = 0; i < vals.length; i++) {
    if (max < vals[i]) {
        max = vals[i];
    }
}
System.out.println("Max value is " + max);
```

4. (14 pts total) **2D Arrays**:
   a. (6 pts) Write code that declares and creates a 2D array of Card objects called `myCards` with 10 rows and 20 columns.

```
Card[][] myCards = new Card[10][20];
```

   b. (8 pts) Write a nested loop to initialize all the elements of the array. Do not use the magic numbers 10 or 20, instead make use of the length variable.

```
for (int i = 0; i < myCards.length; i++) {
    for (int j = 0; j < myCards[i].length; j++) {
        myCards[i][j] = new Card();
    }
}
```

5. (9 pts) **Class vs Instance variables:** Given the class:

```
public class Bag {
    private static int size = 10;
    private String item;

    public Bag(String item) {
          this.item = item;
    }

    public static void setSize(int s) {
        size = s;
    }

    public void setItem(String item) {
        this.item = item;
    }

    public String toString() {
        return item + ", size = " + size;
    }
}
```

What is the output of the following code at Lines 0, 1, and 2:

```
public class Exam2Project {
   public static void main(String[] args) {
       Bag chips = new Bag("Chips");
       Bag donuts = new Bag("Donuts");
Line 0:  System.out.println(chips + " and " + donuts);

       chips.setItem("Corn chips");
       chips.setSize(12);

Line 1:  System.out.println(chips + " and " + donuts);
       Bag.setSize(15);
Line 2:  System.out.println(chips + " and " + donuts);
    }
}
```

Output:

Line 0: Chips, size = 10 and Donuts, size = 10

Line 1: Corn chips, size = 12 and Donuts, size = 12

Line 2: Corn chips, size = 15 and Donuts, size = 15

6. (16 pts total) **Object Diagrams:** Assume the Card class is the same as the one you wrote in the lab assignment. That is, it contains one member variable: the index of the card. Its toString() method prints out the name of the card, e.g. ace of spades.

   Given the code below:

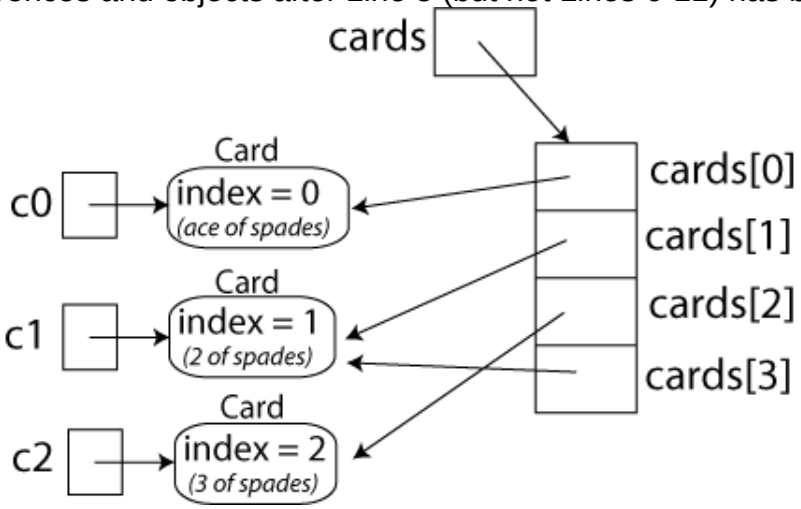
```
Line 0:   public class CardProject {
Line 1:        public static void main(String[] args) {
Line 2:             Card c0 = new Card(0);  // ace of spades
Line 3:             Card c1 = new Card(1);  // 2 of spades
Line 4:             Card c2 = new Card(2);  // 3 of spades

Line 5:             Card[] cards = {c0, c1, c2, c1};
Line 6:             System.out.println(cards[0]+",  "+cards[1] +
                           ",  "+cards[2] +",  "+cards[3]);

Line 7:             cards[0]= c1;
Line 8:             cards[1] = cards[2];
Line 9:             cards[2] = cards[0];
Line 10:            cards[3] = c0;


Line 11:            System.out.println(cards[0]+",  "+cards[1] +
                           ",  "+cards[2] +",  "+cards[3]);
Line 12:       }
Line 13:  }
```

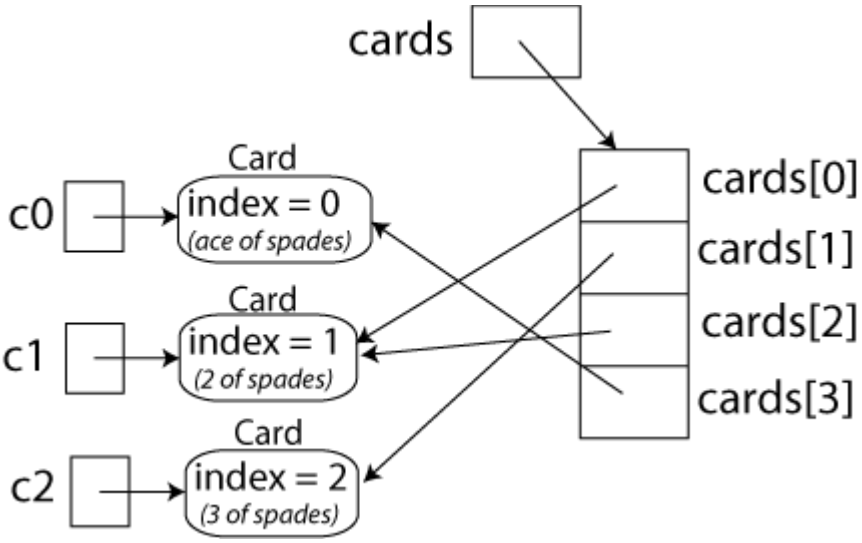
   a) (6 pts) The object diagram for Lines 2-4 is shown below. Add to this diagram, the references and objects after Line 5 (but not Lines 6-11) has been executed.



   b) (2 pts) What is printed at Line 6?

```
ace of spades, 2 of spades, 3 of spades, 2 of spades
```

c) (6 pts) Redraw the entire object diagram from part a) but modified to reflect the objects and references as they would appear after executing ***all lines of code***.



d) (2 pts) What is printed out at Line 11?

```
2 of spades, 3 of spades, 2 of spades, ace of spades
```

7. (16 pts total) **Inheritance:** Consider the classes shown here:

```
public class Car {

    public void m1() {
      System.out.println("car in m1");
   }

   public void m2() {
      System.out.println("car in m2");
   }

   public String toString() {
      return "vroom ";
   }
}
```

```
public class Truck extends Car {
    public void m1() {
      System.out.println("truck in m1");
   }
   public void m2() {
      super.m1();
   }
   public void m3() {
       System.out.print("truck in m3: ");
       m1();
   }
   public String toString() {
      return "truck: " + super.toString();
   }
}
```

Indicate what is the printed at each numbered line below, *or indicate if the line results in an error*.

```
                public class InheritanceProject {
                    public static void main(String[] args) {
                        Car car = new Car();
        Line 1:         System.out.println(car);
        Line 2:         car.m1();
        Line 3:         car.m2();
        Line 4:         car.m3();

                        Truck truck = new Truck();
        Line 5:         System.out.println(truck);
        Line 6:         truck.m1();
        Line 7:         truck.m2();
        Line 8:         truck.m3();
                    }
                }
```

Output:

Line 1: ______vroom_____

Line 2: _____car in m1_____

Line 3: _____car in m2_____

Line 4: _____ ERROR_____

Line 5: _____truck: vroom_____

Line 6: _____truck in m1_____

Line 7: _____car in m1_____

Line 8: _____truck in m3: truck in m1_____