

CSCI 162  
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Review Questions for Exam 1

These questions will not be collected or graded, they are simply for your own exam preparation – we can review any questions you have during the class before the exam.

1. Define and discuss the following terms. Distinguish them from similar concepts.

- a. abstract data type
- b. primitive data type
- c. class invariant
- d. clone
- e. constructor

2. List the phases of software development that we discussed in class. Describe what happens in three of them.

3. Describe the purpose of the instance variables of a class

4. Arrays. Write a function called `sumElements` that will return as its integer return value the sum of all the elements in *field* (a two dimensional integer array which is the only parameter to the function; it already contains values and does not change).

## 5. Simple Container Classes

a. Given a bag, describe its contents (abstract value) after the series of operations:

insert 42, insert 5, insert 56, insert 12, insert 29, insert 8

b. Given a sequence, describe its contents (abstract value) after the series of operations:

addBefore 42, addAfter 5, addAfter 56, addBefore 12, addBefore 29, addBefore 8

c. How do the bag and sequence differ even though they contain the same values?

d. Draw a picture of the internal contents (instance variables) of the sequence where the series was applied.

Be complete with your picture.

e. Describe the representation of the sequence as we implemented it with a partially-filled array.

6. Classes (Hint: refer to the program on the back page and questions 8 to 10) This is a long description, but the problem isn't hard. You're building a game in which the players each set the goal they must meet to win. As players move through the game, they must collect 10 objects from three categories: purple, green, and navy. Before the game begins, each player records how many objects they must collect in each category to win the game. The total of objects a player must collect must total to 10, and no category may have a negative number. For example, Sandy might choose to try to get 4 purple, 2 green, and 4 navy, while Terry might choose 0 purple, 7 green, and 3 navy.

Your task is to build a class to support goal setting and recording. The Goal class has six integer instance variables to record the targets in each category (use  $pT$ ,  $gT$ , and  $nT$  for the targets) and the number of objects accumulated in each category ( $p$ ,  $g$ , and  $n$ ). The constructor will take in the three target values for the categories as its parameters ( $pT0$ ,  $gT0$ , and  $nT0$ ). It will also initialize the accumulated objects counters in each category. Throw an `IllegalArgumentException` if the targets are not each at least zero or don't sum to ten.

The class also has methods that update the accumulated object counts. For the test, we'll have only `addPurple` which adds 1 to the purple count ( $p$ ). The class also has a boolean `hasReachedGoal` method that returns true if the goal has been reached and false otherwise. The goal is reached only when all of the targets have been met (they may be exceeded).

Write the Goal class including the constructor, the two methods described above (`addPurple` and `hasReachedGoal`), and the six instance variables ( $pT$ ,  $gT$ , and  $nT$  and  $p$ ,  $g$ , and  $n$ ).

## 7. Parts of Functions and Classes

- a. What is the purpose of the new in Record papers = new Record( ) ?
  - b. Why is the throw statement used in the method report?
  - c. How many instances of the Game class are created when this program runs?
  - d. In addGame, what would happen if you incremented us at the end of the method?
  - e. Could print add one to the value of games as in r.games++? Why or why not?
8. What does the program on the next page print? Show the steps of execution for partial credit. It does compile and execute cleanly.

## 9. Expanding the Class

- a. Write a concise and precise class invariant for the games instance variable in terms of the other instance variables.
- b. Write the prototype (method header) for a numWins method that returns the number of wins as its integer return value. It has no parameters. Write prototype only.
- c. You want to print a win-loss-tie record (such as 3-1-1) in Game.java. Describe in precise words (not code) the best way to go about doing this. What would change where?

```

////////////////////////////////////
// Game.java
////////////////////////////////////

public class Game {
    public static void main(String[] args) {
        Record papers = new Record( );
        Record scissors = new Record( );
        papers.addGame(4, 3);
        scissors.addGame(0, 4);
        print("Papers", papers);
        print("Scissors", scissors);
        papers.addGame(5, 7);
        scissors.addGame(4, 6);
        scissors.addGame(9, 1);
        papers.addGame(3, 7);
        scissors.addGame(7, 3);
        papers.addGame(0, 5);
        papers.addGame(1, 4);
        scissors.addGame(3, 1);
        print("Papers", papers);
        print("Scissors", scissors);
    }

    public static void print(String name, Record r)
    {
        System.out.println(name + " "
        + r.report( ) + "%");
    }
}

```

```

////////////////////////////////////
// Record.java
////////////////////////////////////

public class Record {
    private int wins;
    private int losses;
    private int ties;
    private int games;

    public Record( ) {
        wins = 0;
        losses = 0;
        ties = 0;
        games = 0;
    }

    public void addGame (int us, int them) {
        if (us > them) {
            wins++;
        } else if (us < them) {
            losses++;
        } else {
            ties++;
        }
        games++;
    }

    public int report ( ) {
        if (games > 0) {
            return (wins * 100) / games;
        } else {
            throw new ArithmeticException
            ("divide by zero");
        }
    }
}

```

10. Write method "clone" for a GroceryCart class that has an int numItems and an array of doubles called prices.

11. Using the GroceryCart class described in the previous question, write a **static** "union" method that takes two GroceryCart objects "c1" and "d2" and returns a new GroceryCart object representing the union of the two GroceryCarts. You can assume a constructor that takes an initial number of items already exists for GroceryCart.