JAVA – AP CS – EXERCISES

Last Update: February, 2017

CONTENTS

About Standard Input / Output 3
Practice Problems I – The Basics 4
Practice Problems II - The String and basic Wrapper Classes 6
Practice Problems III – Super Class, Sub-class, Inheritance and polymorphism 8
Practice Problems IV – Arrays vs. ArrayList 10
Practice Problem V – Recursion 16
Practice Problems V – Sorting, Search Algorithms 17

About Standard Input / Output

```
//Calculate Area of a circle
import java.util.Scanner;

public class Area {

	public static void main (String[] args) {
		Scanner in= new Scanner(System.in);

		System.out.println("Enter Circle Diamenter:   ");
		float dia = in.nextFloat();
		float area = dia * dia * (float)Math.PI;

		System.out.println("\n Area of a circle with " + dia +
				" diameter = " + area);

		System.out.println(" ... or " + String.format("%.2f", area));
	}
}
```

```
	import java.util.Scanner;

	public class Temperature {

		public static void main (String[] args) {
			Scanner in= new Scanner(System.in);

			System.out.println("Enter Fahrenheit:   ");
			float fah = in.nextFloat();
			float cel = (fah -32.0f)  * 5.0f / 9.0f;

			System.out.println("\n F(" + fah + ") + = (C) " + cel);
		}
	}
```

```
import java.util.Scanner;

public class Hyp {

        public static void main (String[] args) {
                Scanner in= new Scanner(System.in);

                System.out.println("Enter height and width:   ");
                int height = in.nextInt();
                int width = in.nextInt();

                System.out.println("\n h=" + height + "   width= " + width +
                        ".  Hypotenuse = " + Math.sqrt(height*height + width*width)) ;
        }
}
```

PRACTICE PROBLEMS I – THE BASICS

1) Review the samples above, and write your own.
2) Create a program to ask user to enter a number as Fahrenheit. Your program will convert this to Celsius.

Celsius = (Fahrenheit – 32) * 5/ 9

3) Then, create another program to ask user to enter Celsius. Your program will convert this to Fahrenheit.
4)
5) Write a program to ask user to provide the radius of a circle, calculate the circumference and area display all values.
6)
7) Plotting the "*" triangle. Write a function that outputs a right triangle of height and width n, so n = 6 would look like the image on the right. You can assume there are only 6 levels. Then, you should allow user to decide the number of levels.
8)
9) Tip: If you have difficulty in figuring out the loop structure, hardcode the layout of 6 levels, find the pattern, and convert to loop structure.
10)
11) You borrow $1000. Your annual interest rate is 12%. You pay back $100 a month. If it is based on compound interest rate, how much do you still own after 4 months? The display should be something like this:

```
     *
    **
   ***
  ****
 *****
******
```

.e.g. interest you own at 1st month = $1000 * (12%/12) = $10

You pay off $100. Thus you still owe $910 at the end of 1st month

i.e. $1000 + $10 - $100.

interest you own at 2nd month = $910 * (12%/12) = $9.10

You pay off $100. Thus you still owe $910 at the end of 1st month

i.e. $910 + $9.10 - $100.

Output should look like this:

```
        Month              total interest paid          still
        owe
            1                    $ 10.00               $910.00
            2                    $ 9.10                $819.10
            3        etc
```

12) Write a program to perform factorial of 2 to 6. Display the result backward as shown on the right.

13)

14) (note: your program must do the calculation, not hardcode the result.

```
6 !=    720
5 !=    120
4 !=    24
3 !=    6
```

PRACTICE PROBLEMS II - THE STRING AND BASIC WRAPPER CLASSES

EX1: MULTIPLE CHOICE REVIEW

Extraction from Java Certification Exam published by Kalpanar.files.wordpress.com.

Note: May use more exercises in the AP Baron's Book for more review materials.

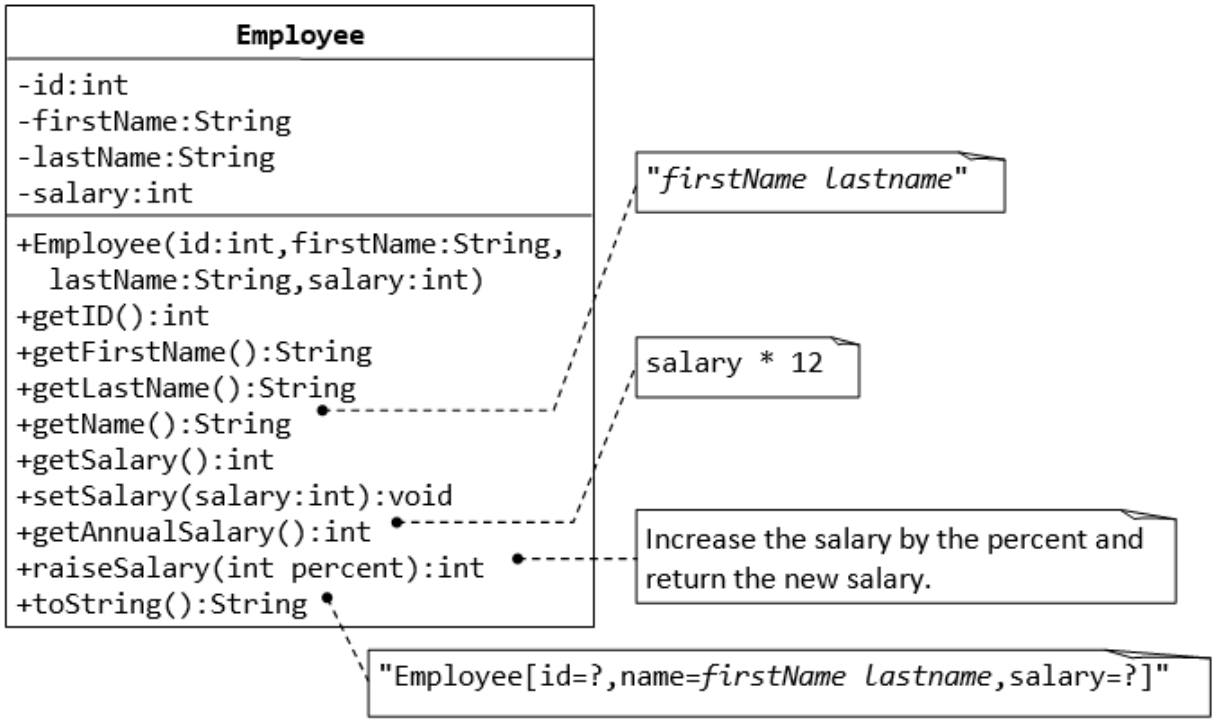
EX2: WRITE YOUR OWN WRAPPER CLASSES

shown in the Learning package under the Module II - Basic Wrapper Classes - Integer, Float, Double

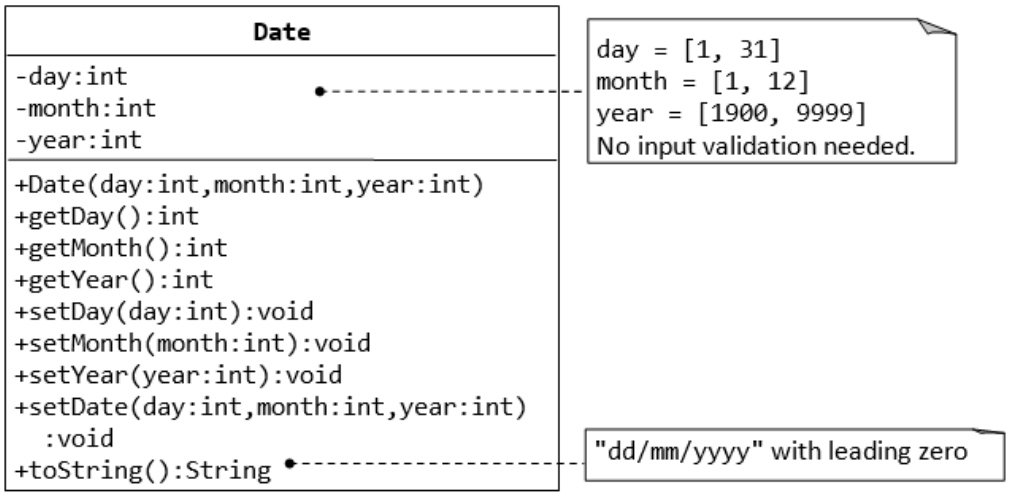
---

Fr the following Exercises, you will need to write your classes, and the test driver class

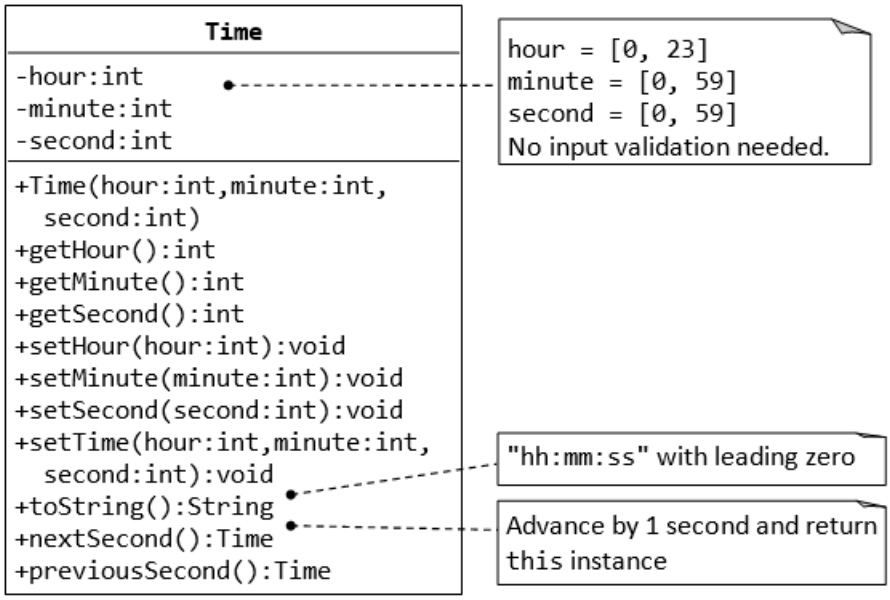
EX3: WRITE YOUR EMPLOYEE CLASS



Ex 4: Write your Date Class



Ex 5: Write your Time Class

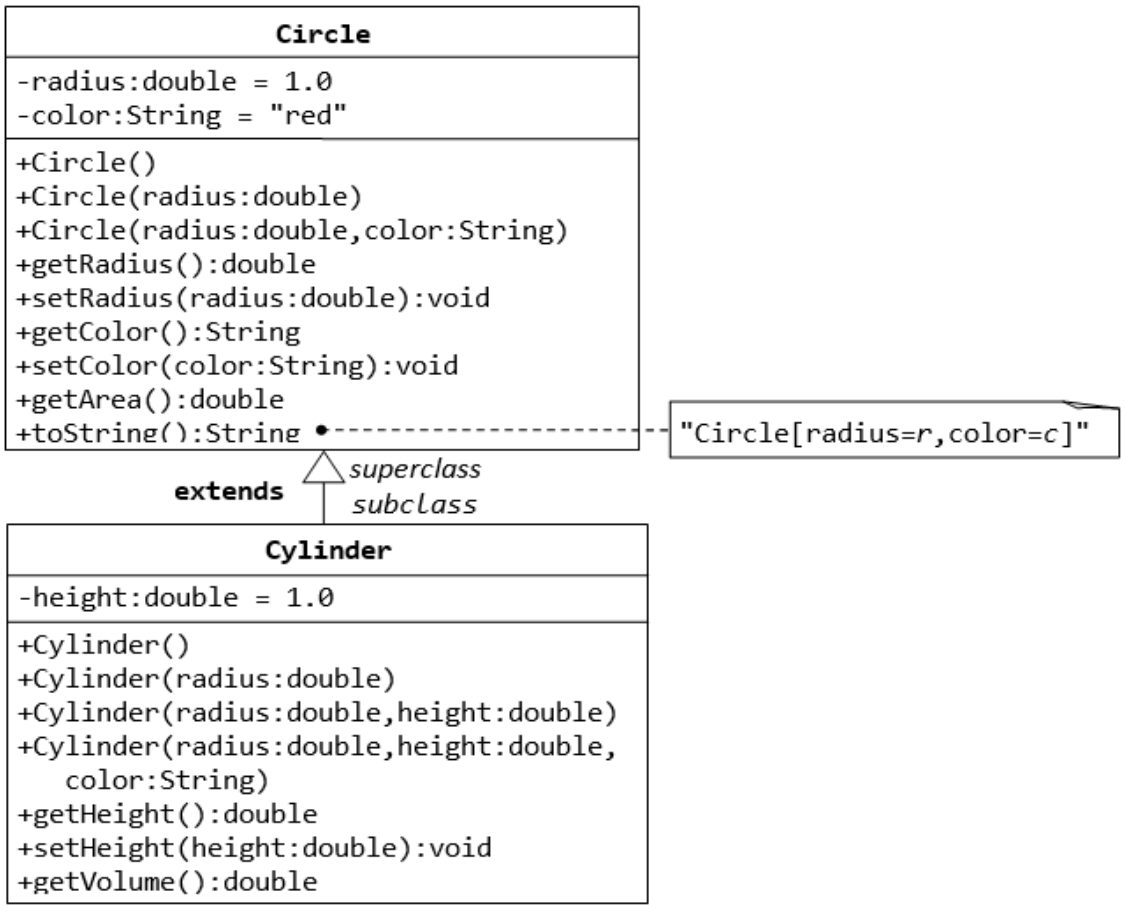


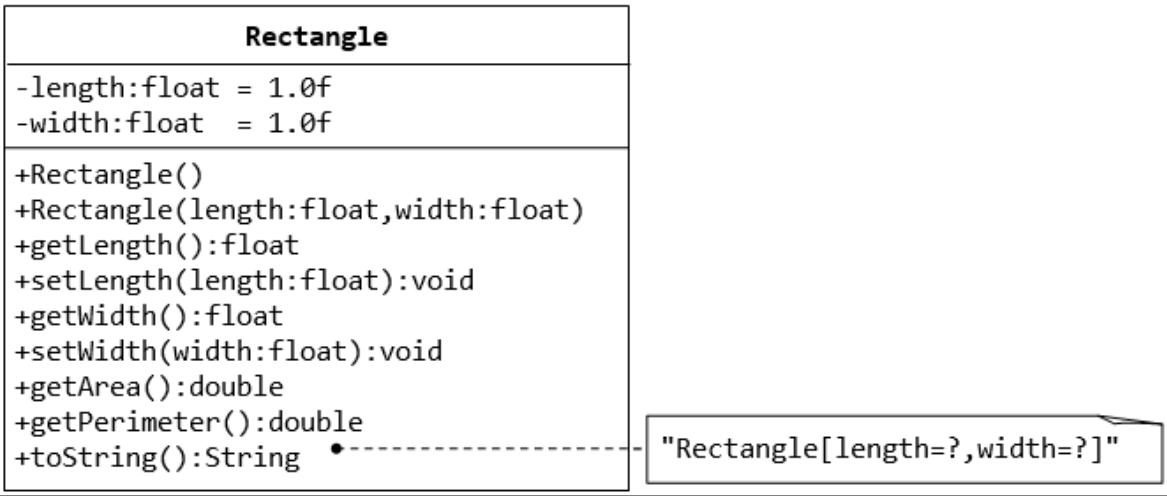
Ex 6:

Work on the Strings problems sets from http://learn.stormingrobots.com.

PRACTICE PROBLEMS III – SUPER CLASS, SUB-CLASS, INHERITANCE AND POLYMORPHISM

EX 1- IMPLEMENT YOUR OWN CIRCLE CLASS, CYLINDER SUBCLASS, AND RECTANGLE SUBCLASS.





EX2 – COMBINE THEM ALL

Create an Interface GeometryInterface Class, create an abstract Class Shapes to implement it. Then, Circle class you did in the past exercise should inherit the new Abstract Shape class.

Let's start with…

```
interface GeometryInterfaces {
  // constant declarations, if any
  …
  void draw();
  void resize();
  void findArea();
  void findPerimeter();
}

abstract class AbsShapes  implements GeometryInterfaces{
    int x, y;
    ...
    void moveTo(int newX, int newY) {
        // this can be method implementation here.
    }
    Void resize();
    {
        // must implement it as it is not an abstract method.
    }
    abstract void draw();   // as it is an abstract method, you do not have to implement
    abstract void resize();
}

class Circle extends GraphicObject {
    void draw() {
        ...
    }
    void resize() {
        ...
    }
}
```

PRACTICE PROBLEMS IV – ARRAYS VS. ARRAYLIST

Review : https://docs.oracle.com/javase/tutorial/java/nutsandbolts/arrays.html

EX1 – ANSWER THE QUESTIONS

1. The term "instance variable" is another name for ___.
2. The term "class variable" is another name for ___.
3. A local variable stores temporary state; it is declared inside a ___.
4. A variable declared within the opening and closing parenthesis of a method signature is called a ____.
5. What are the eight primitive data types supported by the Java programming language?
6. Character strings are represented by the class ___.
7. An ___ is a container object that holds a fixed number of values of a single type
8. Consider the following code snippet.
   arrayOfInts[j] > arrayOfInts[j+1]

   Which operators does the code contain?

9. Consider the following code snippet.
   int i = 10;
   int n = i++%5;

   a) What are the values of `i` and `n` after the code is executed?
   b) What are the final values of `i` and `n` if instead of using the postfix increment operator (`i++`), you use the prefix version (`++i`)?

10. To invert the value of a `boolean`, which operator would you use?
11. Which operator is used to compare two values, = or == ?
12. Explain the following code sample:
    ```
    result = someCondition ? value1 : value2;
    ```

13. What is the difference between **switch** and if-then-else.
14. What is the difference between **do {…} while(..);** statement vs **while(…) {…}** structure.

ANSWERS TO QUESTIONS

1. The term "instance variable" is another name for **non-static field**.
2. The term "class variable" is another name for **static field**.
3. A local variable stores temporary state; it is declared inside a **method**.
4. A variable declared within the opening and closing parenthesis of a method is called a **parameter**.
5. What are the eight primitive data types supported by the Java programming language? **byte, short, int, long, float, double, boolean, char**
6. Character strings are represented by the class **java.lang.String**.
7. An **array** is a container object that holds a fixed number of values of a single type.
8. 1**:** `>`, `+`
9.
    a. `i` is 11, and `n` is 0.
    b. `i` is 11, and `n` is 1.
10. The logical complement operator "!".
11. The `==` operator is used for comparison, and `=` is used for assignment.
12. This code should be read as: "If `someCondition` is `true`, assign the value of `value1` to `result`. Otherwise, assign the value of `value2` to `result`."

Ex2 - answer the multiple choice, write your own arraylist to check out the answer.

1. Which of the following statements is NOT true about ArrayLists?
   a. ArrayLists are slightly faster than arrays.
   b. ArrayLists can store elements of different types.
   c. ArrayLists can increase in size to store more elements.
   d. ArrayLists have methods to manage their content.

2. Given the following code fragment:

```
ArrayList<String> myArrayList = new ArrayList<String>( );
myArrayList.add("One");
myArrayList.add("Two");
myArrayList.add("Three");
myArrayList.add("Four");
```

3. Which of the following expressions will modify myArrayList so it looks like: One; Two; Four
   a. myArrayList.remove (myArrayList.get(3));
   b. myArrayList.remove (myArrayList.indexOf("Three"));
   c. myArrayList.remove (Three);
   d. myArrayList.remove (myArrayList.get(2));

4. Which of the following expressions will modify myArrayList so it looks like: One; Two, Three; Five
   a. myArrayList[3] = "Five"
   b. myArrayList[4] = "Five"
   c. myArrayList.set (myArrayList.indexOf("Four"),
   d. myArrayList.set (myArrayList.indexOf("Five"),

5. Given the following code fragment:

```
ArrayList<Integer> myArrayList = new
ArrayList<Integer>( );
myArrayList.add(1);
myArrayList.add(3);
myArrayList.add(7);
```

6. Which of the following expressions will modify myArrayList so t looks like: 1 3 5 7
   a. myArrayList.add (5);
   b. myArrayList.add (2, 5);
   c. myArrayList.add (4, 5);
   d. myArrayList.add (3, 5);

Ex3 – Implement this ArrayList as Array type

Ask user to enter at least 5 different programming languages. You program should then display them in both the order they are entered and alphabetical order. If the name entered is empty (spaces), eliminate it.

e.g.

```
Enter 5 different programming languages (with ; as the delimiter)

Python; C++  ; Java; PHP ;          C# ;       ;Perl
```

Output

```
Non-sorted:  Python; C++; Java; PHP; C# ; Perl
Sorted: C# ; C++; Java; PHP ; Python; Perl
```

Ex4 - Create class ListName

In main() :

Create an ArrayList<String> students

Add 4 students to the ArrayList:

- Amy, BillyBob, CoolJoe, DennisTheMance
- Add them to the ArrayList directly

Write method to print elements in the ArrayList and its size

Write printArrayzlist() method with ArrayList as the argument

Your output should be:

Amy

BillyBob

CoolJoe

DennisTheMance

There are 4 names

Ex5 – Simple Anagram

Write a program to identify if 2 words are anagram.

Ex6 – find sets of Anagrams

Write a program to identify # of sets of anagrams in a list of 20 words, display which set each word is associated with.

Eg.
Input:

abc	cab	fib	biff	diff	ffid	bif	ifab	abfi	bac	ffib

Output:

abc	1
cab	1
afib	2
biff	3
diff	4
ffib	3
bif	5
ifab	2
abfi	2
bac	1
ffib	3

EX7 - WRITE A PROGRAM THAT READS A TEXT FILE

Specified by:

- 1st argument : File name to read .
- 2nd argument: given the line # which allows your program will display that # of lines

Hint: To determine the number of lines in the file, use `java.io.File.length` to obtain the size of the file, then divide by an assumed size of an average line.

Sample implementation from docs.oracle.com. You should write your own.

```
import java.util.*;
import java.io.*;

public class FileList {
   public static void main(String[] args) {
      final int assumedLineLength = 50;
      File file = new File(args[0]);
      List<String> fileList =
         new ArrayList<String>((int)(file.length() /  assumedLineLength) * 2);
      BufferedReader reader = null;
      int lineCount = 0;
      try {
         reader = new BufferedReader(new FileReader(file));
         for (String line = reader.readLine(); line != null;
               line = reader.readLine()) {
            fileList.add(line);
            lineCount++;
         }
      } catch (IOException e) {
         System.err.format("Could not read %s: %s%n", file, e);
         System.exit(1);
      } finally {
         if (reader != null) {
            try {
               reader.close();
            } catch (IOException e) {}
         }
      }
      int lines = Integer.parseInt(args[1]);
      for (int i = 0; i < lines; i++) {
         System.out.format("%d: %s%n", i, fileList.get(random.nextInt(lineCount - 1)));
      }
   }
}
```

PRACTICE PROBLEM V – RECURSION

Do the simple ones first from Baron's Book

From http://learn.stormingrobots.com. – find Recursion. Instead of using C/C++, use Java.
- note: this set of exercises is beyond AP CS required.

PRACTICE PROBLEMS V – SORTING, SEARCH ALGORITHMS

From Baron's Book:

- must understand the flow of the mergesort algorithm.
- Implement your own insertion sort and selection sort.

For advanced : Write your own qsort sorting implementation.