

CS201

HW#1, 40 points total

Due: Midnight, Wednesday, 9/17

Submit your programs/code via Blackboard

Algorithm Design

1. **(8 points). Running.** You have finished a race and would like to know at what pace you ran the race. Describe an algorithm (i.e. an English description that illustrates step by step how to solve the problem) that takes as input the distance of the race in miles, and the finishing time in hours, minutes, and seconds. Your algorithm should compute the pace per mile in minutes and seconds.

To test your algorithm, an input of 26.2 miles, 3 hours, 16 minutes, and 30 seconds should result in a pace of 7:30 per mile.

For this part, give an algorithm only, do not write code.

Short Answer

2. **(4 points)** Given the algebraic equation

$$y = ax^3 + 2x + 7$$

Which of the following, if any, are correct Java statements for this equation?

- a. `y=a*x*x*x+2*x+7;`
 - b. `y=a*x*x*x+2*(x+7);`
 - c. `y=a*(x*x*x+(2*x)+7);`
 - d. `y=(a*x)*x*x+7+x*2;`
 - e. `y=a*(x*x*x)+(2*x)+7;`
3. **(4 points)** State the order of evaluation of the operators in each of the following Java statements, and show the value of x after each statement is performed.
 - a. `x=7+3*6/2-1;`
 - b. `x=2 % 2+2*2-2/2;`
 - c. `x=(3*9*(3+(9*3/(3))));`

Programming Exercises

For programming exercises, turn in a copy of your code. **For all exercises use the Unix environment, not TextPad or NetBeans.** We will mostly use TextPad or NetBeans for the rest of the class, but you'll have your choice of which environment to use. Turn in your Java files along with any other answers. Your answers can be placed in a word document or textfile.

Fill in the following comment header for all your programs. Add additional comments in your program as you deem necessary.

```
////////////////////////////////////  
// CS201  
// <Your Name Here>  
// <Date>  
// Purpose: <Purpose>  
////////////////////////////////////
```

4. (6 points) One way to measure the amount of energy that is expended during exercise is to use metabolic equivalents (MET). Here are some METS for various activities:

Running 6 MPH:	10 METS
Basketball:	8 METS
Sleeping:	1 MET

The number of calories burned per minute may be estimated using the formula:

$$\text{Calories/Minute} = 0.0175 \times \text{MET} \times \text{Weight(Kg)}$$

Write a program that inputs a person's:

- Weight in pounds
- Minutes spent running 6 MPH
- Minutes spent playing basketball
- Minutes spent sleeping

And outputs the total number of calories burned. One kilogram is equal to 2.2 pounds.

5. (10 points) Running Race Pace Calculator

Implement the running pace calculator described in problem 1. Here is a sample of the desired behavior:

Example (user input in bold):
Input distance in miles: **26.2**
Input hours run: **3**
Input minutes run: **16**
Input seconds run: **30**
Your race pace is 7:30 per mile

Debugging

The program below will compile, but it has **multiple logic errors**. Find the errors and correct them.

The purpose of this program is to convert a quantity expressed as miles per hour into minutes/seconds per mile. Many treadmills output MPH on their consoles, but most runners think in terms of minutes/seconds per mile instead.

The logic the program intends to use is, starting with X mph:

$$\begin{aligned} Y \text{ (miles/min)} &= 1/60 \text{ (h/min)} * X \text{ (miles/h)} \\ M \text{ (minutes/mile)} &= \text{int}(1/Y) && // \text{int chops off fractional part} \\ S \text{ (seconds/mile)} &= ((1/Y) - M) * 60 \text{ (sec)} \end{aligned}$$

Answer is then M:S

```
////////////////////////////////////
// CS201
// <Your Name Here>
// <Date>
// Purpose: Convert mph to minutes/seconds per mile
////////////////////////////////////

import java.util.Scanner;
class ScannerTest {
    public static void main(String[] argv)
    {
        Scanner keyboard = new Scanner(System.in);
        double x, y;           // Original mph, miles/min
        int mins, secs;       // Converted minutes, seconds
        String s;             // String for input

        System.out.println("Enter pace in miles per hour:");
        x = keyboard.nextDouble();

        y = 1 / 60 * x;
        mins = (int) (1/y);
        secs = (int) (1/y - mins * 60);
        System.out.print("Your pace is " + mins + " minutes ");
        System.out.println("and " + secs + " seconds.");
    }
}
```

As an example, the proper answer for an input of 6.5 mph should be 9 minutes and 13 seconds.

6. (8 points) Turn in a fixed version of the conversion program. Identify what the bugs were, and how your solution fixes the problems.