

**UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING**

**APS105 — Computer Fundamentals
Mid-Term Test Solutions**

Exam Type A:

This is a “closed book” examination; no aids are permitted.

Calculator Type 4:

No calculators are allowed.

All questions are to be answered on the test paper. If the space provided for a question is insufficient, continue on the back of the preceding page, indicating clearly on the front that you have done so.

The test has eight pages.

The marks allocated to the questions, out of a total of 90, are shown in the question headings.

For all questions, you may assume that the following `Stdin` methods are available:

`Stdin.getInt()`, `Stdin.getDouble()`, and `Stdin.getChar()`.

You may also use any of the methods from the `Math` and `String` classes.

Name _____

Student Number _____

MARKS

1	2	3	4	5	6	7	8	9	10	11	12	13	Total
/2	/2	/5	/4	/4	/6	/4	/3	/12	/12	/12	/12	/12	/90

Question 1 [2 Marks]

How many bits are required to store values of each of the following types?

- a) double 64
- b) char 16

Question 2 [2 Marks]

Write a *single* Java statement that will print the following, *exactly* as shown.

```
"No!" she said.
"It's wrong."
```

```
System.out.println("\n\"No!\" she said.\n\n\"It's wrong.\n\");
```

Question 3 [5 Marks]

The following program contains five known syntax errors. Find each one, circle it, and correct it as best you can. Marks will be deducted for incorrect suggestions for changes to the program.

```
class Errors
{
    public static main (String[] args)           // missing "void"
    {
        int ij = 0;
        for (ji = 30; ij < ji; ij++)           // ji not declared
        {
            if (ji * ij < ij + ji % 3 * ji < 100); // a < b < c should be a < b && b < c
                ji += --ij;                     // also omit ; in previous line
            else
                ji++;
            System.out.println("The result is" + ji + ij);
        }                                       // missing }
    }
}
```

Question 4 [4 Marks]

What would be printed by the following fragment? (Write your answer in the spaces provided. Use one space for each character.)

```
double x = 2e-1, y = -1e-2;
System.out.println("x: " + x + " y: " + y);

x: 0.2 y: -0.01
```


Question 9 [12 Marks]

Complete the definition of a method `printRectangle` so that it prints an $m \times n$ open rectangle using the character `symbol` as the perimeter of the rectangle. For example, a call of the form

```
printRectangle(4,5,'*');
```

should print the pattern

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

Assume that the parameters specifying the height and width are both larger than two.

```
public static void printRectangle (int height, int width, char symbol)  
{  
    for (int row = 1; row <= height; row++)  
    {  
        for (int col = 1; col <= width; col++)  
            if (row == 1 || row == height || col == 1 || col == width)  
                System.out.print(symbol);  
            else  
                System.out.print(" ");  
        System.out.println();  
    }  
}
```

Question 10 [12 Marks]

A *palindrome* is a string that is unchanged when written backwards. For example, "abba" and "radar" are both palindromes. Write a method `isPalindrome` that has a single `String` parameter, `s`. The method should return `true` if `s` is a palindrome and `false` otherwise.

```
public static boolean isPalindrome (String s)
{
    boolean result = true;
    int sLength = s.length();
    for (int i = 0; i < sLength/2 && result; i++)
        if (s.charAt(i) != s.charAt(sLength - i - 1))
            result = false;
    return result;
}
```

Question 11 [12 Marks]

The government of Simpleton has devised what it thinks is an easy income tax system, but its citizens still need help. They have commissioned you to write a program to ask a citizen a few simple questions and compute the tax that is payable or the refund that is due. You must write your program as clearly as possible so that the government can verify it easily.

Your program should first ask a citizen for his/her income (`income`), housing cost (`houseCost`), number of children (`totalChildren`), and number of children that are in school (`schoolChildren`). It should then compute and print the tax payable or the refund due. The tax rules are as follows. The Simpleton tax rate is 18% but citizens are not taxed on the first \$10 000 of income unless they pay more than \$10 000 for housing. For every child, a Simpleton citizen gets a \$500 tax reduction, or \$1000 if the child is in school. This reduction never results in citizens getting refunds unless their housing costs are less than \$6000 and they have more than two children, at least one of whom is in school. Finally, if the tax payable is more than \$2000, then it is increased by an additional 15% surtax.

```
class Taxes
{
    public static void main (String[] args)
    {
        final double TAX_RATE = 0.18;
        final double SURTAX_RATE = 0.15;
        System.out.println("What is your income?");
        double income = StdIn.getDouble();
        System.out.println("What are your housing costs?");
        double houseCost = StdIn.getDouble();
        System.out.println("How many children?");
        int totalChildren = StdIn.getInt();
        System.out.println("How many children in school?");
        int schoolChildren = StdIn.getInt();

        // find basic tax
        double tax;
        if (houseCost <= 10000)
            tax = TAX_RATE * (income - 10000);
        else
            tax = TAX_RATE * income;

        // reduce tax for children
        tax -= 500*totalChildren + 500*schoolChildren;

        // check if ineligible for refund
        if (tax < 0 && !(houseCost < 6000 && totalChildren > 2 && schoolChildren >= 1))
            tax = 0;

        // check if subject to surtax
        if (tax > 2000)
            tax += tax*SURTAX_RATE;

        // print results
        System.out.println("Your tax is: " + tax + "(Negative amount indicates a refund)");
    }
}
```

Question 12 [12 Marks]

Complete the definition of the method `printSequence` so that it prints the first `n` numbers of the sequence f_n that begins with

1, 2, 3, 4, 6, 9, 13, 19, ...

In the sequence, all values after the first three are defined by the formula

$$f_n = f_{n-1} + f_{n-3}$$

If the value of the parameter `n` is less than one, the method should print nothing.

```
public static void printSequence (int n)
{
    if (n >= 1)
    {
        int[] f = new int [n+3];
        f[1] = 1;
        f[2] = 2;
        f[3] = 3;
        for (int i = 4; i <= n; i++)
            f[i] = f[i-1] + f[i-3];

        for (int i = 1; i <= n; i++)
            System.out.println(f[i]);
    }
}
```

Question 13 [12 Marks]

Complete the definition of the method `bestRally`. The array `price` gives a sequence of daily closing prices of a stock. A *rally* is defined as a period in which the closing price of the stock either increases or stays the same. The method should return the difference in the price of the stock in the rally having the largest increase in price. If the stock price never rises, the method should return the value zero.

```
public static double bestRally (double[] price)
{
    double bestRise = 0;
    double currentRise = 0;
    for (int i = 1; i < price.length; i++)
        if (price[i] >= price[i-1])
            {
                currentRise += price[i] - price[i-1];
                if (currentRise > bestRise)
                    bestRise = currentRise;
            }
        else
            currentRise = 0;
    return bestRise;
}
```