

UNIVERSITY OF TORONTO
 FACULTY OF APPLIED SCIENCE AND ENGINEERING
 APS105 — Computer Fundamentals
 Quiz #1
 October 4, 1999, 6:10–7:30 p.m., 80 minutes

Exam Type A:
 This is a "closed book" examination; no aids are permitted.
 No calculators are permitted.

There are a total of 80 marks divided into 17 questions. Not all questions are of equal value.

Write your answer in the space that follows each question. If more space is required, continue on the back of the page, and be sure to indicate on the front that you have done so.

The examination has 12 pages.

You may assume that the standard Java methods such as `Math.pow()` are available, as well as the following StdIn methods are available:
`StdIn.getInt()`, `StdIn.getDouble()`, and `StdIn.getChar()`.

Name _____

Circle your lecture section: L0101 or L0102 or L0103

Student Number _____

| | | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|------------|
| Question # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Marks | | | | | | | | | |
| Question # | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | TOTAL (80) |
| Marks | | | | | | | | | |

Question 1 [11 marks]
 The statements below all relate to the Java programming language. Circle the appropriate answer, indicating whether the statement is either true or false.

Each correct answer is worth 1 mark. Illegible answers will be marked as incorrect.

| Statement | True | False |
|---|------|-------|
| A. Java is strongly typed | True | False |
| B. The <code>!</code> operator is higher precedence than <code>*</code> | True | False |
| C. An <code>int</code> in Java is stored using 64 bits | True | False |
| D. The compiler finds all syntax errors | True | False |
| E. You must declare all variables at the beginning of your method | True | False |
| F. All Java methods must contain a <code>return</code> statement | True | False |
| G. A <code>while</code> loop may execute its body zero times | True | False |
| H. Floating-point numbers can represent any real number | True | False |
| I. The number of <code>else</code> keywords in a program is always less than the number of <code>if</code> keywords | True | False |
| J. The Unix command to change to your home directory is <code>cd . .</code> | True | False |
| K. The <code>%</code> operator computes remainder | True | False |

Questions #2 and #3 refer to the Java program below:

```
class Hello
{
    public static void main (String[] args)
    {
        System.out.print ("Hello");
        System.out.println("world!");
    }
}
```

Question 2 [3 marks]

If this program is compiled and executed, what will it print?

Question 3 [3 marks]

The program must be stored in a file to be compiled. Explain how would you *create* that file on ECF and what you would name it.

Question 4 [3 marks]

Assume that in your home directory you have a directory called `aps105` and that `aps105` contains files called `A.java` and `A.class`. Give a sequence of UNIX commands to do the following:

1. set your working directory to the `aps105` directory _____
2. rename `A.java` to `B.java` _____
3. run the program `A.class` _____

3

Question 5 [3 marks]

What is the purpose of memory in a computer system (20 words or less)?

Question 6 [3 marks]

What is *Java bytecode*? What is the *Java Virtual Machine (JVM)*? How are these two things related? (30 words or less)

Question 7 [3 marks]

Give a **useful** example of *lazy evaluation* is and explain why it is useful.

4

Question 8 [2 marks]

Give a good reason for writing comments in your program.

Question 9 [4 marks]

What is the output of the following Java program?

```
class Expressions
{
    public static void main( String[] args )
    {
        System.out.println( 5/4 );
        System.out.println( 5.0/4.0 );
        System.out.println( (8/3*2+1)/2.0 );
        System.out.println( 1+3*30/6&4-2 );
    }
}
```

Question 10 [3 marks]

Using a Java for loop, *precisely* rewrite the following Java code fragment. *Be careful.*

```
int index = 1;
while( index < 10 ) {
    index = index+1;
    System.out.println(index);
}
```

Question 11 [6 marks]

In the following Java program, there are exactly 6 errors that prevent it from compiling. Find as many as you can and correct them in the *simplest* way you can think of. Do not try to understand what the program does. *Warning:* this is tricky, and you will lose marks if you identify a correct thing as an error (but you won't go below zero marks).

```
class CompilerTest
{
    public static void main (String[] args)
    {
        int a = StdIn.getInt();
        int b = a % 13.0;
        boolean c = (a > b);

        System.print("The answer is ");

        do {
            boolean d = (a > b*2-43);

            if( !d || !c )
                a = (2 * a + 1) / 3;
            else
                a = a+1;;

            b = b - a;
            d = ! d;
            c = (a = b);

        } while( c && b > 0 )

        System.out.print(d);
    }
}
```

Question 12 [6 marks]

What is the output of the following program? Use the table below to help you show your work (you should not have to use the whole table).

```
class TracingTest
{
    public static void main (String[] args)
    {
        int a = 7, b = 5;
        do {
            if( a > 0 ) {
                System.out.println(a);
                a = a - b;
            } else {
                System.out.println(b);
                b = b - a;
            }
        } while( b + a < 10 );
    }
}
```

| | <i>a</i> | <i>b</i> | <i>a</i> > 0 | Program prints | new <i>a</i> | new <i>b</i> | <i>b</i> + <i>a</i> < 10 |
|------------------|----------|----------|--------------|----------------|--------------|--------------|--------------------------|
| Initially | 7 | 5 | | | | | |
| Iteration 1 | | | | | | | |
| Iteration 2 | | | | | | | |
| Iteration 3 | | | | | | | |
| Iteration 4 | | | | | | | |
| Iteration 5 | | | | | | | |
| Iteration 6 | | | | | | | |
| Iteration 7 | | | | | | | |
| Iteration 8 | | | | | | | |
| Iteration 9 | | | | | | | |
| Iteration 10 | | | | | | | |
| Iteration 11 | | | | | | | |

Question 13 [6 marks]

Write a Java program that repeatedly asks the user for nonnegative double floating-point numbers (≥ 0.0). Upon entering a negative number, the program should print out the **smallest value** entered by the user, not including the negative number itself. You may assume at least one nonnegative number will always be entered.

```
class SmallestNumber
{
    public static void main( String[] args )
    {
```

```
    }
}
```

Question 14 [6 marks]

Write a Java method called `drawTriangle` that contains an integer parameter `n`. It draws a triangular pattern of asterisks "*" with an interior of spaces, spanning a total of `n` rows and `n` columns. Your method may assume that `n ≥ 1`. For example, if `n` was 5 the output would be:

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

However, if `n` was 1, the output would be:

```
*
class PrintStars
{
    public static void drawTriangle( int n )
    {
```

```
    }
}
```

9

Question 15 [6 marks]

A perfect number is a positive integer for which the sum of the positive divisors less than the number is equal to the number itself. As an example, the number 28 is perfect because 1, 2, 4, 7, and 14 are the divisors and $1 + 2 + 4 + 7 + 14 = 28$. Write a Java method `isPerfect` that takes an integer `n` as a parameter and returns `true` only if `n` is perfect.

```
class NumberProperties
{
    public static boolean isPerfect( int n )
    {
```

```
    }
}
```

10

Question 16 [6 marks]

You are asked to write a **single Java method** to help govern the dice game of craps. In the game, a player rolls two regular six-sided dice and enters the total (between 2 and 12) into the computer, which will decide whether the player has won or not. The player wins if the first roll is a 7 or 11, but loses if the first roll is a 2, 3, or 12. Otherwise, the player must make additional rolls until they match the first roll, in which case they win, or until they roll a 7, in which case they lose.

Your method, named `isWinningRoll`, bases its decision on inspecting two integer parameters, the value of the `firstRoll` and the value of any following roll. You may assume that `roll` holds -1 if only the first roll has been made, otherwise it holds the latest value rolled by the player. Your method must return `true` *only* if the user has won the game, otherwise it must return `false`.

```
class Craps
{
    public static boolean isWinningRoll( int firstRoll, int roll )
    {
        }
    }
}
```

11

Question 17 [6 marks]

Any positive integer n can be uniquely written as a sequence of digits $d_r, d_{r-1}, \dots, d_1, d_0$ in an arbitrary base B such that

$$n = d_r B^r + d_{r-1} B^{r-1} + \dots + d_1 B^1 + d_0 B^0$$

where the $d_i, 0 \leq d_i < B$, are integer values representing the digits of the new base. Write a Java method `extractDigit` that takes k, B , and n as integer parameters and returns d_k , the k^{th} digit of n using base B . You may assume that only same parameter values are given to your method (ie, $i \leq r, n \geq 1, B > 0$). *Hint: you can use `Integer arithmetic` and `convert the result of Math.pow() to an integer` as follows:*

```
int Beubed = (int) Math.pow( B, 3 );
```

Write your method below.

```
class BaseArithmetic
{
    public static int extractDigit( int i, int n, int B )
    {
        }
    }
}
```

12