THE UNIVERSITY OF AUCKLAND

SECOND SEMESTER, 2010
Campus: City

COMPUTER SCIENCE

TEST SOLUTIONS

Principles of Programming

(Time Allowed: 75 minutes)

NOTE:
You must answer **all** questions in this test.
No calculators are permitted
Answer in the space provided in this booklet.
There is space at the back for answers that overflow the allotted space.

Surname	
Forenames	
Student ID	
Login (UPI)	
Lab Time	

Q1 (/16)	**Q4** (/8)	**Q7** (/10)
Q2 (/15)	**Q5** (/10)	**Q8** (/20)
Q3 (/12)	**Q6** (/9)	**Total** /100

SURNAME: ..... FORENAMES: .....

Question 1 (16 marks)

a) What is the output produced by the following code?

```
System.out.println(3 + 2 + " + " + 2 + " * " + 6 + (2 + 1));
```

```
5 + 2 * 63
```

(2 marks)

b) What is the output produced by the following code?

```
System.out.println("A\"nB\nC\\nZ");
```

```
A"nB
C\nZ
```

(2 marks)

c) Complete the output produced by the following code.

```
int num = Math.max(Math.min(Math.max(3, 6), 5), 4);
System.out.println("num: " + num);
```

```
num: 5
```

(2 marks)

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d) What is the output produced by the following code?

```
String a = new String("Hello World!");
String b = new String("Hello World!");
System.out.println(a == b);
```

false

(2 marks)

e) What is the output produced by the following code?

```
int number = 56;

if (number % 2 > 0) {
      System.out.println("First");
} else {
      System.out.println("Second");
}
```

Second

(2 marks)

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f) What is the output produced by the following code?

```
String a = "45";

int x = 1 + (Integer.parseInt(a) / 5 + 2) * 4 ;

String b = "" + x;

System.out.println(b.equals(a));
```

```
true
```

(2 marks)

g) Complete the Java statement which assigns a random number which is either 1, 2, 3, 4 or 5 to the `int` variable, `number`.

```
int number = (int)(Math.random() * 5 + 1);
```

(2 marks)

h) Complete the output when the following code is executed.

```
int a = 6;
int b = a + 2;
a = b + 2;
int c = a;
c = c / 5;
a = c / 2;
System.out.println("a: " + a + " b: " + b + " c: " + c);
```

```
a:    1    b: 8    c: 2
```

(2 marks)

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Question 2 (15 marks)

a) Complete the output produced by the following code.

```
String phrase = "LITTLE STAR";
String part1 = phrase.substring(4, 6);
String part2 = phrase.substring(9);
String result = part1 + part2;
System.out.println("Result: " + result);
```

```
Result: LEAR
```

(3 marks)

b) Complete the output produced by the following code.

```
String phrase = "RED BLUE YELLOW";
char c1 = phrase.charAt(phrase.length() - 1);
char c2 = phrase.charAt(1);
String result = "" + c1 + c2;
System.out.println("Result: " + result);
```

```
Result: WE
```

(3 marks)

SURNAME: ..... FORENAMES: .....

c) Complete the output produced by the following code.

```
String phrase = "OVER THE TOP";
int position1 = phrase.indexOf("TH");
int position2 = phrase.indexOf("ET");
int sum = position1 + position2;
System.out.println("Sum: " + sum);
```

```
Sum: 4
```

(3 marks)

d) Why does the following code produce a runtime error?

```
String word = "fabulous";

word = word.substring(9);
```

The last character in the String "fabulous" is the character 's' which is in position 8 of the string.

```
word.substring(9);
```

gets the substring beginning from position 9 to the end of the string but position 9 does not exist for the string, "fabulous". This results in a runtime exception (java.lang.StringIndexOutOfBoundsException).

(3 marks)

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e) Which of the following could NOT be the output of the `UsesRandom` program shown below? Circle your answer.

a) 678912345

b) 912345678

c) 123456789

d) None of the above

(3 marks)

```
public class UsesRandom {
    public void start() {
       aMethod("123456789");
    }
    private void aMethod(String word) {
       int length = word.length() – 1;

       int position = (int)(Math.random() * length) + 1;

       word = word.substring(position) +
                                    word.substring(0, position);
       System.out.println(word);
    }
}
```

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Question 3 (12 marks)

Complete the method header for each of the following methods (i.e. complete the first line of each method definition).

a) The method, `methodA()`, is called in the following way:

```
int resultA = methodA(5, 32);
```

```
private __int__ methodA (____int num1, int num2__) {

    if (num2 > num1) {
         return num1 + 1;
    } else if (num2 < num1) {
         return num1 – 1;
    }

    return num1;}
}
```

(3 marks)

b) The method, `methodB()`, is called in the following way:

```
methodB("cat", "dog");
```

```
private __void___ methodB (__String word1,_

                                    ___String word2__) {

    char letter1 = word1.charAt(0);
    char letter2 = word2.charAt(0);
    System.out.println(letter1 + "" + letter2);

}
```

(3 marks)

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c) The method, `methodC()`, is called in the following way:

```
boolean result = methodC(591, "5912");
```

```
private __boolean_ methodC (___int num,___

                                        _String digits__ ) {

    String numDigits = num + "";
    if (numDigits.equals(digits)) {
         return true;
    }

    return false;

}
```

(3 marks)

d) The method, `methodD()`, is called in the following way:

```
double result4 = methodD(3.5, true);
```

```
private __double__ methodD (____double num,_____

                                ___boolean isPositive_____ ) {

    int number = (int)(Math.random() * 4);

    if (isPositive) {
         return num + number;
    }

    return num – number;

}
```

(3 marks)

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Question 4 (8 marks)

Complete the program below which reads in three `int` numbers and outputs the largest of the three numbers. A running example of the completed program is shown below. (The user input is shown in bold and in a larger font.)

```
C:>Java Example
Please enter the first number: 11
Please enter the second number: 15
Please enter the third number: 10
The largest of the three numbers: 15
```

Please note that your program should work for any three input numbers, not just the example showed above.

```
public class Example {

   public void start() {
```

```
System.out.print("Please enter the first number: ");
int num1 = Integer.parseInt(Keyboard.readInput());

System.out.print("Please enter the second number: ");
int num2 = Integer.parseInt(Keyboard.readInput());

System.out.print("Please enter the third number: ");
int num3 = Integer.parseInt(Keyboard.readInput());

int max = Math.max(Math.max(num1, num2), num3);

System.out.print("The largest of the three
                                        numbers: ");
System.out.println(max);
```

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```
    }
}
```

(8 marks)

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Question 5 (10 marks)

a) Complete the output produced by the following code.

```
boolean result;
boolean a = true;
boolean b = false;
boolean c = true;

boolean d = (a && b) || (a && c);
boolean e = a || (!c);
boolean f = (c || b) && (c || a);

System.out.println("d: " + d + " e: " + e + " f: " + f);

result = (!a && !b) || ((c && !b) || (!e || f));

System.out.println("Result: " + result);
```

```
d:   true   e: true f: true

Result: true
```

(5 marks)

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b) The following program does not compile. Give the line number of the statement which causes the compile error and state the reason for the compile error.

```
1 public class Example {
2   public void start() {
3      double cost = 53.0;
4      int age = 68;
5      final double GST = 0.125;
6      if (age <= 12 || age >= 65){
7        double discount = 0.15;
8        System.out.println("Eligible for discount");
9      }
10     double price = cost * (1 + GST) * (1 - discount);
11     System.out.println(price);
12     int limit = (int)(Math.random() * 999 + 1);
13     if (price / limit > 1) {
14       System.out.println("Too expensive");
15     } else {
16       System.out.println("Affordable");
17     }
18  }
19 }
```

line number: **10**

Reason for the compile error:
The variable 'discount' is declared on line 7 inside the if statement. Its scope is inside the if statement (from line 7 to line 9) and it cannot be used outside the if statement.

(5 marks)

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Question 6 (9 marks)

Complete the definition of the `calculateDiscount()` method in the program below so that a String containing the appropriate percentage is returned by the method. The format of the String which is returned by the `calculateDiscount()` method is a number followed by the '%' symbol, e.g., `"0%", "10%, "20%" or "30%".`

A discount is given based on the purchase amount and the age of the customer as described below:

30% discount for a customer who is 65 years of age or over and whose purchase amount is over 250,
20% discount for a customer whose purchase amount is over 250 but whose age is younger than 65,
10% discount for any customer whose age is 65 or over, and whose purchase amount is not over 250,
0% discount in all other cases.

```
public class Program {

  public void start() {

    System.out.print("Enter amount of purchase:");
    int amount = Integer.parseInt(Keyboard.readInput());

    System.out.print("Enter age of customer:");
    int age = Integer.parseInt(Keyboard.readInput());

    String discount = calculateDiscount(age, amount);

    System.out.println("You have a " + discount +
                                                  " discount!");
  }
```

```
private String calculateDiscount(int age,
                                                  int amount) {


    if (age >= 65 && amount > 250) {
          return "30%";
    } else if (age >= 65) {
          return "10%";
    } else if (amount > 250) {
          return "20%";
    } else {
          return "0%";
    }
```

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```
}
```

(9 marks)

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Question 7 (10 marks)

Give the output when the following program is executed.

```
public class MyProgram {

     public void start() {

          System.out.print("1 ");

          methodOne();

          System.out.print("2 ");

          methodTwo();

          System.out.println("3 ");

     }

     private void methodOne() {
          methodTwo();
          System.out.print("4 ");
     }

     private void methodTwo() {
          System.out.print("5 ");
          methodThree();
     }

     private void methodThree() {
          System.out.print("6 ");
     }

}
```

```
                                   //Show output here



  1 5 6 4 2 5 6 3
```

(10 marks)

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Question 8 (20 marks)

a) You are required to complete the following ATM program. The program code carries out two transactions based on an initial balance of $200:

first a deposit of $55.50,

and then

a withdrawal of $35.50.

The output of the program should be:

```
Balance = $220.0
```

i.e. the balance after the above two transactions should be $220.0

Complete the ATM program so that it produces **exactly** the same output as shown above.

Note: your code **MUST** make one call to the `deposit()` method and one call to the `withdraw()` method.

```
public class ATM {

   public void start() {
     double balance = 200;


     balance = deposit(balance, 55.5);
     balance = withdraw (balance, 35.5);


     System.out.println("Balance = $" + balance);
   }

   private double deposit(double balance, double amount) {
     balance = balance + amount;
     return balance;
   }

   private double withdraw(double balance, double amount) {
     balance = balance - amount;
     return balance;
   }
}
```

(7 marks)

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b) Complete the following `convertToWeeksAndDays()` method. This method is passed an `int` parameter which represents the number of days. The method calculates the equivalent number of weeks and days (7 days in one week) and prints them out.
For example, if the method is called in the following way:

```
convertToWeeksAndDays(30);
```

the output produced is:

```
30 days is 4 weeks and 2 days.
```

Note: it is fine if the number of weeks is 1 or the number of days is 1 and the output is grammatically incorrect, e.g., `"8 days is 1 weeks and 1 days".`

```
private void convertToWeeksAndDays (int days) {

        int weeks;

        System.out.print(days + " days is ");









        weeks = days / 7;
        System.out.print(weeks + " weeks and ");
        days = days % 7;
        System.out.println(days + " days.");


}
```

(7 marks)

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c) The `DiscountCalculation` program should print a message containing the original price, the discount rate, the discounted price and the saved amount. The output which the corrected `DiscountCalculation` program should print is:

```
Original price: $100.0   Discount rate: 0.1
Discounted price: $90.0
You save: $10.0
```

There are **3** mistakes in the `calculateAndPrintDiscount()` method. Locate and correct the 3 mistakes so that the program produces **exactly** the output shown above. **Circle** the errors where they appear in the code below and write the correction immediately below the circled error:

```
public class DiscountCalculation {

   public void start() {

      double price = 100;

      double discountRate = 0.1;

      calculateAndPrintDiscount(price, discountRate);

   }

   private void calculateAndPrintDiscount(int price,
                                          double
                                                double discountRate){

      double discount = price * discountRate;

      double discountedPrice = price - discount;

      System.out.print("Original price: $" + price);

System.out.println("\tDiscount rate: " + discountRate);

System.out.println("Discounted price: $" + discount);
                                         discountedPrice


      System.out.println("You save: $" + discountedPrice);
   }                                          discount
}
```

(6 marks)