THE UNIVERSITY OF AUCKLAND

SECOND SEMESTER, 2005
Campus: City

COMPUTER SCIENCE

Principles of Programming

(Time Allowed: ONE hour and FIFTEEN minutes)

NOTE: **Attempt ALL questions.**
Answer the multiple choice questions in section A by circling the correct answer on the attached answer sheet.
Write the answers to the questions in section B in the space provided on the attached answer sheet.
Calculators are NOT permitted.

SECTION A: MULTIPLE CHOICE QUESTIONS

Each question in this section is worth 3 marks. Circle the letter corresponding to your choice on the attached answer sheet. There is only one correct answer for each question.

1. What is the output produced by the following code?

```
System.out.println(1 + "1" + 1);
```

(a) `111`

(b) `11 + 1`

(c) `21`

(d) `12`

(e) `1 + 11`

2. What is the output produced by the following code?

```
System.out.println(1.0 / 2);
```

(a) `1`

(b) `0.0`

(c) `0`

(d) `0.5`

(e) `1.0 / 2`

3. What is the output produced by the following code?

```
System.out.println("\"" + "\\nn");
```

(a) `"`
`n`

(b) `\"\\nn`

(c) `"\`
`n`

(d) `"\nn`

(e) `\"\`
`n`

4. What is the output produced by the following code?

```
System.out.println( 1 - 6 % 5 + 3 * 4 / 2 - 3 * 3 );
```

(a) `-3`

(b) `-4`

(c) `3`

(d) `4`

(e) none of the above

5. What is the output produced by the following code?

```
String word = "computer";
System.out.println(word.substring(3, word.length()-2));
```

(a) `u`

(b) `put`

(c) `mput`

(d) `pute`

(e) `mpute`

6. What is the output produced by the following code?

```
int a = 1;
int b = 2;
int c = 3;

int w = Math.max(a, b) - Math.min(b, c);
int x = Math.max(c, Math.min(a, b));
int y = Math.min(a, Math.max(b, c));
int z = Math.min(Math.max(a, b), Math.max(b, c));

System.out.println(w + " " + x + " " + y + " " + z);
```

(a) `0 3 1 1`

(b) `0 2 1 3`

(c) `0 3 2 1`

(d) `0 1 3 2`

(e) none of the above

7. Consider the following method call:

```
String answer = getSomeAnswer(34, "Fish", 13.0);
```

From the list of method headers below, which is the **only** correct method header which could have been used to define the `getSomeAnswer()` method?

(a) `public void start()`

(b) `private String getSomeAnswer(double i, String s, double d)`

(c) `private void getSomeAnswer(int i, String s, double d)`

(d) `private String getSomeAnswer(int i, String s, int d)`

(e) `private String GetSomeAnswer(int i, String s, double d)`

8. Which one of the following identifiers is **invalid** in Java?

(a) `txt2me`

(b) `number_Of_Apples`

(c) `fish&chips`

(d) `TIME`

(e) `u`

9. What is the output produced by the following code?

```
int x = 10;
double y = 20.0;
int z = 15;

System.out.println((z/x) + " and " + (z/y) + " and " +z+x*y);
```

(a) `1 and 0 and 215.0`

(b) `1 and 0.75 and 15200.0`

(c) `1 and 0.75 and 215.0`

(d) `1.5 and 0.75 and 15200.0`

(e) `1.5 and 0.75 and 215`

10. The following constructor is contained within a class. We also know that the class compiles correctly and follows the style conventions of the 101 course, but nothing more about this class.

```
public Account(int value, String text){
     v = value;
     name = text;
}
```

Given these three facts, which one of the following statements about the class **may not necessarily be true**?

(a) The class is stored in a file called "`Account.java`".

(b) We can create a new `Account` object with the code:
```
Account p = new Account(29, "Shane");
```

(c) There are instance variables in this class called "`v`" and "`name`".

(d) There are no other constructors in this class.

(e) The class is called "`Account `".

11. What is the output produced by the following code?

```
boolean b = true;
int x = 5;
int y = 15;
double d = 5.1;
String text = "Shane";

System.out.println(b || ((y>x) && (x>d)));
System.out.println((d>x) && ((x==y) || (b)));
System.out.println((text.length()==x && b && y/3==x));
```

(a)
```
true
true
true
```

(b)
```
true
true
false
```

(c)
```
true
false
true
```

(d)
```
true
false
false
```

(e)
```
false
false
false
```

12. Consider the following definition of a class called `Stock`:

```
public class Stock {

     private int value;

     public Stock(int i){
          value = i;
     }

     public Stock(String i){
          value = Integer.parseInt(i);
     }

     public void print(){
          System.out.println( value );
     }

     private void printMore(){
          System.out.println("Value: " + value);
     }
}
```

Which of the following statements (defined in another class) would not compile?

(a)
```
Stock p = new Stock( 8 );
```

(b)
```
Stock p = new Stock( 45 );
p.print();
```

(c)
```
Stock p = new Stock( 45 );
p.printMore();
```

(d)
```
Stock p = new Stock( Integer.parseInt("45") );
```

(e)
```
Stock p = new Stock( "45" );
```

13. What is the output produced by the following code segment?

```
int x = 4;
int y = 45;

if (x < y) {
     System.out.println("Candy ");
}
if (x < 2) {
     System.out.println("Scotch ");
} else if (y/10 == x) {
     System.out.println("Fruit ");
} else {
     System.out.println("Beer ");
}
if (y/5 == 9) {
     System.out.println("Tripe ");
} else if (x==4) {
     System.out.println("Carrots ");
}
```

(a)
```
Scotch
Fruit
```

(b)
```
Candy
Beer
Tripe
```

(c)
```
Candy
Fruit
Tripe
Carrots
```

(d)
```
Candy
Fruit
Beer
Tripe
Carrots
```

(e)
```
Candy
Fruit
Tripe
```

14. What is the output produced by the following code segment?

```
int counter = 2;

while(counter <= 10) {
     System.out.print(counter + ", ");
     counter = counter + 2;
}

System.out.println("done.");
```

(a) `4, 6, 8, done.`

(b) `2, 4, 6, 8, done.`

(c) `4, 6, 8, 10, done.`

(d) `2, 4, 6, 8, 10, done.`

(e) `2, 3, 4, 5, 6, 7, 8, 9, 10, done.`

15. What is the output produced by the following code segment?

```
String s = new String("abc");
String t = s;
String u = new String("abc");

System.out.println( t.equals(u) );
System.out.println( s == u );
```

(a)
```
false
false
```

(b)
```
false
true
```

(c)
```
true
false
```

(d)
```
true
true
```

(e)
```
abc
true
```

SECTION B

16. Consider the segment of code shown below.

```
int r = (int)(Math.random()*5);
int random = ((r + 2) * 5) - 3;
```

Write down a list of all of the possible values that may be stored in the variable `random` when the code segment is executed.

(5 marks)

17. What is the output produced by the following segment of code?

```
System.out.println("a");
System.out.print("b");
System.out.println("c");
System.out.print("d");
System.out.println("e");
```

(5 marks)

18. What is the output produced by the following segment of code?

```
String wordOne = "computer science";
String wordTwo = "test";

int a = wordOne.indexOf('e');

String b = wordOne.substring(2,4);

int c = b.length();

String d = wordTwo.toUpperCase();

int e = wordOne.indexOf(wordTwo);

System.out.println( a );
System.out.println( b );
System.out.println( c );
System.out.println( d );
System.out.println( e );
```

(5 marks)

19. Consider the `Multiply` class defined as follows:

```
public class Multiply {

     public void start() {

          int value = 3;
          int product = timesByTwo(value);
          System.out.println("product: " + product);
     }

     private int plus(int y, int z) {

          System.out.println("plus: " + y + " " + z);
          return y + z;
     }

     private int timesByTwo(int x) {

          System.out.println("double: " + x);

          int result = 0;

          result = plus(x, result);
          result = plus(x, result);

          return result;
     }
}
```

What output would be produced by this class when the `start()` method is executed?

(10 marks)

20. Consider the segment of code below, which creates several objects of type `Animal`, and then calls two methods on each of these objects.

```
Animal myFish = new Animal("fish", 0);
Animal myFriend = new Animal("human", 2);
Animal myBug = new Animal("centipede", 100);

System.out.println( myFish.getType() );
System.out.println( myFriend.getType() );
System.out.println( myBug.getType() );

System.out.println( myFish.canWalk() );
System.out.println( myFriend.canWalk() );
System.out.println( myBug.canWalk() );
```

For this question, you need to write a definition of the `Animal` class. You will need to define two instance variables – one to store the type of animal, and one to store the number of legs that the animal has.

You also need to define a constructor method and two instance methods in the `Animal` class. The first instance method, `getType()`, should return the type of the animal. The second instance method, `canWalk()`, should return `true` if the animal has at least two legs, and `false` otherwise.

If you have defined the `Animal` class correctly, the output from the segment of code above should be as shown below:

```
fish
human
centipede
false
true
true
```

(10 marks)

21. The `CalculateArea` program shown below is supposed to calculate the area of a rectangle, given the width and the height of the rectangle. However, there are 5 syntax errors contained in this source code.

```
public class CalculateArea

     public start() {

          System.out.println("\"Area Calculator"\");

          final double HEIGHT = 5.0;
          double WIDTH = 4.5;

          double area - WIDTH * HEIGHT;

          System.out.println("The area is: " , area);
     }
}
```

An application class called `CalculateAreaApp` will be used to call the `start()` method of the `CalculateArea` class The output of the program should be:

```
c:\Test> java CalculateAreaApp
"Area Calculator"
The area is: 22.5
```

Locate and correct the 5 syntax errors which prevent the `CalculateArea` class from compiling. On the answer sheet, circle the errors where they appear in the code and clearly write the correction to the code.

(10 marks)

22. Define a program called `HalvingProgram` which asks the user to enter an integer, and then repeatedly divides this integer in half until it becomes an odd value (i.e. a value where there would be a remainder of 1 if it was divided by 2).

You should use the `readInput()` method of the `Keyboard` class for reading the input value from the user. The program should then display the word "`Halving:`" and then print the value the user entered, followed by the results of dividing the number repeatedly in half until it becomes an odd value.

An application class called `HalvingApp` will be used to call the `start()` method of your `HalvingProgram` class.

For example, the output below shows how the program should behave given various input values. The text in **bold** denotes input by the user, not output from the program.

```
c:\Test> java HalvingApp
Enter number: 12
Halving:
12
6
3

c:\Test> java HalvingApp
Enter number: 11
Halving:
11

c:\Test> java HalvingApp
Enter number: 512
Halving:
512
256
128
64
32
16
8
4
2
1

c:\Test> java HalvingApp
Enter number: 2
Halving:
2
1
```

You can assume that the value the user enters is a positive integer value greater than 1. You can also assume that the `Keyboard` class is available in the same directory as the `HalvingProgram` class.

(10 marks)