Please fill in your Student Number and Name.	
Student Number :	Student Number:

Name:

University of Cape Town ~ Department of Computer Science Computer Science 1015F ~ 2008

June Exam

Question	Max	Internal	External	Question	Max	Internal	External
1	9			7	3		
2	8			8	8		
3	8			9	9		
4	15			10	8		
5	10			11	8		
6	14						
				TOTAL	100		

Marks: 100

Time : 180 minutes

Instructions:

- a) Answer all questions.
- b) Write your answers in the space provided.
- c) Show all calculations where applicable.

Question 1 [9]

a)	State Moore's Law.	[1]
b)	Does Moore's Law still hold? Explain your answer.	 [1]
c)	What is the purpose of a central processing unit?	— [1] —
d)	What is computer hardware?	— [1] —
e)	What is a computer program?	— [1] —
f)	What is the difference between a high-level and low-level programming language?	[2]
g)	Briefly describe 2 disadvantages of using Java bytecode, as opposed to machine code.	 [2]

Question 2 [8]

Consider the following program and answer the questions that follow.

```
import java.util.Scanner;
     class Test
         public static void main ( String [] args )
         {
            Scanner input = new Scanner (System.in);
            int a = input.nextInt();
            int b = input.nextInt();
            int c = input.nextInt();
             int x = Math.min (Math.min (a, b), c);
            int y = Math.max (Math.max (a, b), c);
            System.out.println (a+b+c-x-y);
         }
      }
a) What does this program do?
                                                                          [2]
b) What is the output if the input is the numbers 5, 3 and 7?
                                                                          [1]
c) List all variables from within the main method.
                                                                          [1]
d) Why must the main method be public?
                                                                          [1]
```

e)	Rewrite the last statement of the main method so there is a logic error.	[1]
f)	What are 2 techniques that can be used to find the logic error?	[2]

Question 3 [8]

	There should be at most 6 steps.	
	the Java statement to input the number of pairs of shoes into the variable N . You is already declared as an int and there is already a Scanner object named input	
	the Java statement to input the number of pairs of shoes into the variable N . Ye N is already declared as an int and there is already a Scanner object named inpu	
write t		t.
Write ta cost	e N is already declared as an int and there is already a Scanner object named input	t.
Write to a cost already	the Java statement to calculate the variable totalWorth as the price of N pairs of of pricePerPair for each pair. You may assume totalWorth and pricePer	t.

Question 4 [15]

Examine the following code and answer the questions that follow.

```
// print quarter information for specific months
     int month = 0;
     for (month=0; month<10; month++ )</pre>
       switch (month) {
          case 1:
          case 2:
          case 3: System.out.println("First quarter: Month " +
     month);
          break;
          case 4:
          case 5:
          case 6: System.out.println("Second quarter: Month " +
     month);
          break;
          default: System.out.println("No information");
       }
     }
a) What is the output of this program?
                                                                     [4]
```

b)	Rewrite this program, converting the nested if-else statement to a switch statement.	[2]
c)	Rewrite the program using a while loop instead of a for loop. Note: You do not need to the body of the loop.	write
d)	What is the result of each of the following expressions? The result will be either true or Assume variable week $= 7$.	false [2]
	i. week > 3 && week < 20	
	ii. week >=0 week <2	

Write a.	Java me	thod	to p	rint	out a	blank gı	rid for a	workin	ig week	calendar	, such a	s:
+ -	+	- -	+	-	+							
1	1 1		1		I							
+ -	+	-	+	-	+							
I	1 1		I		I							
+ -	+		+	-	+							
	d pri	ntG:	rid	(int	numbe					fWork	ingDay
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voi	d pri	ntG:	rid	(int	numbe					fWork	ingDay
voi	d pri	ntG:	rid	(int	numbe					fWork	ingDay
voi	d pri	ntG:	rid	(int	numbe					fWork	ingDay

iii. week > 0 && week < 5

Question 5 [10]

Study the following code and answer the questions that follow.

```
public class ClassA
      {
          method()
          {
              /*
                 Variable declarations and other code is here
              */
              if (problem) // no point in continuing so we
                              //terminate the method
                  return; //terminate the method
                 More code in here
              */
              return usefulDataValue; // return some data value of
                                              //a particular data type
           } //end of method
      } //end of class declaration
a) Identify the program errors in the code fragment. All of the variables needed have been declared
   and initialized. (Choose two).
                                                                                  [2]
      i. The return data type for the method is not specified.
      ii. The formal parameter list is not specified (should be declared as void).
      iii. An access modifier is not specified.
      iv. The method is attempting to return both a data type and a void type concurrently.
      v. There should never be more than one return statement in any method
b) Write the syntax of a method that returns a value.
                                                                                 [2]
```

c)	Write the syntax of a void method.	[1]
d)	What are Java classes?	[2]
e)	Write minimal Java code to create a class and an object of the class.	[3]

Question 6 [14]

a) Consider the Student class below, and add constructors, accessor and mutator methods as described by the comments.

pub] {	lic clas	s Stude:	nt				
	private private private	String		rade;			
// i) Cons	structor with	three argu	iments that is u	sed to initiali	ize the instan	ce variables	[2]
// ii) Acc	essor metho	ds for all t	he instance var	iables			[3]
				 			

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iv) Or	ne mutator	method,	with	an arra	ay argu	ment,	that is	s used	to	calculate	
	ne mutator erage_grade						that is	s used	to	calculate	
							that is	s used	to	calculate	
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b) Consider the driver class below, and add statements to create an object called *aStudent* of type **Student** for "Peter" with id no "id1" and an average grade of 0.0, using your constructor above. Use your mutator method above to calculate the average grade of the student after writing four tests for which his grades were 59.12%, 88.55%, 66.21% and 75.20%. Display the name, id and average grade for the student using your accessor methods above. [4]

<pre>public class ConstructorsDemo {</pre>
<pre>public static void main (String args[]) {</pre>
} 1

Question 7 [3]

When used with objects, what is the equality (==) operator really comparing?	[3

Question 8 [8]

The following set of methods sorts an array of numbers in descending order. Complete the missing methods as indicated by the comments.

```
/**
Precondition: The array has values.
Action:Sorts a so that a[0] >= a[1] >= ... >= a[a.length-1]
*/
public void selectionSort ( int[] a )
   int indexOfLargest;
   for ( int i=0; i<a.length; ++i )</pre>
   {
      indexOfLargest = LargestIndex (i, a);
      swap (i, indexOfLargest, a);
   }
}
/**
Returns the index of the largest value among
a[start], a[start + 1], ... a[a.length-1]
                                                              [5]
*/
private int LargestIndex ( int start, int[] a )
{
   return indexOfMax;
}
```

```
/**
Precondition: i and j are legal indices for the array a.
Postcondition: Values of a[i] and a[j] have been
interchanged [3]
*/
private void swap ( int i, int j, int[] a )
{
```

Question 9 [9]

A 2-dimensional array table has been created and filled with values as shown below:

int[][] table = new int[6][4];
table = fillArrayWithValues(6,4); // puts values in table

a)	Write Java code to print out the values inside table. The values in each row must be came line, with each row of values on a new line of output.	on the
	same me, war cach few of variety on a new me of carpain	[0]
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		-
		-
	,	-
		-
		-
		-
		_

b) Now write some Java code to change table to be a ragged array that has 55 rows and a triangular shape. Every element should contain the value zero, as shown below: [4]

0				
0	0			
0	0	0		
0	0	0	0	
0	0	0	0	0

--- etc. --- for 55 rows altogether.

Question 10 [8]

Consider the Java class below:

```
public class Book
{
    private String title;
    private String number;
    public Book()
    {
        title = "unknown"; number = "?";
    }
    public Book( String bTitle, String num)
    {
        title = bTitle; number = num;
    }
//
// --- other methods not shown here
//
}
```

J	Using the concept of inheritance, create a subclass (derived class) of Book ca	alled
(ChildrensBook which has 2 extra instance variables author and ageGroup (both of	type
	String). Include the code for a ChildrensBook constructor that takes 2 arguments – the	
		[3]
U	being the author and the second the age group for that book.	[ی]
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															 -
i	iii. W	hich i	s a m	ethoc	l that r	eturns	a rep	resent	ation	of the	class (of an ol	bject	:?	
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Question 11 [8]

Convert 125.125 ₁₀ to binary (i.e., convert the decimal number 12 working.	25.125 to base 2).	Show	you [3]
Convert the binary number 01100101101111 to hexadecimal.			[2]

c)	What is the value of the floating point number below? Assume IEEE754 single pred	ricion
C)	format, i.e., the leftmost bit is the sign bit, the next 8 bits are the biased exponent, and rightmost 23 bits are the significand. The exponent is biased by 127. Show your working.	d the
	1 10000001 1001000000000000000	
		•