University of Cape Town

Department of Computer Science

Computer Science CSC115F

Final Exam

June 2005

Marks: 100

- Approximate marks per question are shown in brackets

Time: 3 hours

- The use of calculators is permitted

	Surname						Initials
NAME:							

STUDENT NO: | | **COURSE CODE:** | CSC |

This paper consists of 13 questions and 23 pages (including this cover page).

Mark Allocation							
Question	**Marks**	**Internal**	**External**	**Quest**	**Marks**	**Internal**	**External**
1	[10]			8	[5]		
2	[5]			9	[13]		
3	[10]			10	[5]		
4	[5]			11	[10]		
5	[5]			12	[8]		
6	[5]			13	[5]		
7	[5]			14	[4]		
	Total				**Total**		

	Grand Total		
	Final Mark		
Internal Examiner:	**External Examiner:**		

Question 1.   **[10]**

a) Describe the function of an assembler.

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[1]

b) Describe the function of a compiler.

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[1]

c) Describe the four steps in writing a computer program

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Question 2. **[5]**

Write a program that converts temperature in degrees Fahrenheit to degrees Celsius. The formula for conversion is $c = \frac{5}{9} \times (f - 32)$, where c is degree Celsius and f is degrees Fahrenheit.

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Question 3. **[10 marks]**

Consider the following class representing an employee. In the open lines supplied in some of the methods below, describe the following:

- The type of method (void,typed,default constructor, parameterized constructor)
- The usage of the method
- Identify parameters for each method, if any

```
public class Employee
{
  private String name;     // Name of the employee
  private int age;         // Age of the employee
  private double salary;   // Salary of the employee

  public Employee()
  {
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```
    name = "John Davies";
    age = 30;
    salary = 30000.0;
  }

  public Employee(String name, int age, double salary)
  {
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[3]

```
    this.name = name;
    this.age = age;
```

```
        this.salary = salary;
    }

    public void setName(String firstName,  String lastName)
    {
```

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                                                    [3]
```
      name = firstName + " " + lastName;
    }

    public void setAge(int age)
    {
      this.age = age;
    }

    public void setSalary(double salary)
    {
      this.salary = salary;
    }

    public String getName()
    {
```

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```
      return name;
    }

    public int getAge()
    {
      return age;
```

```
  }

  public double getSalary()
  {
    return salary;
  }


}
```

Question 4   **[5 marks]**

   a) Write a Java class that uses for loops to produce the following pattern
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      432
      4321

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   b) Write a Java class that uses for loops to produce the following pattern
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<div align="right">[3]</div>

## Question 5      [5 marks]

The code below is intended to find the average of a list of integer numbers (as a double)
terminated by the user entering a "0" value:

```
import essential.Keyboard;
class Average
{
    public static void main(String[] args)
    {
    double avg=0;
    int count=0;
    System.out.print("Enter a number (end with 0)");
    int num = Keyboard.readInt( );
    count++;
    while(num != 0)
    {
    System.out.print("Enter a number (end with 0)");
    num = Keyboard.readInt();
    count++;
    avg = avg + num;
    }
    avg = avg/count;
    System.out.println("The average is: " + avg);
    }

}
```

a.) rewrite this program using a 'do-while' rather than a 'while' loop.    [4]

b.) What do you gain with the new version?    [1]

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**Question 6**    **[5 marks]**

Suppose we have integer constants for the months JAN = 1, FEB = 2 ... DEC = 12
consider the following code fragment:

```
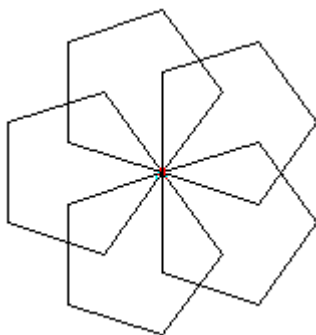System.out.print("type month number (1 to 12): ") ;
int month = Keyboard.readInt() ;
int days ;
if ((month == SEP) || (month == APR) ||
    (month == JUN) || (month == NOV))
    days = 30 ;
else if (month == FEB)
    days = 28 ;
else
    days - 31;
```

Now write a Java class Calendar with a method days(int month) that uses a case
statement to return the number of days in the month sent to it as a parameter. You
should define the months as integer constants as indicated above.

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Question 7   **[5 marks]**

Write a java - turtle class to draw the following shape:

The size of each rectangle is 200 turtle steps by .600, 400 and 200 respectively.
Make your program as efficient as possible.
The Turtle instruction set:
- Move( )   // Moves the Turtle, if the pen is down leave a line.
                 // Max turn is 180 degrees.
- TurnRight( )   // Turns the turtle to the right.

- PenUp( )　　// Picks up the Turtle pen.
- PenDown( )　// Puts down the Turtle pen.
- IsPenDown( ) // Returns true or false depending on the state of the Turtle.

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Question 8　　　　**[5 marks]**

The following shape is produced by repeatedly drawing a hexagon and turning through an angle of 72 degrees.

Write a completeJava class RotatedHexagon that will produce this shape using the Turtle class. (You are required to include all of the class details, like main method etc).

The Turtle instruction set:
- Move( )   // Moves the Turtle, if the pen is down leave a line.
                 // Max turn is 180 degrees.
- TurnRight( )   // Turns the turtle to the right.
- PenUp( )   // Picks up the Turtle pen.
- PenDown( )   // Puts down the Turtle pen.
- IsPenDown( )   // Returns true or false depending on the state of the Turtle.

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Question 9   **[13 marks]**

a) Create a MyLine class with field variables of type Point called p1 and p2. *The Point class is included in the java.awt package.*

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b) Add constructors to the MyLine class that enables object initialisation for the below code which appears in the main () method:

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Myline line_one = new MyLine(0, 0, 2, 3);
Point p_one = new Point(3,3);
Point p_two = new Point(5,8);
Myline line_two = new MyLine(p_one , p_two);
```

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c) Add a method to the *MyLine* class called length, which calculates the length of a line segment, and a method called slope which returns the slope of a line segment. The formulae you'll need are outlined below:

Length of line $= \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$ [2]

Slope of line $= (y_2 - y_1) / (x_2 - x_1)$ [2]

Given the method:

static double **sqrt**(double a)

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d) Add a print method to the myLine class, which prints the points that constitute the line segment.

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e) Write a toString() which return A String representation of a MyLine object's state.

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Question 10   **[5 marks]**

You are given the definitions below.

Write a method called "set" that sets the elements of the array to the values shown below. Your solution must use 2 nested loops in a sensible way.

1	-1	-1	-1	-1

2	1	-1	-1	-1
3	3	1	-1	-1
4	4	4	1	-1
5	5	5	5	1

Given: final static int max = 5;
          int [] [] p = new int [max] [max];

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Question 11   [10 marks]

Complete the following 2 classes given below:

1. A "Driver" class that declares an array of type "Array", fills it, finds the element with the largest value and prints this value.

2. The "Array" class which has a predefined method called "fill" (as shown below).

    You must:
        1. define an integer array with 5 rows and 10 columns,

2. write a method called "largest" that returns the largest value in the array, and
3. complete the class "Array"

public class Array
{

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...fill()
{   //predefined
}

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}

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

16

{

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}
}

Question 12   **[8 marks]**

A. Give a psuedocode algorithm for merge sort.

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B. Sort the following values into ascending order using merge sort. Show all your working to illustrate that you understand the given algorithm. Given:

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Question 13   **[5 marks]**

Consider a computer system for a motor dealership. The dealership keeps stock of many cars, 4 X 4's and motorcycles. They can all be ordered from several different manufacturers and put in the stock. The dealership sells its stock.

Draw a UML diagram giving:
  a) classes involved;
  b) relationships between the classes; and
  c) methods on the classes.

[5]

Question 14   **[4 marks]**

Booch has developed a micro development process for object orientated analysis and design. Give the 4 major steps.

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[4]