Please fill in your Student Number and Name.		<u></u>
Student Number :		Student Number:
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Name:

University of Cape Town ~ Department of Computer Science Computer Science 1016S / 1011H ~ 2009 January Exam

Question	Max	Internal	External	Question	Max	Internal	External
1	4			7	10		
2	4			8	10		
3	10			9	20		
4	2			10	20		
5	8						
6	12						
				TOTAL	100		

Marks : 100

Time : 180 minutes

Instructions:

a) Answer all questions.

b) Write your answers in pen in the spaces provided.

c) Show all calculations where applicable.

Question 1 [4]

Write the recursive function evaluate that returns the n th number in the following sequence:
3 4 7 11 18 29 47
The first two numbers of this sequence $-F_0=3$ and $F_1=4$ - are given.
In general,
$F_{i+2} = F_i + F_{i+1}$
(This is very similar to the Fibonacci sequence.) [4]
Note: No recursion means no marks.

Question 2 [4]

a)

Examine the following Java application. It uses a Binary search algorithm to find the position of a key in an array.

```
public class Exam2Demo {
   public static void main ( String [] args ) {
      int [] a = {2, 6, 8, 19, 21, 30, 38};
      int result, no=25;
      System.out.println ("First Last Middle");
      result = search (a, 0, 6, no);
      if (result >= 0)
         System.out.println (no+" in element "+result);
      else
         System.out.println (no+" not found");
   }
   public static int search (int[]a, int first, int last, int item)
      int result = 0;
      if (first > last)
         System.out.println (first+" "+last);
         result = -1;
      }
      else
         int centre = (first + last)/2;
         System.out.println (first+" "+last +" "+ centre);
         if (item == a[centre])
            result = centre;
         else if (item < a[centre])</pre>
            result=search(a, first, centre-1, item);
         else if (item > a[centre])
            result=search(a, centre+1, last, item);
      return result;
```

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hat is the output from this program?	

Question 3 [10]

You are given the Java program below: import java.util.Scanner; public class Test public static void main (String args[]) Scanner keyboard = new Scanner(System.in); $int[] x = \{20, 30, 50, 60, 10, 70, 31, 53, 62, 25\}; // 10 integer values$ System.out.print("Pick an integer from 1 to 10: "); int guess = keyboard.nextInt(); int box_number = guess - 1; System.out.println("You have won R" + x[box_number] + "!"); } a) In this program, the following 2 errors could easily occur: A float rather than an integer could be input; or A "guess" greater than 10 could be input. Show how exceptions can be used to indicate these errors by adding appropriate code into the [3] program.

b) Assume that the 10 integer values are stored in a file called "data.dat", instead of being specified within the program.

Complete the following Java program that reads these values into the x[] array from the file.[7]

```
import java.util.Scanner;
import java.io.*;
public class Test
  public static void main (String args[])
      Scanner keyboard = new Scanner(System.in);
      int [] x = new int[10];
      System.out.print("Pick an integer from 1 to 10: ");
      int guess = keyboard.nextInt();
      int box_number = guess - 1;
      System.out.println("You have won R" + x[box_number] + "!");
```

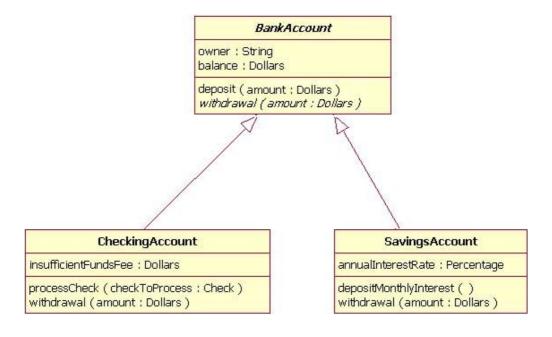
}

Question 4 [2]

Describe 2 advantages of using binary files instead of text files.	[2]
	

Question 5 [12]

Use the following UML diagram to answer the questions that follow.



a)	What principle of OOP design is illustrated in the inter-class relationships? What are the relationships among each set of related classes?	exact [2]
		-
		-
		-
b)	Which of the classes are abstract and which are concrete? How can you determine this fro UML?	m the [2]
		-
		-

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-		following sequence of statements that appears in a method in an unrelated one which statements will result in a compile-time error.
		BankAccount ba = new BankAccount();
	2.	BankAccount ba = new CheckAccount();
	3.	CheckingAccount ca = new BankAccount();
	4.	CheckingAccount ca = new SavingAccount();
	5.	CheckingAccount ca = new CheckingAccount();
	6.	BankAccount ba = new SavingAccount();
	7.	ba.withdrawal(100);
	8.	ba.depositMonthlyInterest();
	9.	ba.deposit(200);

Question 6 [8]

Use the following program to answer the questions that follow.

```
1 public class ASorter {
        public void sort(double[] a, int begin, int end) {
 3
            if ((end - begin) >= 1) {
                int splitPoint = split(a, begin, end);
 4
                sort(a, begin, splitPoint);
 5
 6
                sort(a, splitPoint + 1, end);
 7
                join(a, begin, splitPoint, end);
 8
 9
       }
10
11
       protected int split(double[] a, int begin, int end)
12
13
            double[] temp;
14
            int \ size = (end - begin + 1);
15
            temp = new double[size];
16
17
           double splitValue = a[begin];
18
            int up = 0;
19
           int down = size - 1;
20
21
           for (int i = begin + 1; i \le end; i++)
22
23
                if (a[i] <= splitValue)</pre>
24
25
                    temp[up] = a[i];
26
                    up++;
27
28
                else
29
30
                    temp[down] = a[i];
31
                    down--;
32
                }
33
            }
34
35
           temp[up] = a[begin];
36
37
            for (int i = 0; i < size; i++)</pre>
38
                a[begin + i] = temp[i];
39
40
           return (begin + up);
41
42
       protected void join(double[] a, int begin, int splitPoint,
43
                               int end)
44
45
            //Nothing to do.
46
47 }
```

a)	What is the name of this sorting algorithm?

[2]

the Comparabl		rt an array of objects which lines of co	

Question 7 [10]

{9 4 0 2 7 1 6 3 8}

[3]

c) Build a binary search tree for the following data:

[3]

d) Is there a difference in the search efficiency of the two trees? Why or why not?

[2]

Question 8 [10]

Use the code below to answer this question.

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
public class Buttons extends JFrame implements ActionListener
  public static final int WIDTH = 300;
  public static final int HEIGHT = 200;
  private JButton[] buttons = new JButton[12];
  public static void main(String[] args)
      Buttons gui = new Buttons();
      gui.setVisible(true);
  public Buttons( )
      super("Buttons");
      setSize(WIDTH, HEIGHT);
      setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      setLayout(new GridLayout(4,3));
      setResizable(false);
      for (int i=0; i<12; i++)
         buttons[i] = new JButton();
         buttons[i].setActionCommand(Integer.toString(i));
         buttons[i].addActionListener(this);
         add(buttons[i]);
   }
  public void actionPerformed(ActionEvent e)
      JButton button = (JButton)e.getSource(); // See question (b)
      button.setBackground(Color.PINK);
      button.setText("Button " + e.getActionCommand());
      button.setForeground(Color.WHITE);
}
```

a) Draw the GUI that is displayed when the program is run.

[3]

b)	What does the first line in the actionPerformed method do?	[2]
c)	Draw the GUI again, showing what happens when all the buttons have been clicked describe what you cannot draw, e.g. colours.	and [5]

Question 9 [20]

,	How is ethics related to morality?	[1]
		-
		-
	What would be one possible drawback or problem with using the ethical philosophy of "ub as a basis for computer ethics?	ounti [2]
		-
		-
	Consider the following passage from "Little Brother" by Cory Doctorow (p 11):	-
	"The answer is something ingenious called TOR The Onion Router. An onion router Internet site that takes requests for webpages and passes them onto other onion routers, and other onion routers, until one of them finally decides to fetch the page and pass it back the the layers of the onion until it reaches you. The traffic to the onion routers is encrypted, we means that the school can't see what you're asking for, and the layers of the onion don't who they're working for. There are millions of nodes the program was set up by the US Off Naval Research to help their people get around the censor ware in countries like Syria and C"	on roug which know ice

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-	
l	Professor Peter Sommer from the London School of Economics, says he changed his mabout the sort of technology that allows people anonymity and he is no longer in favour obecause: "really nasty people, who were using precisely the same sort of technology in orde conceal their activities".
	Are you in favour of technologies that enable online anonymity (that is, the ability to hide with they are)? Discuss arguments in favour and against and come to a conclusion.
-	
-	
-	
_	
-	

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Question 10 [20]

Multimedia Sharing Kiosks

Information kiosks are desktop computers placed in secure locations for members of the public to access various forms of information.

You have been hired as a consultant to develop additional software for existing kiosks to allow users to swap multimedia files such as images, movies and audio clips.

The multimedia files will be stored on the disk in sequentially numbered files. A description of each file will then be stored in a listing file (named "listing.txt"), with the following format:

```
1.jpg image 2009-10-01 picture of UCT buildings 3.avi movie 2008-06-21 students writing exams 4.avi movie 2009-04-02 more students writing exams 2.mp3 audio 2009-05-10 sounds of despair
```

The first field is the filename; the second field is one of {image, movie, audio}; the third field is the date; and the rest of the line is the title for the file.

a) Write a Java method to read the contents of this listing file into a singly linked list of objects of type Entry (without using the built-in methods for linked lists). Assume that there is a head instance variable, already initialised to null.

cl	ass Entry	
{		
	<pre>public String filename;</pre>	
	public String type;	
	public String date;	
	public String title;	
	public Entry next;	
}		
,		

b)	Users will want to browse through the list of files that are available, by sorting the list on are the 4 fields. Describe how you would adapt a standard sorting algorithm implementation cater for sorting by one of the specified fields. How does the time complexity for this algorithm compare to the fixed field sorting algorithm?	on to
	Note: Do NOT write code – simply describe the changes you would make.	
c)	Sketch a user interface for your application and explain how a user will interact with application.	this

Discuss 2 major professional issues that arise in designing this application.	