Please fill in your Student Number and, optionally, Name.	For Official Use
Student Number : _____	**Mark** : _____
Name : _____	**Marker** : _____

University of Cape Town ~ Department of Computer Science

Computer Science 1016S ~ 2007

Theory Test 3A

Question	Mark	Marker
1		
2		
3		
4		
Total		

Marks : **30**

Time : **40 minutes**

Instructions:

a) Answer all questions.

b) Write your answers in the space provided.

c) Show all calculations where applicable.

Question 1: [5 marks]

a) What is the advantage of a doubly linked list? **[1 mark]**

b) Provide a diagram to show how a doubly linked list is structured. **[2 marks]**

c) Give the Java code that would implement a suitable node for a doubly linked list. **[2 marks]**

Question 2: [5 marks]

a) What is a stack? Provide a diagram and describe how a stack works **[2 marks]**

b) Given the stack implementation below (as a linked data structure). Write a Java method *pop()* that returns the value from the top of the stack. Your method should remove the item that has been popped off the stack. **[3 marks]**

```
public class Stack
{
    private class Node
    {
        private int item;
        private Node link;

        public Node( )
        {
             item = null;
             link = null;
```

```
        }



        public Node(int newItem )
        {
            item = newItem;
            link = top;
        }
     }//End of Node inner class

    private Node top;

    public stack( )
    {
        top = null;
    }
    /**
     Adds a node at the start of the stack with the specified data.
     The added node will be the first node in the stack.
    */
    public void push(int item)
    {
        top = new Node(item, top);
    }

    /**
     Pops the top element of the stack.  Returns -1 if the list is empty.
    */
    public int pop(  )
    {
```

```
}

    /**
     Returns the number of nodes in the list.
    */
    public int size( )
    {
        ...
    }

    public boolean isEmpty( )
    {
        return (top == null);
```

```
    }

    public void clearStack( )
    {
        top = null;
    }
  }

}
```

Question 3: [5 marks]

a) Convert 572_8 from octal to the following Show all of your working :

Binary:

[2 marks]

Hexadecimal:

[1 mark]

Decimal

[1 mark]

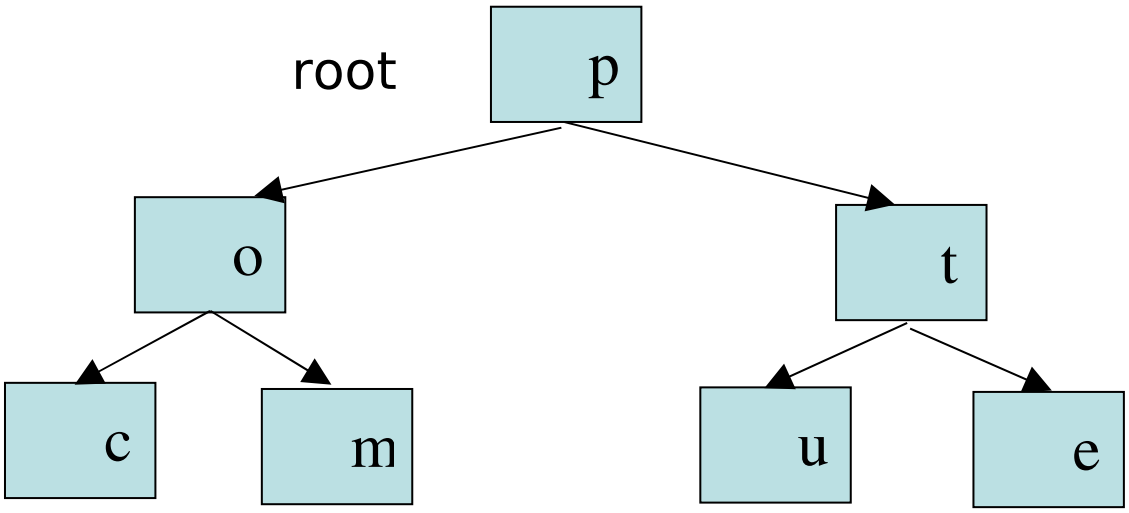
b) Illustrate the IEEE 754 format for single precision floating point numbers **[1 mark]**

Question 4: [5 marks]

a) What is a binary tree? Explain your answer with a diagram. **[1 mark]**

b) Provide the **algorithm** for an inOrder walk around a binary tree that prints out the value at each node. **[2 marks]**

c) Apply your algorithm to this tree; show your output as string. **[2 marks]**



Output:

Question 5: [5 marks]

Consider the following program.

```
 1    import javax.swing.*;
 2    import java.awt.*;
 3    import java.awt.event.*;
 4
 5     public class GuiDemo extends JFrame implements ActionListener
 6    {
 7       private JPanel redPanel;
 8       private JPanel bluePanel;
 9
10        public static void main(String[] args)
11       {
12          GuiDemo gui = new GuiDemo( );
13          gui.setVisible(true);
14       }
15
16        public GuiDemo( )
17       {
18          super("Menu Demonstration");
19          setSize(300, 200);
20          setDefaultCloseOperation(JFrame.DO_NOTHING_ON_CLOSE);
21          setLayout(new GridLayout(2,1));
22
23          redPanel = new JPanel( );
24          add(redPanel);
25
26          bluePanel = new JPanel( );
27          add(bluePanel);
28
29          JMenu colorMenu = new JMenu("Colours");
30
31          JMenuItem redChoice = new JMenuItem("Red");
32          redChoice.addActionListener(this);
33          colorMenu.add(redChoice);
34
35          JMenuItem blueChoice = new JMenuItem("Blue");
36          blueChoice.addActionListener(this);
37          colorMenu.add(blueChoice);
38
39          JMenuItem exitChoice = new JMenuItem("Exit");
40          exitChoice.addActionListener(this);
41          colorMenu.add(exitChoice);
42
43          JMenuBar bar = new JMenuBar( );
44          bar.add(colorMenu);
45          setJMenuBar(bar);
46       }
47
48        public void actionPerformed(ActionEvent e)
49       {
50          String command = e.getActionCommand( );
51
52          if (command.equals("Red"))
53             redPanel.setBackground(Color.RED);
54          else if (command.equals("Blue"))
55             bluePanel.setBackground(Color.BLUE);
56          else if (command.equals("Exit"))
57             System.exit(0);
58       }
59    }
60
```

a) Illustrate the GUI produced by the above program when the program is run. **[2 marks]**

b) Describe clearly the content of the menu using a diagram. **[2 marks]**

c) What is the effect of activating the menu item “Blue”? Illustrate you answer with a diagram. **[2 marks]**

d) Explain the code at lines 16 – 21. What does it do and why is it used? **[2 marks]**

e) Describe the purpose and actions of the code in line 48 -59 **[2 marks]**

Question 6: [5 marks]

a) Draw up a truth table to represent **A** · **B** (A and B) for all values of A and of B. **[2 marks]**

b) Show that

$$\overline{((\overline{P \cdot Q}) + R)} = P \cdot Q \cdot \overline{R}$$

[3 marks]