

## 1999 Paper 11 Question 2

### Foundations of Programming

The Java program below has been written by someone new to list-processing. This test program is intended to set up a list whose elements are 4, 7 and 11.

```
public class ListTest
{ public static void main(String[] args)
  { Link start = null;
    start.put(4); start.put(7); start.put(11);
    System.out.println("List elements: " + start);
  }
}

class Link
{ private int val;
  private Link next;

  public Link(int n)
  { this.val = n;
    this.next = null;
  }

  public void put(int k)
  { if (this == null)
    { this = new Link(k);          // Error noted here
    }
    else
    { this.next.put(k);
    }
  }

  public String toString()
  { return (this == null ? "" : " " + this.next.toString());
  }
}
```

The Java compiler gives a single error message, complaining about the statement indicated. What is the problem? Explain why there is more to fixing the program than merely changing this statement. [5 marks]

Making the minimum number of changes, modify the program so that it works approximately in the way the author intended. [6 marks]

Provide for class `Link` a method `sum()` which returns the sum of the elements in the list. [3 marks]

Provide for class `Link` a method `reverse()` which returns a new list whose elements are in the reverse order of those in the original list. [6 marks]