

2007 Paper 10 Question 2

Foundations of Programming

(a) What are the principal characteristics of a linked list? [2 marks]

(b) Consider a stack that consists solely of characters. A linked list can be used to model such a stack and a programmer has embarked on a class `ChLink` which begins thus:

```
class ChLink
{ private char val;
  private ChLink next;

  public ChLink()
  { this.val = '\\';
    this.next = null;
  }
```

The backstroke character `'\'` is reserved and marks the bottom of the stack. Why does it have to be keyed in twice? [1 mark]

(c) Augment class `ChLink` with two methods `push(char)` which pushes a character onto the stack and a method `pop()` which returns the character at the top of the stack and, unless it is backstroke, removes that character from the stack. It is not possible to pop the bottom marker. [10 marks]

(d) Write a test program which uses class `ChLink` to verify that a sequence of square brackets is properly nested. The test program might begin thus:

```
public class ChLinkEx
{ public static void main(String[] args)
  { char[] chseq = {'[','[','[','A',']',']',']','[','A',']'};
    ChLink start = new ChLink();
    for (int i=0; i<chseq.length; i++)
```

Opening brackets are pushed onto the stack. No other characters are pushed onto the stack but any closing bracket results in a pop and a suitable test. The test program should print either `Full Match` or `Match Error` without further explanation. Only class `ChLinkEx` need be written in this part.

[7 marks]