2000 Paper 10 Question 2

Foundations of Programming

A Java programmer is attempting to write a class `BigNo` which is intended to handle integers of arbitrary size. An integer is represented as a list of single digits arranged so that the least significant digit is at the head of the list. In outline, `class BigNo` is declared thus:

```
class BigNo
 { private int dig;
   private BigNo rest;

   public BigNo(int n)
    { this.dig = n%10;
      if (n/10 == 0)
         this.rest = null;
      else
         this.rest = new BigNo(n/10);
    }

   private BigNo add(int c)
      .

   public BigNo add(BigNo that)
      .

   private BigNo add(BigNo that, int c)
    { if (this.rest == null)
         return that.add(this.dig+c);
      if (that.rest == null)
         return this.add(that.dig+c);
      int d = this.dig + that.dig + c;
      return new BigNo(d%10, this.rest.add(that.rest,d/10));
    }
```

The final `return` statement refers to a constructor which is not shown. Why are two constructors needed? Provide the missing constructor. Does it have to be `public`? [4 marks]

Why are there three `add()` methods? Explain why one is `public` and two are `private`. Provide bodies for the two `add()` methods for which only heading lines are shown. [6 marks]

Provide a suitable `toString()` method. [4 marks]

Suppose `jack` and `jill` are `BigNo` representations of the integers 46 and 57 respectively. Describe carefully the effect of the call `jack.add(jill)` [6 marks]

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