QUEEN MARY, UNIVERSITY OF LONDON
DCS/128 ALGORITHMS AND DATA STRUCTURES

Class Test Monday 16th February 2004 11.05-11.55

Please fill in your Examination Number here: .....

Student Number here: .....

All answers to this test should be written on the test sheet, but you may use spare paper for rough working. Answer as many of the questions as you can.

1) Explain in the space below how the "merge sort" algorithm works. You do not need to give any Java code for it.

2)

a) Write in the space below a static method which takes as its arguments an integer and an array of integers, and changes the array destructively so that every integer in the array is multiplied by the integer argument. For example if the integer argument is 5 and the array is

7	11	13	8	5	10

the array will be changed to:

35	55	65	40	25	50

b) Write in the space below a static method which performs the same operation as in part a), but does it constructively.

3) In each case below, write in the box the order of computation in time of a call `p(n)` using the big-O notation, and assuming that the calls `dosomething()` and `saysomething()` always takes one time unit.

a)
```
void p(int n)
{
 for(int i=n; i>0; i--)
    dosomething();
}
```

b)
```
void p(int n)
{
 for(int i=0; i<n; i++)
    dosomething();
 for(int i=0; i<n; i++)
    saysomething();
}
```

c)
```
void p(int n)
{
 if(n>0)
   {
    for(int i=n; i>0; i--)
       {
        dosomething();
        saysomething();
       }
    p(n-1);
   }
}
```

d)
```
void p(int n)
{
 if(n>0)
    {
     dosomething();
     p(n/2);
    }
}
```

e)
```
void p(int n)
{
 if(n>0)
   {
    p(n/2);
    for(int i=0; i<n i++)
       dosomething();
   }
}
```

4) a) Describe briefly the difference between a data structure and an abstract data type.

b) Describe briefly the difference between a constructive and a destructive implementation of an abstract data type.

c) The class giving a constructive implementation of an abstract data type may need to have a private constructor. Say why this is the case.

d) A method in a class giving a constructive implementation of an abstract data type may return a value written in Java as `this`. Explain what this means.