Foundations of Programming

(a) Briefly describe the operation of each of the following Java operators:

\&  |  \^  \<\<  \>\>  \>\>\>  

[6 marks]

(b) On what primitive types do these operators operate? [2 marks]

(c) A Java program which is designed to exercise some of these operators begins thus:

```java
public class Changes
{
    public static void main(String[] args)
    {
        int n = 0x87654321;
        System.out.println(Integer.toHexString(cross(n)));
        System.out.println(Integer.toHexString(one8(n)));
    }
}
```

The method `cross()` accepts an eight-digit hexadecimal number (for example 0x87654321) as an argument and interchanges the digits in pairs (returning, in this example, 78563412).

The method `one8()` also accepts an eight-digit hexadecimal number (such as 0x87654321) as an argument but interchanges only the three inner pairs of digits (thereby returning, in this example, 86745231).

Supply the methods `cross()` and `one8()`. [8 marks]

(d) Write a method `msb()` which accepts an `int n` and returns 0 if `n` is zero but otherwise returns an eight-digit hexadecimal number with a single bit set at the position of the most significant 1 bit in `n`. [4 marks]