

## SOLUTION NOTES

## Foundations of Programming 2001 Paper 10 Question 2 (FHK)

- a) `&` bitwise and  
`!` bitwise or  
`^` bitwise exclusive-or  
`<<` left-shift  
`>>` right-shift using sign-extension  
`>>>` right-shift using zero extension [6 marks]
- b) All six of the above operators operate on the integral primitive types: byte, char, short, int, long [2 marks]
- c) The following test program incorporates example methods `cross()` and `one8()` ... [8 marks]
- d) ... and also an example method `msd()` [4 marks]

```
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)));
        System.out.println(Integer.toHexString(msb(0x0F000000)));
    }

    private static int cross(int n)
    {
        int l = 0x0F0F0F0F;
        int r = 0xF0F0F0F0;
        int L = (n&l) << 4;
        int R = (n&r) >>> 4;
        return(L | R);
    }

    private static int one8(int n)
    {
        int s = 0xF000000F;
        int l = 0x00F0F0F0;
        int r = 0x0F0F0F00;
        int S = n&s;
        int L = (n&l) << 4;
    }
}
```

```
        int R = (n&r) >>> 4;
        return(S | L | R);
    }

private static int msb(int n)
{ int r = 0x80000000;
  while ((r|n)!=n)
    r>>>=1;
  return(r);
}
}
```