CS3021/3421 Tutorial 3

Q1. Translate the following C/C++ code segment into RISC-1 assembly language.

```
int g = 256;

int p(int i, int j)
{
        int k;
        k= i + j;
        return (k << 2) - 1;
}

int q(int i)
{
        return p(g, -i);
}

int f(int n)
{
        if (n > 0) {
            return n*f(n-1);            // assume a multiply procedure is available
        } else {
            return 1;
        }
}
```

Q2. Consider the following function:

```
int ackermann(int x, int y)
{
        if (x == 0) {
            return y+1;
        } else if (y == 0) {
            return ackermann(x-1, 1);
        } else {
            return ackermann(x-1, ackermann(x, y-1));
        }
}
```

Determine, by instrumenting the code, the number of procedure calls, maximum register window depth, the number of register window overflows and the number of register window underflows that would occur during the calculation of ackerman(3,6) given a RISC-I processor with 6, 8 and 16 register sets respectively [remember one register window must always be kept "free"]. See http://en.wikipedia.org/wiki/Ackermann function for further information.

Q3 Determine how long it takes to calculate ackermann(3, 6) on your computer. Make sure you time the release version of your code. Describe any difficulties encountered.