Maths 1261 Quiz 4 Friday 22/11/13 *(it is ok to collaborate)*

(1: 12 marks) Write a function

```
double sum ( int n, double x[] )
{ ... }
```

which returns the sum of the first n elements of array x. This is by now easy, but make sure that suitable variables are declared inside the body of the function.

```
double sum ( int n, double x[] )
{
  double s;
  int i;
  s = 0;
  for (i=0; i<n; ++i)
  { s += x[i];}
  return s;
}
```

(2: 12 marks) Simulate the following program. What does `xxx( n )` return, in general, given $n \geq 1$?

```
#include <stdio.h>
int xxx ( int n )
{
  int m, s;

  m = 2;
  s = 0;

  while ( m <= n )
  {
    m *= 2;
    ++ s;
  }
  return s;
}
main( int argc, char * argv[])
{
  printf("xxx(19)=%d\n", xxx(19));
}
```

```
Answer.
  n     m     s
 19
        2
              0
        4
              1
        8
              2
       16
              3
       32
              4
       32 > 19
returns 4
prints
xxx(19)=4
```

In general, it returns $\lfloor \log_2(n) \rfloor$.

(3: 13 marks) Simulate the following program. In general, given $n \geq 0$, what does `yyy ( n )` return?

```
#include <stdio.h>
int yyy ( int n )
{
  int s = 0, t = 1;
  while ( n > 0 )
  {
    s += t * ( n % 10 );
    if ( s < 0 )
      s += 11;
    else if ( s >= 11 )
      s -= 11;
    n = n/10;
    t = -t;
  }
  return s;
}
main()
{ printf ( "yyy(14649) = %d\n", yyy( 14649 ) );}
```

Answer.

```
    n       s    t
14640
           0
                1
------------------
           0
1464
               -1
------------------
          -4
           7
146
                1
------------------
          13
           1
14
               -1
------------------
          -2
           9
1
                1
------------------
          10
0
               -1
------------------
prints
zzz(14640) = 10
```

(4: 13 marks) Show what the following program prints, explaining in terms of local variables, static variables, etcetera.

```
#include <stdio.h>
int a=1, b=2, c=3;
void xxx ( int a )
{
  static int b = 0;
  printf ("xxx: a %d b %d c %d\n", a, b, c );
  ++ a;
  ++ b;
}
void yyy ()
{
  int b = 0;
  printf ( "yyy: a %d b %d\n", a, b );
  ++a;
  ++b;
}
main()
{ xxx (c); yyy(); xxx (c); yyy (); xxx (c); }
```

```
Answer: initially
        a 1 b 2 c 3, global variables
xxx: a 3 b 0 c 3
        a is a copy of global c
        b becomes 1
yyy: a 1 b 0
        a is global and unchanged by xxx
        b is local and initialised to 0
        yyy changes a to 2
xxx: a 3 b 1 c 3
        a is a copy of global c
        b is 1, being static
        xxx changes b to 2
yyy: a 2 b 0

xxx: a 3 b 2 c 3
        b is now 2
```
