AMAT 2120 — Fall 2005
Assignment 3 — Due Monday Oct.24, 2005

1 Write a C program that prints all divisors of a given positive integer N. (Note: 1 and N are always divisors of N. If N is a prime, there are no other divisors.) Make your program accept the number N interactively. Make it report an error and quit if $N \leq 0$. Otherwise, running a loop through all numbers from 1 to N, check if every single number divides N. (Hint: operator %.)

(If you come up with a more economical algorithm to find all divisors of N, you may implement it instead of the suggested one.)

Please don't forget also to submit your program electronically.

2 Take a couple of sample values of the argument `x` in the following function and trace the code. Guess the purpose of the function.

```
10 int f(int x)
11 {
12    int sum=0;
13    while (x>0)
14    {
15        sum+=(x%10);
16        x/=10;
17    }
18    return(sum);
19 }
```

3 The program presented below was supposed to compute the size (number of decimals) of $n!$ for the given integer $n \geq 0$. (Recall that $n! = 1 \cdot 2 \cdot \ldots \cdot n$ and $0! = 1! = 1$.) The approach here is based on the following mathematical facts:

a. The number of decimal figures in a natural number n is the integral part of $\log_{10} n$ plus 1. For example, the singlets $1, \ldots, 9$ satisfy the two-side estimate $0 \leq \log_{10} n < 1$. Then, for double-digit integers $n = 10 \ldots 99$ we have $1 \leq \log_{10} n < 2$, etc.

b. The values $\log_{10} n! = \log_{10} 1 + \log_{10} 2 + \ldots \log_{10} n$ obey the recurrence

$$\log_{10} n! = \log_{10}(n-1)! + \log_{10} n, \qquad n > 1,$$

with initial value $\log_{10} 0! = \log_{10} 1 = 0$.

While the approach is smart and allows input values n, for which $n!$ is well beyond the range of C type `int`, the code was written in a rush and contains a lot of programming errors. (Something like this usually happens if one writes a program all at once, rather than incrementally). Find as many as you can. The programming style is also sloppy. Advise the programmer.

```
1  My first C program ''Hello World!'' */
2  includes <stdio.h>;
3
4  main()
5  {
6     integer len; /* size of n!, to be found
7     integer n  /* given value */
8     int i; /* iteration index */
9
10    print("Given an n>=0, this program computes the size of n!");
11    scanf("n=%lf", n);
12    if n<=0 {
13      printf(n<0, factorial undefined); return(0)
14      }
15    else
16    double logNFac; /* accumulator for log10 (j!), j=0,...,n.
17        note: log10 (0!)=0.*/
18
19  /* In loop: log10 (n!) = sum log10(j), j=1,..,n. */
20 for {j==1.0; j<n; n++};
21    (
22    logNFac+=log(j)  /* using function log10 from <math.h> */
23    );
24
25    /* Now that log10(n!) is computed, find its integral part */
26    len=(int) logNFac; /* cast to int */
27
28    /* if the value was rounded up, subtract one */
29    if (Len > lognfac) then
30     --len;
31    /* To obtain the size of n!, add 1 to the computed integral part */
32    size=+1;
33    /* Print result, like this: Size of 4!=2 */
34    printf("Size of %lf ! is %lf /n, n, len");
35    reburn.
36  }
```

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