A brief introduction to LATEXdocument preparation system

Benjamin Dahl

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Abstract

We will explain some basics about the exponential function, and discuss a simple code to calcluate it in C.

1 The exponential function

The exponential function is an important function for both math and physics, since it describes exponential growth, which is important for example for radioactive decay. It can be defined in many ways; one is through its power series as the following equation:

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} \tag{1}$$

It can also be written as the limit of the following sequence

$$e^x = \lim_{n \to \infty} (1 + x/n)^n \tag{2}$$

2 The code

```
double ex(double x)
if(x<0)return 1/ex(-x);
if(x>1./8)return pow(ex(x/2),2);
return 1+x*(1+x/2*(1+x/3*(1+x/4*(1+x/5*(1+x/6*(1+x/7*(1+x/8*(1+x/9*(1+x/10)))))))));
```

The above code first checks if its argument is negative, because if it is, it will call itself again with a new argument, so it will end up returning a value on the form $\frac{1}{ex(-x)}$, which is mathematically identical. Then it checks if the argument is of a certain size, since this approach works best for small arguments, if it is above 1/8 we half the argument through another mathematical identity. When all this is checked and dealt with it finally tries to calculate e^x based on the first 10 values of the taylor series written in an convoluted version to optimize the compilation speed.

3 Test of code

To test the method we have plotted it on figure 1 together with the exp function from math.h, and the results are very neat.
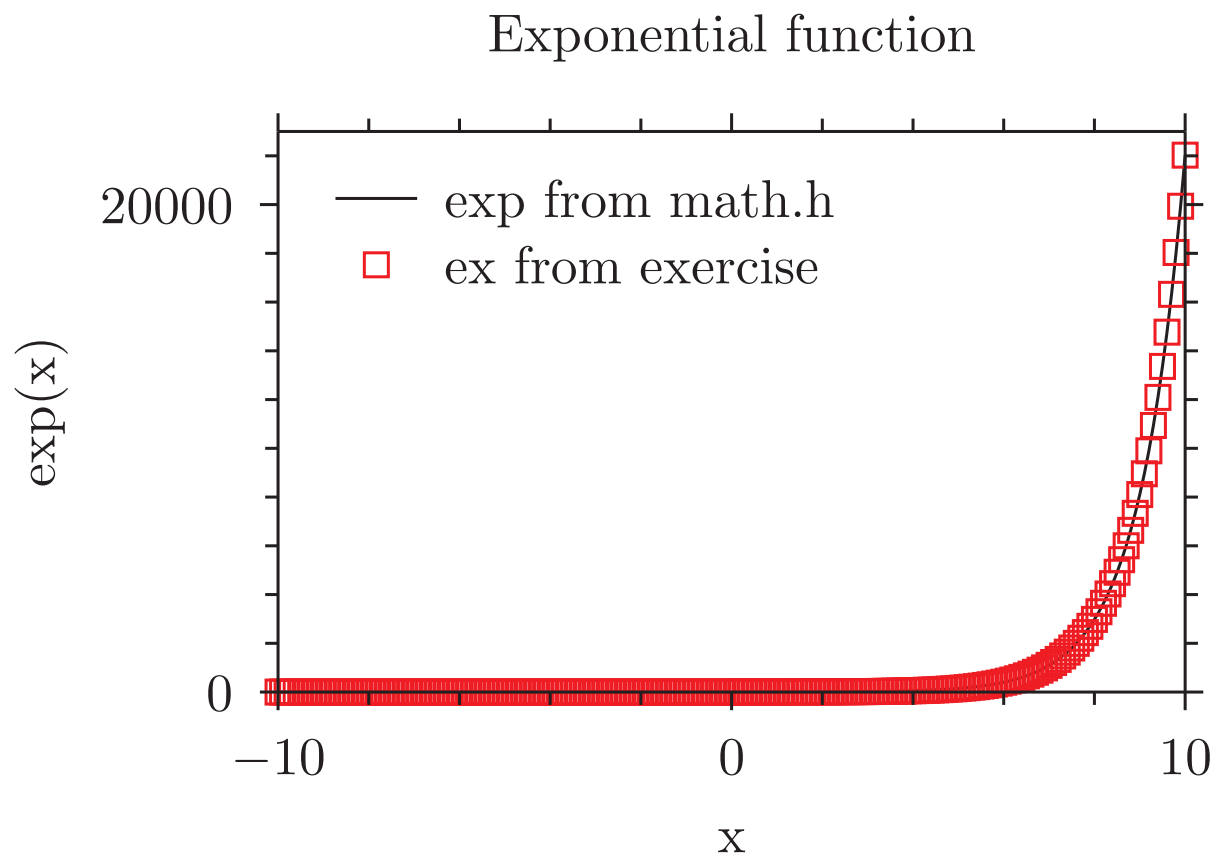
Exponential function

Figure 1: Excercise function vs math.h exp.