

**Use MATLAB to Explore the Numerical Limits of Your Computer**

The BFB text (p16) suggests that on a 64-bit computer the **smallest positive number** that can be represented is

$$2^{-1022}(1 + 0) \approx 0.22251 \times 10^{-307}$$

and

the **largest positive number** that can be represented is

$$2^{1023}(2 - 2^{-52}) \approx 0.17977 \times 10^{309}$$

I wrote a short *MATLAB* script (outputs are attached) that illustrates that the **smallest positive number** that can be represented on my computer is about

$$4.940656458412465e-324 = 0.4940656458412465 \times 10^{-323}$$

which is a factor of  $10^{-16}$  smaller than in BFB

and

the **largest positive number** that can be represented on my computer is about

$$8.988465674311580e+307 = 0.8988465674311580 \times 10^{308}$$

which is a factor of 10 smaller than in BFB.

**ASSIGNMENT:**

The goal of this investigation is to estimate the smallest positive number and largest positive number your computer processor can handle. Write a few lines of *MATLAB* code (probably a script or a function) that allows you to explore the numerical limits of your computer.

Hand-in a hardcopy or send a digital copy to [weiss@fairfield.edu](mailto:weiss@fairfield.edu) of your solution by the beginning of class on **Monday, September 17, 2018**.

Your solution should include:

1. A copy of your *MATLAB* code and output(s);
2. A list the **smallest positive number** and the **largest positive number** that can be represented on your computer and how these compare to the values listed in BFB.

```
>> ComputerLimits  
Enter a power of 2: -1070
```

```
p = -1070
```

```
i = -1070  
number = 7.905050333459945e-323
```

```
i = -1071  
number = 3.952525166729972e-323
```

```
i = -1072  
number = 1.976262583364986e-323
```

```
i = -1073  
number = 9.881312916824931e-324
```

```
i = -1074  
number = 4.940656458412465e-324
```

```
i = -1075  
number = 0
```

```
i = -1076  
number = 0
```

>> ComputerLimits

Enter a power of 2: 1015

p =1015

i =1015

number = 3.511119404027961e+305

i =1016

number =7.022238808055922e+305

i =1017

number = 1.404447761611184e+306

i =1018

number = 2.808895523222369e+306

i =1019

number = 5.617791046444737e+306

i =1020

number = 1.123558209288947e+307

i =1021

number = 2.247116418577895e+307

i =1022

number = 4.494232837155790e+307

i =1023

number = 8.988465674311580e+307

i =1024

number = Inf

i =1025

number = Inf