Running Parallel Programming Data-Acquisition Scripts from a Windows Powershell

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Here's How our Sample Code Sets NUMT and NUMTRIES

The sample code uses defined constants and global arrays, like this:

```
#ifndef NUMT
#define NUMT                    2
#endif

#ifndef NUMTRIALS
#define NUMTRIALS               10000
#endif

float Heights[NUMTRIALS];
```

which you can then set from the command line in a script, like this:

```
#!/bin/bash
# number of threads:
for  t  in 1 2 4 6 8
do
        echo NUMT = $t
        # number of trials:
        for n in 1 10 100 1000 10000 100000 1000000
        do
                g++   -DNUMTRIALS=$n   -DNUMT=$t   prog.cpp  -o prog  -lm  -fopenmp
                ./prog
        done
done
```

If You Want to Use Powershell From Windows, You Need to do it Differently

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        g++ -DNUMTRIALS=$n -DNUMT=$t prog.cpp -lm -fopenmp
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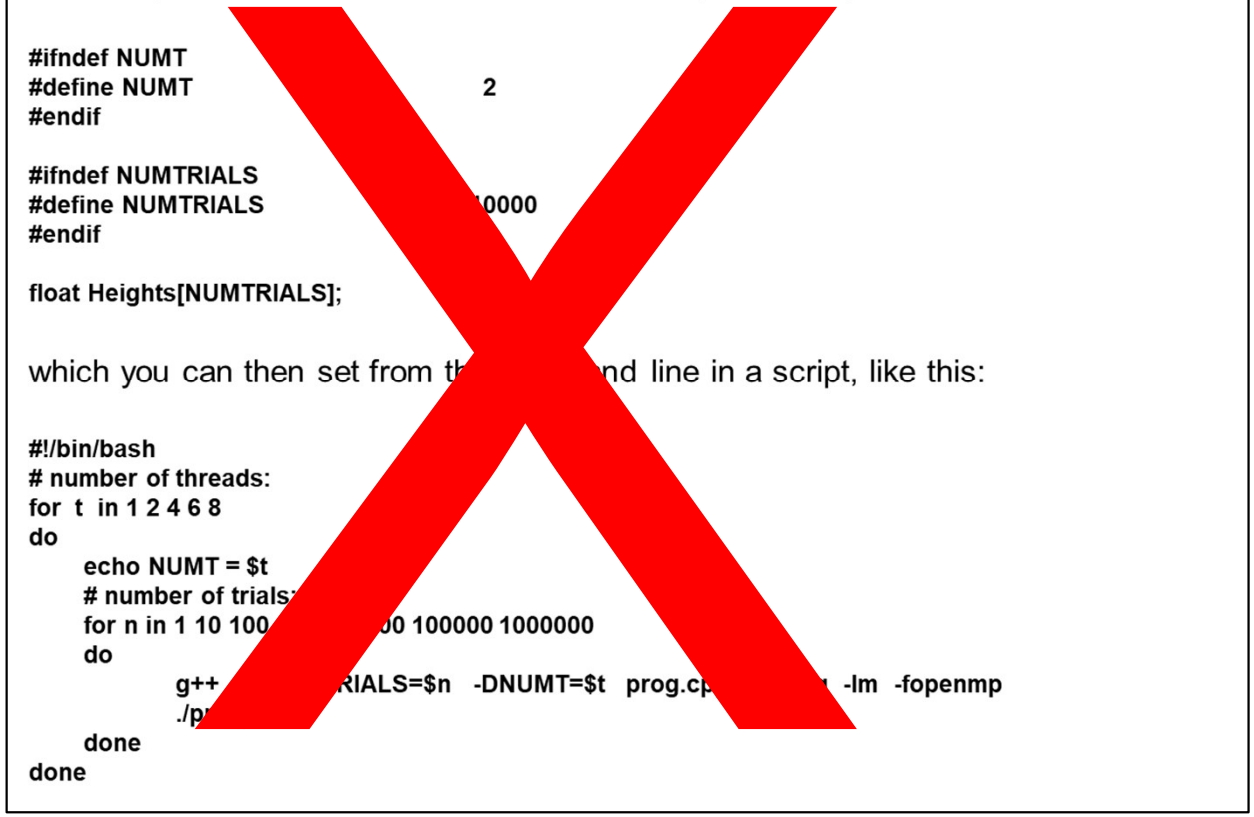


If You Want to Use Powershell From Windows, We Need to do it Differently

1. Change the NUMT and NUMTRIES to global *int* variables:

```
int NUMT =   2;
int NUMTRIALS = 10000;
```

2. Change the global arrays to be global pointers:

```
float *Height;
```

argc and argv

When you write in C or C++, your *main* program, which is really a special function, looks like this:

```
int main( int argc, char *argv[ ] )
{
        . . .
```

These arguments describe what was entered on the command line used to run the program.
The **argc** is the number of arguments (the arg **c**ount)
The **argv** is a list of argc character strings that were typed (the arg **v**ector).
The name of the program counts as the 0th argv (i.e., argv[0])

So, for example, when you type

ls -l

in a shell, the *ls* program sees argc and argv filled like this:

argc = 2
argv[0] = “ls”
argv[1] = “-l”

argc and argv

So, NUMT and NUMTRIALS are global int variables with default values:

```
int NUMT =   2;
int NUMTRIALS = 10000;
```

You want to set them from the command line, like this:

./prog 4 50000

Then, *inside your main program*, you would say this:

```
if( argc >= 2 )
        NUMT = atoi(  argv[1]  );

if( argc >= 3 )
        NUMTRIALS = atoi(  argv[2]  );
```

The if-statements guarantee that nothing bad happens if you forget to type values on the command line.

The ***atoi*** function converts a string into an integer ("ascii-to-integer").
If you ever need it, there is also an ***atof*** function for floating-point.

If You Want to Use Powershell From Windows, We Need to do it Differently

1. Change the NUMT and NUMTRIES to global *int* variables:

```
int NUMT =   2;
int NUMTRIALS = 10000;
```

2. Change the global arrays to be global pointers:

```
float *Height;
```

3. In the main program, after you have set NUMT and NUMTRIALS using *atoi*, dynamically allocate the arrays, like this:

```
Height = new float [NUMTRIALS];
```

From then on, you can treat Heights as a normal array. For example:

```
float height = Heights[n];
```

shared( ) in the *#pragma omp* Line

Also, remember, since NUMTRIALS is a variable, it needs to be declared as *shared* in the *#pragma omp* line:

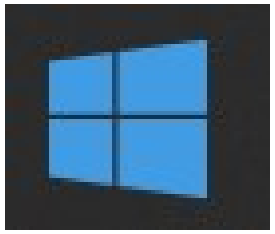
#pragma omp parallel for default(none) shared(NUMTRIALS,Height,Width) reduction(+:numHits)

NUMT does not need to be declared in this way because it is not used in the for-loop that has the *#pragma omp* in front of it.

Windows Powershell

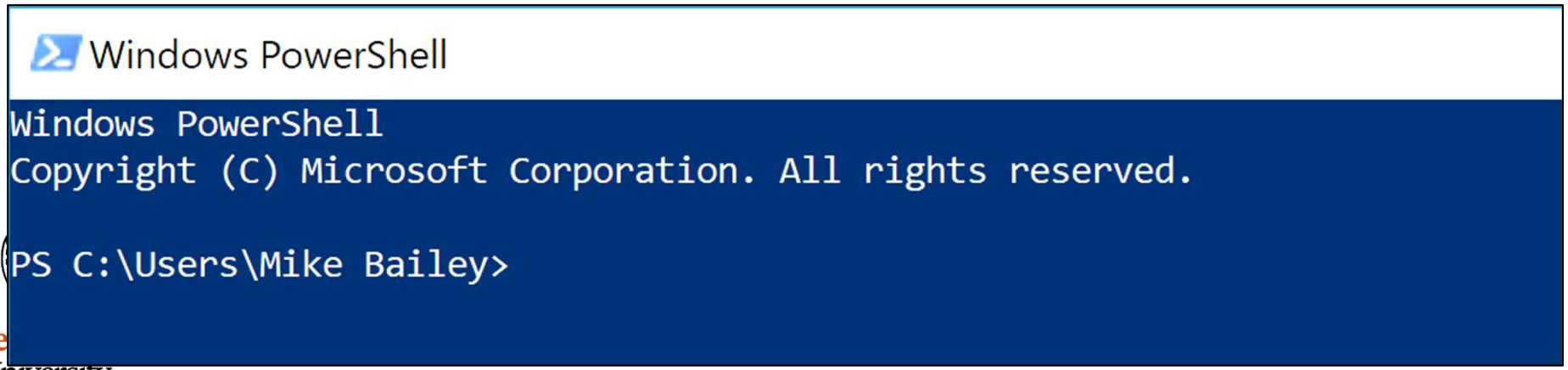
Windows comes with a shell program called *Powershell*. It might not be as familiar to most of us as some of the Linux shells are (bash, csh), but it can still be used to run multiple combinations of your program parameters in one shot.

There are a number of ways to get Powershell running. Either:



- Click on the Microsoft icon. Then scroll down to **Windows Powershell** and run **Windows Powershell.**
- *Shift right-click* in the directory you want to work in and select **Open Powershell Window**.
- Hold down the Windows key and hit the 'x' key, then select **Windows Powershell.**

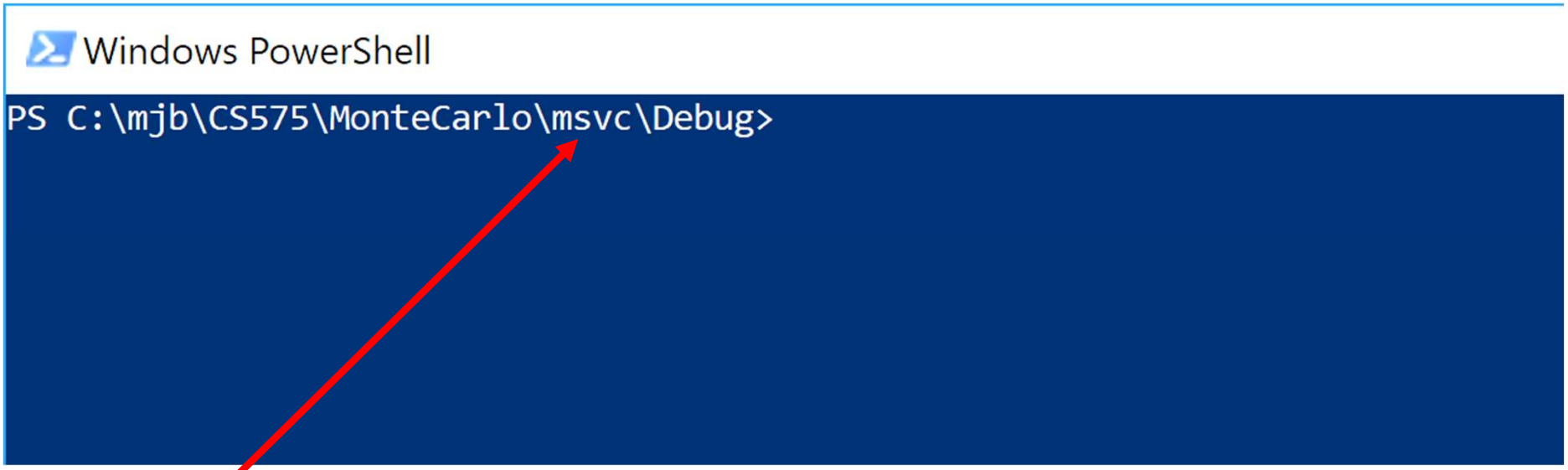
The resulting window should look like this:



Change Directory to Where Your .exe File Lives

Then:

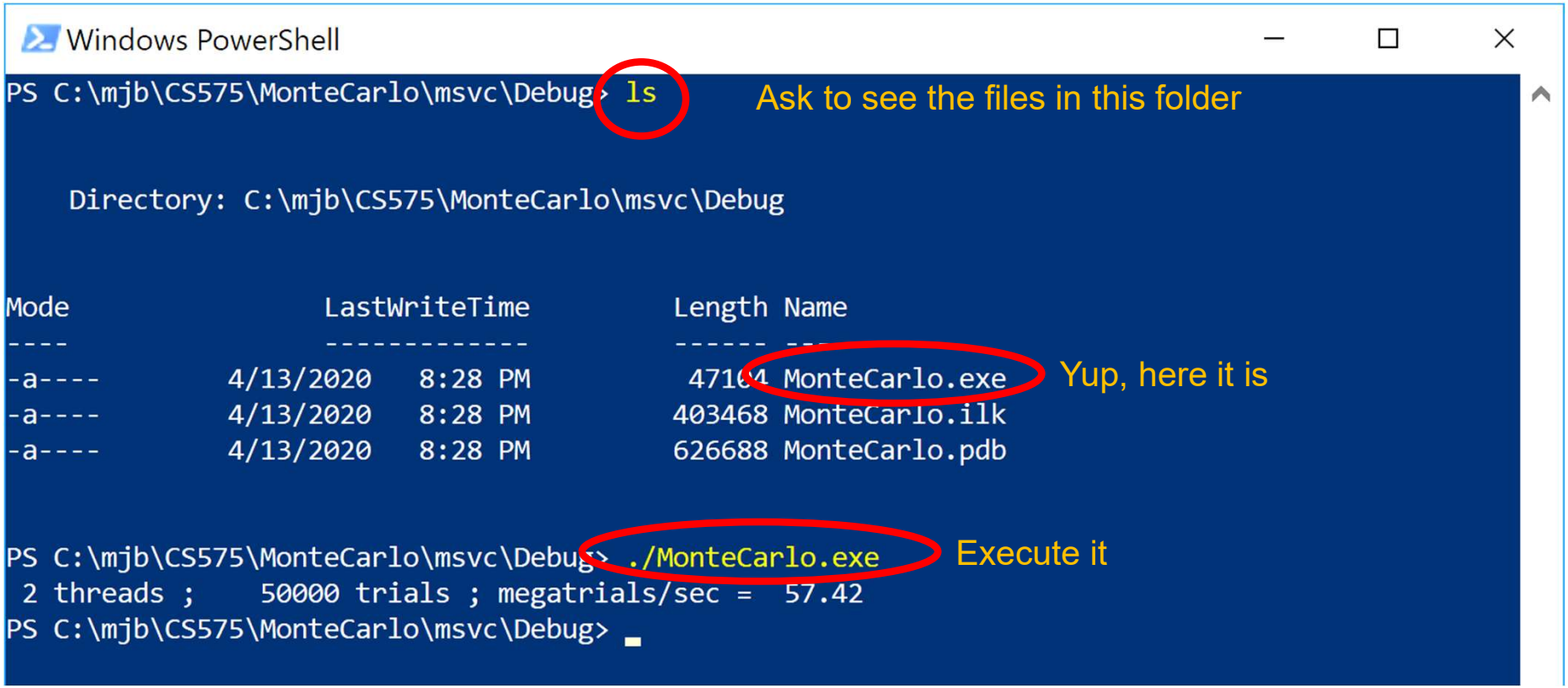
1. *cd* (change directory) to your home directory.
2. Then *cd* to the folder with your project
3. Then *cd* to the folder with your executable (*.exe)
   (for Visual Studio, this is usually a folder named ***Debug***)



The prompt will always tell you where you are in the file system.

Running an Executable

So, if you have *cd*'ed to where your executable (.exe) file lives, you can run it from the command line like this:

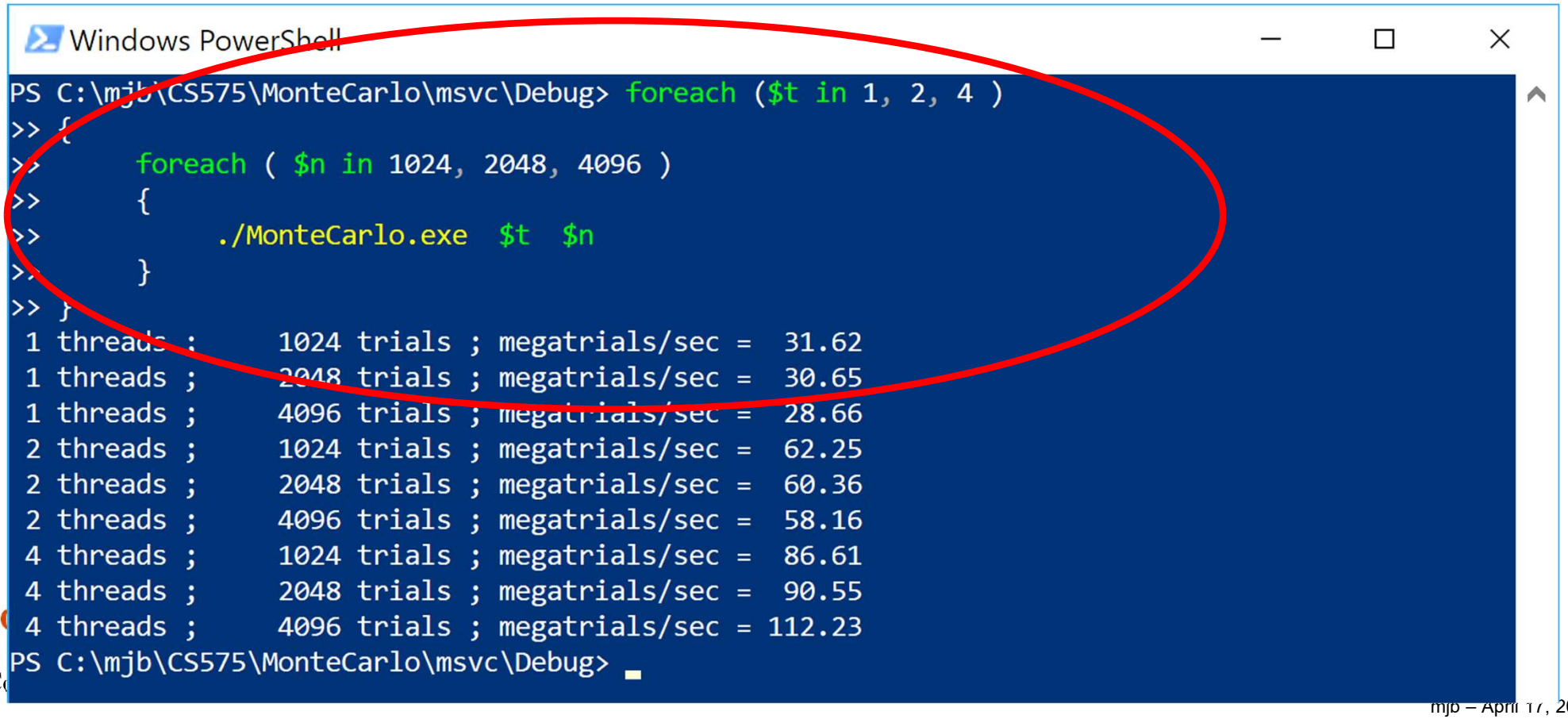


Running a Loop

But, here's the cool part. Type:

```
foreach ( $t in 1, 2, 4 )
{
        foreach ( $n in 1024, 2048, 4096)
        {
                ./MonteCarlo.exe  $t  $n
        }
}
```

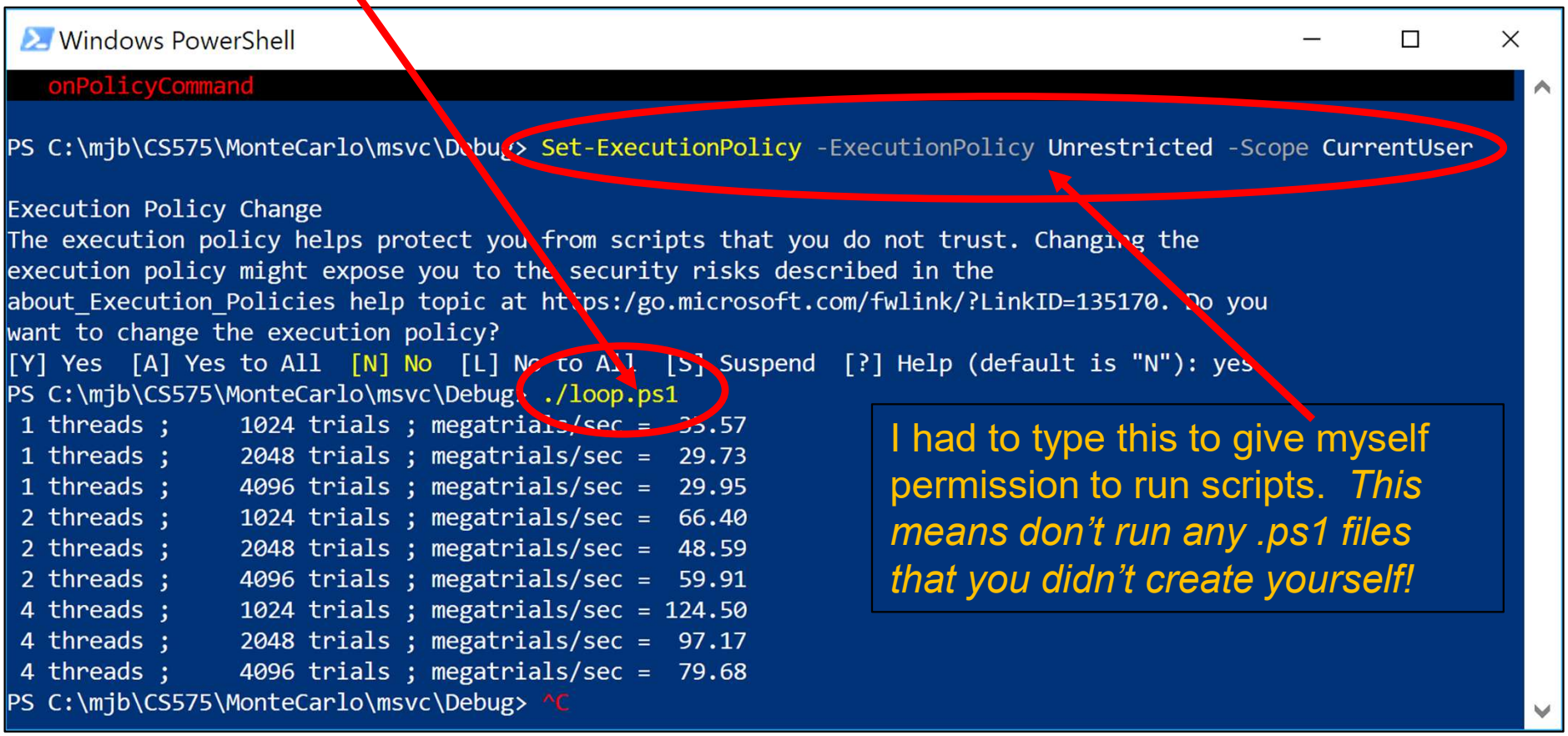
followed by Enter:



Running a Loop from a File

You can also use a text editor like *notepad* or *notepad++* and put these lines into a file called, say, l**oop.ps1** (ps1 is the Powershell file extension).

Then, you can run this script from Powershell just by typing it:



Instead of printing these lines to the screen, you probably want to divert them to a CSV file that can then by imported by Excel.

Diverting Output to an Excel CSV File from Powershell

To divert just the printf's to a file, do this:

./loop.ps1 > out.csv

or this:

./loop.ps1 1> out.csv

To divert *both* printf's *and* fprintf(stderr,…)'s together, do this:

./loop.ps1 2>&1> out.csv

Use this because the sample code does a lot of printing to stderr