

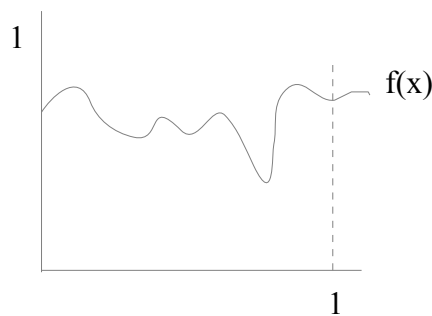
159.240 Monte Carlo Tutorial

Don't hand in this program. This is not for marks – feel free to work on your assignment instead if you like.

Your task is to use Monte Carlo simulation to integrate the function $\exp(-x^2 / 2.0)$ between 0.0f and 1.0f. This is a lot easier than it looks.

The function $f(x) = \exp(-x^2 / 2.0)$ is impossible to integrate, so the only way to find the area under the curve $f(x)$ is by estimating it using a method like Monte Carlo.

Imagine you have a graph with an x and y axis, and you have the curve $f(x)$ on this graph like this:



You want to calculate the area under this curve. There are reasonable reasons for wanting to do this. Like integrating under the normal distribution curve to obtain a probability. Basically what you want to do, is throw darts at this graph, and count the number of darts above and below the curve.

Follow these steps:

1. Set up a new program
2. Set up a loop to repeat $N = 10000$ times
3. Inside the loop, generate two random numbers in $[0,1]$, call them x and y . You can use `rand()` to help.
 1. Remember, it looks like this: `float x = rand() / (RAND_MAX + 1.0f);`
 2. Calculate the formula for your x value. Do it like this:
 3. `float formula_y = exp(-x*x / 2.0f);`
 4. Remember that you need to `#include <math.h>` for this
 5. Now check to see if your y value is less than `formula_y`. If it is, then you add 1 to a global variable called `M`.
4. Once the loop has done the last 5 sub steps 10000 times, divide M / N and you should have 0.855800.