

Let's learn about Continuous Uniform Distributions. Note: You should look at Discrete Uniform Distributions first.

If we took a discrete uniform distribution to probability of any outcome was $1/n$ for any outcome, however for a *continuous* distribution, our data can not be divided in discrete components, for example weighing an object. With perfect precision on weight, the data can take on any value between two points (e.g 5.4 grams, 5.423 grams, 5.42322 grams, etc.)

This means that our n possible values from the discrete uniform distribution is going towards infinity, thus the probability of any *individual* outcome for a continuous distribution is $1/\infty$, technically undefined or zero if we take the limit to infinity. Thus we can only take probability measurements of ranges of values, and not just a specific point. Let's look at some definitions and examples to get a better understanding!

#####A continuous random variable X with a probability density function is a continuous uniform random variable when:

$$f(x) = \frac{1}{(b - a)}$$
$$a \leq x \leq b$$

This makes sense, since for a discrete uniform distribution the $f(x)=1/n$ but in the continuous case we don't have a specific n possibilities, we have a range from the min (a) to the max (b)!

The mean is simply the average of the min and max:

$$\frac{(a + b)}{2}$$

The variance is defined as:

$$\sigma^2 = \frac{(b - a)^2}{12}$$

So what would an example problem look like? Let's say on average, a taxi ride in NYC takes 22 minutes. After taking some time measurements from experiments we gather that all the taxi rides are uniformly distributed between 19 and 27 minutes. What is the probability density function of a taxi ride, or $f(x)$?

In [4]: *#Let's solve this with python*

```
#Lower bound time
a = 19

#Upper bound time
b = 27

#Then using our probability density function we get
fx = 1.0/(b-a)

#show
print 'The probability density function results in %1.3f' %fx
```

The probability density function results in 0.125

In [7]: *#We can also get the variance*

```
var = ((b-a)**2 )/12

#Show
print 'The variance of the continous unifrom distribution is %1.1f' %var
```

The variance of the continous unifrom distribution is 5.0

So let's ask the question, what's the probability that the taxi ride will last *at least* 25 minutes?

In [10]: *# This is the same as the PDF of f(27) (the entire space) minus the probability s*

```
#f(27)
fx_1 = 27.0/(b-a)
#f(25)
fx_2 = 25.0/(b-a)

#Our answer is then
ans = fx_1-fx_2

#print
print ' The probability that the taxi ride will last at least 25 minutes is %2.1f
```

The probability that the taxi ride will last at least 25 minutes is 25.0%

Now let's see how to do this automatically with scipy.

```
In [50]: # Import the following
from scipy.stats import uniform
import numpy as np

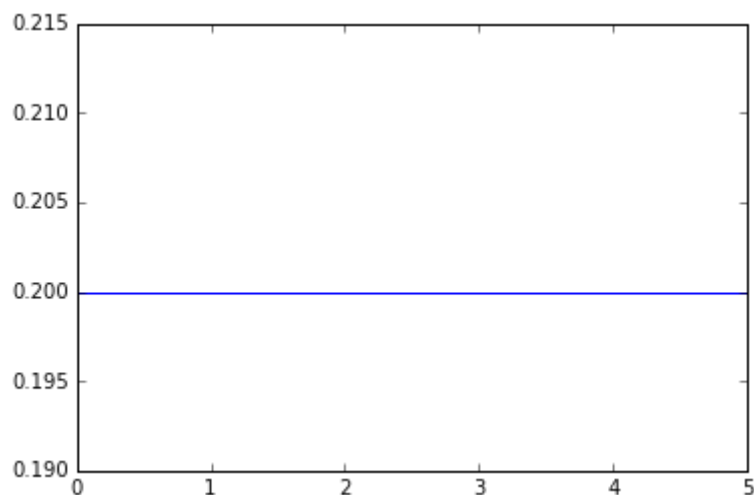
#Let's set an A and B
A=0
B=5

# Set x as 100 linearly spaced points between A and B
x = np.linspace(A,B,100)

# Use uniform(loc=start point,scale=endpoint)
rv = uniform(loc=A,scale=B)

#Plot the PDF of that uniform distirbution
plt.plot(x,rv.pdf(x))
```

```
Out[50]: [ <matplotlib.lines.Line2D at 0x192a10f0>]
```



Note the above line is at 0.2, as we would expect since $1/(5-0)$ is $1/5$ or 0.2.

####That's it for Uniform Continuous Distributions. Here are some more resource for you:

- 1.)http://en.wikipedia.org/wiki/Uniform_distribution_%28continuous%29
(http://en.wikipedia.org/wiki/Uniform_distribution_%28continuous%29)
- 2.)<http://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.uniform.html>
(<http://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.uniform.html>)
- 3.)<http://mathworld.wolfram.com/UniformDistribution.html>
(<http://mathworld.wolfram.com/UniformDistribution.html>)

In []:

