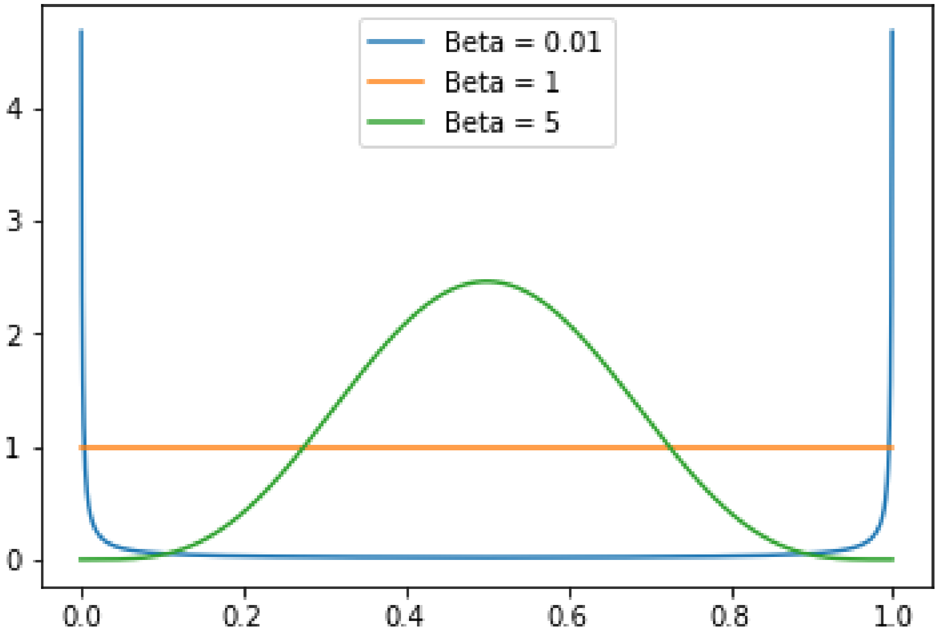
Ex 2

March 28, 2019

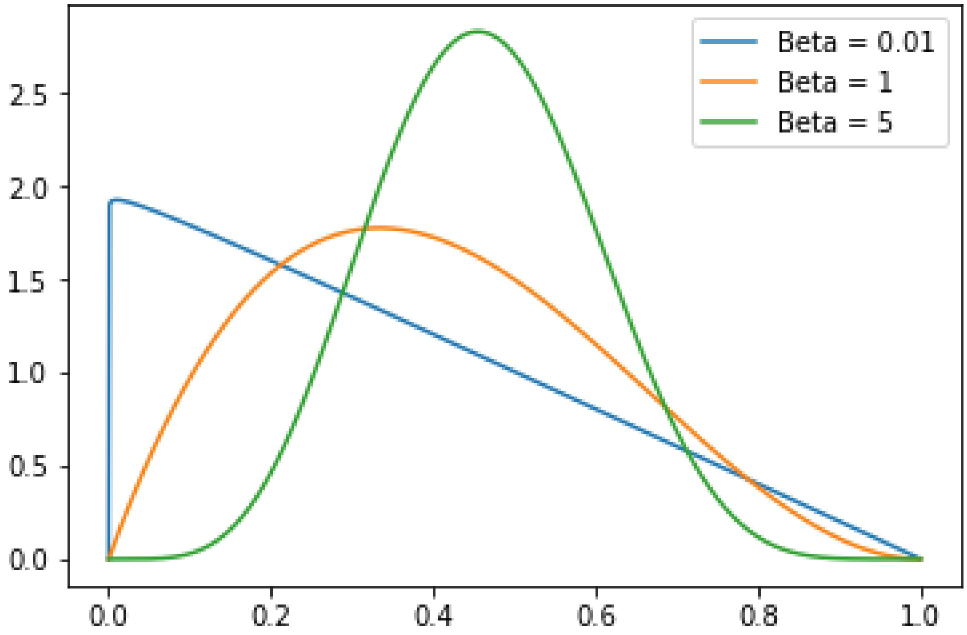
```
In [2]: import numpy as np
        import matplotlib.pyplot as plt
        from scipy.stats import gamma, expon, dirichlet, beta
        from scipy import special
        from mpl_toolkits.mplot3d import Axes3D
```

```
In [3]: betas = [
            [0.01, 0.01],
            [1, 1],
            [5, 5]
        ]

        seq = np.arange(0, 1, 0.001)

        for b in betas:
            plt.plot(seq, beta.pdf(seq, b[0], b[1]), label='Beta = ' + str(b[0]))

        plt.legend()
        plt.show()
```



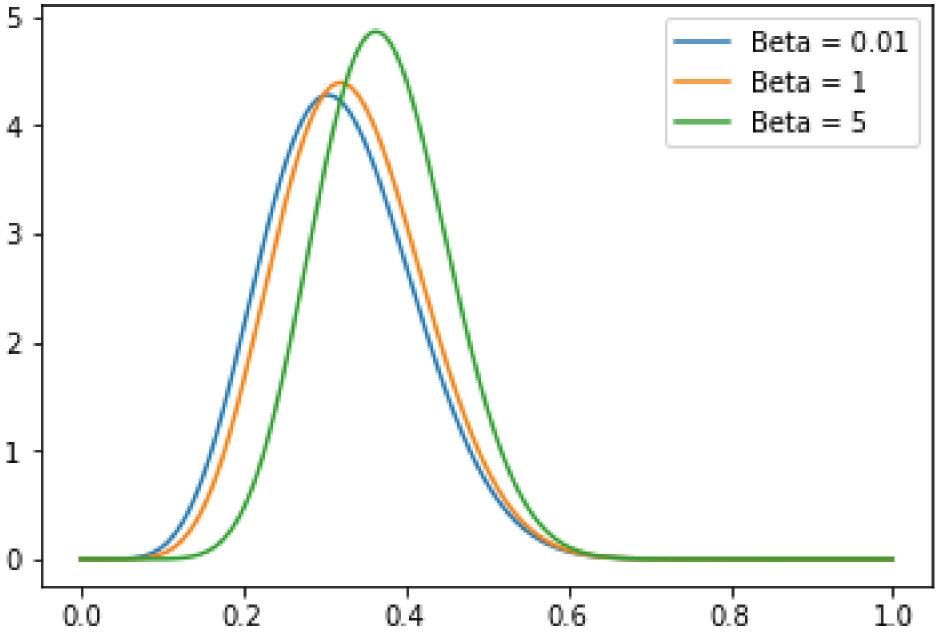
```
In [5]: up = 1
        down = 2

        for b in betas:
            plt.plot(seq, beta.pdf(seq, b[0] + up, b[1] + down), label='Beta = ' + str(b[0]))
            print('P theta < 0.5 = ' + str(beta.cdf(seq, b[0] + up, b[1] + down)[len(seq) // 2]))

        plt.legend()
        plt.show()
```

```
P theta < 0.5 = 0.7490397188646494
P theta < 0.5 = 0.6875
P theta < 0.5 = 0.6127929687499998
```



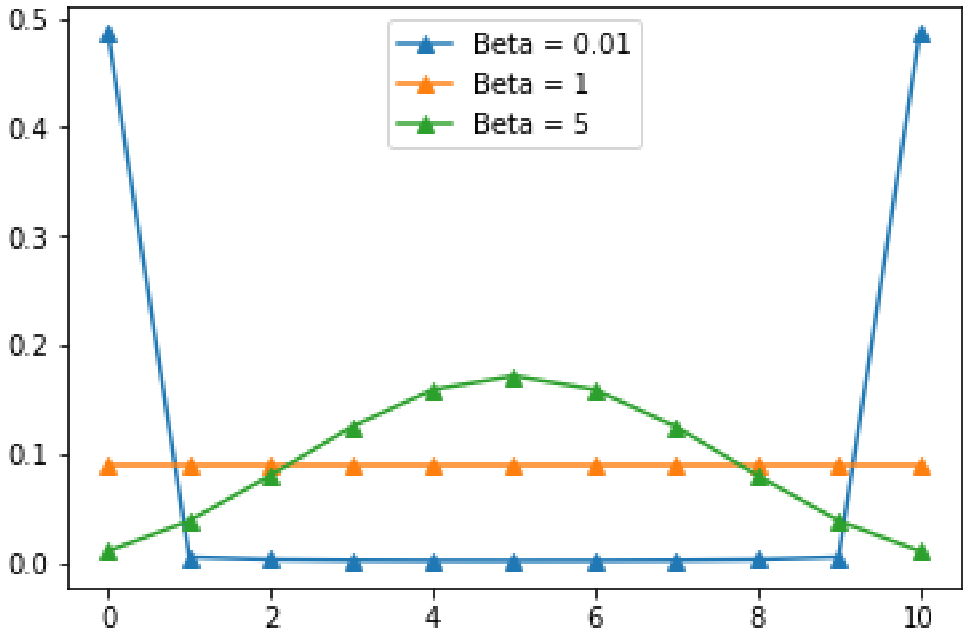
```
In [7]: up = 8
        down = 17

        for b in betas:
            plt.plot(seq, beta.pdf(seq, b[0] + up, b[1] + down), label='Beta = ' + str(b[0]))
            print('P theta < 0.5 = ' + str(beta.cdf(seq, b[0] + up, b[1] + down)[len(seq) // 2]))

        plt.legend()
        plt.show()
```

```
P theta < 0.5 = 0.9679849403227562
P theta < 0.5 = 0.9622406512498856
P theta < 0.5 = 0.9392752575222403
```

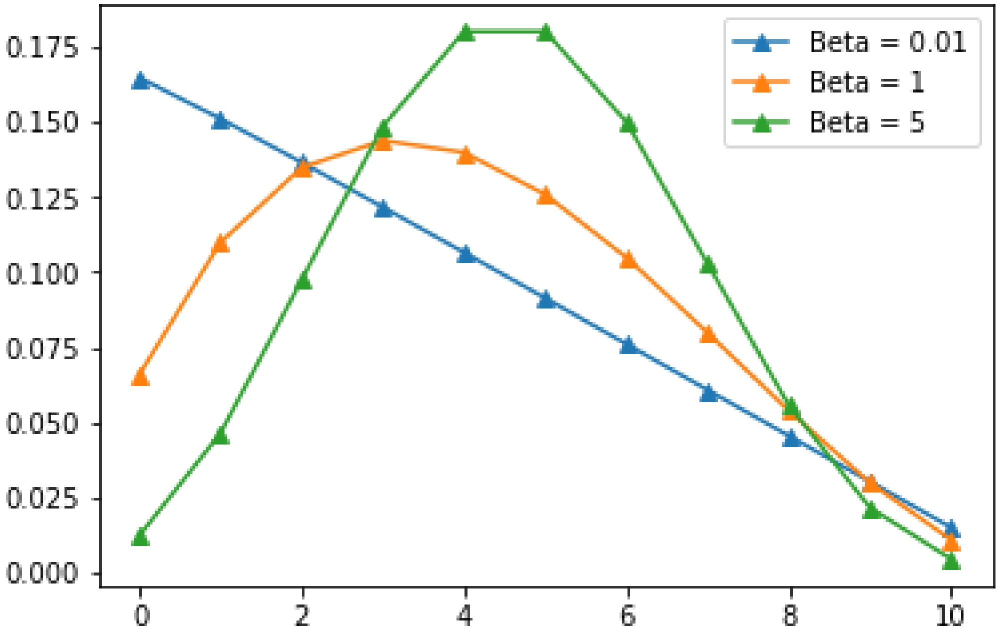


```
In [8]: def beta_binomial(n, k, b, a):
            return special.comb(n, k) * (special.beta(k + a, n - k + b) / special.beta(a, b))
```

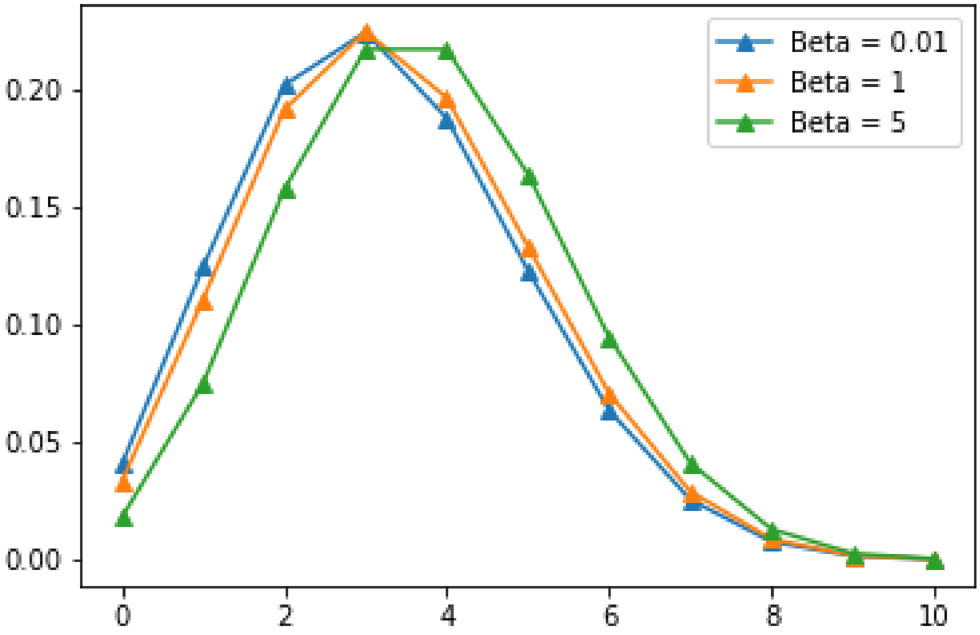
```
In [9]: m = 10
        points = range(11)

        for b in betas:
            evs = [ beta_binomial(10, x, b[0], b[1]) for x in points ]
            plt.plot(points, evs, marker=’^’, label=’Beta = ’ + str(b[0]))

        plt.legend()
        plt.show()
```



```
In [10]: m = 10
         points = range(11)

         for b in betas:
             evs = [ beta_binomial(10, x, b[0] + 2, b[1] + 1) for x in points ]
             plt.plot(points, evs, marker='^', label='Beta = ' + str(b[0]))

         plt.legend()
         plt.show()
```

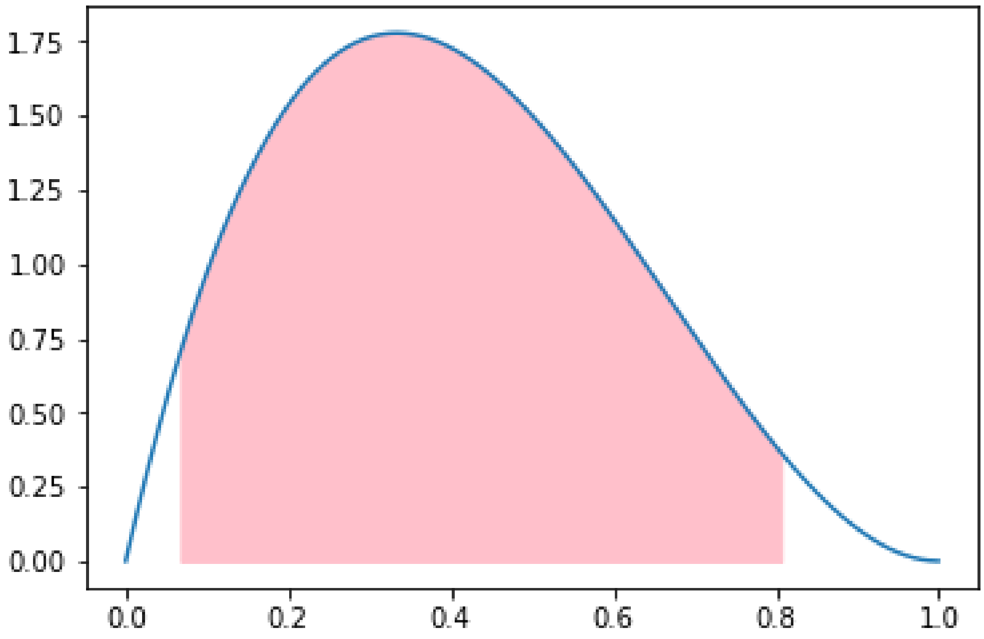


```
In [11]: m = 10
         points = range(11)

         for b in betas:
             evs = [ beta_binomial(10, x, b[0] + down, b[1] + up) for x in points ]
             plt.plot(points, evs, marker='^', label='Beta = ' + str(b[0]))

         plt.legend()
         plt.show()
```

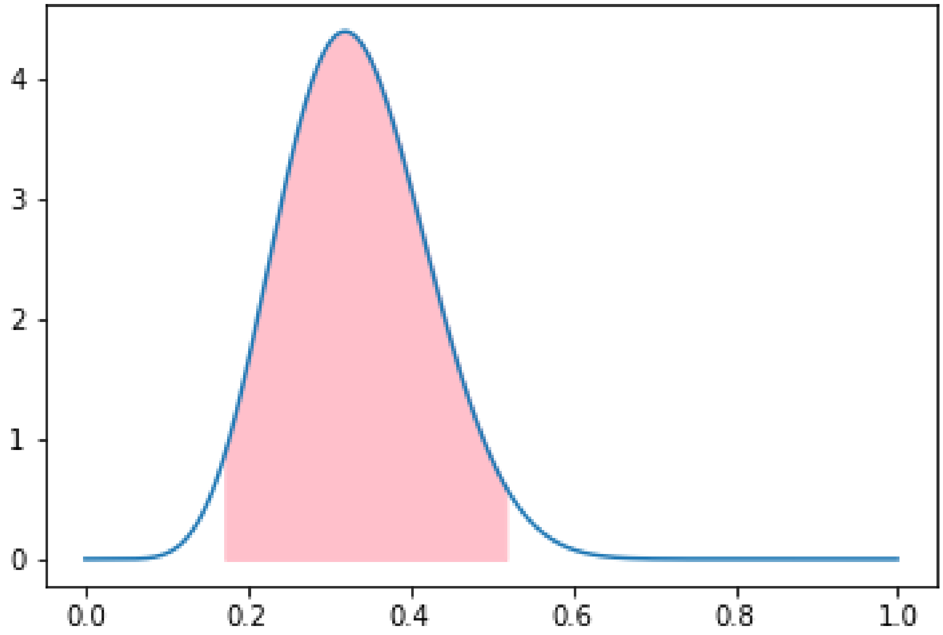


```
In [12]: print('For three ' + str(beta.ppf([0.025, 0.975], 2, 3)))

         print('For five and twenty ' + str(beta.ppf([0.025, 0.975], 1 + up, 1+ down )))

For three [0.06758599 0.80587955]
For five and twenty [0.17214414 0.51789644]
```

```
In [13]: ppf = beta.ppf([0.025, 0.975], 2, 3)
         pdf = beta.pdf(seq, 2, 3)
         plt.plot(seq, beta.pdf(seq, 2, 3))
         section = np.arange(ppf[0], ppf[1], step=0.001)
         plt.fill_between(section, beta.pdf(section, 2, 3), color='pink')
         plt.show( )
```



```
In [14]: ppf = beta.ppf([0.025, 0.975], 1 + up, 1 + down)

         plt.plot(seq, beta.pdf(seq, 1 + up,  1 + down))
         section = np.arange(ppf[0], ppf[1], step=0.001)
         plt.fill_between(section, beta.pdf(section, 1 + up, 1 + down), color='pink')
         plt.show( )
```



```
In [ ]:
```