Basic Probability

In [9]:

```python
import mxnet as mx
from mxnet import nd
%matplotlib inline
from matplotlib import pyplot as plt
from IPython import display
display.set_matplotlib_formats('svg')
```

Let's define a discrete distribution over 6 outcomes and sample from it.

In [2]:

```python
probabilities = nd.ones(6) / 6
nd.random.multinomial(probabilities)
```

Out[2]:

```
[3]
<NDArray 1 @cpu(0)>
```

Let's draw from it multiple times.

```
In [3]: print(nd.random.multinomial(probabilities, shape=(10)))
        print(nd.random.multinomial(probabilities, shape=(5,10)))
```

```
[3 4 5 3 5 3 5 2 3 3]
<NDArray 10 @cpu(0)>

[[2 2 1 5 0 5 1 2 2 4]
 [4 3 2 3 2 5 5 0 2 0]
 [3 0 2 4 5 4 0 5 5 5]
 [2 4 4 2 3 4 4 0 4 3]
 [3 0 3 5 4 3 0 2 2 1]]
<NDArray 5x10 @cpu(0)>
```

Let's see what happens for 1000 samples.

In [4]:

```
rolls = nd.random.multinomial(probabilities, shape=(1000))
counts = nd.zeros((6,1000))
totals = nd.zeros(6)
for i, roll in enumerate(rolls):
    totals[int(roll.asscalar())] += 1
    counts[:, i] = totals
```

To start, we can inspect the final tally at the end of 1000 rolls.

In [5]:

```
totals / 1000
```

Out[5]:

```
[0.167 0.168 0.175 0.159 0.158 0.173]
<NDArray 6 @cpu(0)>
```

Let's look at the counts.

In [6]:

```
counts
```

Out[6]:

```
[[   0.    0.    0. ... 165. 166. 167.]
 [   1.    1.    1. ... 168. 168. 168.]
 [   0.    0.    0. ... 175. 175. 175.]
 [   0.    0.    0. ... 159. 159. 159.]
 [   0.    1.    2. ... 158. 158. 158.]
 [   0.    0.    0. ... 173. 173. 173.]]
<NDArray 6x1000 @cpu(0)>
```

Normalizing by the number of tosses, we get:

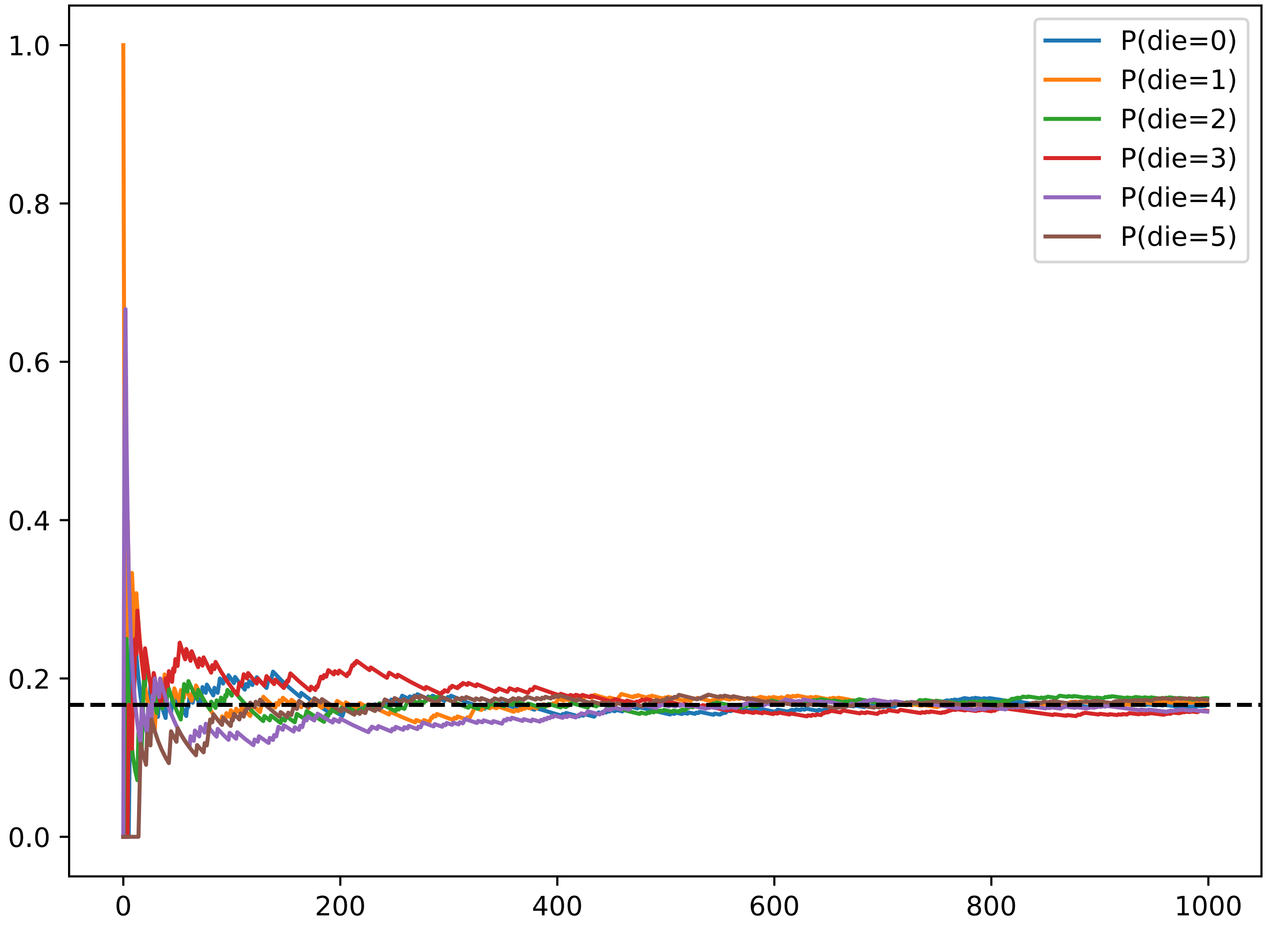
In [7]:

```
x = nd.arange(1000).reshape((1,1000)) + 1
estimates = counts / x
print(estimates[:,0])
print(estimates[:,1])
print(estimates[:,100])
```

```
[0. 1. 0. 0. 0. 0.]
<NDArray 6 @cpu(0)>

[0.  0.5 0.  0.  0.5 0. ]
<NDArray 6 @cpu(0)>

[0.1980198  0.15841584 0.17821783 0.18811882 0.12871288 0.14851485]
<NDArray 6 @cpu(0)>
```

In [10]:

```
plt.figure(figsize=(8, 6))
for i in range(6):
    plt.plot(estimates[i, :].asnumpy(), label=("P(die=" + str(i) +")"))

plt.axhline(y=0.16666, color='black', linestyle='dashed')
plt.legend()
plt.show()
```


P(die=0)
P(die=1)
P(die=2)
P(die=3)
P(die=4)
P(die=5)