Assignment9_3

October 30, 2021

1 Calculate the probability of a model ensemble that uses simple majority voting making an incorrect prediction in the following scenarios

[2]:
```
from scipy.stats import binom
import numpy as np
```

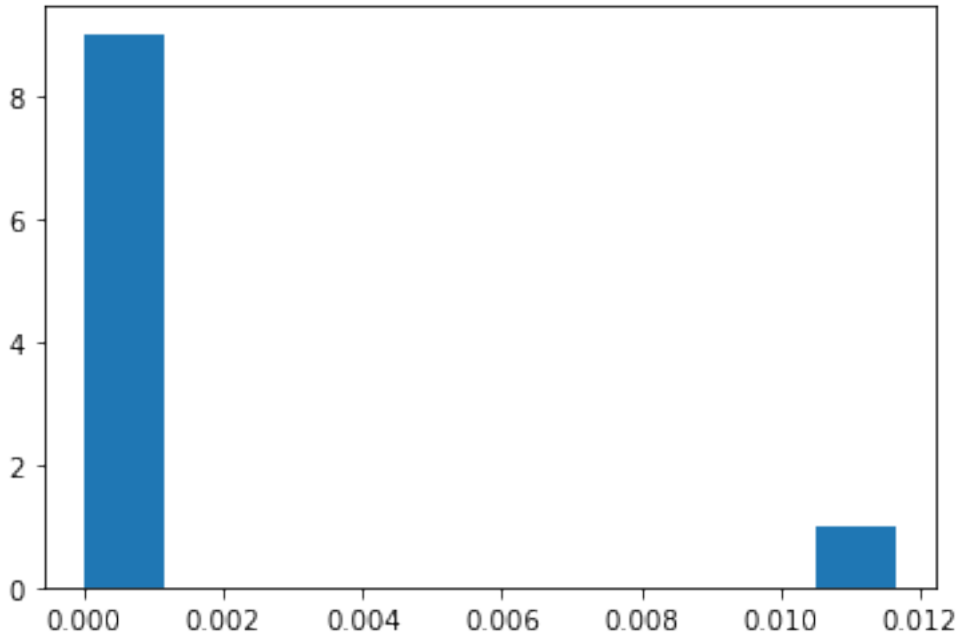
2 1. The ensemble contains 11 independent models, all of which have an error rate of 0.2.

[3]:
```
n = 11
p = 0.2
k = np.ceil(n / 2)
binomial = 1 - binom.cdf(k-1,n,p)
print(binomial)
```

```
0.011654205439999954
```

[4]:
```
import matplotlib.pyplot as plt
def binomcdf():
    p = 0.2
    n = 11
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(1- binom.cdf(x-1, n, p))
        x += 10
    return result

plt.hist(binomcdf())
plt.show()
```



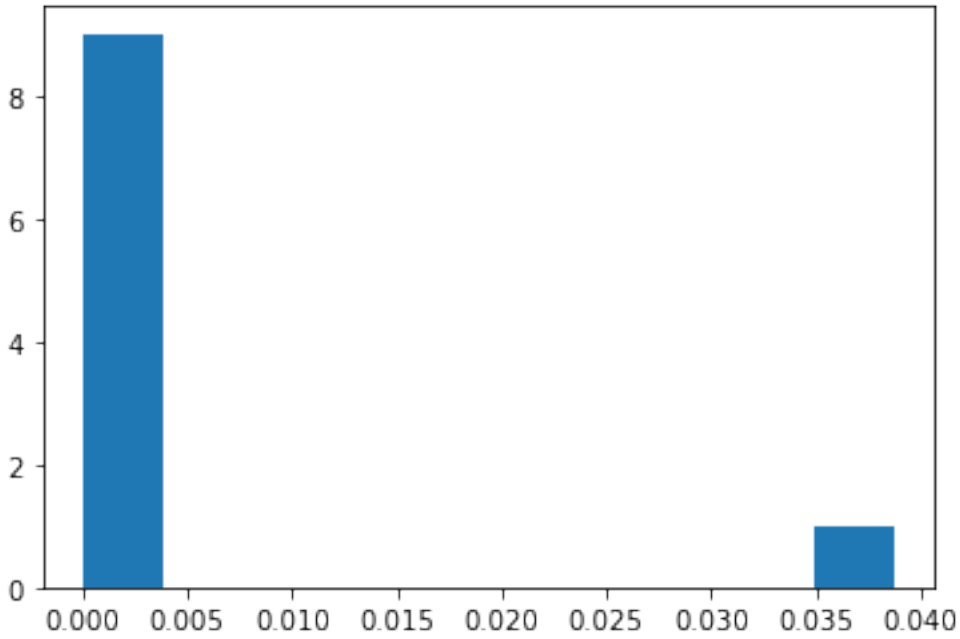
[5]:
```
binomial_pmf=binom.pmf(k-1,n,p)
```

[6]:
```
print (binomial_pmf)
```

```
0.038755368959999995
```

[7]:
```
import matplotlib.pyplot as plt
def binompmf():
    p = 0.2
    n = 11
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(binom.pmf(x-1, n, p))
        x += 10
    return result

plt.hist(binompmf())
plt.show()
```



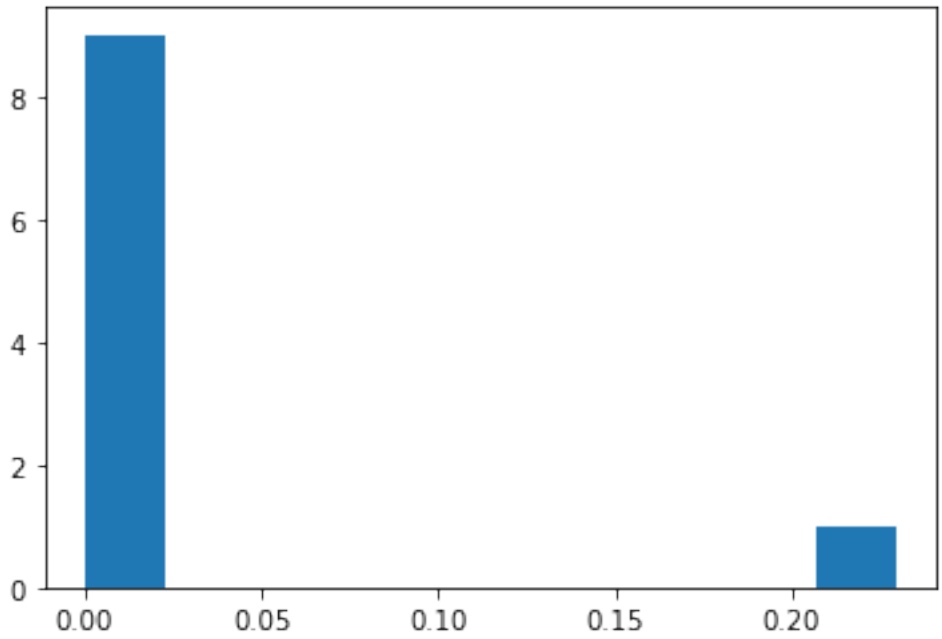
3 2. The ensemble contains 11 independent models, all of which have an error rate of 0.49.

[9]:
```
import matplotlib.pyplot as plt
def binompmf():
    p = 0.49
    n = 11
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(binom.pmf(x-1, n, p))
        x += 10
        print(result)
    return result

plt.hist(binompmf())
plt.show()
```

```
[0.2296378289465168]
[0.2296378289465168, 0.0]
[0.2296378289465168, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
```

```
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.2296378289465168, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
```

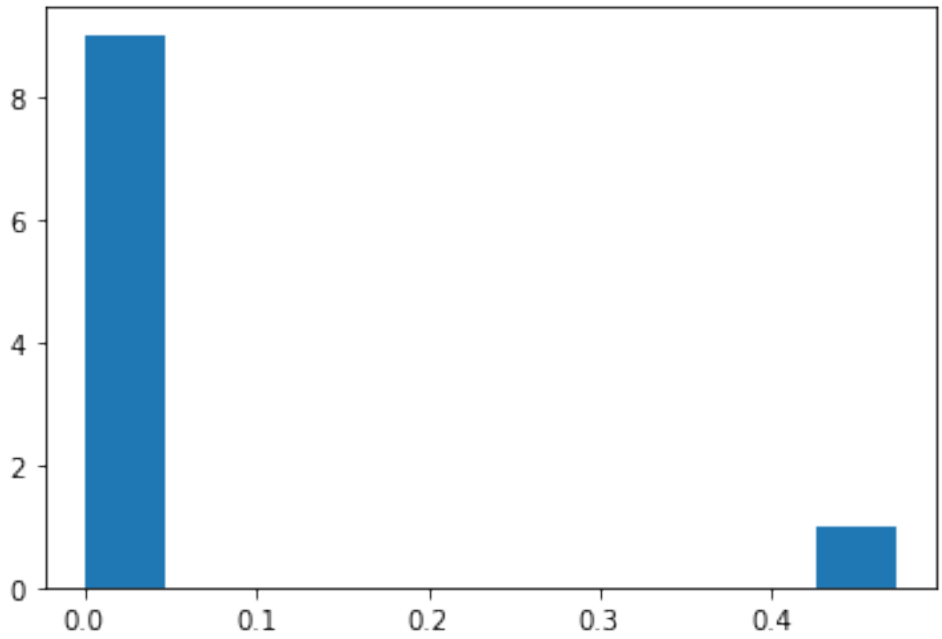


[10]:
```
import matplotlib.pyplot as plt
def binomcdf():
    p = 0.49
    n = 11
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(1- binom.cdf(x-1, n, p))
        x += 10
        print (result)
    return result

plt.hist(binomcdf())
plt.show()
```

```
[0.4729477257149748]
[0.4729477257149748, 0.0]
[0.4729477257149748, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
```

```
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4729477257149748, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
```



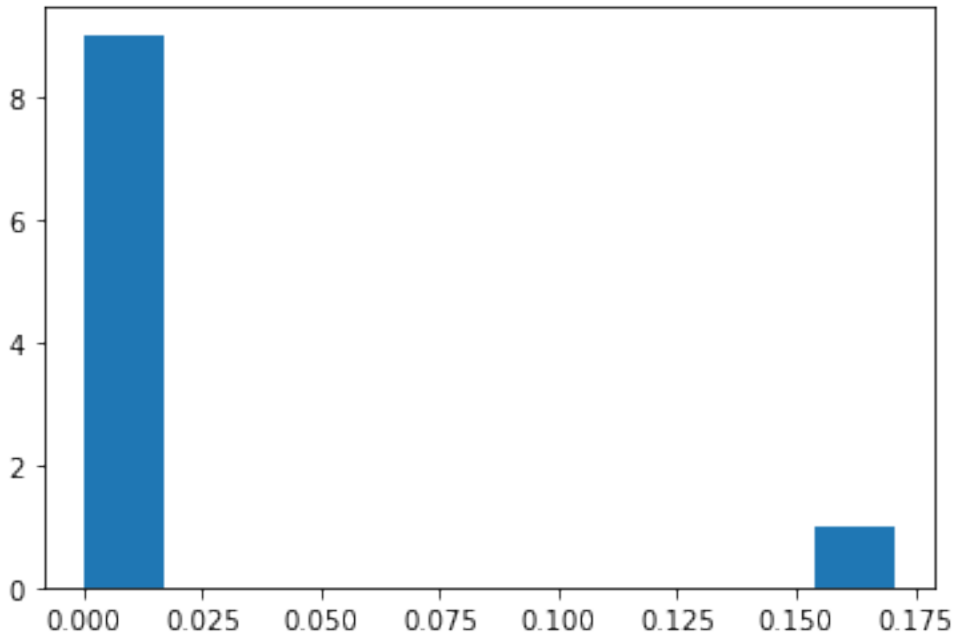
4 3.The ensemble contains 21 independent models, all of which have an error rate of 0.49.

[11]:
```
def binompmf():
    p = 0.49
    n = 21
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(binom.pmf(x-1, n, p))
        x += 10
        print(result)
    return result

plt.hist(binompmf())
plt.show()
```

```
[0.17086688342342418]
[0.17086688342342418, 6.818848969933559e-06]
[0.17086688342342418, 6.818848969933559e-06, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0]
```

```
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.17086688342342418, 6.818848969933559e-06, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0]
```



[12]:
```
def binomcdf():
    p = 0.49
    n = 21
    x = np.ceil(n / 2)
    result = []
    for a in range(10):
        result.append(1- binom.cdf(x-1, n, p))
        x += 10
        print (result)
    return result

plt.hist(binomcdf())
plt.show()
```

```
[0.4630479010127354]
[0.4630479010127354, 3.119734822698561e-07]
[0.4630479010127354, 3.119734822698561e-07, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0]
```

```
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
[0.4630479010127354, 3.119734822698561e-07, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0]
```