# finalproject_python

May 9, 2025

[340]:

```
import pandas as pd
import numpy as np
from scipy import stats
from scipy import special
import matplotlib as mpl
import matplotlib.pyplot as plt
```

[464]:

```
def simCorn(overallEffect=0, fertilizerEffect=[0,0,0], rowEffect=[0,0,0],␣
 ↪colEffect=[0,0,0], seed= None, dist: callable = np.random.normal, **extra):
    n = len(fertilizerEffect)**2

    if type(seed) is not int and seed is not None:
        return print("You entered an invalid seed")


    elif seed is not None:
        np.random.seed(seed)
        dist = dist
        errors = dist(size = (n), **extra)

        fert_vec = np.array(fertilizerEffect)
        row_vec = np.array(rowEffect)
        col_vec = np.array(colEffect)

        fert_vec = np.resize(fert_vec,n)
        row_vec = np.resize(row_vec,n)
        col_vec = np.resize(col_vec,n)


        Fertilizer = np.array(["A", "B", "C", "C", "A", "B", "B", "C", "A"])
        Row = np.array([1, 1, 1, 2, 2, 2, 3, 3, 3])
        Column = np.array([1, 2, 3, 1, 2, 3, 1, 2, 3])



        Yield = overallEffect + fert_vec + row_vec + col_vec + errors
        data = np.zeros(n,
                    dtype = {'names': ('Fertilizer', 'Row', 'Column', 'Yield'),
                             'formats': ('U16', 'i8', 'i8', 'f8')})

        data['Fertilizer'] = Fertilizer
        data['Row'] = Row
        data['Column'] = Column
        data['Yield'] = Yield


        x = pd.DataFrame(data = data)


    elif seed is None:
        dist = dist
        errors = dist(size = (n), **extra)

        fert_vec = np.array(fertilizerEffect)
        row_vec = np.array(rowEffect)
        col_vec = np.array(colEffect)

        fert_vec = np.resize(fert_vec,n)
        row_vec = np.resize(row_vec,n)
        col_vec = np.resize(col_vec,n)


        Fertilizer = np.array(["A", "B", "C", "C", "A", "B", "B", "C", "A"])
        Row = np.array([1, 1, 1, 2, 2, 2, 3, 3, 3])
        Column = np.array([1, 2, 3, 1, 2, 3, 1, 2, 3])



        Yield = overallEffect + fert_vec + row_vec + col_vec + errors

        data = np.zeros(n,
                    dtype = {'names': ('Fertilizer', 'Row', 'Column', 'Yield'),
                             'formats': ('U16', 'i8', 'i8', 'f8')})

        data['Fertilizer'] = Fertilizer
        data['Row'] = Row
        data['Column'] = Column
        data['Yield'] = Yield


        x = pd.DataFrame(data = data)
        return x
```

[466]:
```
simCorn()
```

[466]:
```
  Fertilizer  Row  Column     Yield
0          A    1       1  0.441227
1          B    1       2 -0.330870
2          C    1       3  2.430771
3          C    2       1 -0.252092
4          A    2       2  0.109610
5          B    2       3  1.582481
6          B    3       1 -0.909232
7          C    3       2 -0.591637
8          A    3       3  0.187603
```

[468]:
```
mu = 7
alpha = np.array(1,2,3)
beta = np.array(2,2,1)
gamma = np.array(3,3,2)
y = simCorn(overallEffect=mu, fertilizerEffect=alpha, rowEffect=beta,␣
 ↪colEffect=gamma,
              seed=29429, rnorm, mean=3, sd=2)
```

```
  Cell In[468], line 6
    seed=29429, rnorm, mean=3, sd=2)
                                   ^
SyntaxError: positional argument follows keyword argument
```

[470]:
```
sim_1 = simCorn(overallEffect=10, dist=np.random.normal)
sim_2 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(0,0,1),␣
 ↪colEffect=(0,0,1), dist=np.random.normal)
sim_3 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(1,0,1),␣
 ↪colEffect=(0,1,1), dist=np.random.normal)
sim_4 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(1,0,1),␣
 ↪colEffect=(0,1,1), dist=np.random.normal)
sim_5 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(0,0,1),␣
 ↪colEffect=(0,0,1), dist=np.random.exponential)
sim_6 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(1,0,1),␣
 ↪colEffect=(0,1,1), dist=np.random.exponential)
```

```
sim_7 = simCorn(overallEffect=10, fertilizerEffect=(1,2,3), rowEffect=(0,1,0),␣
 ↪colEffect=(0,1,0), dist=np.random.exponential)
```

[472]:

```
p_vector_1 = np.zeros(100)
np.random.seed(1331)
for i in range(100):
    df = sim_1

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val

print(p_vector)
```

```
[0.07649011 0.07649011 0.07649011 0.07649011 0.07649011 0.07649011
 0.07649011 0.07649011 0.07649011 0.07649011 0.07649011 0.07649011
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 0.07649011 0.07649011 0.07649011 0.07649011]
```

[476]:

```
p_vector_2 = np.zeros(100)
np.random.seed(18694)
for i in range(100):
    df = sim_2

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val
```

```
print(p_vector)
```

```
[0.79839736 0.79839736 0.79839736 0.79839736 0.79839736 0.79839736
 0.79839736 0.79839736 0.79839736 0.79839736 0.79839736 0.79839736
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 0.79839736 0.79839736 0.79839736 0.79839736]
```

[478]:

```
p_vector_3 = np.zeros(100)
np.random.seed(6516)
for i in range(100):
    df = sim_3

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val

print(p_vector)
```

```
[0.93880998 0.93880998 0.93880998 0.93880998 0.93880998 0.93880998
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 0.93880998 0.93880998 0.93880998 0.93880998]
```

[488]:

```
p_vector_4 = np.zeros(100)
np.random.seed(5)
for i in range(100):
    df = sim_4

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val

print(p_vector)
```

```
[0.87824839 0.87824839 0.87824839 0.87824839 0.87824839 0.87824839
 0.87824839 0.87824839 0.87824839 0.87824839 0.87824839 0.87824839
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```

[490]:

```
p_vector_5 = np.zeros(100)
np.random.seed(574)
for i in range(100):
    df = sim_5

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val
```

```
print(p_vector)
```

```
[0.87711739 0.87711739 0.87711739 0.87711739 0.87711739 0.87711739
 0.87711739 0.87711739 0.87711739 0.87711739 0.87711739 0.87711739
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 0.87711739 0.87711739 0.87711739 0.87711739]
```

[492]:

```
p_vector_6 = np.zeros(100)
np.random.seed(9476)
for i in range(100):
    df = sim_6

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val

print(p_vector)
```

```
[0.97840681 0.97840681 0.97840681 0.97840681 0.97840681 0.97840681
 0.97840681 0.97840681 0.97840681 0.97840681 0.97840681 0.97840681
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```

[494]:

```
p_vector_7 = np.zeros(100)
np.random.seed(9743)
for i in range(100):
    df = sim_7

    groups = [grp["Yield"].values
              for _, grp in df.groupby("Fertilizer")]

    F_stat, p_val = stats.f_oneway(*groups)

    p_vector[i] = p_val

print(p_vector)
```

```
[0.99968651 0.99968651 0.99968651 0.99968651 0.99968651 0.99968651
 0.99968651 0.99968651 0.99968651 0.99968651 0.99968651 0.99968651
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 0.99968651 0.99968651 0.99968651 0.99968651]
```
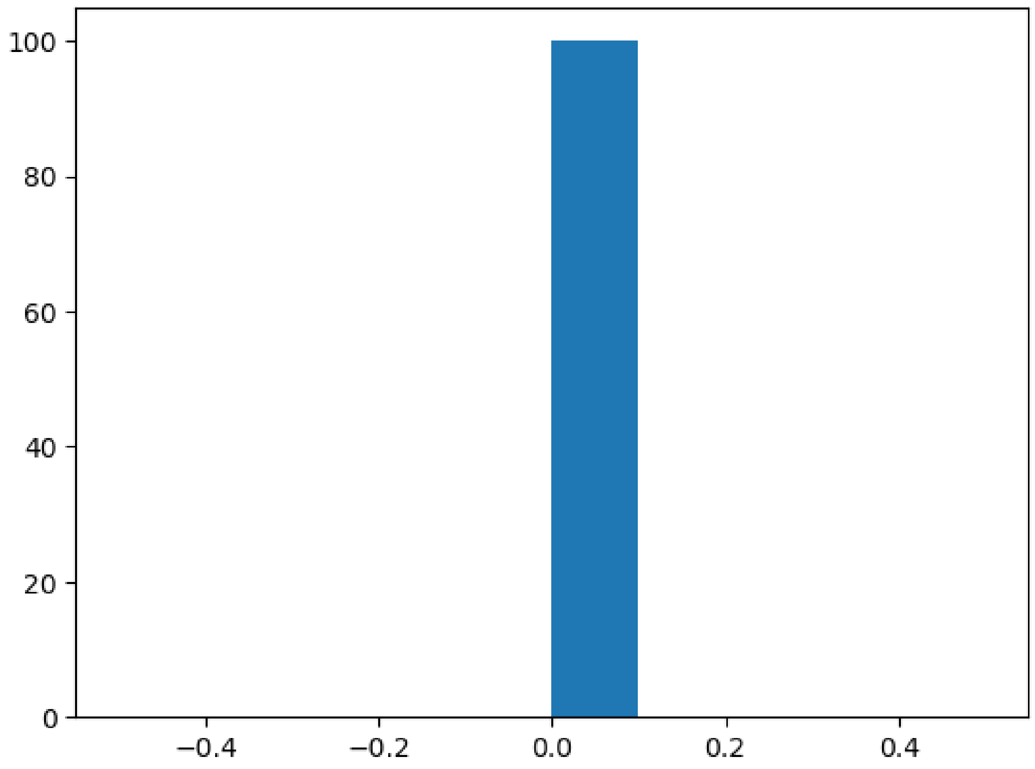

[511]:

```
plt.hist(p_vector_1)
```

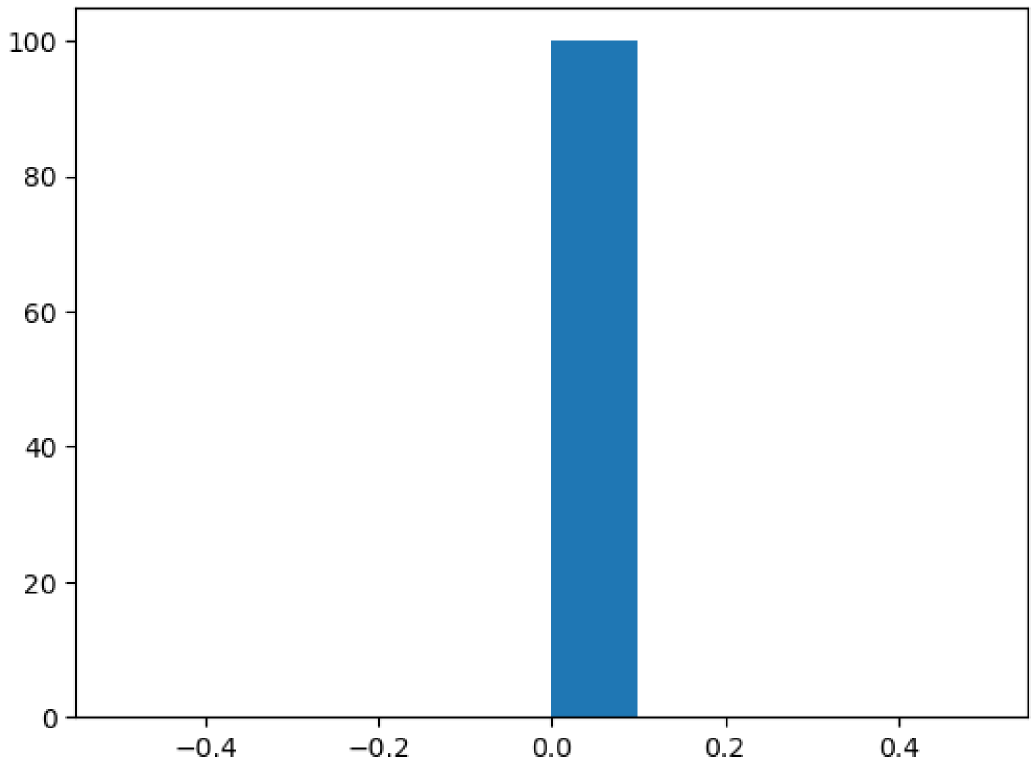
[511]:

```
(array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
 array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
 <BarContainer object of 10 artists>)
```



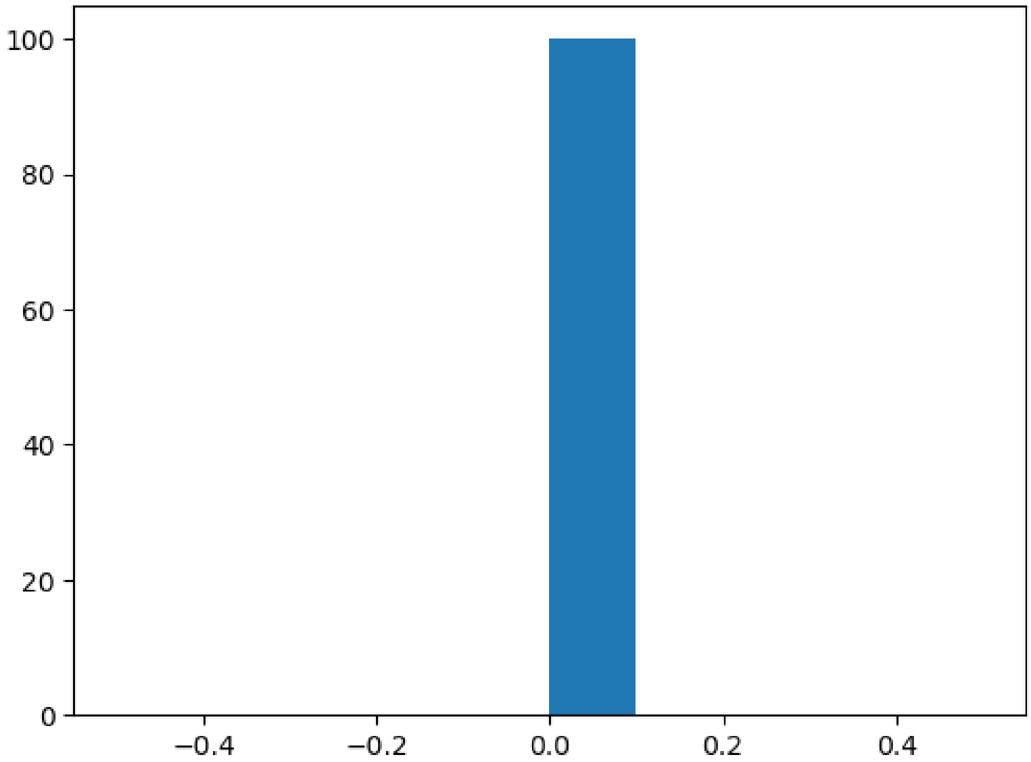
```
[513]: plt.hist(p_vector_2)
```

```
[513]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```



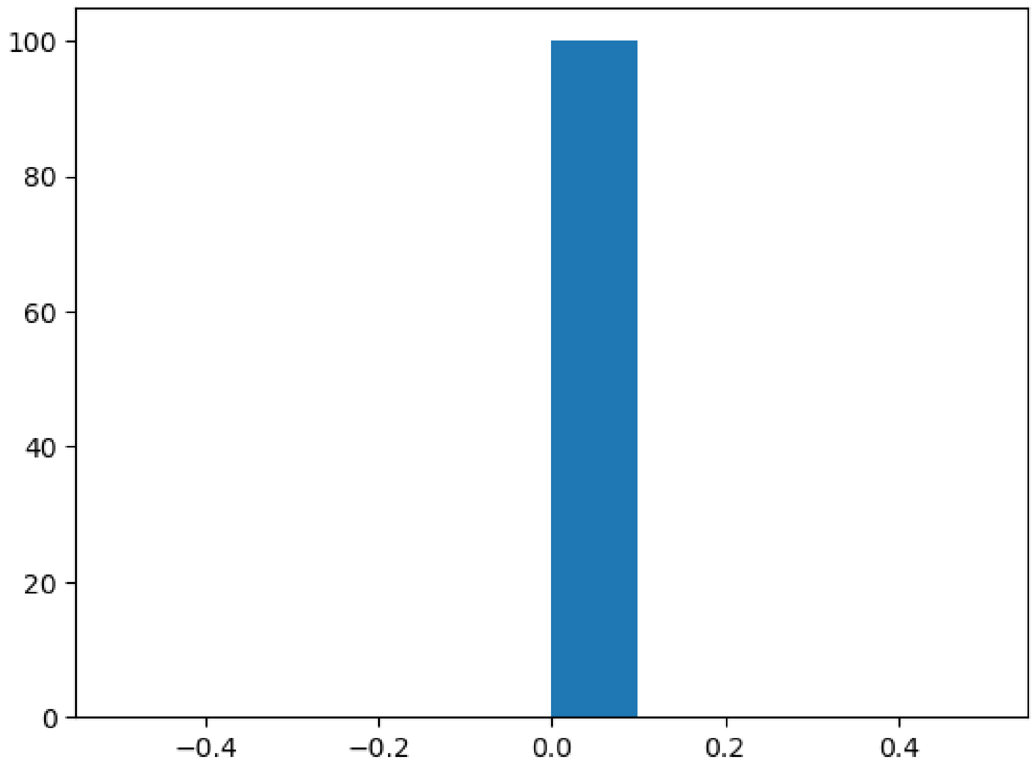
```
[515]: plt.hist(p_vector_3)
```

```
[515]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```



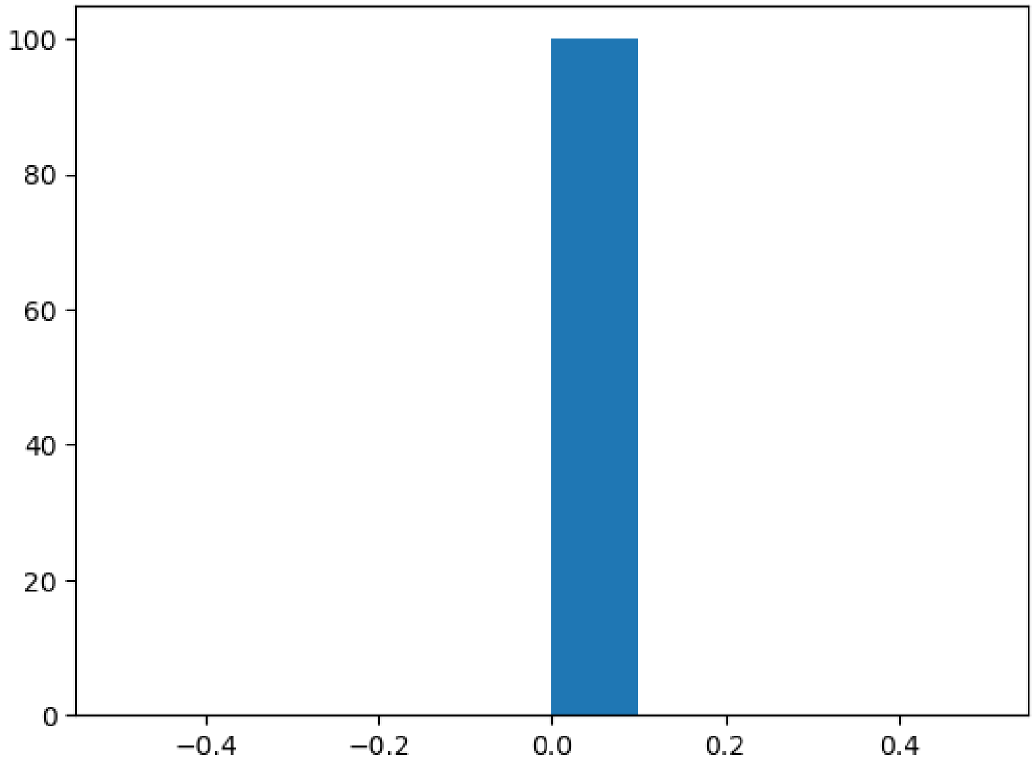
```
[517]: plt.hist(p_vector_4)
```

```
[517]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```



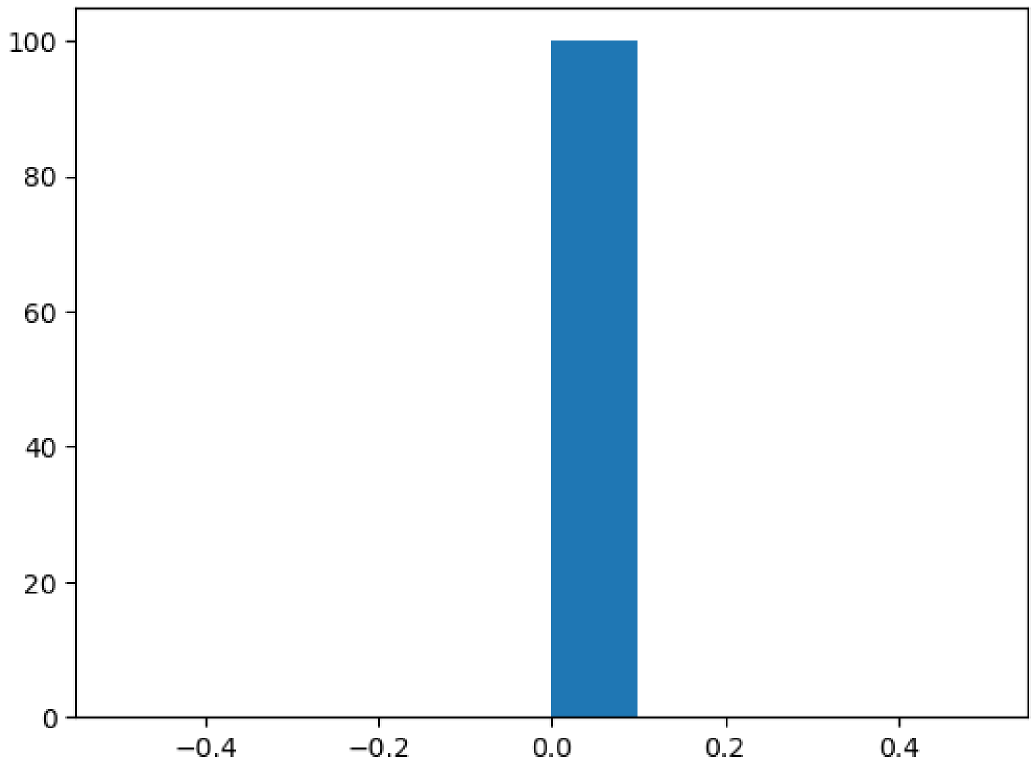
```
[519]: plt.hist(p_vector_5)
```

```
[519]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```



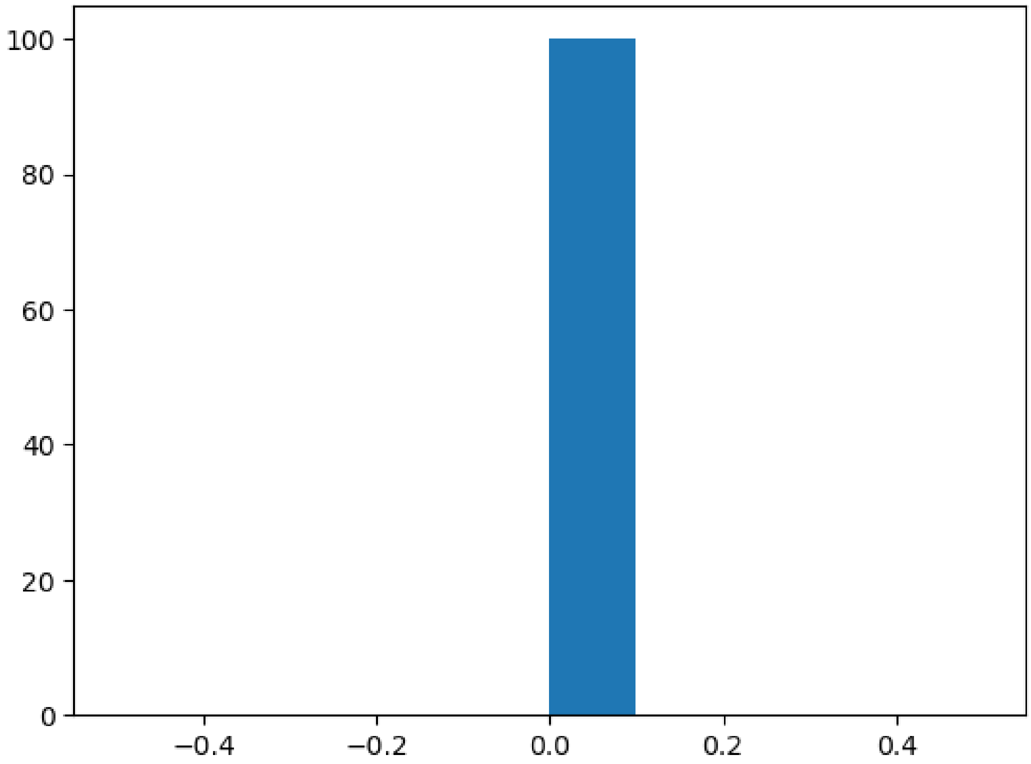
```
[521]: plt.hist(p_vector_6)
```

```
[521]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```



```
[523]: plt.hist(p_vector_7)
```

```
[523]: (array([  0.,   0.,   0.,   0.,   0., 100.,   0.,   0.,   0.,   0.]),
        array([-0.5, -0.4, -0.3, -0.2, -0.1,  0. ,  0.1,  0.2,  0.3,  0.4,  0.5]),
        <BarContainer object of 10 artists>)
```


100
80
60
40
20
0
−0.4
−0.2
0.0
0.2
0.4

[ ]:

[ ]: