cheg304 hw5 question 3

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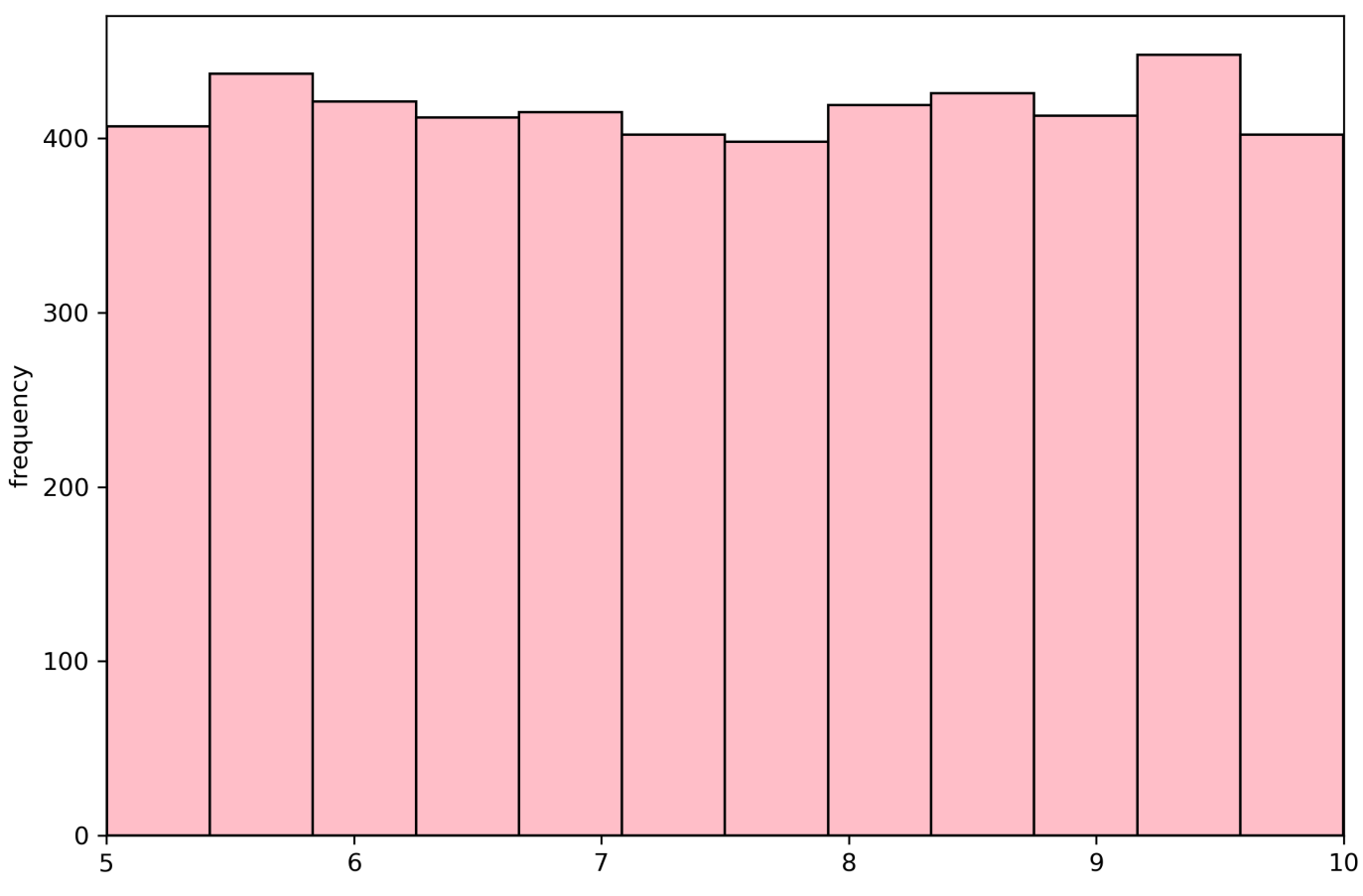
```
import numpy as np
import matplotlib.pyplot as plt

low, high = 5, 10
rng = np.random.default_rng()
s = rng.uniform(low, high, 5000)

fig,ax = plt.subplots(dpi=300, figsize=(9,6), subplot_kw={'xlim':(5,10),'ylabel':'frequen
ax.hist(s, bins=12, edgecolor='black', facecolor='pink');
```



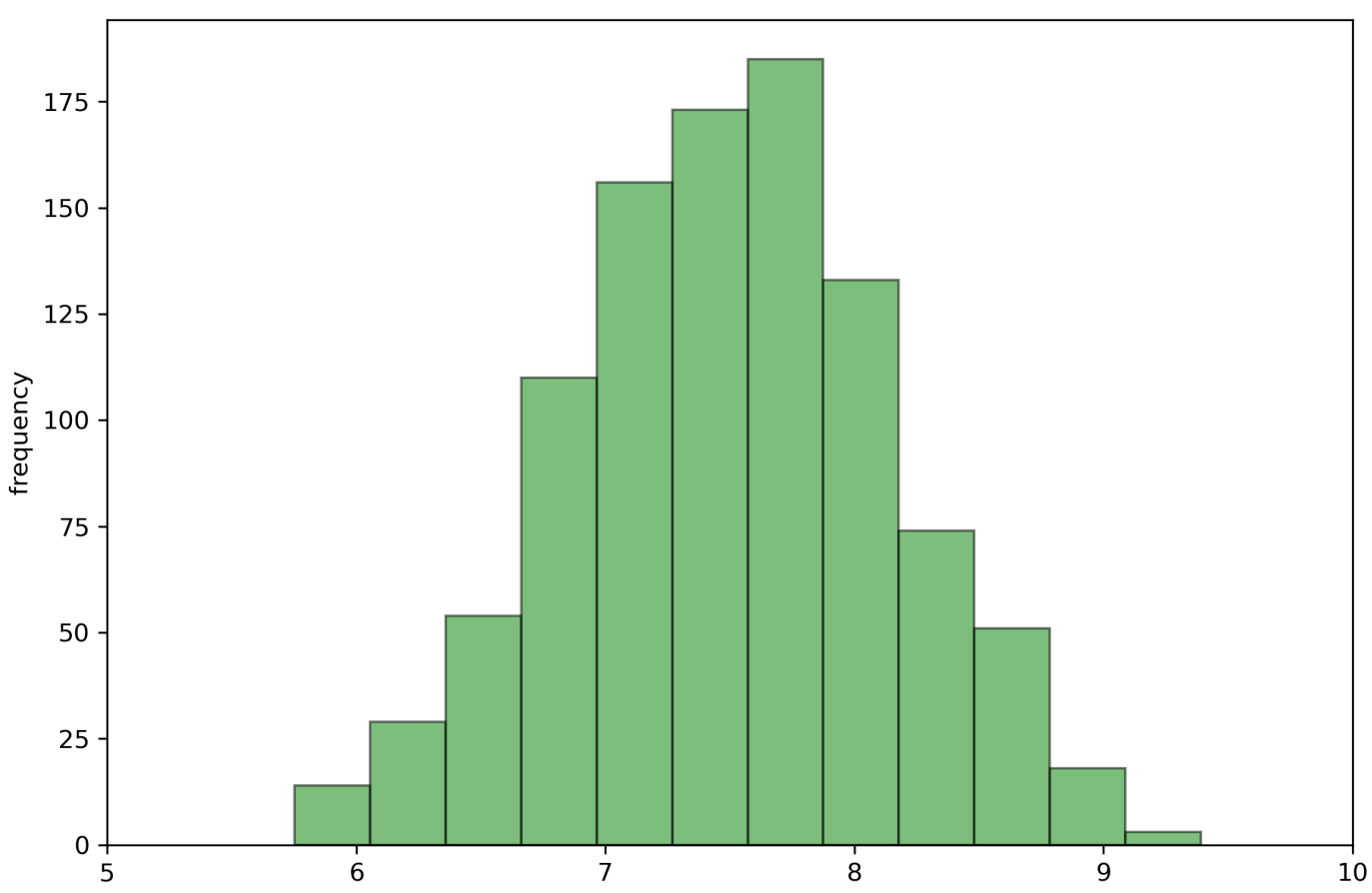
looking very normal distribution to me!!!!!

okay let's do some monte carlo

```
samples = s.reshape(1000,5) # 1000 rows, 5 columns

def sample_mean(sample):
    return np.mean(sample)

mean_values = np.apply_along_axis(sample_mean, 1, samples)
fig,ax = plt.subplots(dpi=300, figsize=(9,6), subplot_kw={'xlim':(5,10),'ylabel':'frequen
ax.hist(mean_values, bins=12, edgecolor='black', facecolor='green', alpha=0.5);
```

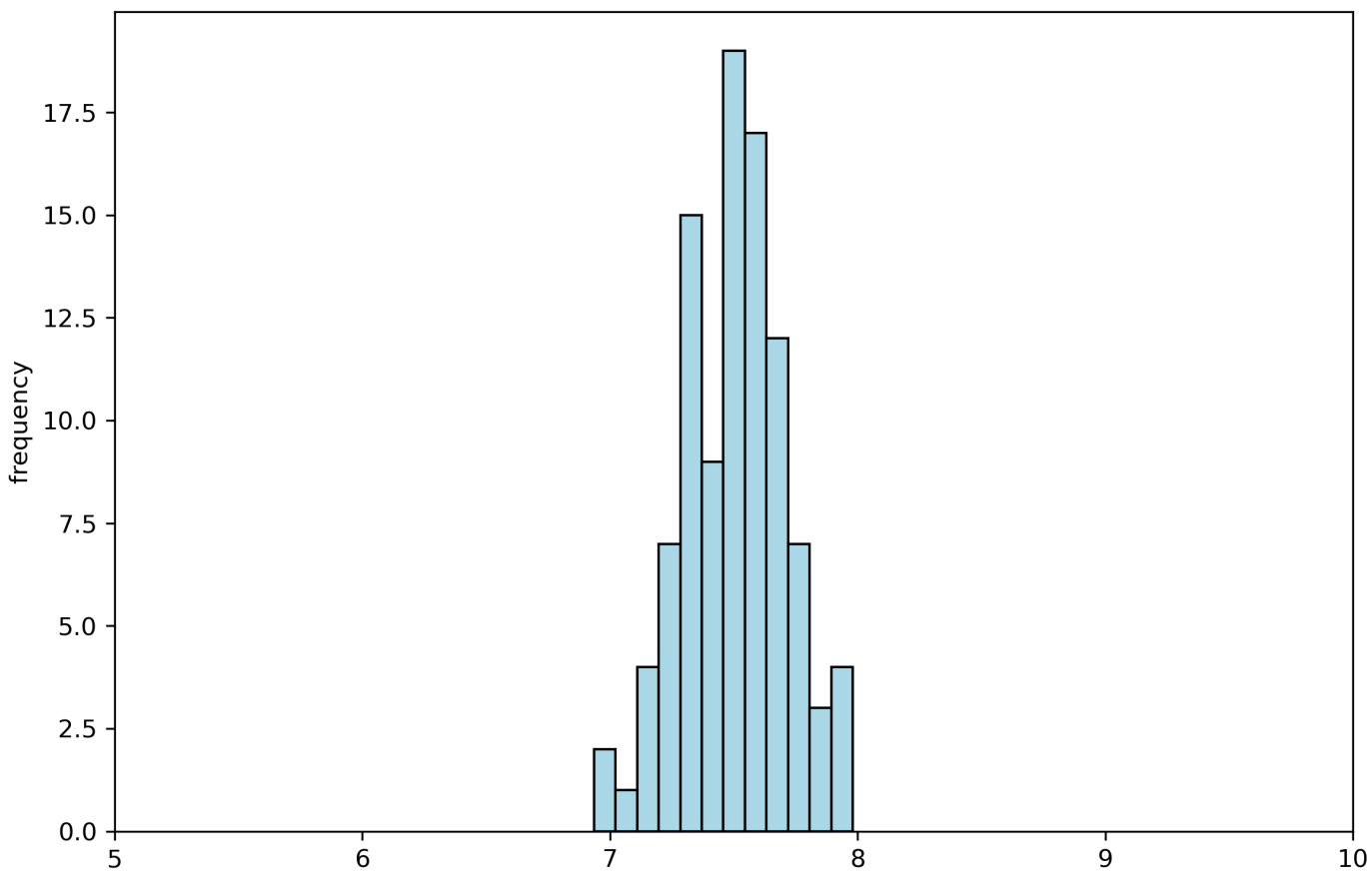


its starting to look like a nice little bell curve. it definitely has a center about where $\frac{b-a}{2} = 7.5$

```
samples = s.reshape(100,50) # 1000 rows, 5 columns

def sample_mean(sample):
    return np.mean(sample)

mean_values = np.apply_along_axis(sample_mean, 1, samples)
fig,ax = plt.subplots(dpi=300, figsize=(9,6), subplot_kw={'xlim':(5,10),'ylabel':'frequen
ax.hist(mean_values, bins=12, edgecolor='black', facecolor='lightblue');
```



the distribution is looking way less spread out and really concentrated around the theoretical mean! let's calculate the mean and standard deviation:

```
print(f'avg. sample mean: {mean_values.mean():.3f}')
print(f'avg. sample std: {mean_values.std():.3f}')
```

```
avg. sample mean: 7.502
avg. sample std: 0.212
```

and now calculating our population mean and std

```
pop_mean = (10+5)/2
pop_std = np.sqrt( (10-5)**2 / 12 )
print(f'population mean: {pop_mean:.3f}')
print(f'population std: {pop_std:.3f}')
```

```
population mean: 7.500
population std: 1.443
```

the mean lines up super well, and the standard deviation is larger and should be larger since the sample mean distribution's variance is decreases as the sample size increases.

```
# ignore this.
```