Q1: The average time taken for customers to complete a purchase is 4 minutes with a std dev of 1 minute.

Find the probability that a randomly selected customer will complete a purchase within 6 minutes?
Assume Gaussian

```
norm.cdf(2)
```

Q2: Average body temperature has a mean of 98.6°F and a standard deviation of 0.5°F.

What is the probability that a randomly chosen patient has a body temperature higher than 99.5°F?

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import scipy.stats
from scipy.stats import norm
```

What is the probability that the average time of the next 5 customers is less than 6 minutes?

```
z = (6-4) / (1 / np.sqrt(5))
z
```

```
     4.47213595499958
```

```
norm.cdf(z)
```

```
     0.9999961278917845
```

Height Example

Q: The mean height of a sample of 100 adults was found to be 65 inches, with a standard deviation of 2.5 inches.

```
z1 = norm.ppf(0.025)
z1
```

```
     -1.9599639845400545
```

```
z2 = norm.ppf(0.975)
z2
```

```
     1.959963984540054
```

```
## std dev of the sample mean: std error
std_error = 2.5 / np.sqrt(100)
std_error
```

```
     0.25
```

```
x1 = 65 + z1 * std_error
x1
```

```
     64.51000900386498
```

```
x2 = 65 + z2 * std_error
x2
```

```
     65.48999099613502
```

The sample mean recovery time of 100 patients after taking a drug was seen to be 10.5 days with a standard deviation of 2 days

Find the 95% confidence interval of the true mean.

```
std_error = 2 / np.sqrt(100)
std_error
```

```
0.2
```

```
z1 = norm.ppf(0.025)
x1 = 10.5 + z1*std_error
x1
```

```
10.108007203091988
```

```
z2 = norm.ppf(0.975)
x2 = 10.5 + z2*std_error
x2
```

```
10.89199279690801
```

The mean Youtube watch time of a sample of 100 students was found to be 3.5 hours,
with a standard deviation of 1 hour.
Construct a 90% confidence interval for the true watch time.

```
def calc_CI(mean, std, N, confidence):
    # calculate std_error
    std_error = std / np.sqrt(N)
    print("Standard Error: ", std_error)

    # calculate the remaining fractions
    frac = (1 - (confidence/100)) / 2

    # calculate z1 and z2
    z1 = norm.ppf(frac)
    z2 = norm.ppf(1 - frac)

    # calculate end points
    x1 = mean + (z1 * std_error)
    x2 = mean + (z2 * std_error)

    return x1, x2
```

```
calc_CI(3.5, 1, 100, 90)
```

```
Standard Error:  0.1
(3.3355146373048528, 3.6644853626951472)
```

Confidence Interval using Bootstrap

```
survey_1 = [35, 36, 33, 37, 34, 35]
np.mean(survey_1)
```

```
35.0
```

```
survey_2 = [20, 37, 17, 50, 53, 33]
np.mean(survey_2)
```

```
35.0
```

```
## sampling with replacement
n = 6
bootstrapped_samples = np.random.choice(survey_1, size=n)
np.mean(bootstrapped_samples)
```

```
35.5
```

```
n = 6
bootstrapped_samples_2 = np.random.choice(survey_2, size=n)
np.mean(bootstrapped_samples_2)
```

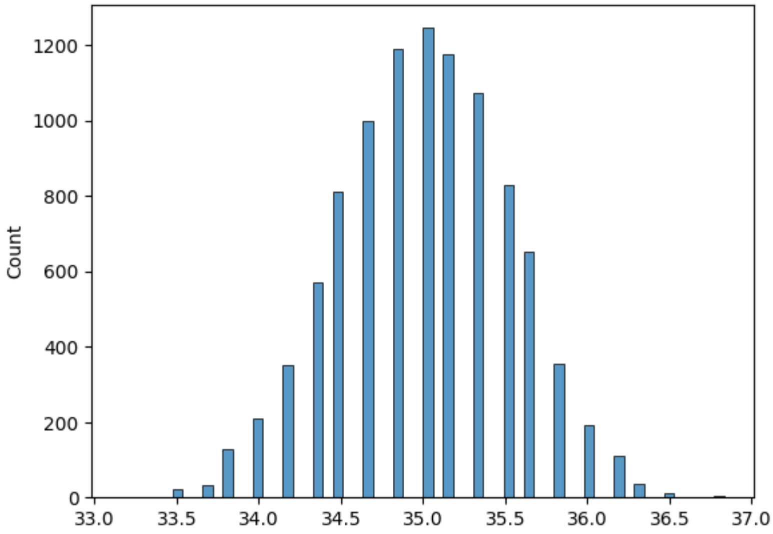
```
46.5
```

```
bootstrapped_means_survey_1 = []

for reps in range(10000):
    bootstrapped_samples = np.random.choice(survey_1, size=n)
    means = np.mean(bootstrapped_samples)
    bootstrapped_means_survey_1.append(means)
```

```
sns.histplot(bootstrapped_means_survey_1)
```

```
<Axes: ylabel='Count'>
```

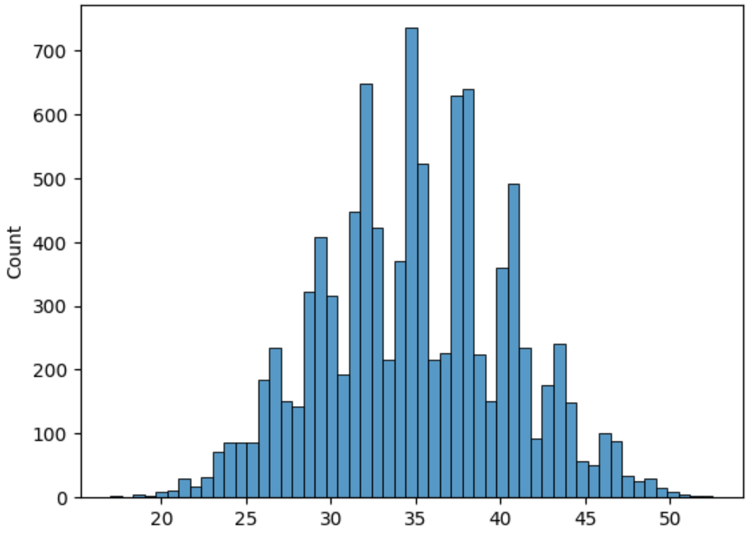


```
bootstrapped_means_survey_2 = []

for reps in range(10000):
    bootstrapped_samples = np.random.choice(survey_2, size=n)
    means = np.mean(bootstrapped_samples)
    bootstrapped_means_survey_2.append(means)
```

```
sns.histplot(bootstrapped_means_survey_2)
```

```
<Axes: ylabel='Count'>
```



```
len(bootstrapped_means_survey_1)
```

```
10000
```

```
x1 = np.percentile(bootstrapped_means_survey_1, 2.5)
x1
```

```
34.0
```

```
x2 = np.percentile(bootstrapped_means_survey_1, 97.5)
x2
```

```
36.0
```

95% of the numbers lie between 34 & 36. confidence interval (34, 36)

```
x1 = np.percentile(bootstrapped_means_survey_2, 2.5)
x1
```

```
24.0
```

```
x2 = np.percentile(bootstrapped_means_survey_2, 97.5)
x2
```

```
46.0
```

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