Standard Normal Distribution

The standard normal distribution is a normal distribution with a mean of zero and a standard deviation of 1. The standard normal distribution is centred at zero and the degree to which a given measurement deviates from the mean is given by the standard deviation. Main points to note about the standard normal distribution:

- The standard normal distribution is a special case of the normal distribution -
  - when a normal random variable has a mean of zero and
  - a standard deviation of one

- So if we shift the mean by μ and the standard deviation by σ for any normal distribution we will arrive at the standard normal distribution. We use the letter Z to denote it

$$z = (X - μ) / σ$$

- The normal random variable of a standard normal distribution is called a standard score or a z score.

Let's visualize an example of the standard normal distribution with z-score representation in python.

Exercise: Create a standard normal distribution (mean=0, Std Deviation=1) curve in python and then shade area to the left, right and the middle of z-score(s).

```python
from scipy.stats import norm
import matplotlib.pyplot as plt
import numpy as np


def draw_z_score(x, cond, mu, sigma, title):
    y = norm.pdf(x, mu, sigma)
    z = x[cond]
    plt.plot(x, y)
    plt.fill_between(z, 0, norm.pdf(z, mu, sigma))
    plt.title(title)
    plt.show()


x = np.arange(-3,3,0.001)
z0 = -0.75
```
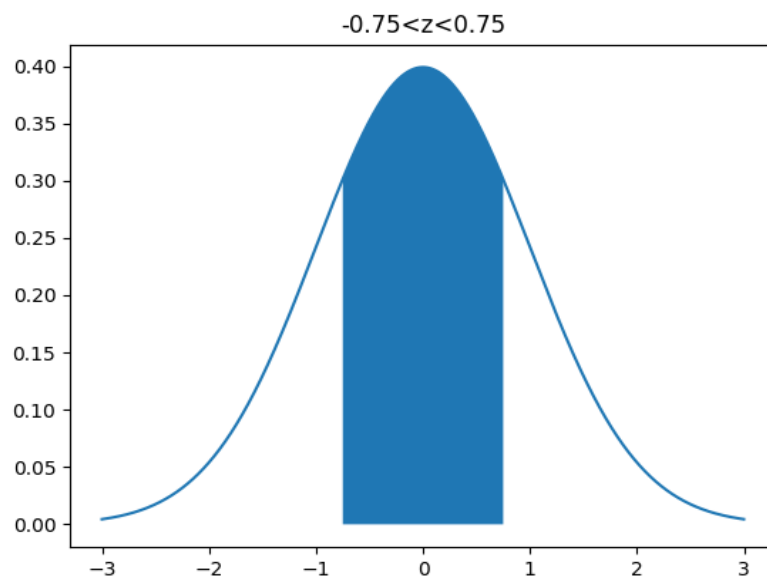
```
draw_z_score(x, x<z0, 0, 1, 'z<-0.75')
```
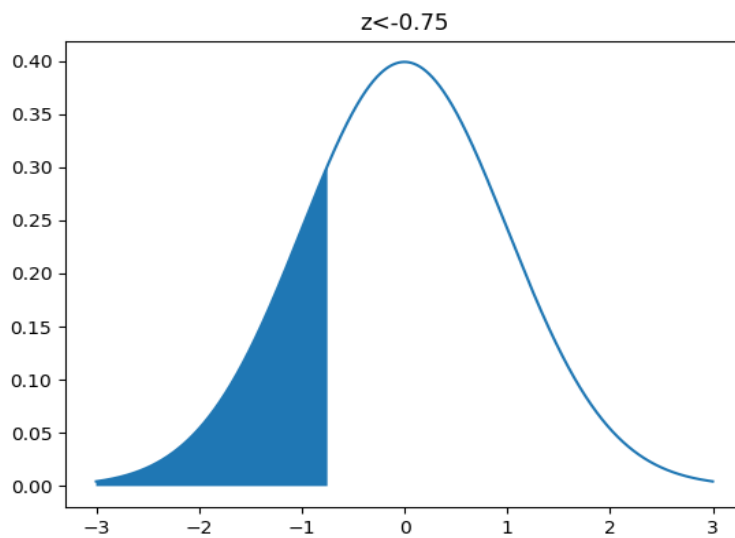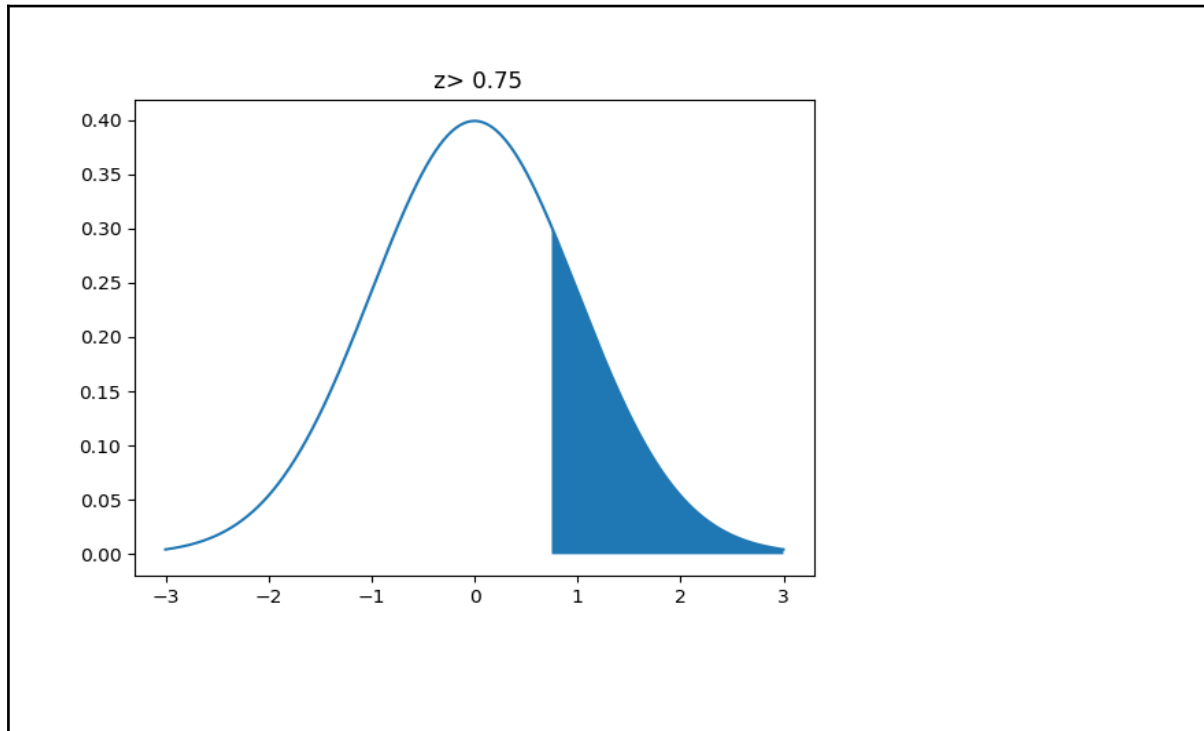


```
x = np.arange(-3,3,0.001)
z0 = 0.75
draw_z_score(x, (-z0 < x) & (x < z0), 0, 1, '-0.75<z<0.75')
```



```
x = np.arange(-3,3,0.001)
z0 = 0.75
draw_z_score(x, x > z0, 0, 1, ' z> 0.75')
```

Why do we need standard Normal Distribution

- Makes predictions and inferences much easier
- Compare different normally distributed datasets
- Detect normality
- Detect outliers
- Create confidence intervals
- Test Hypothesis