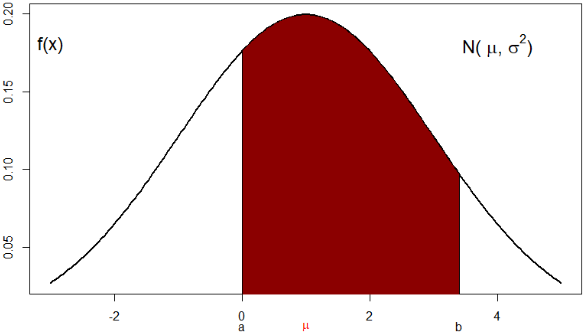
Normal probabilities (1/3)

To compute Normal probabilities, we use the following result

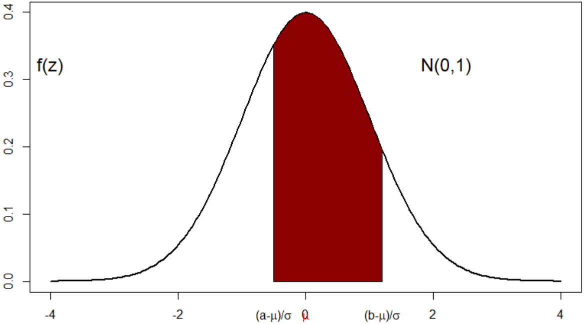
$$P(a < X < b) = P\left(\frac{a-\mu}{\sigma} < \frac{X-\mu}{\sigma} < \frac{b-\mu}{\sigma}\right)$$



Normal probabilities (2/3)

Since $Z = \frac{X-\mu}{\sigma}$, it follows that

$$P(a < X < b) = P\left(\frac{a-\mu}{\sigma} < Z < \frac{b-\mu}{\sigma}\right)$$



Normal probabilities (3/3)

Both surfaces in red are strictly equivalent. We use the notation $\Phi(x)$ to denote the Cumulative Distribution Function (CDF) of the standard Normal distribution [1]. We have

$$\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-x^2/2} dx$$

By symmetry of the Normal distribution, we have that $\Phi(-x) = 1 - \Phi(x)$.

R program to generate a Normal table

```r
library(xtable)

u = seq(0,3.09,by=0.01)
p = pnorm(u)
res = round(matrix(p,ncol=10,byrow=TRUE),4)
colnames(res) = seq(0, 0.09, by = 0.01)
rownames(res) = seq(0,3, by = 0.1)

# export the results in LaTex document
print(xtable(res, type = "latex", digits=4), file = "tables.tex")
```

Python program to generate a Normal table

```
import numpy as np

u = np.linspace(start=0, stop=3.09, num=310)

from scipy.stats import norm

p = norm.cdf(u)
res = np.array([[p]]).reshape(31, 10)

import pandas as pd

resdf = pd.DataFrame(data = res.round(4),
                     index = np.linspace(start=0, stop=3, num=31),
                     columns = np.linspace(start=0, stop=0.9, num=10))


# export the results in LaTex document
print(resdf.to_latex())
```