Sampling from Truncated Normal Distribution

Suppose you wish to sample from

$$X \sim N(\mu, \sigma) I(a < X < b) \tag{3}$$

, i.e. a normal random variable with mean μ and variance σ^2, but truncated to interval (a, b). Let ϕ be the standard normal CDF.

1. Calculate endpoits (quantile)

$$\begin{aligned} p_a &= \Phi\left(\frac{a-\mu}{\sigma}\right) \\ p_b &= \Phi\left(\frac{b-\mu}{\sigma}\right) \end{aligned} \tag{4}$$

2. Sample

$$U \sim Unif(p_a, p_b) \tag{5}$$

3. Set

$$X = \sigma\, \Phi^{-1}(U) + \mu \tag{6}$$

In [4]:

```
# install.packages('truncnorm')
library(truncnorm)
```

In [2]:

```
vec <- seq(0, 6, by = 0.01)
mu = 5
sigma = 3
test=dtruncnorm(vec,a=1,b=6,mean=mu,sd=sigma)
```

In [3]:

```
## Generating Random draw
pa = pnorm((1-5)/3)
pb = pnorm((6-5)/3)
uu = runif(length(vec),min = pa,max = pb)
XX= 3*qnorm(uu,) + 5
hist(XX,freq = FALSE,breaks = 20,col='yellow1')
lines(y=test,type = 'l',x=vec,col='deeppink',lwd=2)
legend('topleft',legend = c('True distribution','simulated distribution'),col=c
```