Explanation for Z-score

Usage of pnorm and qnorm

$pnorm(x)$ gives the value of $P(X \leq x), X \sim N(0,1)$

$pnorm(x, mean = \mu, sd = \sigma)$, gives the value
$P(X \leq x), X \sim N(\mu, \sigma^2)$

`p` for probability, `q` for quantile

$qnorm(x)$ gives the value of z which makes
$P(X \leq z) = x, X \sim N(0,1)$

$qnorm(x, mean = \mu, sd = \sigma)$, gives the value of z which makes
$P(X \leq z) = x, X \sim N(\mu, \sigma^2)$

pnorm

$$\text{If } X \sim N(\mu, \sigma^2), \text{with mean value } \mu, \text{SD } \sigma$$

Question: How to calc $P(X \geq x)$?

When we have standard normal random variable $Y \sim N(0,1)$, We can use pnorm() to calc probability: pnorm(y) = $P(Y \leq y)$

In order to answer previous question, we introduce Z-score.

$$\text{Z-score } z = \frac{x-\mu}{\sigma}$$
$$\therefore x = \mu + z \times \sigma$$

And we have this equation:

$$P(X \geq x) = P(Y \geq z) = 1 - pnorm(z),$$

qnorm

Assume that $P(X < x) = q$, we want to know the value of x.

Again, consider standard normal r.v. first, if we have $P(Y < z) = q$, what is z?

Answer: z=qnorm(q).

So we recover the value of x by $x = \mu + z * \sigma$.