

Normal Dist.

Note Title

10/31/2008

Shape - always unimodal, symmetric & bell-shaped.

Mean - μ

Variance - σ^2

Parameters

$F(y) = P(Y \leq y)$ has to found by numerical methods.

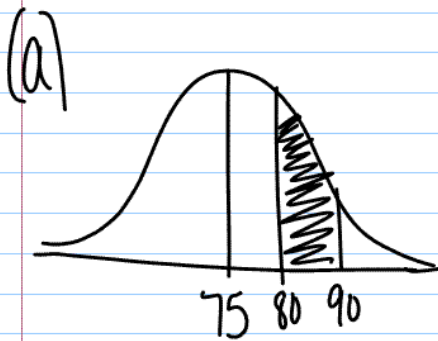
$F(y)$ by tables or R.

$$F(y) = \text{pnorm}(y, \mu, \sigma)$$

Find y s.t. that $F(y) = p = \text{qnorm}(p, \mu, \sigma)$

Generation of normal data = $\text{rnorm}(10000, \mu, \sigma)$

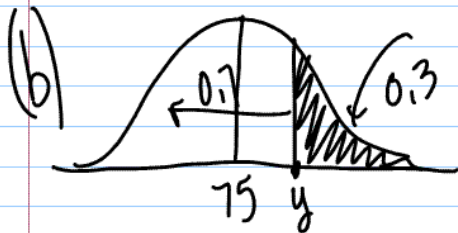
① $\mu = 75, \sigma^2 = 100 \quad N(75, 100)$



$$P(80 \leq Y \leq 90)$$

$$F(90) - F(80)$$

$$pnorm(90, 75, 10) - pnorm(80, 75, 10)$$

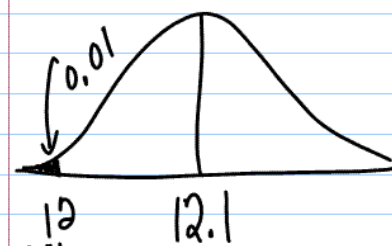


Find y so that $P(Y \leq y) = F(y) = 0.7$

$$qnorm(0.7, 75, 10)$$

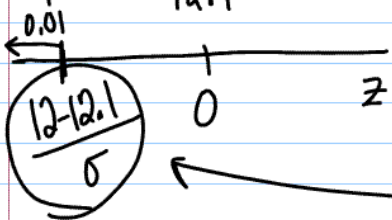
② (a) $\mu = 12.1$ find σ^2 so that

$$P(Y < 12) = 0.01$$



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$$P\left(\frac{Y - \mu}{\sigma} < \frac{12 - 12.1}{\sigma}\right) = 0.01$$



$$P\left(Z < \frac{12 - 12.1}{\sigma}\right) = 0.01$$

Z is $N(0,1)$. $q_{\text{norm}}(0.01, 0, 1) = -2.326$

$$\text{so } \frac{12 - 12.1}{\sigma} = -2.326$$

$$\sigma = 0.0430$$

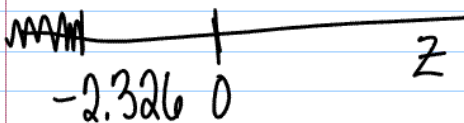
(b) $\sigma = 0.05$ find μ so that

$$P(Y < 12) = 0.01$$



$$P(Y < 12) = 0.01$$

$$P\left(\frac{Y - \mu}{\sigma} < \frac{12 - \mu}{0.05}\right) = 0.01$$



$$\frac{12 - \mu}{0.05} = -2.326 \quad \mu = 12.1163$$

$$(3) P(Y < 12) = \text{pnorm}(12, 12.2, 0.1) = 0.0228$$

$$\mu = 12.2$$

$$\sigma = 0.1$$

(b) randomly select 50 packages — assume packages are independent.

$P(\text{at least 1 out of 50 are underfilled})$.

$1 - P(\text{none are underfilled})$

$$1 - \left(P(\text{not being underfilled}) \right)^{50}$$

$$= 1 - (0.9772)^{50} = 0.6844$$

$n = 50$. $X = \#$ of bottles that are underfilled

$$p = 0.0228$$

$$P(X \geq 1) = 1 - P(X = 0) = 0.6844$$

When data follows a normal dist?

① Make a histogram

② Normal Quantile Plot (QQ Plot, etc).

≡ If Normal dist - straight line plot