9.1 Z-Test and confidence intervals for a difference between two population mean.

- Basic Assumption
  - $X_1 \cdots X_m$ has μ_1, σ_1^2
    $Y_1 \cdots Y_n$ has μ_2, σ_2^2
    X, Y are independent.
- Proposition of $\bar{X} - \bar{Y}$
  - Expected value: $\mu_1 - \mu_2$
    Standard Deviation: $\sigma_{\bar{X}-\bar{Y}} = \sqrt{\frac{\sigma_1^2}{m} + \frac{\sigma_2^2}{n}}$
- Test Procedure:

① $H_0: \mu_1 - \mu_2 = \Delta_0$
$H_a: \mu_1 - \mu_2 > \Delta_0$

② $$z = \frac{\bar{x} - \bar{y} - \Delta_0}{\sqrt{\frac{\sigma_1^2}{m} + \frac{\sigma_2^2}{n}}}$$

③ P-value from z
④ Compare with α.
⑤ Conclude.

- β and choice of Sample size.

$\beta(\Delta') = P(\text{Not rejecting } H_0 \text{ when } \mu_1 - \mu_2 = \Delta')$
$= P(\text{Type II error})$

- large sample test.
  When $m > 40$ && $n > 40$, we can apply CLT and assume normal distribution.

- CI for $\mu_1 - \mu_2$.
  $$\bar{x} - \bar{y} \pm z_{\alpha/2} \sqrt{\frac{S_1^2}{m} + \frac{S_2^2}{n}}.$$