◉ HW 2

I. Two sample data with equal variance case and without outliers

A. Normal Distribution

We want to generate $X_1, \ldots, X_m$ from $N(\mu_x, \sigma_x^2)$ and $Y_1, \ldots, Y_n$ from $N(\mu_y, \sigma_y^2)$, where $\mu_x = 0,\ \mu_y = \Delta,\ \sigma_x^2 = \sigma_y^2 = 1.$

1. For $m = n = 5$ and $\Delta = 0$, generate one set of samples and perform
   (1) Two sample t-test with the equal variance assumption
   (2) Two sample t-test without the equal variance assumption
   (3) Wilcoxon rank sum test
   (4) Permutation test using t-statistics with the equal variance assumption (1000 replication)

(5) Permutation test using t-statistics without the equal variance assumption (1000 replication)

2. Repeat the whole process 100 times and compute the type one errors
3. For $m = n = 5$, and $\Delta = 1$, repeat the whole process 100 times and compute the power
4. For $m = n = 5$ and $\Delta = 2$, repeat the whole process 100 times and compute the power
5. For $m = n = 5$ and $\Delta = 3$, repeat the whole process 100 times and compute the power
6. Draw a power graph where the x-axis represents the values of Δ and the y-axis does the power. Make your conclusion.

B. Normal + Gamma Distribution

Generate $X_1, \ldots, X_m$ from $N(\mu_x, \sigma_x^2)$ and $Y_1, \ldots, Y_n$ from $\Gamma(\alpha_y, \beta_y)$, where $\mu_y = \alpha_y \beta_y$, $\sigma_y^2 = \alpha_y \beta_y^2$. Assume $\mu_x = 2$, $\sigma_x^2 = 1$. If we set $\beta_y = 1/\sqrt{\alpha_y}$, then $\sigma_y^2 = 1$.

1. For $m = n = 5$, choose the value of α_y so that $\Delta = 0$. Perform the type one error analysis.
2. For $m = n = 5$, choose the several values of α_y in a systematic manner for $\Delta > 0$. Perform the type power analysis.
3. Make your conclusion.

C. Gamma Distributions

Generate $X_1, \ldots, X_m$ from $\Gamma(\alpha_x, \beta_x)$, where $\mu_x = \sqrt{\alpha_x}$, $\sigma_x^2 = 1$ and $Y_1, \ldots, Y_n$ from $\Gamma(\alpha_y, \beta_y)$, where $\mu_y = \sqrt{\alpha_y}$, $\sigma_y^2 = 1$.

1. For $m = n = 5$, assume that $\alpha_x = \alpha_y = 4$ so that $\Delta = 0$. Perform the type one error analysis.
2. For $m = n = 5$, fix $\alpha_x = 4$ and choose the several values of α_y in a systematic manner for $\Delta > 0$. Perform the type power analysis.
3. Make your conclusion.

II. Two sample data with equal variance case and with outliers

Among the generated X's, choose the largest value and add 5(?) to it. Perform the same analysis.

A'. Normal Distribution

B'. Normal + Gamma Distribution

C'. Gamma Distributions

III. Two sample data with different variances and without outliers

A‘‘. Normal Distribution
B‘‘. Normal + Gamma Distribution
C‘‘. Gamma Distributions

IV. Two sample data with different variances and with outliers

A‘‘‘‘. Normal Distribution
B‘‘‘‘. Normal + Gamma Distribution
C‘‘‘‘. Gamma Distributions