Confidence Interval (CI)

By D4R6

- The confidence interval of known the population mean case

$$\sum_{i=1}^{n}\frac{(X_i-\mu)^2}{\sigma^2}\sim\chi^2(n)$$

$$\frac{\frac{V_1}{r_1}}{\frac{V_2}{r_2}}\sim F(r_1,r_2)\ ,V_i\sim\chi^2(r_i)\ \ where\ \ i=1,2\ and\ \ V_1,V_2=i.i.d.$$

$$\frac{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n\sigma_x^2}}{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m\sigma_y^2}}\sim\frac{\frac{\chi^2(n)}{n}}{\frac{\chi^2(m)}{m}}\sim F(n,m)$$

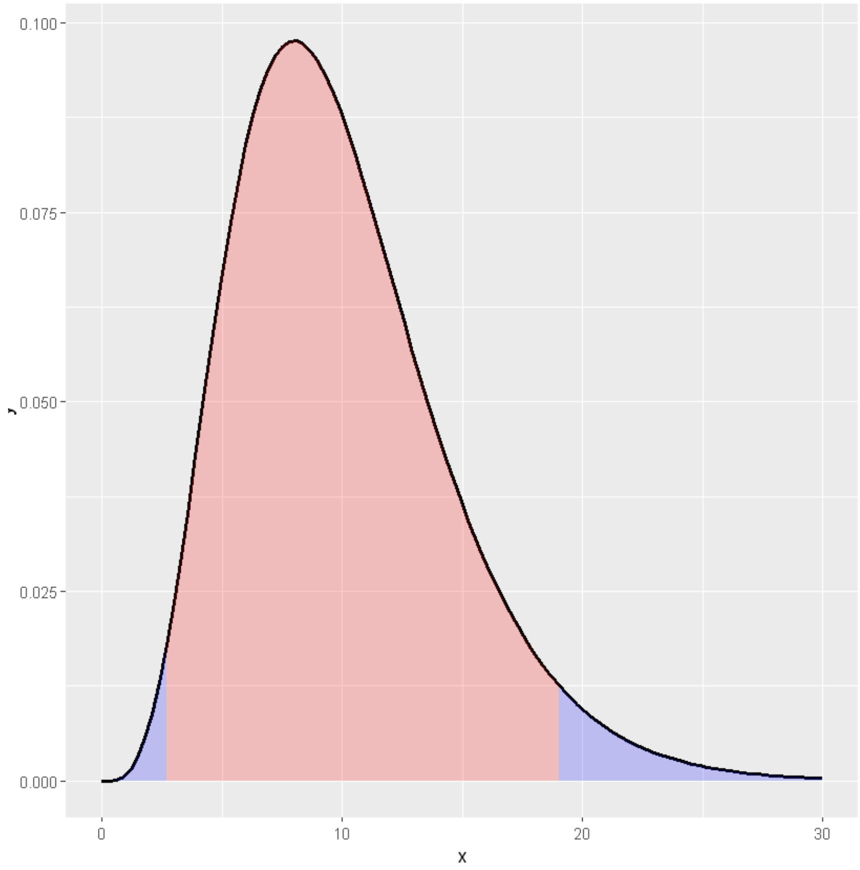
$$\boxed{F_{\left(1-\frac{\alpha}{2}\right)}(n,m)}<\frac{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n\sigma_x^2}}{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m\sigma_y^2}}<F_{\left(\frac{\alpha}{2}\right)}(n,m)$$

$$\boxed{\frac{1}{F_{\left(\frac{\alpha}{2}\right)}(m,n)}}<\frac{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n\sigma_x^2}}{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m\sigma_y^2}}<\frac{1}{F_{\left(1-\frac{\alpha}{2}\right)}(m,n)}$$

$$F_{\left(1-\frac{\alpha}{2}\right)}(m,n)<\frac{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m\sigma_y^2}}{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n\sigma_x^2}}<F_{\left(\frac{\alpha}{2}\right)}(m,n)$$

$$\boxed{F_{\left(1-\frac{\alpha}{2}\right)}(n,m)=\frac{1}{F_{\left(\frac{\alpha}{2}\right)}(m,n)}}$$

$$\frac{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n}}{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m}}\times F_{\left(1-\frac{\alpha}{2}\right)}(m,n)<\frac{\sigma_x^2}{\sigma_y^2}<\frac{\sum_{i=1}^{n}\frac{(X_i-\mu_x)^2}{n}}{\sum_{i=1}^{m}\frac{(Y_i-\mu_y)^2}{m}}\times F_{\left(\frac{\alpha}{2}\right)}(m,n)$$

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In [20]: n <- 10; s_sq <- 4.5

# 모평균이 알려져 있지 않은 경우의 신뢰 구간
CI_L <- (s_sq * (n - 1)) / qchisq(p = 0.05/2, df = n - 1, lower.tail = FALSE)
CI_R <- (s_sq * (n - 1)) / qchisq(p = 0.05/2, df = n - 1, lower.tail = TRUE)

sprintf("%s%.5f%s%.5f%s",'(' ,CI_L ,',' ,CI_R ,')')

significant_left <- qchisq(p = 0.05/2, df = n - 1, lower.tail = TRUE)
significant_right <- qchisq(p = 0.05/2, df = n - 1, lower.tail = FALSE)

ggplot(data.frame(x = c(0,30)), aes(x = x)) +
    stat_function(fun = dchisq, args = list(df = n), size = 1) +
    geom_area(stat = "function", fun = dchisq, args = list(df = n), fill = "red", alpha = 0.2
            , xlim = c(significant_left, significant_right)) +
    geom_area(stat = "function", fun = dchisq, args = list(df = n), fill = "blue", alpha = 0.2
            , xlim = c(0, significant_left)) +
    geom_area(stat = "function", fun = dchisq, args = list(df = n), fill = "blue", alpha = 0.2
            , xlim = c(significant_right, 30))
```

'(2.12903,14.99784)'