P3
Compute each model's criterian

```r
# Define the function to collect criteria
collect_criterian <- function(y, x) {
    n <- length(y)
    k <- ncol(x)
    x_matrix <- as.matrix(x)
    beta_hat <- solve(t(x_matrix) %*% x_matrix) %*% t(x_matrix) %*% y
    y_hat <- x_matrix %*% beta_hat
    residuals <- y - y_hat
    rss <- sum(residuals^2)
    tss <- sum((y - mean(y))^2)
    sigma_hat <- rss / (n - k)
    r2 <- 1 - rss / tss
    adjusted_r2 <- 1 - ((1 - r2) * (n - 1) / (n - k))
    aic <- n * log(rss / n) + 2 * k
    bic <- n * log(rss / n) + k * log(n)
    cp <- rss + 2 * k * sigma_hat
    h_ii <- rowSums((x_matrix %*% solve(t(x_matrix) %*% x_matrix)) * x_matrix)
    loo_cv <- mean((residuals / (1 - h_ii))^2)

    model_results <- list(r2 = r2, adjusted_r2 = adjusted_r2, aic = aic,
                          bic = bic, cp = cp, loo_cv = loo_cv)
    return(model_results)
}
```

Results
Value of the criteria vs model index
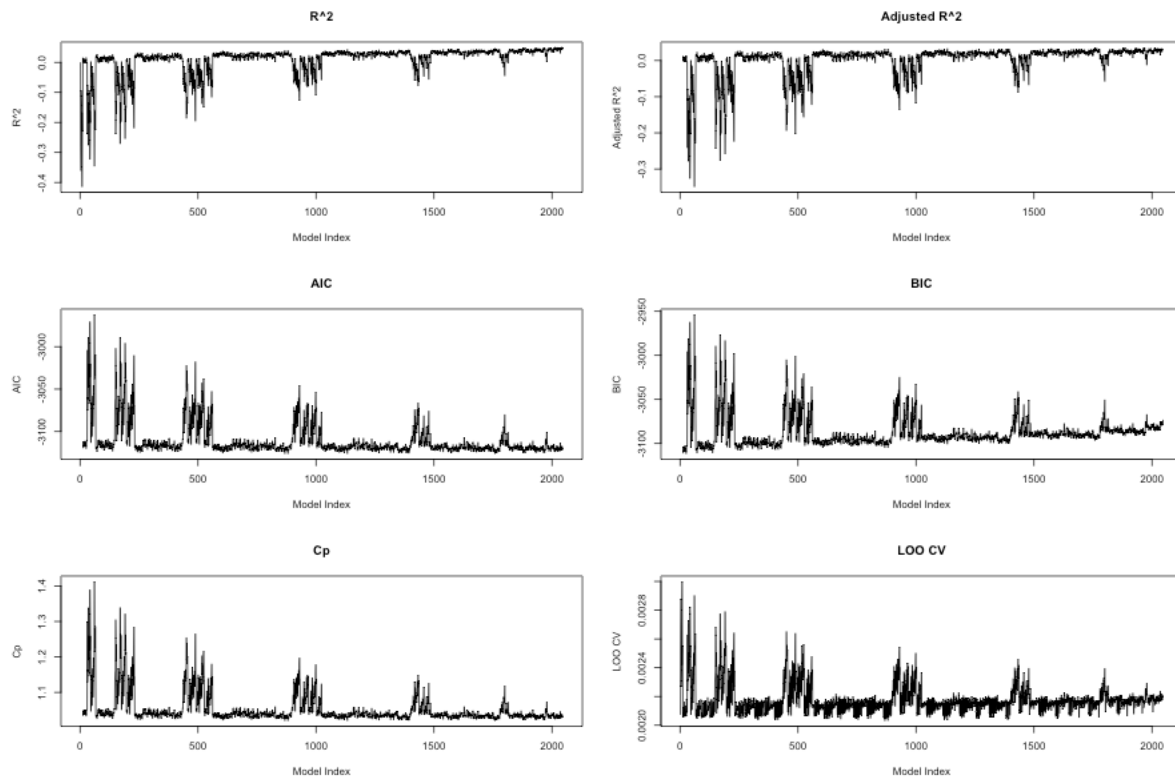
Model index is ordered by coverting the parameter selection type into binary number. For instance, the model selecting only "ones" has index 1 and the model selecting "ones", "dfy", "dfy_square" has index 1+2+64=67.

Best model selected from each criteria

```
Best Model Based on R2:
Predictors:
 [1] "ones"           "x_dfy"          "x_infl"         "x_svar"         "x_tms"          "x_tbl"          "x_dfy_squared"  "x_infl_squared"
 [9] "x_svar_squared" "x_tms_squared"  "x_tbl_squared"
r2: 0.0493

Best Model Based on ADJUSTED_R2:
Predictors:
[1] "ones"           "x_dfy"          "x_svar"         "x_tms"          "x_infl_squared" "x_svar_squared" "x_tms_squared"  "x_tbl_squared"
adjusted_r2: 0.0358

Best Model Based on AIC:
Predictors:
[1] "x_dfy"          "x_tms"          "x_tbl"          "x_infl_squared" "x_tms_squared"
aic: -3126.1674

Best Model Based on BIC:
Predictors:
[1] "x_dfy"          "x_dfy_squared"
bic: -3111.6190

Best Model Based on CP:
Predictors:
[1] "x_dfy"          "x_tms"          "x_tbl"          "x_infl_squared" "x_tms_squared"
cp: 1.0201

Best Model Based on LOO_CV:
Predictors:
[1] "x_dfy"          "x_tms"          "x_tbl"          "x_infl_squared" "x_tms_squared"
loo_cv: 0.0020
```

Noted that AIC, Cp, LOOCV choose the same model as the best model.

Number of predictors that the best model selected
r2: 11 (predictors)
sdjusted_r2: 8
AIC: 5
BIC: 2
Cp: 5
Loo_cv: 5