Problem 1 (3pts)

Given the dataset in problem1.csv

1. Mean: 1.04897 ; Variance: 5.427221 ; Skewness: 0.8819321; Kurtosis: 26.06998

2. Built-in Mean: 1.04897; Built-in Variance: 5.427221; Built-in Skewness: 0.8806086; Built-in Kurtosis: 26.1222

3. It is biased for the difference skewness and kurtosis between two situations.

Problem 2 (5pts)

1.

OLS: beta values:0.77527410; standard deviation:1.008813

MLS: beta values:0.7691145; standard deviation:1.0076435

The OLS and MLE coefficients (β) and standard deviation are very similar when the data follows a normal distribution because MLE under normality gives the same estimates as OLS.

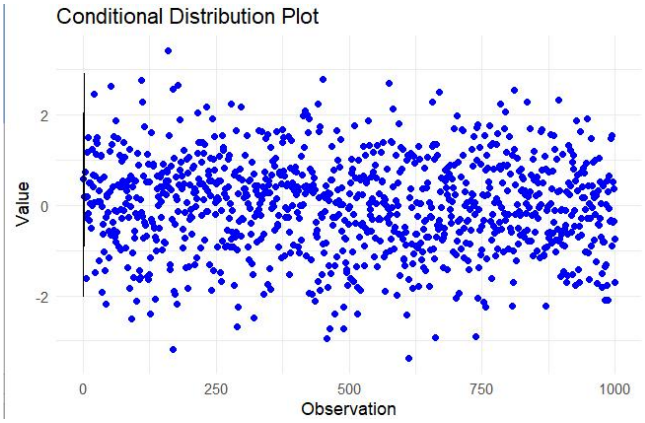
2.

```
> cat("Estimated coefficients (Beta):", mle_t_fit$par[1], "\n")
Estimated coefficients (Beta): -7.075366e+12
> cat("Estimated sigma:", mle_t_fit$par[2], "\n")
Estimated sigma: 0.001
> cat("Estimated degrees of freedom (nu):", mle_t_fit$par[3], "\n")
Estimated degrees of freedom (nu): 3.184881e+13
>
```

Normality is the best fit.

3.

```
> conditional_mean
         x1          x2
0.001022695 0.990243819
> conditional_var
          x1        x2
x1 1.0697746 0.5306846
x2 0.5306846 0.9614733
```



4. (1 point Extra Credit). $Y = X\beta + \epsilon$ and $\epsilon \sim N(0, \sigma^2)$. Derive the maximum likelihood estimators for β and σ^2

Problem 3 (2pts)

I expect AR3 model fit best. Actually, AR3 is the best fit among these models. It confirm my hypothesis

```
           df      AIC
ar1_model   3 1644.656
ar2_model   4 1581.079
ar3_model   5 1436.660
ma1_model   3 1567.404
ma2_model   4 1537.941
ma3_model   5 1536.868
```