Problem 1:
a.
Mean (manually calculated): 1.0489703904839582
Variance (manually calculated): 5.4272206818817255
Skewness (manually calculated): 0.8792880598472457
Kurtosis (manually calculated): 23.06998251061053
b.
Mean (package): 1.0489703904839585
Variance (package): 5.427220681881727
Skewness (package): 0.8806086425277364
Kurtosis (package): 23.122200789989723
c.
I think there's no bias for the calculation from the package. I have compared the manually calculated statistics with those obtained from the statistical package. The results show no difference in the Mean and Variance values, supporting the accuracy of the package for these measures. The differences in Skewness and Kurtosis are minimal, approximately 0.001 and 0.05 respectively, which are within an acceptable range for statistical calculations. These small differences are likely due to the inherent limitations of computational precision and do not indicate a systematic bias in the statistical package's functions."

Problem 2:
a.
OLS Beta:
0.775274
Standard deviation of the OLS error:
1.008813058320225

MLE Beta:
0.775274
Standard deviation of the MLE error:
1.008813058320225
Base on my result, the Beta and STD of error are the same for both method, which could because that the error terms in both method are assumed to be normally distributed. It can also because that I directly used the calculation from package.

b.
MLE(t-distribution)Estimated coefficients:
[-0.09726724 0.67501019 0.85510333 7.15978048]

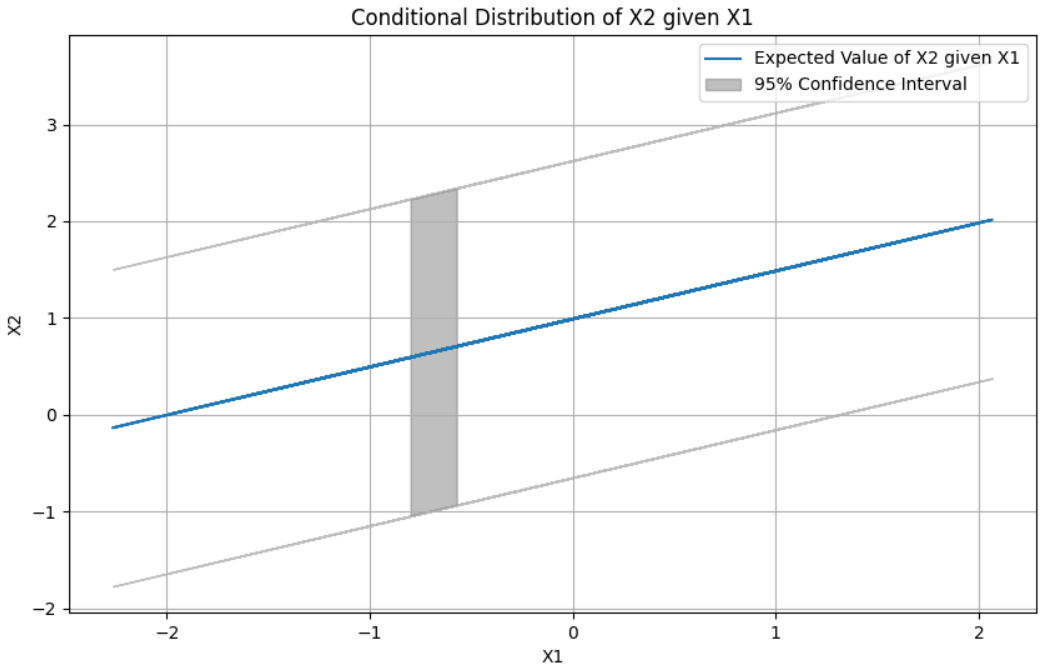
MLE error under normal distribution:
Y = -0.087384 + 0.775274*X + 1.008813058320225

MLE error under t-distribution:
Y = -0.09726724 +0.67501019*X+0.85510333

MLE AIC(error normal distribution):
573.0751261088554
MLE(t-distribution)Estimated AIC:
570.5868063607221

Base on the AIC, the MLE assume error fit in t-distribution is the best of fit.

c.




3.
AR(3)-MA(2): AIC = 1438.483705754461
AR(3)-MA(1): AIC = 1438.6068639620967
AR(3)-MA(3): AIC = 1440.1583217576056
AR(2)-MA(3): AIC = 1455.2599900521445
AR(2)-MA(2): AIC = 1476.9585841959024
AR(2)-MA(1): AIC = 1505.6460262743199
AR(1)-MA(3): AIC = 1517.133608956427
AR(1)-MA(2): AIC = 1539.796951737931
AR(1)-MA(1): AIC = 1550.5843565488663

AR(3)-MA(2) is the best fit.