WEEK 2 HW

Dong Pu

PROBLEM 1

- Question : Remember from last week we discussed that skewness and kurtosis functions in statistical packages are often biased. Is your function biased? Prove or disprove your hypothesis.

PROBLEM 1

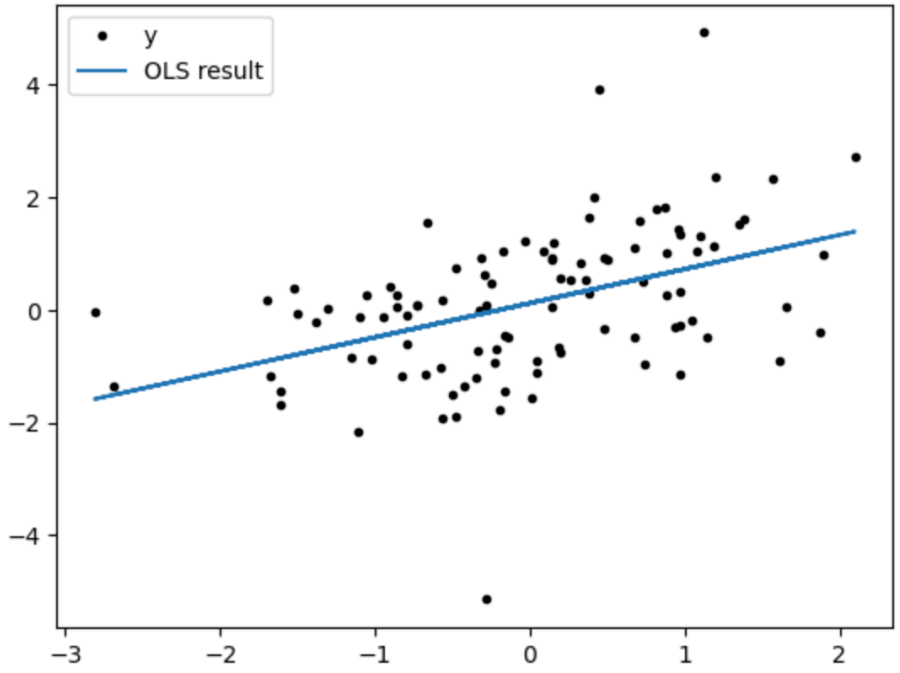
- **Answer**: My function is biased and the packages are indeed biased.
- The skewness calculated from my function: 0.016943075248578927
- The excess kurtosis calculated from my function: -0.0028577909994692 52
- The skewness for standard normal distribution should be 0 in theory, but the calculation from my function is slightly deviated from 0, which means the packages are biased.
- The excess kurtosis for standard normal distribution should be 0 in theory, but the calculation from my function is slightly deviated from 0, which means the packages are biased.

PROBLEM 2

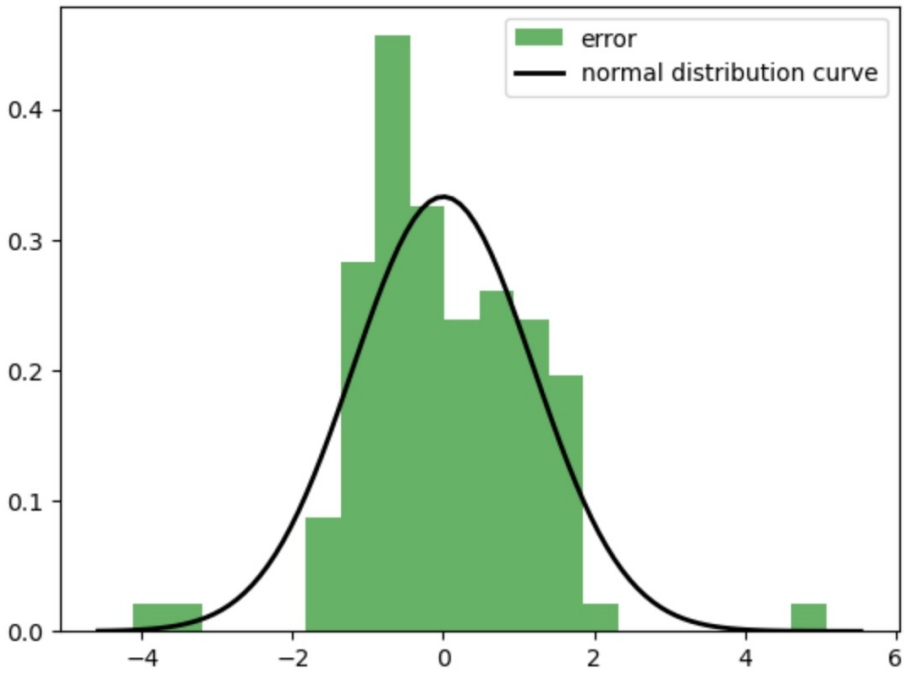
- Question:
- (a). Fit the data in problem2.csv using OLS and calculate the error vector. Look at its distribution. How well does it fit the assumption of normally distributed errors?
- (b). Fit the data using MLE given the assumption of normality. Then fit the MLE using the assumption of a T distribution of the errors. Which is the best fit?
- (c). What are the fitted parameters of each and how do they compare? What does this tell us about the breaking of the normality assumption in regards to expected values in this case?

PROBLEM 2(A)

- Fit data using OLS:



Error vector:



PROBLEM 2(A)

- Answer: As shown in the graph above, the error vector follows some parts of the normal distribution but not a lot. In conclusion, I don’t think error vector is following the normal distribution according to the graph above.

PROBLEM 2(B)

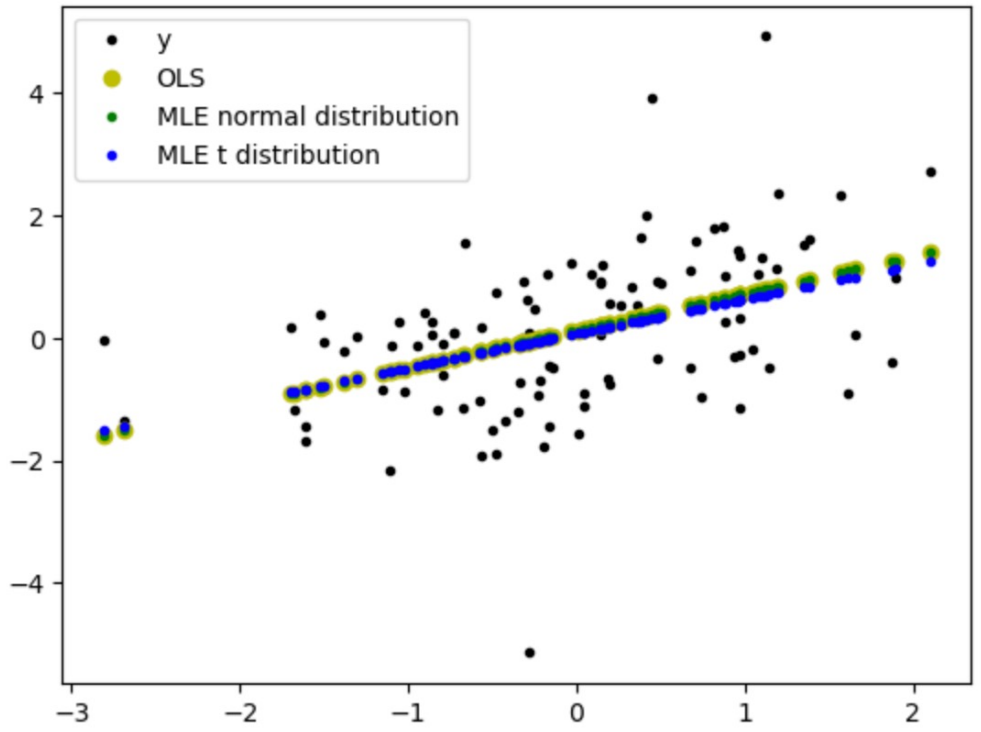
- Answer:

```
SSE_normal_dist = 143.61484854062613 , SSE_t_dist = 144.06627090325546
AIC_normal_dist = 325.9841933783248 , AIC_t_dist = 319.030574551578
BIC_normal_dist = 333.79970393628906 , BIC_t_dist = 329.45125529553036
```

- From the results given from the code, we can see that the one assmes t distribution has a slightly higher SSE, but it has a much lower AIC and also BIC. In conclusion, t distribution has a better fit in this case.

PROBLEM 2(C)

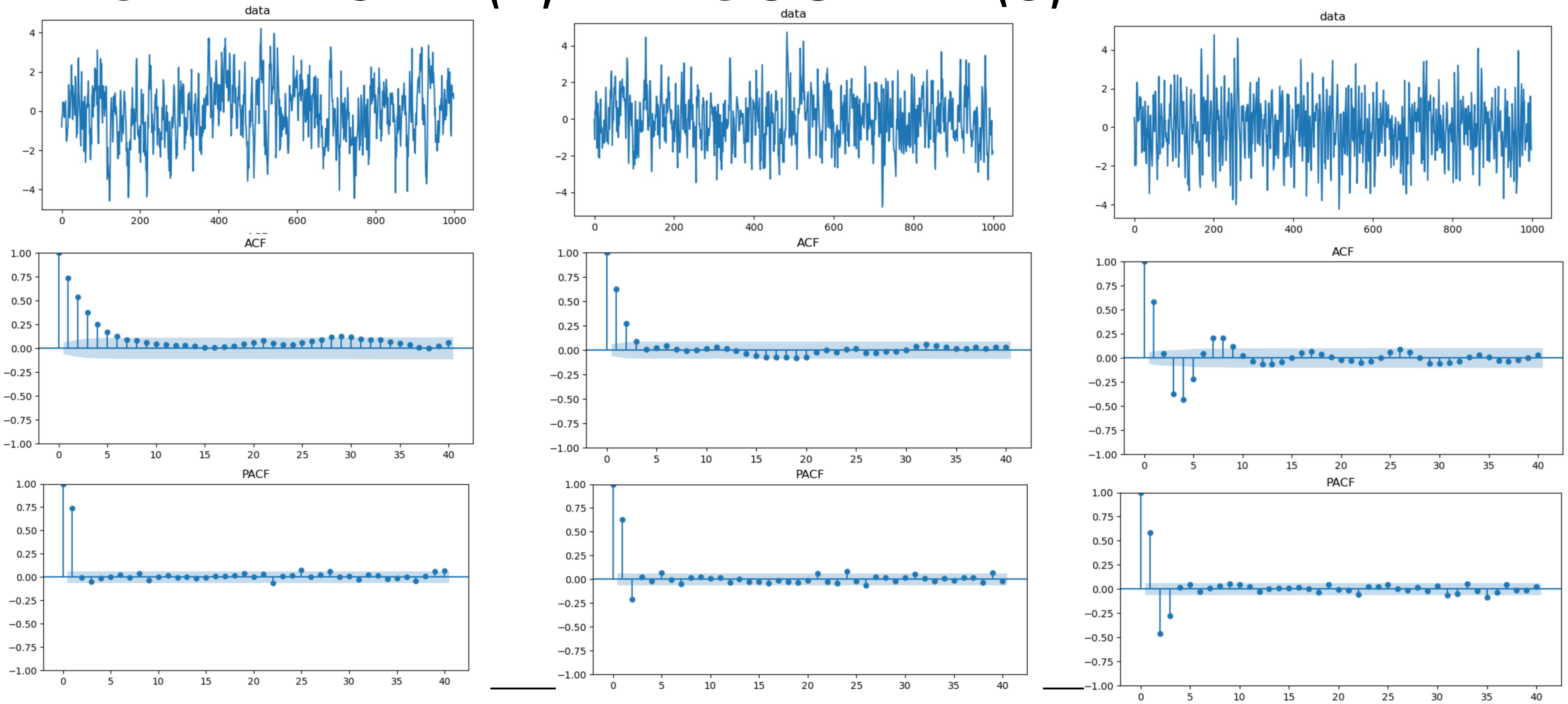
- Answer: From the graph on the right, we can see that the k and b parameters are very very close, but not identical. It means that if the error breaks the assumption of normality, the expected value of y based upon MLE will be different from the one based on OLS.



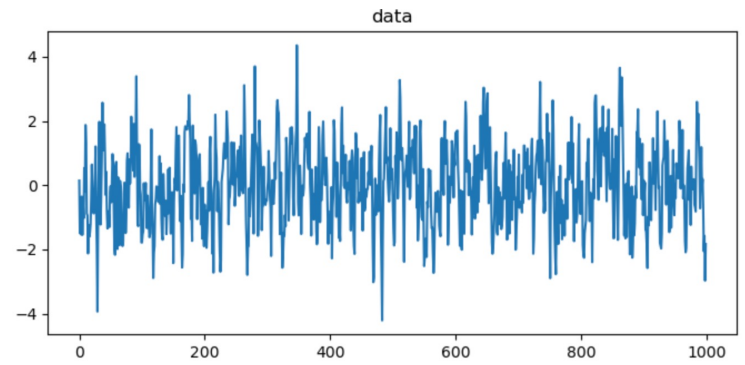
PROBLEM 3

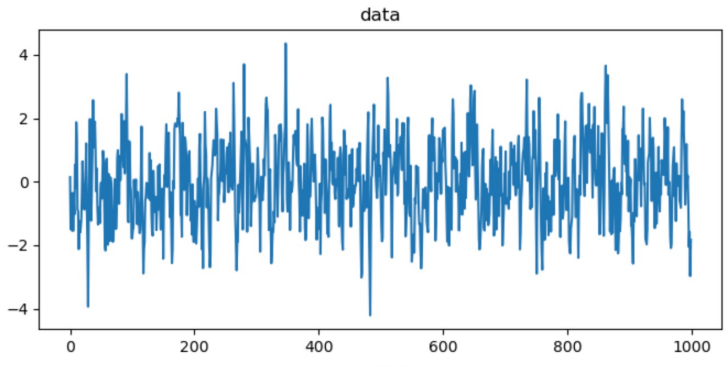
- Question:
- Simulate AR(1) through AR(3) and MA(1) through MA(3) processes. Compare their ACF and PACF graphs. How do the graphs help us to identify the type and order of each process?

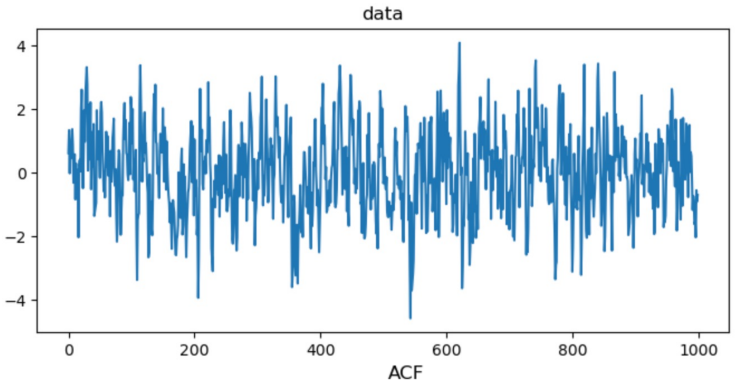
PROBLEM 3 AR(1) THROUGH AR(3)

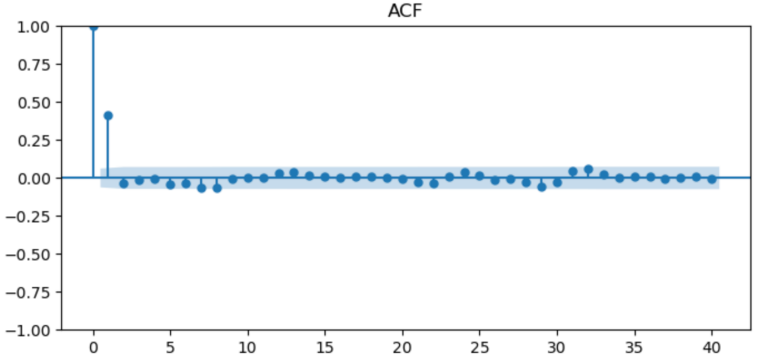


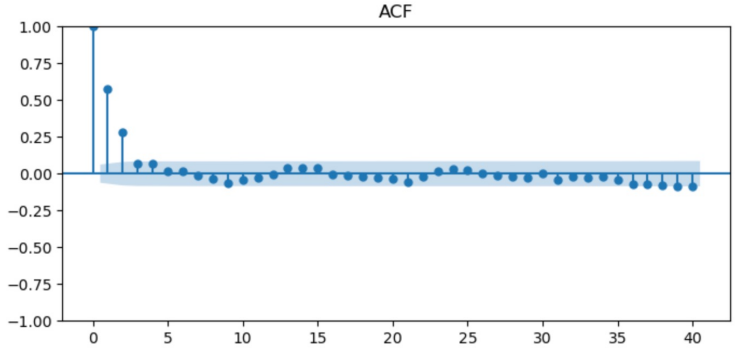
PROBLEM3 MA(1) THROUGH MA(3)

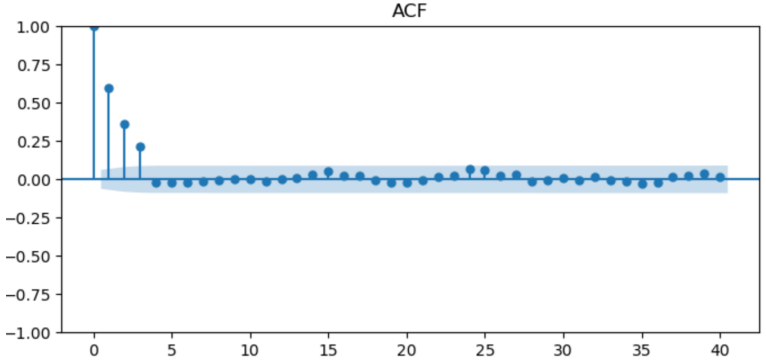


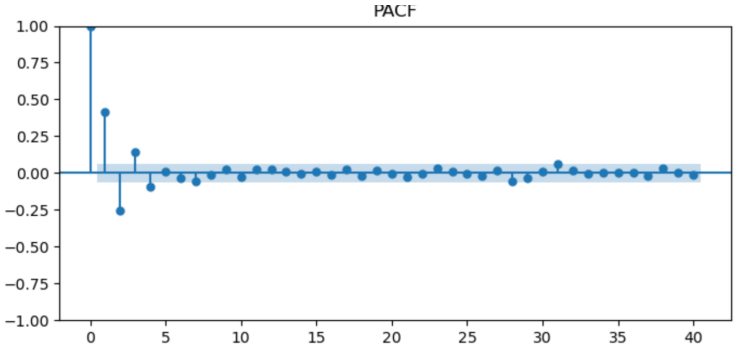


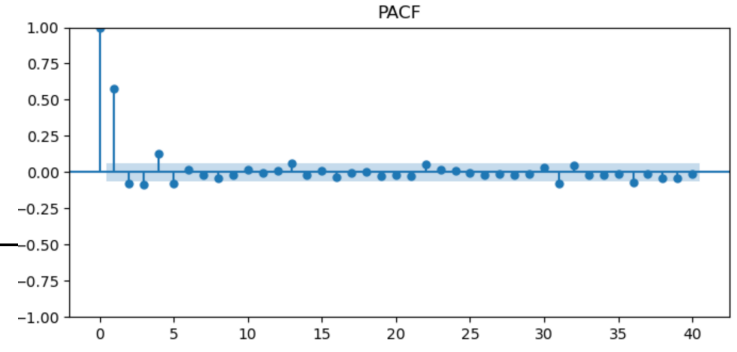


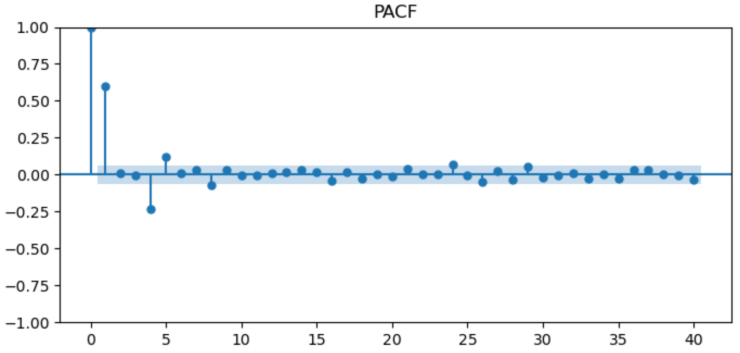












PROBLEM 3

- Answer: For AR, PCAF displays a sharp cutoff while the ACF decays more slowly, meaning that the autocorrelation pattern can be explained more easily by adding AR terms than by adding MA terms. For MA, the two plots behave the opposite.