WEEK 2 PROJECT

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PROBLEM 1

- Compare the conditional distribution of the Multivariate Normal, to the OLS equations.
- Compare Values
- Use data to prove answer

For conditional Variance:

$E[(Y-f(x))^2] = E[(Y - E(Y|X) + E(Y|X) - f(X))^2]$

$= E[E\{(Y - E(Y|X) + E(Y|X) - f(X))^2|X\}]$

$= E[Var(Y|X)] + E[(E(Y|X) - f(X))^2]$

For $f(X) = E(Y|X)$ the second term becomes zero

$E[(Y-f(x))^2] = E[Var(Y|X)]$

$Y = E[Y|X] + (Y - E(Y|X))]$

$= E(Y|X) + E(error|X)$ → error to 0

$= E(Y|X)$

PROBLEM 1 - ANSWER

- The values are **Same** – sample size large, function close
- **Result:**

```
#Compare the variance difference between these two methods
var_hat, results.resid @ results.resid.T / (100 - 1)
```

```
(0.6579563030192092, 0.6579563030192092)
```

```
#Compare the mean difference between these two methods
u_hat, results.predict(1 - x_mean) + y_mean
```

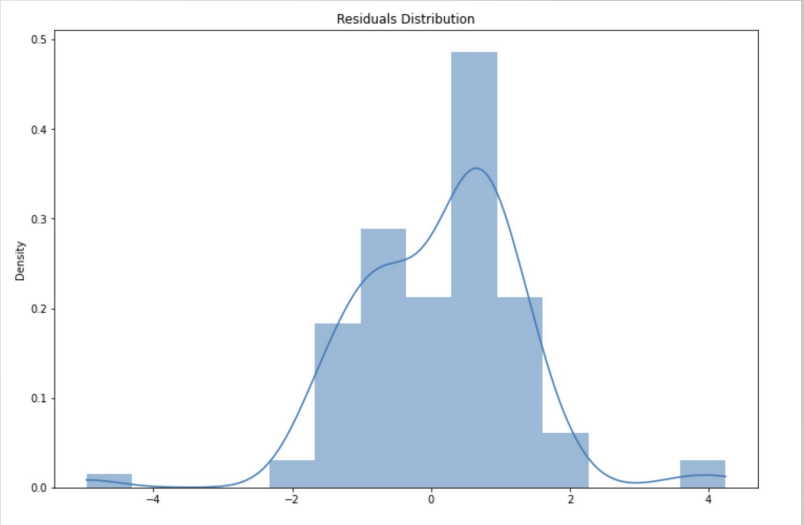
```
(0.46588056652086507, array([0.46588057]))
```

PROBLEM 2

- Using OLS calculate the error vector
- Compare distribution with error distribution
- Using MLE (normality & T distribution) fit data
- Compare which is the best
- What are the fitted parameters of each and how do they compare?
- What does this tell us?

PROBLEM 2 - ANSWER

- **Not fit** the assumption of normally distributed errors



Normal test:

```
stat = 14.146, p = 0.001

It is not normal distribution
```

Shapiro test:

```
stat = 0.938, p = 0.000

It is not normal distribution
```

PROBLEM 2 - ANSWER

- **T Distribution** best fit

	Normality	T distribution
AIC	325.98419338057477	317.1186022971749

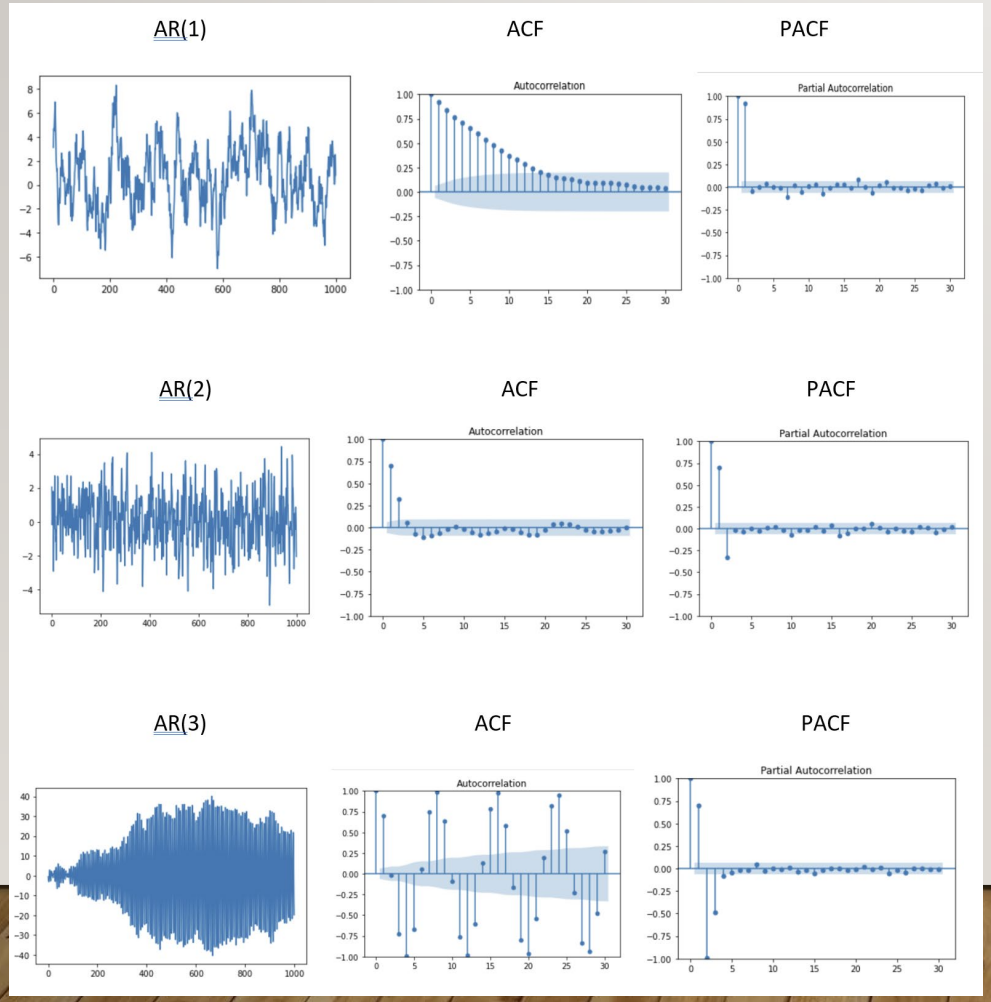
- Compare SD. Each method has close result

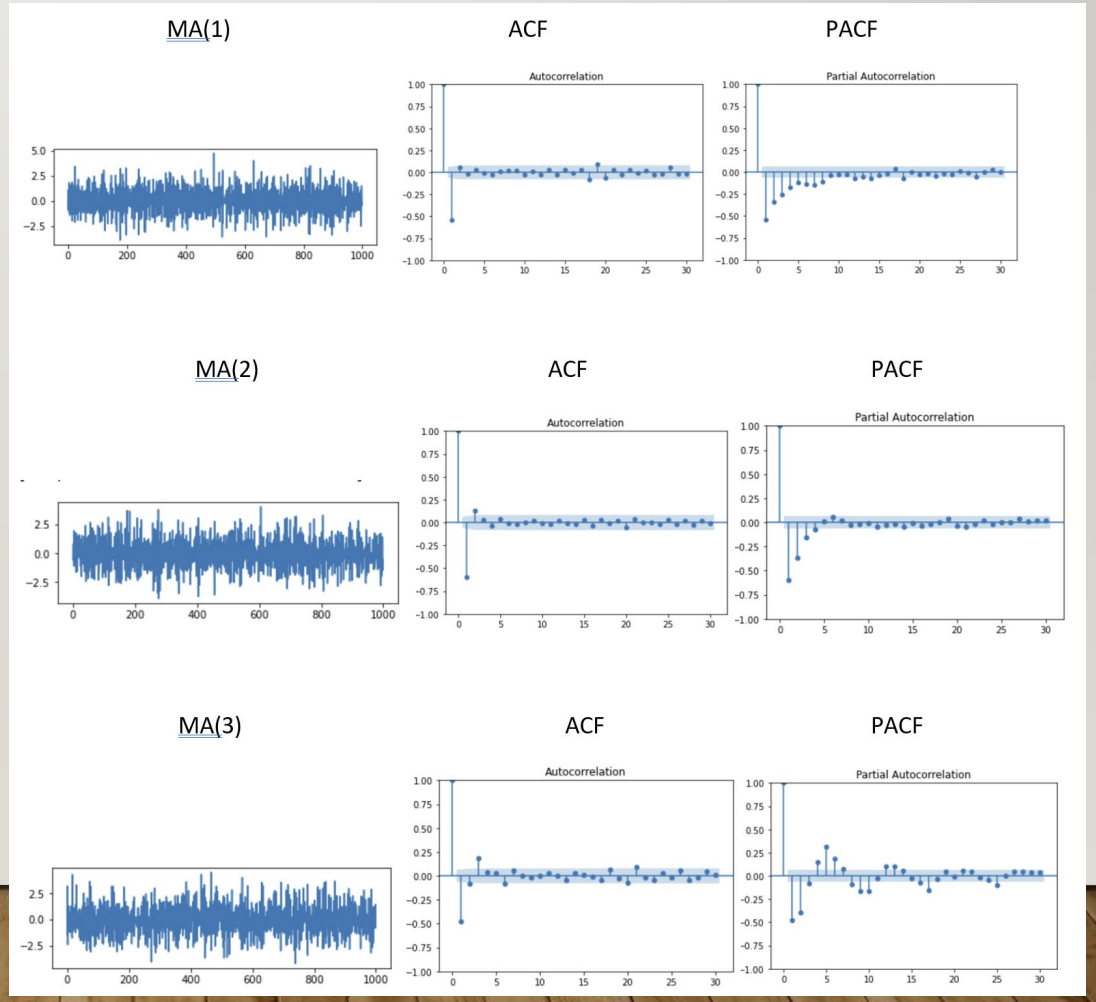
	Residuals	Normality	T distribution
SD	1.198394128	1.19839547	0.9735875321845389

PROBLEM 3

- 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 - ANSWER





PROBLEM 3 - ANSWER

Type:

- The ACF for AR has many long line that excess the shadow; however, the ACF for MA only have few.
- The PACF for MA has many long line that excess the shadow; however, the PACF for AR only have few.

RA Order:

- ACF: For AR(1), almost all line are same direction. For AR(2), many of the line are different direction; however, there is one direction are short. For AR(3), the line from two direction are close to equal and both have short and long line.
- PACF: there two long line for AR(1), 3 long line for AR(2), 4 long line for AR(3)

MA Order:

- ACF: there two long line for MA(1), 3 long line for MA(2), 4 long line for MA(3)
- PACF: For MA(1), Almost all line are same direction. For MA(2), there are some short line are different direction. For MA(3), there are some long line and short line are different direction.