'BJsales' dataset

Quiz, 12 questions

11/12 points (91.66%)

Congratulations! You passed!

Next Item

1 / 1
points

1.
This Quiz has several questions all of which are related and are steps toward modeling the time series titled 'BJsales' in 'datasets' package in R.

Plot the time series in the code block below.

```
# Plot time series 'BJsales'
plot(BJsales)
```

Run

Reset

Which one of the following is plausible?

- [x] There are ups and downs with a general upward trend.

Correct
Correct!

- [ ] There is no trend at all.

Un-selected is correct

- [x] Time series is not stationary.

Correct
Correct!

There is a trend which means mean is changing.

- [ ]

Time series is stationary.

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Un-selected is correct

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points

2.
Plot the differenced data below. Does it seem stationary?

```
1  plot(diff(BJsales))
```

Run

Reset

- (selected) It does not seem to be stationary since there are still upward or downward trends in different parts of the time plot.

Correct
Correct!

There is, for example, an upward trend between (50,100) but a downward trend between (100,150). That means the mean is changing.

- It does seem stationary since there is no general upward or downward trend.

1 / 1
points

3.

To get rid of a still remaining trend, we apply one more differencing. Plot the twice differenced time series in the code block below.

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```
plot(diff(diff(BJsales)))
```

Run

Reset

Which one or more of the following are plausible?

- [ ] Mean level seems to be changing.

Un-selected is correct

- [x] There is no systematic change in mean.

Correct
Correct!

Mean level seems to be constant, around 0.

- [x] Variance towards the end of the series seems to be different from the variance in the other parts of the plot.

Correct
Correct!

It seems that variance is smaller towards the end of the plot. One may say that difference in the change of the variance is not high, and thus can be ignored.

---

1 / 1
points

4.

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Find the PACF of diff(diff(BJsales)) in the code block below. Which lags are significant?

```
pacf(diff(diff(BJsales)))
```

Run

Reset

- (selected) Lag 1, Lag 2, Lag 3, Lag 10, Lag 19

Correct

Correct!

One might say that Lag 19 is barely significant.

- Lag 1, Lag 8, Lag 11
- Lag 1, Lag 2, Lag 3

---

1 / 1 points

5.

Find the ACF of diff(diff(BJsales)) in the code block below. Which lags are significant?

```
acf(diff(diff(BJsales)))
```

Run

Reset

- (selected) Lag 1, Lag 8, Lag 11

Correct

Correct!

Lag 8 and Lag 11 are barely significant.

- Lag 1
- Lag 1, Lag 2, Lag 3, Lag 10, Lag 19

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1 / 1 points

6.
What does ACF suggest?

- [ ] Keeping parsimony principle in mind, AR term has order of 0 or 1.

Un-selected is correct

- [x] If we ignore barely significant lags, the order of MA term can be 0 or 1.

Correct
Correct!

- [x] Keeping parsimony principle in mind, the order of MA term can be 0 or 1.

Correct
Correct!

1 / 1 points

7.
What does PACF suggest?

- [x] Keeping parsimony principle in mind, the order of AR terms can be 0,1,2 or 3.

Correct
Correct!

- [ ] If we ignore barely significant lags, the order of MA terms can be 0, 1,2 or 3.

Un-selected is correct

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0 / 1
points

8.
Now we try few different models and compare their AIC values.

```
d=2
for(p in 1:4){
  for(q in 1:2){
        if(p+d+q<=8){
          model<-arima(x=BJsales, order = c((p-1),d,(q-1)))
          pval<-Box.test(model$residuals, lag=log(length(model$residuals)))
          sse<-sum(model$residuals^2)
          cat(p-1,d,q-1, 'AIC=', model$aic, ' SSE=',sse,' p-VALUE=', pval$p.value,'\n')
        }
      }
}
```

Run

Reset

```
0 2 0 AIC= 577.6777  SSE= 423.7908  p-VALUE= 7.610494e-07
0 2 1 AIC= 517.1371  SSE= 276.2293  p-VALUE= 0.9632467
1 2 0 AIC= 541.9646  SSE= 327.92  p-VALUE= 0.003606979
1 2 1 AIC= 518.9734  SSE= 275.8554  p-VALUE= 0.941776
2 2 0 AIC= 532.2986  SSE= 302.7467  p-VALUE= 0.05824473
2 2 1 AIC= 520.2684  SSE= 274.0474  p-VALUE= 0.7955439
3 2 0 AIC= 524.7648  SSE= 283.4941  p-VALUE= 0.7035291
3 2 1 AIC= 519.4182  SSE= 264.0684  p-VALUE= 0.6948066
```

Which model has the smallest AIC value?

- ARIMA(0,2,1)
- ARIMA(3,2,1)
- ARIMA(1,2,1)

This should not be selected
This model has relatively small AIC and SSE values, but not smallest.

1 / 1
points

9.

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11/12 points (91.66%)

```
d=2
for(p in 1:4){
  for(q in 1:2){
        if(p+d+q<=8){
          model<-arima(x=BJsales, order = c((p-1),d,(q-1)))
          pval<-Box.test(model$residuals, lag=log(length
            (model$residuals)))
          sse<-sum(model$residuals^2)
          cat(p-1,d,q-1, 'AIC=', model$aic, ' SSE=',sse,' p-VALUE=',
            pval$p.value,'\n')
        }
      }
}
```

Run

Reset

Which model has the smallest SSE (sum of squared errors) value?

- (selected) ARIMA(3,2,1)

Correct

Correct!

Smallest SSE value is 264.0684.

- ARIMA(0,2,1)
- ARIMA(1,2,0)

---

1 / 1 points

10.

We fit ARIMA(0,2,1), and look at the time plot, ACF and PACF of the residuals.

```
model<-arima(BJsales, order=c(0,2,1))

par(mfrow=c(2,2))

plot(model$residuals)
acf(model$residuals)
pacf(model$residuals)
qqnorm(model$residuals)
```

Run

Reset

Is there compelling evidence against the whiteness of the residuals?

- [x] No, since QQ-plot seems linear.

Correct

Correct!

- [x] No, since ACF nad PACF has no significant lags.

Correct

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Correct!

11/12 points (91.66%)

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1 / 1 points

11.
Let X_t=BJsales and $Y_t = diff(diff(BJsales))$. What is the fitted model for Y_t?

- [ ] $Y_t = Z_t - 0.7480Z_{t-1}$ and $\sigma_Z = 1.866$.

Un-selected is correct

- [x] $Y_t = (1 - 0.7480B)Z_t$ and $\sigma_Z^2 = 1.866$.

Correct
Correct!

- [ ] $Y_t = (1 - 0.7480B)Z_t$ and $\sigma_Z = 1.866$.

Un-selected is correct

- [x] $Y_t = Z_t - 0.7480Z_{t-1}$ and $\sigma_Z^2 = 1.866$.

Correct
Correct!

1 / 1 points

12.
Let X_t=BJsales and $Y_t = diff(diff(BJsales))$. What is the fitted model for X_t?

- [x] $X_t = 2X_{t-1} - X_{t-2} + Z_t - 0.7480Z_{t-1}$ and $\sigma_Z^2 = 1.866$.

Correct

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Correct!

11/12 points (91.66%)

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$(1-B)^2 X_t = Z_t - 0.7480 Z_{t-1}$ and $\sigma_Z^2 = 1.866.$

Correct

Correct!

$Y_t = (1-B)^2 X_t.$

$(1-2B+B^2) X_t = (1-0.7480B) Z_t$ and $\sigma_Z^2 = 1.866.$

Correct

Correct!

$\nabla^2 = 1-2B+B^2.$

$\nabla^2 X_t = Z_t - 0.7480 Z_{t-1}$ and $\sigma_Z^2 = 1.866.$

Correct

Correct!

$1-B=\nabla.$