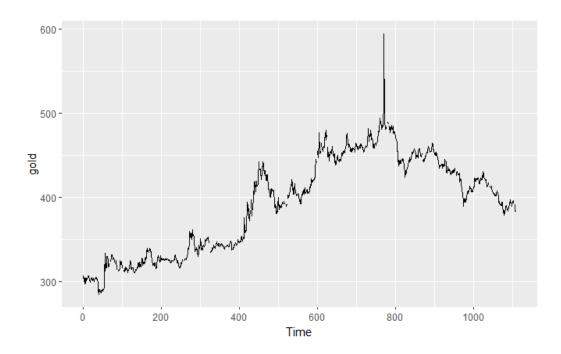
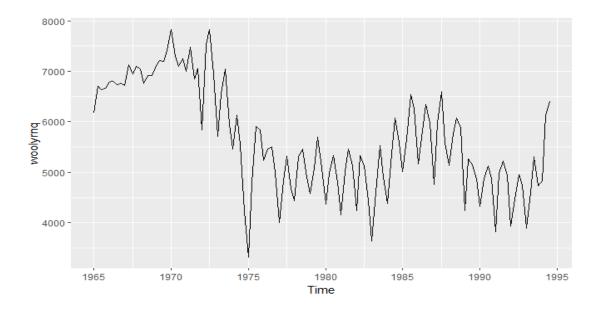
# Assignment

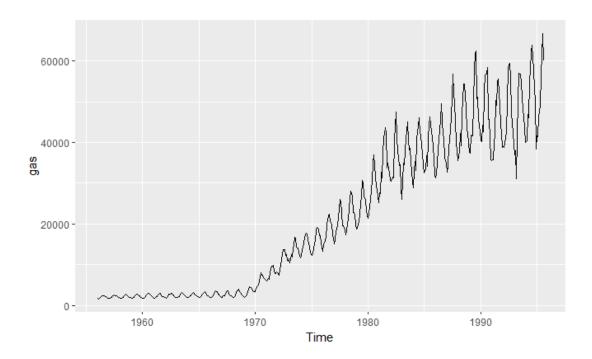
SUBMITTED TO	Nasrin Khatun Assistant Professor Department of Statistics Jahangirnagar University	
SUBMITTED BY	Aka Saha Syama Binta Faruque Muttaqir Rahman Saikat Mandal Tanu Md. Mashiur Rahman Mahabubur Rahman Mohammad Taslim Mazumder Sohel	ID:20231087 ID:20231084 ID: 20231089 ID:20231092 ID:20231088 ID:20231093 ID:20231091
	Time Series Analysis & Forecasting WM-ASDS10, (10 <sup>th</sup> Batch), Section: B Semester: Fall, 2024	
SUBMISSION DA	ΓΕ 15 <sup>th</sup> May, 2024	

## Q1(a) Use autoplot () to plot each of these in separate plots.



**Comment:** The help functions tell us that gold is the "daily morning gold prices" in US dollars for the time period spanning January 1, 1985 through March 31, 1989. The blurb that appeared with the help function mentioned an example of tsdisplay(gold), so I tried that out and included the output. I'm not quite sure what the bottom two plots are but I'm sure I'll find out before I finish this assignment. My next step is to use the autoplot () function on the gold t data.





**Comment:** There are two things that my eyes immediately jump to on this plot; the enormous spike about a quarter of the way in the 700's and the dip shortly after we started at about day 30. It looked to be a consistent dip as opposed the spikes that other valleys show. The next task to to use the frequency function to determine the frequency of the old series.

```
autoplot(gold)
autoplot(woolyrnq)
autoplot(gas)
writeLines("")
Q1(b) What is the frequency of each commodity series? Hint: apply the frequency() function.
```

```
> print("Frequency")
[1] "Frequency"
> print("gold")
[1] "gold"
> frequency(gold)
[1] 1
> print("woolyrnq")
[1] "woolyrnq"
> frequency(woolyrnq)
[1] 4
> print("gas")
[1] "gas"
> frequency(gas)
[1] 12
```

Comment: The frequency is shown to be one but we know from the description of the gold time seri es data that it is daily information. I assume that the 1 the frequency is stating is daily and not annual . Now to "spot the outlier" in this series. We can see that the woolyrnq provides the data on the "quar terly production of woolen yarn in Australia" for the time period of March 1965 - September 1994. The wool is measured in tones. Lastly, we'll take a look at the gas series, using the help and autoplot functions to see what we can gather.

#### Code:

```
print("Frequency")
print("gold")
frequency(gold)
print("woolyrnq")
frequency(woolyrnq)
print("gas")
frequency(gas)
```

## Q1(c) Use which.max() to spot the outlier in the gold series. Which observation was it?

```
> print("when gold got maximum value?")
[1] "when gold got maximum value?"
> which.max(gold)
[1] 770
> print("what was the gold's maximum value?")
[1] "what was the gold's maximum value?"
> gold[which.max(gold)]
[1] 593.7
```

**Comment:** We see that the gas time series data is the data for the Australia's monthly gas production for 1956 through 1995. The auto plot shows what I think is a dramatic overall increase in the production of gas in Australia that began in 1970.

```
print("When gold got maximum value?")
which.max(gold)
print("What was the gold's maximum value?")
gold[which.max(gold)]
```

# **Q2(a)** You can read the data into R with the following script:

```
30dget GDP
659.2 251.8
589.0 290.9
512.5 290.8
614.1 292.4
647.2 279.1
602.0 254.0
```

### Code:

```
tute1 <- read.csv("C:/Users/User/Downloads/tute1.csv", header=TRUE)
head(tute1)
```

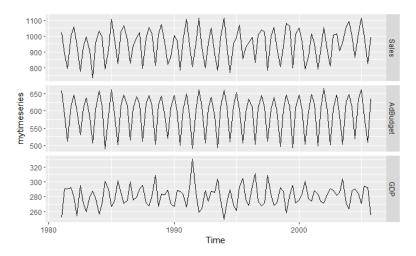
# Q2(b) Convert the data to time series.

### > head(mytimeseries)

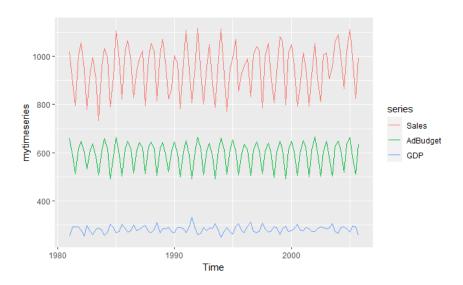
Sales	AdBudget	GDP
1020.2	659.2	251.8
889.2	589.0	290.9
795.0	512.5	290.8
	614.1	292.4
1057.7	647.2	279.1
944.4	602.0	254.0
	Sales 1020.2	795.0 512.5 1003.9 614.1 1057.7 647.2

```
mytimeseries <- ts(tute1[,-1], start=1981, frequency=4)
head(mytimeseries)
```

# Q2(c) Construct time series plots of each of the three series.



**Comment:** Looking at this output, I would guess that not adding facets = TRUE will generate an output that is not broken down by sales, ad budget, and GDP. Let's try and see



**Comment:** I was correct I appears that without the facet = TRUE, it's one plot showing the 3 different time series, and not three distinct plots when it is included. A ledgend is required to show which plot goes to which time series.

### Code:

autoplot(mytimeseries, facets=TRUE)

autoplot(mytimeseries)

# **3(a)** You can read the data into R with the following script:

Series ID A334933ST A3349627V A334938X A334938A A3349468W A334936V		le a a d Coast a d	174545					
1 1982-04-01 303.1 41.7 63.9 408.7 65.8 91.8 21982-05-01 297.8 43.1 64.0 404.9 65.8 102.6 3 1982-06-01 298.0 40.3 62.7 401.0 62.3 105.0 41982-07-01 307.9 40.9 65.6 414.4 68.2 106.0 96.9 51982-08-01 299.2 42.1 62.6 403.8 66.0 96.9 A334937W A3349937X A3349399C A3349874C A3349871W A3349790V A3349556W 1 53.6 211.3 94.0 32.7 126.7 178.3 50.4 48.0 125.7 95.1 32.5 127.6 176.3 48.0 1 52.1 226.3 95.3 33.5 128.8 172.6 48.6 55.4 223.8 105.7 35.6 141.3 202.8 49.9 3 48.4 215.7 95.1 32.5 127.6 176.3 48.0 55.4 223.8 105.7 35.6 141.3 128.8 172.6 48.6 55.4 223.8 105.7 35.6 141.3 169.6 51.3 34.8 122.2 24.3 0 62.4 112.3 169.6 51.3 34.8 122.2 22.1 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1.8 1	>	Sorios T		r x22/0627\	/ ^22/0228\	/ A22/0208/	\ \22/Q/69\	v v3340336V
2 1982-05-01 297.8 43.1 64.0 404.9 65.8 102.6 4 1982-07-01 307.9 40.9 65.6 414.4 68.2 105.0 5 1982-08-01 299.2 40.9 65.6 414.4 68.2 106.0 96.9 A334937W A3349397X A3349399C A3349874C A3349871W A3349790V A3349556W 66.0 96.9 5 62.6 403.8 66.0 96.9 A334937W A3349397X A3349399C A3349874C A3349871W A3349790V A3349556W 67.0 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5	1							
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4 1982-07-01 307.9 40.9 65.6 414.4 68.2 106.0 96.9 A334937W A334937X A334939X A334939C A3349874C A3349871W A3349790V A3349556W 51982-08-01 299.2 42.1 62.6 12.6 7 178.3 66.0 96.9 A334937W A334939X A334939C A3349874C A3349871W A33494950W A3349556W A334937W A3349401C A3348787A A3349872X A3349700X A334973V A334978W A3349791W A3349910L A334873A A3349872X A3349700X A334972X A334978W A33499791W A3349910L A334873A A3349872X A3349700X A334972X A334978W A33499791W A33499401C A334873A A3349872X A3349700X A334973Y A334978W A3349955V A3349555V A3349565X A3349414W A3349555V A3349565X A3349414R A3349799R A3349642T A3349355V A3349565X A3349414R A3349799R A3349642T A3349355V A3349565X A3349414R A3349799R A3349642T A33493413L A3349564W A3349555V A3349565X A3349431X A334972X A3349772X A3349413L A3349564W A3349656W A334966W A334968W A334968W A334968W A334968W A334968W A334968W A334968W A334968W A334968W					L 64.0	J 404.3	05.0	
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5 54.2 217.1 82.8 29.4 112.3 169.6 51.3 A3349971w A3349901C A3349873w A3349978w A3349971w A3349901C A3349873w A3349878w A3349979x A334978w A3349971w A334978w A3349971w A334978w A3349971w A334978w A3349971w A334971w A334971w A334978w A3349971w A334941w A3349565w A3349565w A3349565w A3349565w A3349565w A3349565w A3349565w A3349964w A334941w A3349970w A334941w A334941h A334964w A334941w A334948w A3349970w A334941w A334948w A334972c A334941w A344941w A34941w A3				95.1	32.5	127.6		
A3349791w A3349901c A3349873A A3349782X A3349709X A3349792X A3349792K A3349789k 1				95.3	33.5	128.8		
1 22.2 43.0 62.4 178.0 61.8 85.4 147.2 2 23.1 45.3 63.1 181.5 60.8 84.8 145.6 3 22.8 43.7 59.6 174.1 58.7 80.7 139.4 4 23.2 46.5 61.9 180.2 60.3 82.4 142.7 136.8 A3349555V A3349565X A3349414R A3349799R A3349642T A3349413L A3349564W 11250.2 257.9 17.3 34.9 310.2 55.8 1200.0 257.4 18.1 34.6 310.1 62.0 58.4 1234.2 261.2 18.1 34.6 310.1 62.0 58.4 1224.2 261.2 18.1 34.6 310.1 62.0 58.4 1224.2 261.2 18.1 34.6 313.9 53.8 53.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 1217.6 247.2 19.0 33.8 3495634 A33495354 A33495404 A33495639 A33495404 A33495404 A33495403 A33495404 A33495403 A33495404 A33495403 A33495404 A33495403 A33495404 A33495403 A33495404 A33495404 A33495403 A33495404 A	5		217.1	82.8	29.4	112.3	169.6	
2 23.1 45.3 63.1 181.5 60.8 84.8 145.6 4 423.2 46.5 61.9 180.2 60.3 82.4 142.7 5 21.4 44.8 60.7 178.1 56.1 80.7 139.4 4 125.6 11.9 180.2 60.3 82.4 142.7 5 21.4 44.8 60.7 178.1 56.1 80.7 136.8 1 1250.2 257.9 17.3 34.9 310.2 58.2 55.8 2 1300.0 257.4 18.1 34.6 310.1 62.0 58.4 3 1234.2 261.2 18.1 34.6 310.1 62.0 58.4 3 1234.2 261.2 18.1 34.6 310.1 62.0 58.4 3 1234.2 261.2 18.1 34.6 310.1 52.0 56.7 4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 56.7 1217.6 247.2 19.0 33.8 300.1 52.0 56.7 A3349416v A3349643v A3349883v A3349722T A3349727C A3349641k A3349639c 15.1 121.5 59.1 173.1 93.6 26.3 119.9 104.2 42.2 25.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0								
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5 21.4 44.8 60.7 178.1 56.1 80.7 136.8 A3349555V A3349565X A3349414R A3349799R A3349642T A3349413L A3349564W 1 1250.2 257.9 17.3 34.9 310.2 58.2 55.8 2 1300.0 257.4 18.1 34.6 310.1 62.0 58.4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 A3349416V A3349643V A3349483V A3349727T A3349777C A3349641R A334963V A3349483V A3349727T A3349777C A3349641R A3349639C 1 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 15.8 31.5 34.4 123.9 36.2 48.9 85.1 14.5 34.7 33.2 12.0 32.5 49.3 81.8 A349452V A3349882C A3349561R A3349885F A3349721R A33497478A A3349637X 1 916.2 139.3 NA NA 166.8 35.7 47.1 82.8 49.6 931.2 136.0 NA NA 158.7 32.8 49.6 49.21.3 150.2 NA NA 166.6 34.9 51.4 4921.3 150.2 NA NA 166.9 32.9 51.6 A3349470C A3349970K A3349870K A3349477X A3349710C A3349884 A3349567 A3349348C A3349770K A3349477X A3349710C A3349884 A3349567 A3349348C A3349470K A3349470K A3349881A A3349656F A33493610K A3349470K A3349881A A3349470K A3349881A A3349656F A33493610K A3349470K	3	22.8		59.6	174.1			139.4
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1 1250.2 257.9 17.3 34.9 310.2 58.2 55.8 4 1300.0 257.4 18.1 34.6 310.1 62.0 58.4 1234.2 261.2 18.1 34.6 310.1 62.0 58.4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 51.1 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 A3349416V A3349643V A3349483V A3349722T A3349727C A3349641R A3349639C 25.9 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 69.8 174.5 91.6 25.6 117.2 104.6 38.9 56.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 15.6 31.5 34.4 123.7 36.4 48.7 85.1 15.2 29.6 33.5 116.8 35.7 47.1 82.8 49.6 15.2 29.6 33.5 116.8 35.7 47.1 82.8 49.6 334.5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349835R A3349721R A334978A A3349637X 1 916.2 139.3 NA NA 166.8 34.9 31.2 136.0 NA NA 166.6 34.9 31.8 46.6 50.9 143.5 NA NA 166.6 34.9 91.2 139.3 150.2 NA NA 166.6 34.9 32.9 144.0 NA NA 166.6 34.9 92.1 3 150.2 NA NA 166.6 34.9 92.3 150.2 NA NA 166.9 32.9 51.6 A334979C A334977K A334977K A334977K A334977C A33498841 A3349762T A3349348C A334977YK A3349477X A3349710 A33498841 A3349562T A3349348C A334977YK A3349477X A3349710 A33498841 A3349567 A3349348C A334977YK A3349477X A3349478 A3349881A A3349566F A3349718A A33493491D A3349470C A3349881A A3349718A A33493491D A3349470C A3349881A A3349718A A33493491D A3349470C A3349881A A3349470C A3349881A A3349718A A3349341D A3349470C A3349881A A3349470C A3349881A A3349718A A3349341D A3349470C A3349881A A3349470C A3349881A A3349718A A3349366F A3349718A A3349366F A3349971B A3349470C A3349881A A3349470C A3349881A A3349470C A3349881A A3349718A A3349366F A33493491D A3349470C A3349881A A334	5					56.1		
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3 1234.2 261.2 18.1 34.6 313.9 53.8 53.7 4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 51217.6 247.2 19.0 33.8 300.1 59.2 56.7 A3349416V A3349643V A3349483V A3349722T A3349727C A3349641R A3349630C 1 59.1 173.1 93.6 26.3 119.9 104.2 42.2 2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 4 59.8 174.5 91.6 25.6 117.2 104.6 38.9 562.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 15.8 31.5 34.4 123.9 36.2 48.9 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A334948A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 34.9 931.2 136.0 NA NA 158.7 32.8 49.6 38.7 49.1 31.8 46.6 34.9 921.3 150.2 NA NA 166.6 34.9 921.3 150.2 NA NA NA 166.6 34.9 921.4 92.8 83.4 921.4 92.8 92.8 92.4 92.8 80.6 5.4 11.1 92.9 92.5 92.5 92.5 92.5 92.5 92.5 92.5			257.9	17.3				55.8
4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 A3349416V A3349643V A3349483V A3349722T A3349727C A3349641R A3349639C 2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349560R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.9 36.2 48.9 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 14.5 34.7 33.4 122.7 34.6 47.5 82.1 14.5 34.7 33.2 122.0 32.5 108.7 47.1 82.8 43349352V A3349882C A3349561R A3349833F A3349721R A3349478A A3349357X 1 1916.2 139.3 NA NA 161.8 31.8 46.6 47.5 82.1 1 1916.2 139.3 NA NA 161.8 31.8 46.6 6 34.9 51.4 91.3 15.2 29.6 NA NA 158.7 32.8 49.6 NA NA 158.7 32.8 49.6 NA NA 161.8 31.8 46.6 6 34.9 51.4 13.3 91.6 2 8.9 13.9 42.8 67.5 18.4 13.3 99.4 27.9 13.9 34.6 20.2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 18.4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 13.1 22.0 25.8 77.3 18.7 26.7 17.7 18.4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 11.1 12.0 25.8 77.3 18.7 26.7 17.7 18.4 13.1 22.0 25.8 77.3 18.7 26.7 17.7 18.4 13.1 22.0 25.8 77.3 18.7 26.7 17.7 18.6 26.2 44.8 13.1 22.0 25.8 77.3 18.7 26.7 47.8 18.4 13.1 24.3 28.7 28.7 28.7 28.7 28.7 28.7 28.9 13.9 42.8 67.5 18.4 13.1 22.0 25.8 77.3 18.7 26.7 48.8 14.1 11.1 22.0 25.9 77.7 18.6 26.2 44.8 13.1 24.3 28.7 28.7 28.7 28.7 28.7 28.7 28.7 28.7	2	1300.0	257.4		34.6	310.1	62.0	58.4
4 1265.0 266.1 18.9 35.2 320.2 57.9 56.9 1217.6 247.2 19.0 33.8 300.1 59.2 56.7 A3349416V A3349643V A3349483V A3349722T A3349727C A3349641R A3349639C 2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.9 36.2 48.9 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 35.1 16.8 35.7 47.1 82.8 4 15.2 35.2 35.2 136.0 NA NA 165.8 31.5 34.4 122.7 34.6 47.5 82.1 19.9 36.2 48.9 85.1 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349833F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 34.9 51.4 91.3 150.2 NA NA 165.8 31.5 34.4 122.7 34.6 47.5 82.1 1 19.6 31.8 46.6 34.9 51.4 34.5 34.7 33.2 122.0 32.5 49.3 81.8 46.6 34.9 51.4 34.5 34.7 33.9 34.5 44.0 NA 165.8 34.7 32.8 49.6 33.8 70.1 43.5 NA NA 165.8 34.9 51.4 34.9 51.4 34.9 34.9 51.4 34.9 34.9 51.4 34.9 34.9 51.4 34.9 34.9 51.4 34.9 34.9 51.4 34.9 34.9 51.6 A3349479C A334977K A3349477X A3349719C A33498841 A3349567T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 34.9 51.6 A3349480L A3349476A A3349477X A3349719C A33498841 A3349578A A3349348C 1 13.9 99.4 27.9 15.2 43.1 67.9 18.4 41.1 12.9 99.7 18.6 67.7 17.7 41.1 11.1 22.0 25.8 77.3 18.7 26.7 17.7 18.6 26.2 44.8 34.9 46.8 11.1 22.0 25.8 77.3 18.7 26.7 44.8 34.9 44.1 11.1 22.0 25.8 77.3 18.7 26.7 44.8 34.9 44.1 11.1 22.0 25.8 77.7 18.6 26.2 44.8 34.9 44.1 11.1 22.0 25.9 77.7 18.6 26.2 44.8 34.9 44.1 11.1 22.0 25.9 77.7 18.6 26.2 47.8 24.1 11.1 22.0 25.9 77.7 18.6 26.2 47.8 24.1 11.1 22.0 25.8 77.7 19.5 27.3 46.8 24.9 27.9 15.2 43.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.4 45.1 67.9 18.6 18.9 18.9 18.9 18.9 18.9 18.9 18.9 18.9	3		261.2	18.1	34.6	313.9	53.8	53.7
5         1217.6         247.2         19.0         33.8         300.1         59.2         56.7           1         59.1         173.1         93.6         26.3         119.9         104.2         42.2           2         59.2         179.5         95.3         27.1         122.5         110.2         42.1           3         59.8         167.3         85.2         24.3         109.6         96.7         38.5           4         59.8         174.5         91.6         25.6         117.2         104.6         38.9           5         62.2         178.1         85.2         23.5         108.7         92.5         39.5           4         59.8         13.6         3349563V         A334950R         A3349566A         A3349417W           1         15.6         31.6         34.4         123.7         36.4         48.7         85.1           2         15.8         31.5         34.4         123.7         36.2         48.9         85.1           3         15.2         35.2         33.4         122.7         34.6         47.5         82.1           4         15.2         35.2         33.4         12	4	1265.0	266.1		35.2	320.2	57.9	56.9
A3349416V A3349643V A3349483V A3349722T A3349777C A3349641R A3349639C 1 59.1 173.1 93.6 26.3 119.9 104.2 42.1 2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A334960L A3349566A A3349417W 1 15.6 31.6 31.6 34.4 123.7 36.4 48.7 85.1 2 15.8 31.5 34.4 123.7 36.4 48.7 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 34.9 931.2 139.3 NA NA 161.8 31.8 46.6 34.9 91.4 921.3 150.2 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 A921.3 150.2 NA NA 166.6 34.9 51.4 A921.3 150.2 NA NA 166.9 32.9 51.6 A3349479C A334979K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 27.9 55.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 44.8 11.5 22.7 25.9 77.7 18.6 26.2 44.8 44.8 11.5 22.7 25.9 77.7 18.6 26.2 44.8 24.8 49.8 11.5 22.7 25.9 77.7 18.6 26.2 44.8 24.8 49.1 12.9 25.9 77.7 18.6 26.2 44.8 24.8 24.8 24.8 25.5 6 12.1 105.9 18.7 20.3 55.0 14.8 2.3 5.7 11.7 99.7 18.6 19.6	5	1217.6	247.2	19.0	33.8	300.1	59.2	56.7
1 59.1 173.1 93.6 26.3 119.9 104.2 42.2 2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 4 59.8 174.5 91.6 25.6 117.2 104.6 38.9 5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 166.6 34.9 51.4 4 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 66.5 12.8 97.3 27.4 14.1 1 15.5 66.5 17.8 A334968NA A3349654A A3349881A A334910F A3349481R A3349718A A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 49.8 A3349636N 1 486.3 83.5 6.0 11.3 100.8 15.2 44.8 A3349636N 1 486.3 83.5 6.0 11.3 100.8 15.2 47.8 A3349638A A3349654A A334999L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 47.8 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 65.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 65.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 65.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 65.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 65.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A334936NW 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 5.9 10.5 10.5 10.5 10.5 10.5 10.5 10.5 10.5		A3349416V	A3349643V	A3349483V	A3349722T	A3349727C	A3349641R	A3349639C
2 59.2 179.5 95.3 27.1 122.5 110.2 42.1 3 59.8 167.3 85.2 24.3 109.6 96.7 38.5 4 59.8 174.5 91.6 25.6 117.2 104.6 38.9 5 62.2 178.1 85.2 23.5 108.7 92.5 39.5 A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 2 15.8 31.5 34.4 123.7 36.4 48.7 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A334983F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 41.8 41.8 41.8 41.8 41.8 41.8 41.8 4	1			93.6	26.3	119.9		42.2
\$ 159.8	2	59.2	179.5	95.3	27.1	122.5	110.2	42.1
4       59.8       174.5       91.6       25.6       117.2       104.6       38.9         5       62.2       178.1       85.2       23.5       108.7       92.5       39.5         A3349415T       A3349369F       A3349563V       A3349560L       A3349566A       A3349466A       A3349466A       A3349466A       A3349466A       A3349466A       A3349466A       A3349466A       A3349466A       A3349466A       A334946C       A3349477A       A3349477A       A3349477A       A3349771A       A3349886A       A3349886A       A3349886A       A334986AC       A3349477A       A3349477A       A3349477A       A3349477A       A3349477A		59.8		85.2	24.3	109.6		38.5
5         62.2         178.1         85.2         23.5         108.7         92.5         39.5           A3349415T         A3349349F         A3349350R         A3349640L         A3349566A         A3349417W           1         15.6         31.6         34.4         123.7         36.4         48.7         85.1           2         15.8         31.5         34.4         123.9         36.2         48.9         85.1           3         15.2         29.6         33.5         116.8         35.7         47.1         82.8           4         15.2         35.2         33.4         122.7         34.6         47.5         82.1           5         14.5         34.7         33.2         122.0         32.5         49.3         81.8           A3349352V         A3349882C         A3349561R         A3349883F         A3349478A         A3349478A         A3349478A         A3349478A         A3349478A         A3349478A         A3349478A         A3349478A         A349496A         38.7         32.8         49.6         38.7         32.8         49.6         39.2         36.6         34.9         51.4         49.2         33.3         14.0         NA         NA         NA	4		174.5	91.6	25.6	117.2		38.9
A3349415T A3349349F A3349563V A3349350R A3349640L A3349566A A3349417W 1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 12.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 172.9 34.6 50.9 5 883.2 144.0 NA NA 172.9 34.6 50.9 5 883.2 144.0 NA NA 172.9 34.6 50.9 5 883.2 144.0 NA NA 165.9 32.9 51.6 A3349479C A334977K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.2 19.5 27.3 46.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 55.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A334999L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 4 515.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6		62.2	178.1	85.2	23.5	108.7	92.5	39.5
1 15.6 31.6 34.4 123.7 36.4 48.7 85.1 2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 31.5 2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA NA 165.9 32.9 51.6 A3349479C A334977K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A334949DL A3349902A A3349432V A334965FA A3349361M A3349902A A3349342V A334966FA A3349361M A3349902A A3349432V A334966FA A3349361M A33494902A A3349342V A334966FA A3349361M A3349491 A3349902A A3349432V A334966FA A3349361M A33494902A A3349342V A334966FA A3349361M A33494902A A3349432V A334966FA A3349361M A33494732 A3349368 A3349654A A334949DL A3349902A A3349432V A334966FA A3349361M A334941 82.3 5.2 11.2 98.7 17.4 18.1 45.5 6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6					A3349350R			A3349417W
2 15.8 31.5 34.4 123.9 36.2 48.9 85.1 3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA NA 172.9 34.6 50.9 5 883.2 144.0 NA NA 165.9 32.9 51.6 A3349479C A3349797K A3349477X A3349719C A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 11.1 22.0 25.8 77.3 18.7 26.7 45.4 11.1 1.1 22.0 25.8 77.3 18.7 26.7 45.4 11.1 1.1 22.0 25.8 77.3 18.7 26.7 45.4 13.1 24.3 28.7 84.4 22.6 25.2 44.8 13.1 24.3 28.7 84.4 22.6 25.2 47.8 13.0 23.6 27.7 25.9 77.7 18.6 26.2 44.8 4.3349638A A3349654A A3349499L A3349902A A334932V A3349656F A334936IW 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 4.5 515.6 88.2 5.6 12.1 105.9 18.7 20.3 501.4 82.3 5.7 11.7 99.7 18.6 19.6	1		31.6	34.4	123.7	36.4	48.7	
3 15.2 29.6 33.5 116.8 35.7 47.1 82.8 4 15.2 35.2 33.4 122.7 34.6 47.5 82.1 5 14.5 34.7 33.2 122.0 32.5 49.3 81.8 A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 1 916.2 139.3 NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 921.3 150.2 NA NA 166.6 34.9 51.4 921.3 150.2 NA NA 165.9 32.9 51.6 A3349479C A334977K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349411F A3349481R A3349718A A3349411J 11.1 22.0 25.8 77.3 18.7 26.7 45.4 5 11.7 21.9 25.9 77.2 19.5 27.3 46.8 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 45.5 6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	2	15.8	31.5	34.4	123.9	36.2	48.9	85.1
4       15.2       35.2       33.4       122.0       32.5       49.3       81.8         A3349352V       A3349882C       A3349561R       A3349883F       A3349721R       A3349478A       A3349637X         1       916.2       139.3       NA       NA       161.8       31.8       46.6         2       931.2       136.0       NA       NA       158.7       32.8       49.6         3       887.0       143.5       NA       NA       166.6       34.9       51.4         4       921.3       150.2       NA       NA       165.9       32.9       51.6         A3349479C       A334977K       A3349477X       A3349719C       A3349884J       A3349562T       A3349348C         1       13.3       91.6       28.9       13.9       42.8       67.5       18.4         2       12.7       95.0       30.6       14.7       45.3       69.7       17.7         4       13.9       99.4       27.9       15.2       43.1       67.9       18.4         5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476w       <								
5       14.5       34.7       33.2       122.0       32.5       49.3       81.8         A3349352V       A3349882C       A3349561R       A3349883F       A3349721R       A3349478A       A3349637X         1       916.2       139.3       NA       NA       161.8       31.8       46.6         2       931.2       136.0       NA       NA       158.7       32.8       49.6         3       887.0       143.5       NA       NA       166.6       34.9       51.4         4       921.3       150.2       NA       NA       172.9       34.6       50.9         5       883.2       144.0       NA       NA       165.9       32.9       51.6         A3349479C       A334977K       A3349477X       A3349719C       A3349884J       A3349562T       A3349348C         1       13.3       91.6       28.9       13.9       42.8       67.5       18.4         2       12.7       95.0       30.6       14.7       45.3       69.7       17.7         3       12.9       99.2       30.5       14.5       45.1       60.7       17.7         4       13.9       99.4	4	15.2	35.2	33.4	122.7	34.6	47.5	82.1
A3349352V A3349882C A3349561R A3349883F A3349721R A3349478A A3349637X 916.2 139.3 NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 165.9 32.9 51.6 A3349479C A3349797K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.2 19.5 27.3 46.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A334999L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 5 55.6 88.2 5.6 12.1 105.9 18.7 20.3 501.4 82.3 5.7 11.7 99.7 18.6 19.6				33.2	122.0	32.5	49.3	81.8
1 916.2 139.3 NA NA 161.8 31.8 46.6 2 931.2 136.0 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 166.6 34.9 51.4 5 883.2 144.0 NA NA 165.9 32.9 51.6 A3349479C A334979K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 45.5 66.5 17.4 18.1 5 55.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	_			A3349561R				A3349637X
2 931.2 136.0 NA NA 158.7 32.8 49.6 3 887.0 143.5 NA NA 166.6 34.9 51.4 4 921.3 150.2 NA NA 172.9 34.6 50.9 5 883.2 144.0 NA NA 165.9 32.9 51.6 A3349479C A334977K A3349477X A3349719C A3349884J A3349562T A3349348C 1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A334941J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 5 55.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	1							
3       887.0       143.5       NA       NA       166.6       34.9       51.4         4       921.3       150.2       NA       NA       172.9       34.6       50.9         5       883.2       144.0       NA       NA       165.9       32.9       51.6         A3349479C       A3349797K       A3349477X       A3349719C       A3349884J       A3349562T       A3349348C         1       13.3       91.6       28.9       13.9       42.8       67.5       18.4         2       12.7       95.0       30.6       14.7       45.3       69.7       17.7         3       12.9       99.2       30.5       14.5       45.1       60.7       17.7         4       13.9       99.4       27.9       15.2       43.1       67.9       18.4         5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476w       A3349881A       A3349481R       A3349718A       A3349911J         1       11.1       22.0       25.8       77.3       18.6       26.2       45.4         2       11.7       21.9       25.9	2			NA	NA			
4       921.3       150.2       NA       NA       172.9       34.6       50.9         5       883.2       144.0       NA       NA       NA       165.9       32.9       51.6         A3349479C       A3349797K       A3349477X       A3349719C       A3349884J       A3349562T       A3349348C         1       13.3       91.6       28.9       13.9       42.8       67.5       18.4         2       12.7       95.0       30.6       14.7       45.3       69.7       17.7         3       12.9       99.2       30.5       14.5       45.1       60.7       17.7         4       13.9       99.4       27.9       15.2       43.1       67.9       18.4         5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476W       A3349881A       A3349481R       A3349718A       A3349411J         1       11.1       22.0       25.8       77.3       18.6       26.7       45.4         2       11.7       21.9       25.9       77.7       18.6       26.2       44.8         3       11.5       22.7						166.6		51.4
5       883.2       144.0       NA       NA       165.9       32.9       51.6         A3349479C       A3349797K       A3349477X       A3349719C       A3349884J       A3349562T       A3349348C         1       13.3       91.6       28.9       13.9       42.8       67.5       18.4         2       12.7       95.0       30.6       14.7       45.3       69.7       17.7         3       12.9       99.2       30.5       14.5       45.1       60.7       17.7         4       13.9       99.4       27.9       15.2       43.1       67.9       18.4         5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476W       A3349881A       A3349410F       A3349481R       A3349718A       A3349411J         1       11.1       22.0       25.8       77.3       18.7       26.7       45.4         2       11.7       21.9       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6 <td>4</td> <td>921.3</td> <td></td> <td></td> <td></td> <td>172.9</td> <td>34.6</td> <td>50.9</td>	4	921.3				172.9	34.6	50.9
A3349479C A3349797K A3349477X A3349719C A3349884J A3349562T A3349348C  1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 3 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 4 515.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	5	883.2						51.6
1 13.3 91.6 28.9 13.9 42.8 67.5 18.4 21.7 95.0 30.6 14.7 45.3 69.7 17.7 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A334949L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 4 515.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	_							A3349348C
2 12.7 95.0 30.6 14.7 45.3 69.7 17.7 12.9 99.2 30.5 14.5 45.1 60.7 17.7 4 13.9 99.4 27.9 15.2 43.1 67.9 18.4 5 12.8 97.3 27.4 14.1 41.5 66.5 17.8 A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J 1 11.1 22.0 25.8 77.3 18.7 26.7 45.4 2 11.7 21.9 25.9 77.2 19.5 27.3 46.8 3 11.5 22.7 25.9 77.7 18.6 26.2 44.8 4 13.1 24.3 28.7 84.4 22.6 25.2 47.8 5 13.0 23.6 27.7 82.1 22.6 25.6 48.2 A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W 1 486.3 83.5 6.0 11.3 100.8 15.2 16.0 2 492.8 80.6 5.4 11.1 97.1 17.2 19.0 3 494.1 82.3 5.2 11.2 98.7 17.4 18.1 4 515.6 88.2 5.6 12.1 105.9 18.7 20.3 5 501.4 82.3 5.7 11.7 99.7 18.6 19.6	1		04.0	20.0		40.0		
3       12.9       99.2       30.5       14.5       45.1       60.7       17.7         4       13.9       99.4       27.9       15.2       43.1       67.9       18.4         5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476W       A3349881A       A3349410F       A3349481R       A3349718A       A3349411J         1       11.1       22.0       25.8       77.3       18.7       26.7       45.4         2       11.7       21.9       25.9       77.2       19.5       27.3       46.8         3       11.5       22.7       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6       27.7       82.1       22.6       25.6       48.2         A3349638A       A3349654A       A3349499L       A3349902A       A3349432V       A3349656F       A3349361W         1       486.3       83.5       6.0       11.3       100.8       15.2       16.0         2       492.8       80.6	2							
5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476W       A3349881A       A3349410F       A3349481R       A3349718A       A3349411J         1       11.1       22.0       25.8       77.3       18.7       26.7       45.4         2       11.7       21.9       25.9       77.2       19.5       27.3       46.8         3       11.5       22.7       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6       27.7       82.1       22.6       25.6       48.2         A3349638A       A3349654A       A3349499L       A3349902A       A3349432V       A3349656F       A3349361W         1       486.3       83.5       6.0       11.3       100.8       15.2       16.0         2       492.8       80.6       5.4       11.1       97.1       17.2       19.0         3       494.1       82.3       5.2       11.2       98.7       17.4       18.1         4       515.6       88.2	3	12.9						
5       12.8       97.3       27.4       14.1       41.5       66.5       17.8         A3349480L       A3349476W       A3349881A       A3349410F       A3349481R       A3349718A       A3349411J         1       11.1       22.0       25.8       77.3       18.7       26.7       45.4         2       11.7       21.9       25.9       77.2       19.5       27.3       46.8         3       11.5       22.7       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6       27.7       82.1       22.6       25.6       48.2         A3349638A       A3349654A       A3349499L       A3349902A       A3349432V       A3349656F       A3349361W         1       486.3       83.5       6.0       11.3       100.8       15.2       16.0         2       492.8       80.6       5.4       11.1       97.1       17.2       19.0         3       494.1       82.3       5.2       11.2       98.7       17.4       18.1         4       515.6       88.2	4							
A3349480L A3349476W A3349881A A3349410F A3349481R A3349718A A3349411J  1	5			27 4		41 5		
1       11.1       22.0       25.8       77.3       18.7       26.7       45.4         2       11.7       21.9       25.9       77.2       19.5       27.3       46.8         3       11.5       22.7       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6       27.7       82.1       22.6       25.6       48.2         A3349638A       A3349654A       A3349499L       A3349902A       A3349432V       A3349656F       A3349361W         1       486.3       83.5       6.0       11.3       100.8       15.2       16.0         2       492.8       80.6       5.4       11.1       97.1       17.2       19.0         3       494.1       82.3       5.2       11.2       98.7       17.4       18.1         4       515.6       88.2       5.6       12.1       105.9       18.7       20.3         5       501.4       82.3       5.7       11.7       99.7       18.6       19.6	•					Δ3349481R		
3       11.5       22.7       25.9       77.7       18.6       26.2       44.8         4       13.1       24.3       28.7       84.4       22.6       25.2       47.8         5       13.0       23.6       27.7       82.1       22.6       25.6       48.2         A3349638A       A3349654A       A3349499L       A3349902A       A3349432V       A3349656F       A3349361W         1       486.3       83.5       6.0       11.3       100.8       15.2       16.0         2       492.8       80.6       5.4       11.1       97.1       17.2       19.0         3       494.1       82.3       5.2       11.2       98.7       17.4       18.1         4       515.6       88.2       5.6       12.1       105.9       18.7       20.3         5       501.4       82.3       5.7       11.7       99.7       18.6       19.6	1		22 0				26.7	
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5     13.0     23.6     27.7     82.1     22.6     25.6     48.2       A3349638A     A3349654A     A3349499L     A3349902A     A3349432V     A3349656F     A3349361W       1     486.3     83.5     6.0     11.3     100.8     15.2     16.0       2     492.8     80.6     5.4     11.1     97.1     17.2     19.0       3     494.1     82.3     5.2     11.2     98.7     17.4     18.1       4     515.6     88.2     5.6     12.1     105.9     18.7     20.3       5     501.4     82.3     5.7     11.7     99.7     18.6     19.6	3							
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A3349638A A3349654A A3349499L A3349902A A3349432V A3349656F A3349361W  1	5			27.7		22.6	25.6	
1     486.3     83.5     6.0     11.3     100.8     15.2     16.0       2     492.8     80.6     5.4     11.1     97.1     17.2     19.0       3     494.1     82.3     5.2     11.2     98.7     17.4     18.1       4     515.6     88.2     5.6     12.1     105.9     18.7     20.3       5     501.4     82.3     5.7     11.7     99.7     18.6     19.6	,					Δ3349432\/	Δ3349656E	
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                              NA
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                                             NA
                                                    NA
                                                            NA
                                                                   NA
                                                                           NA
                                                                                  NA
      3357.8
               NA
                       NA
                              NA
                                      NA
                                             NA
                                                    NA
                                                            NA
                                                                   NA
                                                                           NA
                                                                                  NA
4
      3486.8
               NA
                       NA
                              NA
                                      NA
                                             NA
                                                    NA
                                                            NA
                                                                   NA
                                                                           NA
                                                                                  NA
      3355.9
               NA
                       NA
                              NA
                                      NA
                                             NA
                                                    NA
                                                            NA
                                                                   NA
                                                                           NA
                                                                                  NA
                    / getOption("max.print") -- omitted 1 rows ]
 [ reached 'max'
```

### Code:

library(xlsx)

retaildata <- xlsx::read.xlsx("C:/Users/User/Downloads/retail.xlsx", sheetIndex = 1, startRow = 2)

head(retaildata)

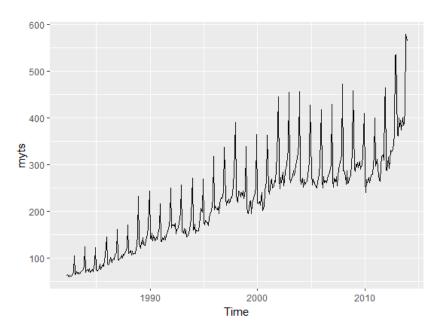
# Q3(b) Select one of the time series as follows (but replace the column name with your own chosen column:

```
> myts
                                      Feb
                                                                                                                           Jul
                                                                                                                                                                               0ct
                     Jan
                                                       Mar
                                                                        Apr
                                                                                         May
                                                                                                          Jun
                                                                                                                                             Aug
                                                                                                                                                              Sep
                                                                                                                                                                                                Nov
                                                                                                                                                                                                                  Dec
                                                                                                                                                                            62.1
74.9
                                                                     62.4
65.3
                                                                                                        59.6
                                                                                                                                          60.7
 1982
                                                                                      63.1
                                                                                                                         61.9
                                                                                                                                                            61.2
                                                                                                                                                                                              68.3
                                                                                                                                                                                                           104.0
 1983
                                                                                                        65.7
                                                                                                                                                                                                           122.8
                                   64.8
                                                     70.0
                                                                                      68.9
                                                                                                                         66.9
                                                                                                                                                            71.6
                                                                                                                                                                                              83.4
                  63.9
                                                                                                                                          70.4
                                                                     70.2
 1984
                  69.0
                                   71.8
                                                    74.9
                                                                                                       68.7
                                                                                                                         70.1
                                                                                                                                          74.6
                                                                                                                                                           70.6
                                                                                                                                                                            80.5
                                                                                                                                                                                              87.2
                                                                                                                                                                                                           121.3
                                                                                      76.6
                                                    75.7
 1985
                  73.3
                                   71.1
                                                                     76.0
                                                                                                       75.2
                                                                                                                         83.4
                                                                                                                                          85.3
                                                                                                                                                            81.3
                                                                                                                                                                            93.9
                                                                                                                                                                                          104.7 143.8
                                                                                      86.1
 1986
                  88.5
                                   85.2
                                                    86.2
                                                                     92.4 100.9
                                                                                                       90.1
                                                                                                                        96.1
                                                                                                                                          97.2
                                                                                                                                                           96.8 107.7 110.9 161.0
 1987 98.1 94.5 97.7 99.3 106.3 98.5 107.1 105.9 108.5 117.1 121.4 170.1 1988 109.0 110.7 115.5 105.7 114.3 107.5 108.8 109.6 118.4 125.5 151.8 232.4
 1989 129.4 120.6 133.2 129.3 142.8 127.6 126.0 136.7 144.5 147.8 168.4 242.6
1990 141.2 139.8 152.1 135.8 148.0 135.8 138.7 144.8 139.9 151.6 163.9 215.8 1991 135.1 135.5 142.4 137.3 146.5 137.6 147.0 152.9 157.5 169.3 184.8 250.1 1992 164.4 169.8 171.0 167.5 173.2 150.8 160.9 164.5 173.6 182.7 196.9 255.5
 1993 156.1 152.6 162.0 151.5
                                                                                   160.5 144.9 147.0 151.5 161.6 169.4 186.7 270.1
1993 156.1 152.6 162.0 151.5 160.5 144.9 147.0 151.5 161.6 169.4 186.7 270.1 1994 159.6 161.0 171.3 152.6 159.5 157.4 156.9 169.6 186.2 206.3 198.3 269.5 1995 176.6 170.8 179.7 174.9 174.9 169.1 184.9 192.5 201.5 210.5 227.9 316.5 1996 202.2 210.0 204.5 203.3 209.4 194.8 215.7 228.6 226.6 229.8 242.6 336.5 1997 228.4 212.9 222.3 217.2 225.4 217.2 228.2 227.9 234.9 257.6 280.7 390.1 1998 235.6 224.4 219.1 242.2 239.6 230.5 240.5 233.9 242.7 227.3 243.9 337.8 1999 211.2 197.0 194.3 218.5 222.6 195.0 215.2 222.7 232.6 236.7 252.2 364.6 2000 219.2 215.2 221.0 212.6 228.6 239.4 201.0 211.4 241.1 253.9 261.2 362.6 2001 244.9 236.1 249.7 263.4 268.1 248.9 253.3 266.0 262.2 291.6 316.8 445.0 2002 268.6 248.4 272.4 261.5 283.1 254.4 265.3 284.9 291.2 299.7 332.0 454.8 2003 271.8 261.3 266.7 275.8 287.3 277.5 285.4 297.1 314.4 323.0 346.5 456.0 2004 268.5 256.8 270.7 250.9 266.4 255.2 261.0 263.9 276.3 291.2 304.8 427.0 2005 279.4 255.7 268.3 260.6 260.1 254.4 249.9 262.4 269.9 277.8 303.0 417.3
 2005 279.4 255.7 268.3 260.6 260.1 254.4 249.9 262.4 269.9 277.8 303.0 417.3
 2006 265.8 248.7 273.1 261.0 266.3 260.4 268.3 275.9 278.2 284.1 299.2 429.1 2007 266.0 251.1 269.9 261.7 273.7 254.8 275.2 290.4 306.7 309.8 324.3 472.0
2007 266.0 251.1 269.9 261.7 273.7 254.8 275.2 290.4 306.7 309.8 324.3 472.0 2008 285.9 286.8 275.3 257.2 285.8 259.7 261.2 273.4 275.2 300.5 323.5 457.3 2009 290.8 285.2 300.6 294.4 304.9 292.5 305.3 289.1 296.2 298.6 321.0 408.9 2010 266.2 240.0 267.5 260.7 272.8 260.5 268.5 277.0 278.7 279.0 319.3 400.2 2011 296.2 302.5 310.8 274.8 267.0 263.8 294.6 317.8 320.4 308.6 427.5 463.9 2012 288.6 287.1 315.6 291.2 309.3 330.0 327.0 331.1 344.6 366.0 534.2 535.4 2013 364.5 360.1 400.3 379.4 395.1 373.6 400.1 384.1 388.4 418.2 577.9 564.3
```

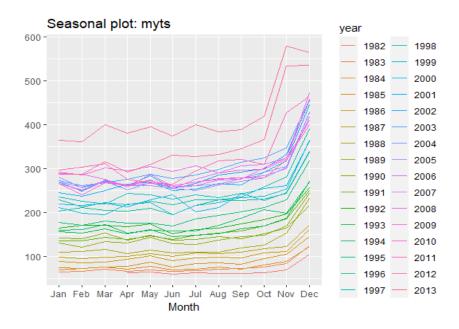
```
myts <- ts(retaildata[,"A3349873A"], frequency=12, start=c(1982,4)) head(myts)
```

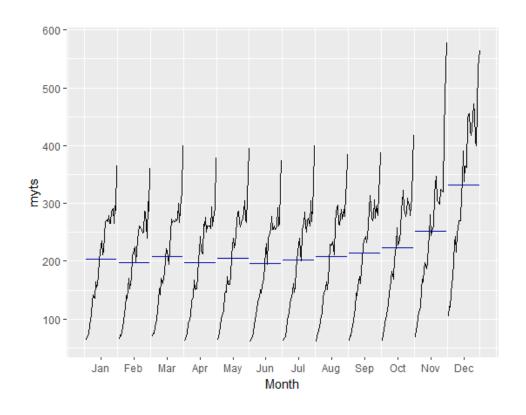
# Q3(c) Explore your chosen retail time series using the following functions: autoplot, ggseasonplot, ggsubseriesplot, gglagplot, ggAcf

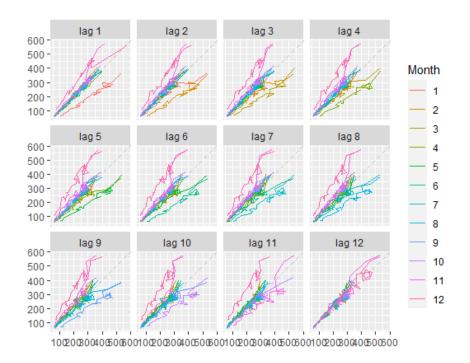
Can you spot any seasonality, cyclicity, and trend? What do you learn about the series?

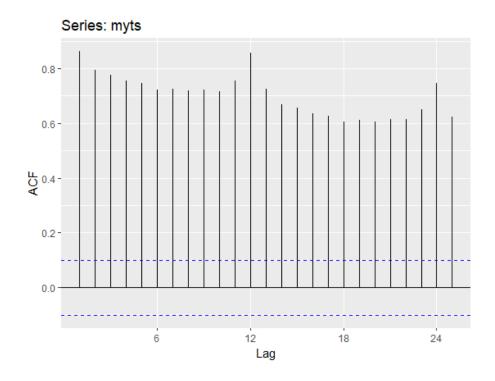


**Comment:** From what I can gather, the time series I chose is for electronic and electrical goods retailing in New South Wales. There has been an overall upward trend with a spike in 2009.I am seeing some seasonality and not so much a cyclicity. I say this because there's a frequency to changes that occur.









**Comment:** The plots show that there are definite seasonality. The monthly average is about the same and jumps in December. Lag 12 jumps out at me as it looks very different from the others. They all show a positive relationship. The ACF plot blows my "overall trend" theory as it does not show this, although it shows the seasonality.

### Code:

autoplot(myts)

ggseasonplot(myts)

ggsubseriesplot(myts)

Code:

help(bicoal)

help(chicken)

help(dole)

help(usdeaths)

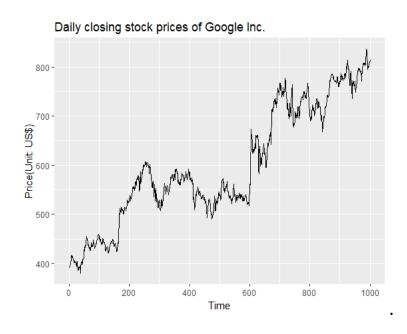
help(lynx)

help(goog)

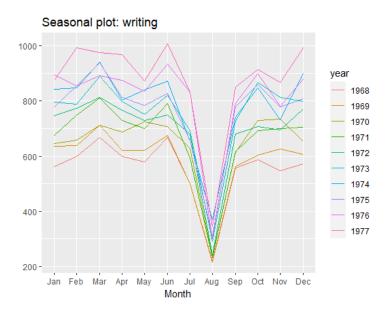
```
help(writing)
help(fancy)
help(a10)
help(h02)

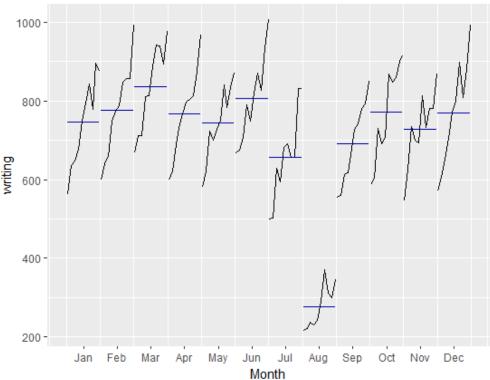
autoplot(goog) +
   ggtitle("Daily closing stock prices of Google Inc.") +
   xlab("Time") +
   ylab("Price(Unit: US$)")
gglagplot(myts, lags = 12)ggAcf(myts)
```

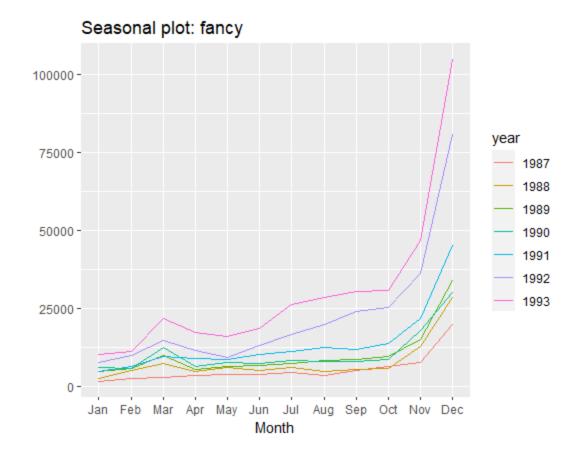
**Q4.** Create time plots of the following times series: bicoal, chicken, dole, usdeaths, lynx, goog, writing, fancy, a10, h02

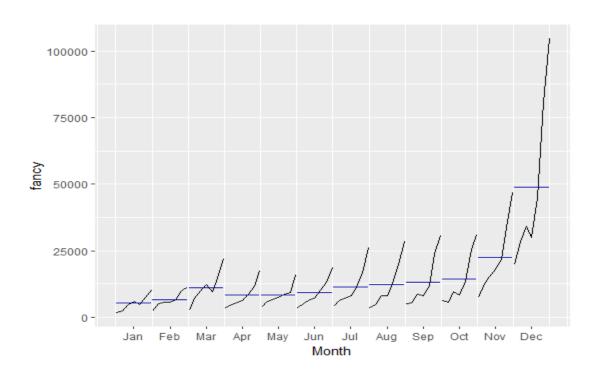


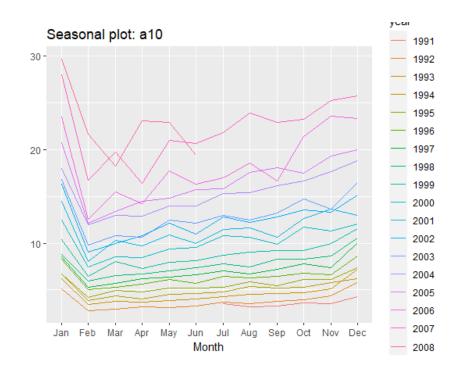
**Q5.** Use the ggseasonplot and ggsubseriesplot functions to explore the seasonal patterns in the following time series: writing, fancy, a10, h02.

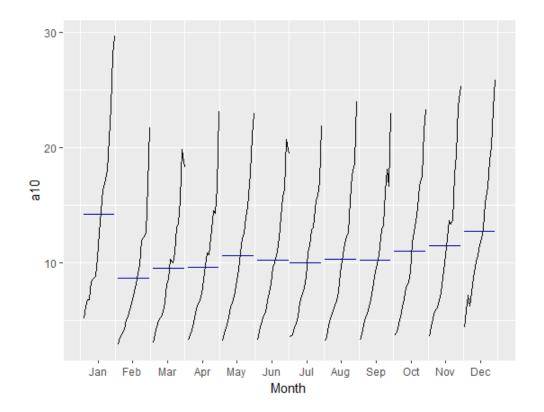


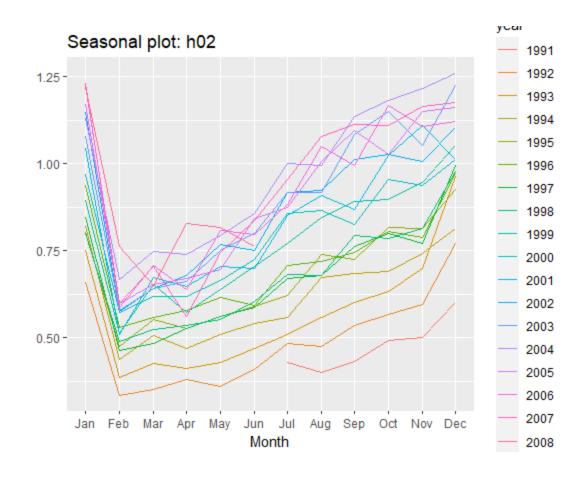


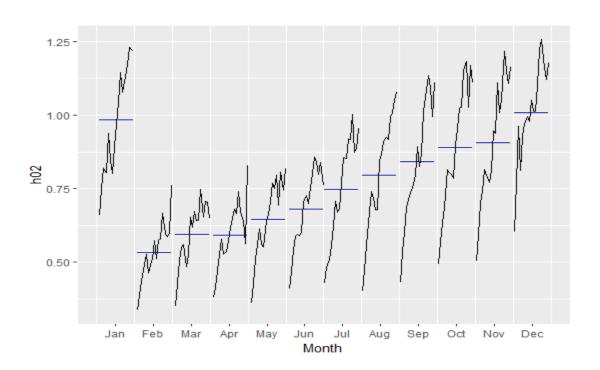












### Codes:

ggseasonplot(writing)

ggsubseriesplot(writing)

# The sales amount of paper falls down in August annually

ggseasonplot(fancy)

ggsubseriesplot(fancy)

# In December, 1992 the monthly sales for a souvenir shop increased dramatically compared to the same month of the last year

ggseasonplot(a10)

ggsubseriesplot(a10)

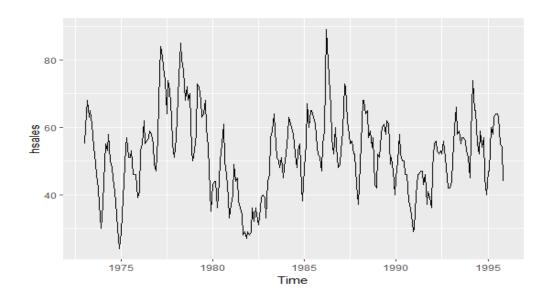
# The amount of antidiabetes monthly scripts falls down in February annually

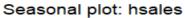
ggseasonplot(h02)

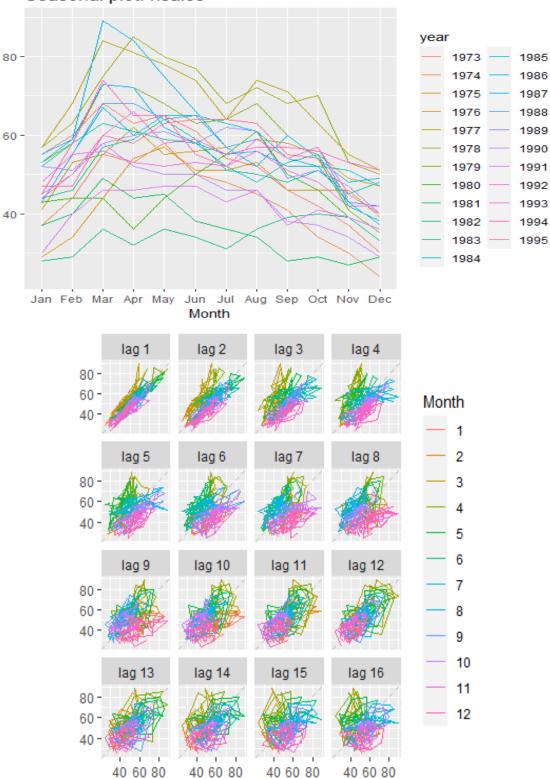
ggsubseriesplot(h02)

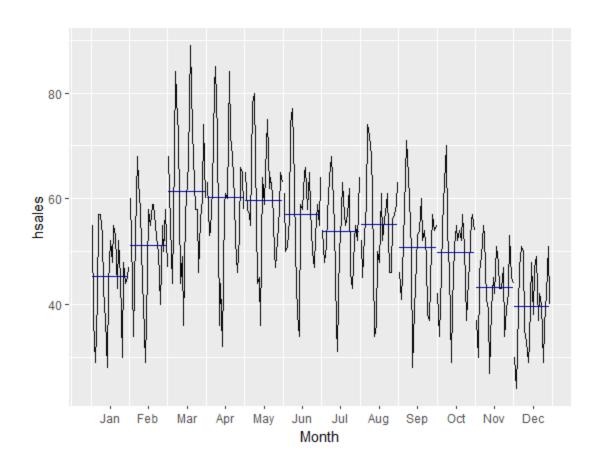
# The amount of corticosteroid monthly scripts also falls down in February annually

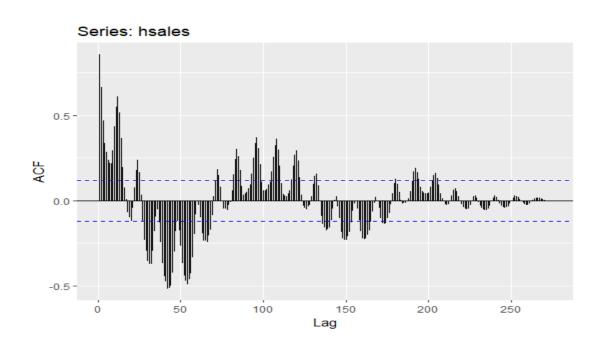
**Q6.** Can you spot any seasonality, cyclicity and trend? What do you learn about the series?









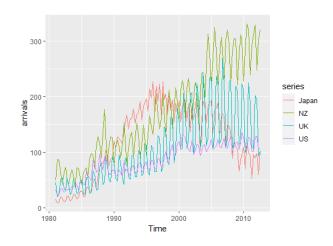


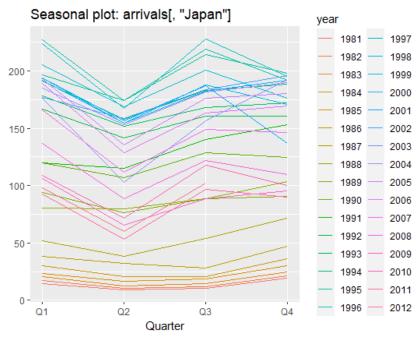
We can spot seasonality and cyclicity. The cycle period is about 4 years (100 months) for hsales. can spot little seasonality and strong trend for bricksq. can spot strong cyclicity for sunspotarea. The number of weeks is 52 and it looked like it is too much for subseries plot in gasoline data. We can spot seasonality and trend.

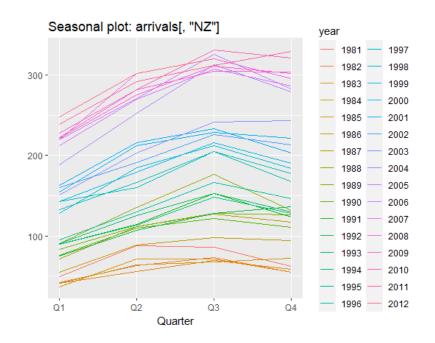
```
autoplot(hsales)
ggseasonplot(hsales)
ggsubseriesplot(hsales)
gglagplot(hsales)
ggAcf(hsales, lag.max = 400)
autoplot(usdeaths)
ggseasonplot(usdeaths)
ggsubseriesplot(usdeaths)
gglagplot(usdeaths)
ggAcf(usdeaths, lag.max = 60)
autoplot(bricksq)
ggseasonplot(bricksq)
ggsubseriesplot(bricksq)
gglagplot(bricksq)
ggAcf(bricksq, lag.max = 200)
autoplot(sunspotarea)
gglagplot(sunspotarea)
ggAcf(sunspotarea, lag.max = 50)
autoplot(gasoline)
ggseasonplot(gasoline)
```

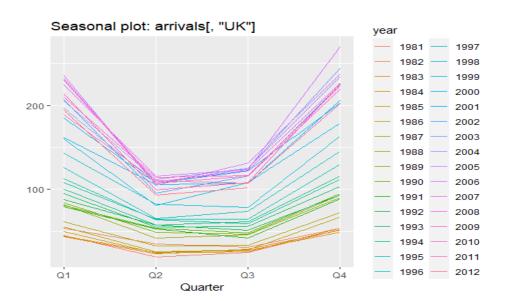
gglagplot(gasoline)
ggAcf(gasoline, lag.max = 1000)

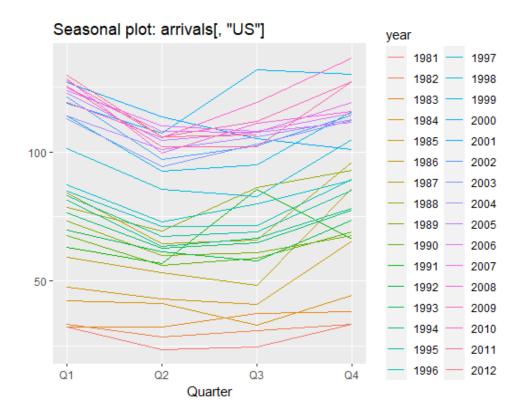
**Q7.** The arrivals data set comprises quarterly international arrivals (in thousands) to Australia from Japan, New Zealand, UK and the US.

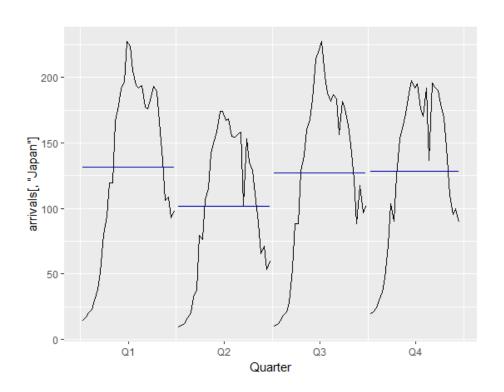


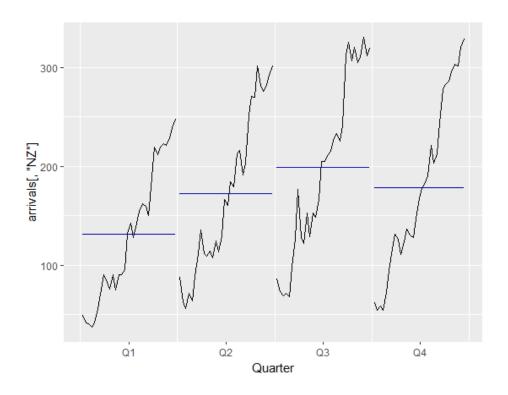


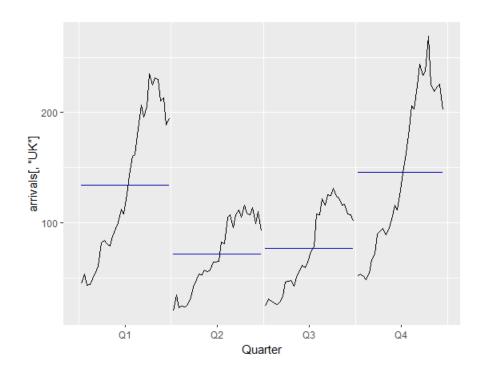


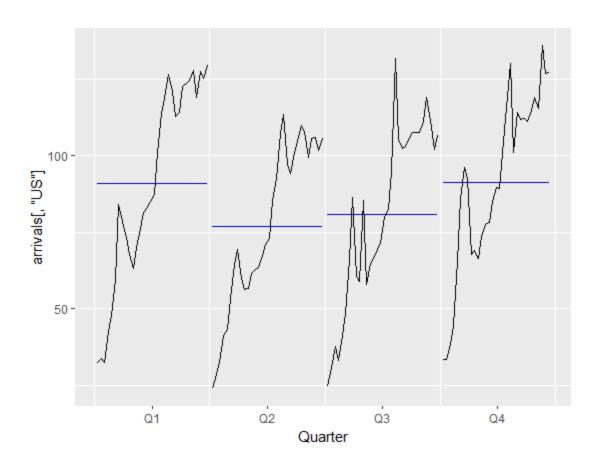












The arrivals from Japan decrease a lot in 2nd quarter compared to the other quarteres.

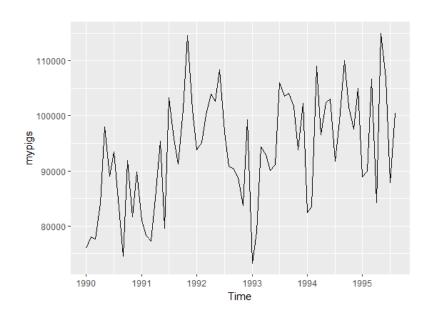
The arrivals from New Zealand are highest in 3rd quarter and lowest in 1st quarter.

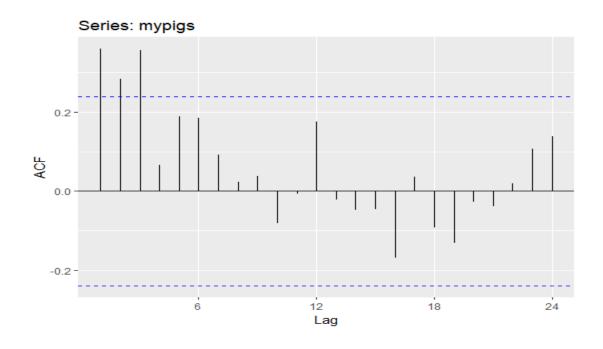
The arrivals from UK and US are low in 2nd and 3rd quarters and high in 1st and 4th quarters.

```
ggseasonplot(arrivals[, "Japan"])
ggseasonplot(arrivals[, "NZ"])
ggseasonplot(arrivals[, "UK"])
ggseasonplot(arrivals[, "US"])
ggsubseriesplot(arrivals[, "Japan"])
```

ggsubseriesplot(arrivals[, "NZ"])
ggsubseriesplot(arrivals[, "UK"])
ggsubseriesplot(arrivals[, "US"])

**Q8.** Use autoplot and ggAcf for mypigs series and compare these to white noise plots from Figures 2.15 and 2.16.





We can find that 3 autocorrelation values were outside of bounds. Therefore mypigs isn't probably white noise.

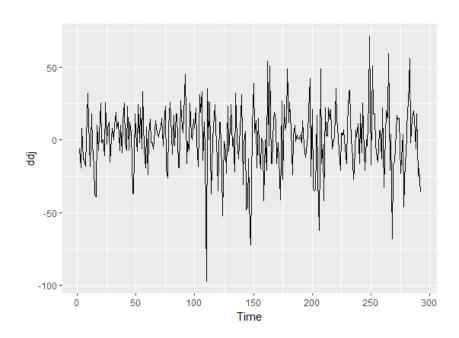
### Code:

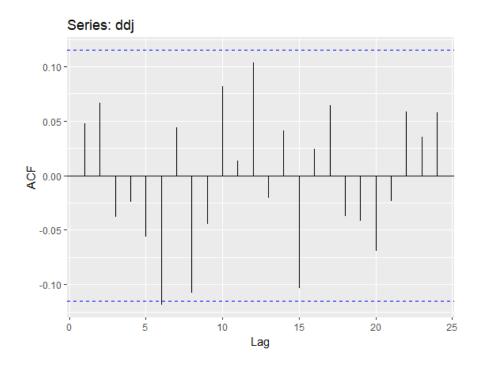
mypigs <- window(pigs, start=1990)
str(mypigs)</pre>

autoplot(mypigs)

ggAcf(mypigs)

Q10. dj contains 292 consecutive trading days of the Dow Jones Index. Use ddj <- diff(dj) to compute the daily changes in the index. Plot ddj and its ACF. Do the changes in the Dow Jones Index look like white noise?





We can find that substantially less than 5% of autocorrelation values were outside of bounds. Therefore ddj can be white noise.

### Code:

ddj <- diff(dj)

str(ddj)

autoplot(ddj)

ggAcf(ddj)