Ch2 | Time Series Graphics

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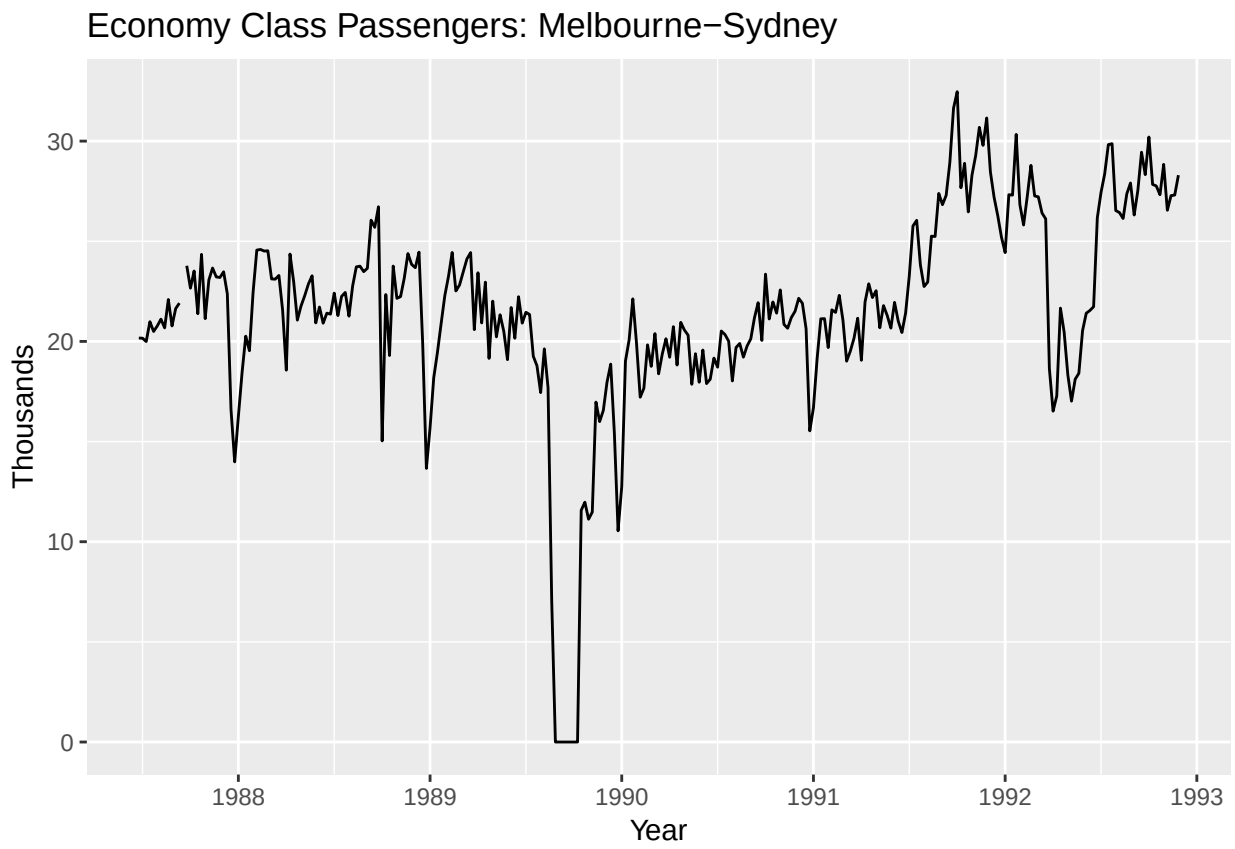
2.1 | ts Objects

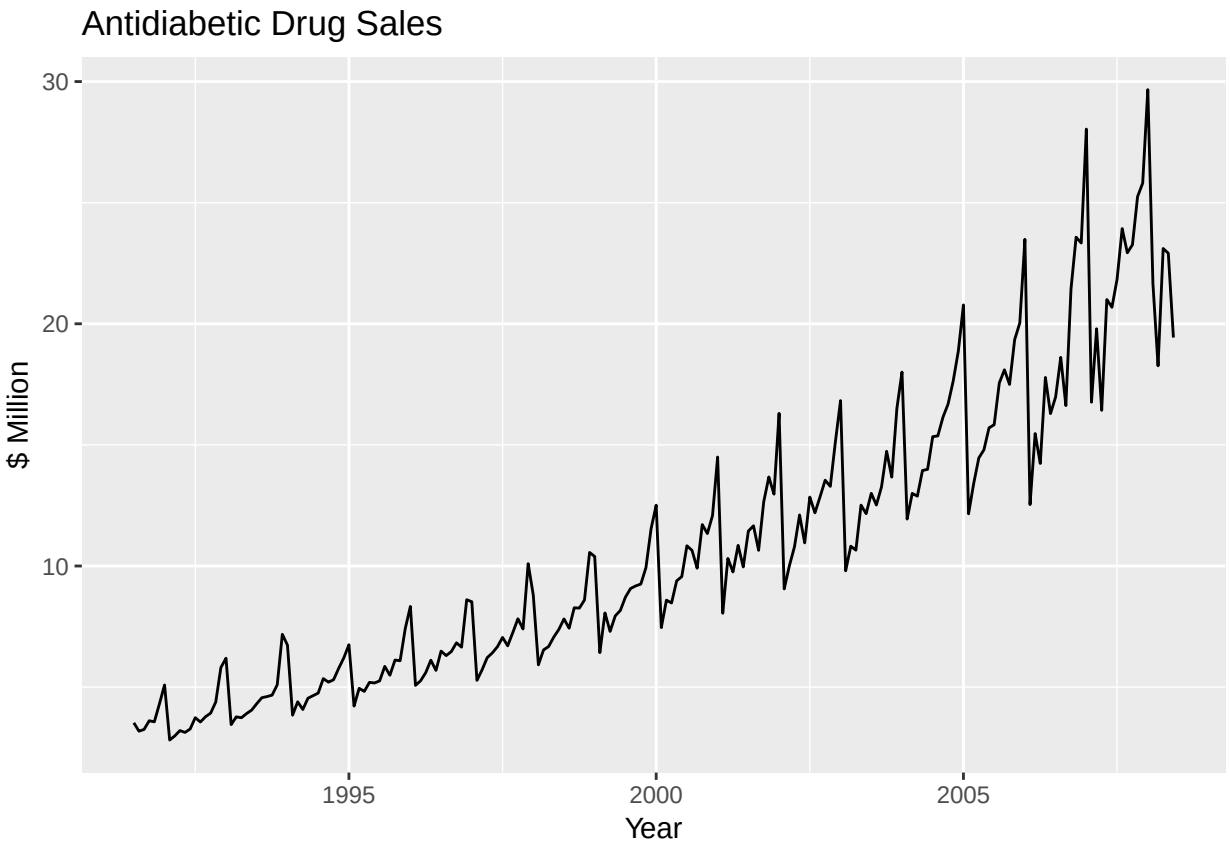
```
# create a time series object
y <- ts(c(123, 39, 78, 52, 110), start = 2012)

# for observations more frequent than yearly, we can use the frequency argument

# generate some data
vec_length <- 15*12
z <- vector(mode = "numeric", length = vec_length)

for (i in seq_along(z)){
  z[i] <- rnorm(1, mean = 0, sd = 1)
}

# create a monthly data table as a ts object
y <- ts(z, start = 2003, frequency = 12)
```

2.2 | Time Plots

```
# plot economy class passengers in melbourne-sydney flights
autoplot(melsyd[, "Economy.Class"]) +
  ggtitle("Economy Class Passengers: Melbourne-Sydney") +
  xlab("Year") + ylab("Thousands")
```




```
# antidiabetic drug sales
autoplot(a10) +
  ggtitle("Antidiabetic Drug Sales") +
  ylab("$ Million") + xlab("Year") +
  theme_gray()
```



2.3 | Time Series Patterns

Trend

A *trend* exists when there is a long term increase or decrease in the data. It does not have to be linear.

Seasonal

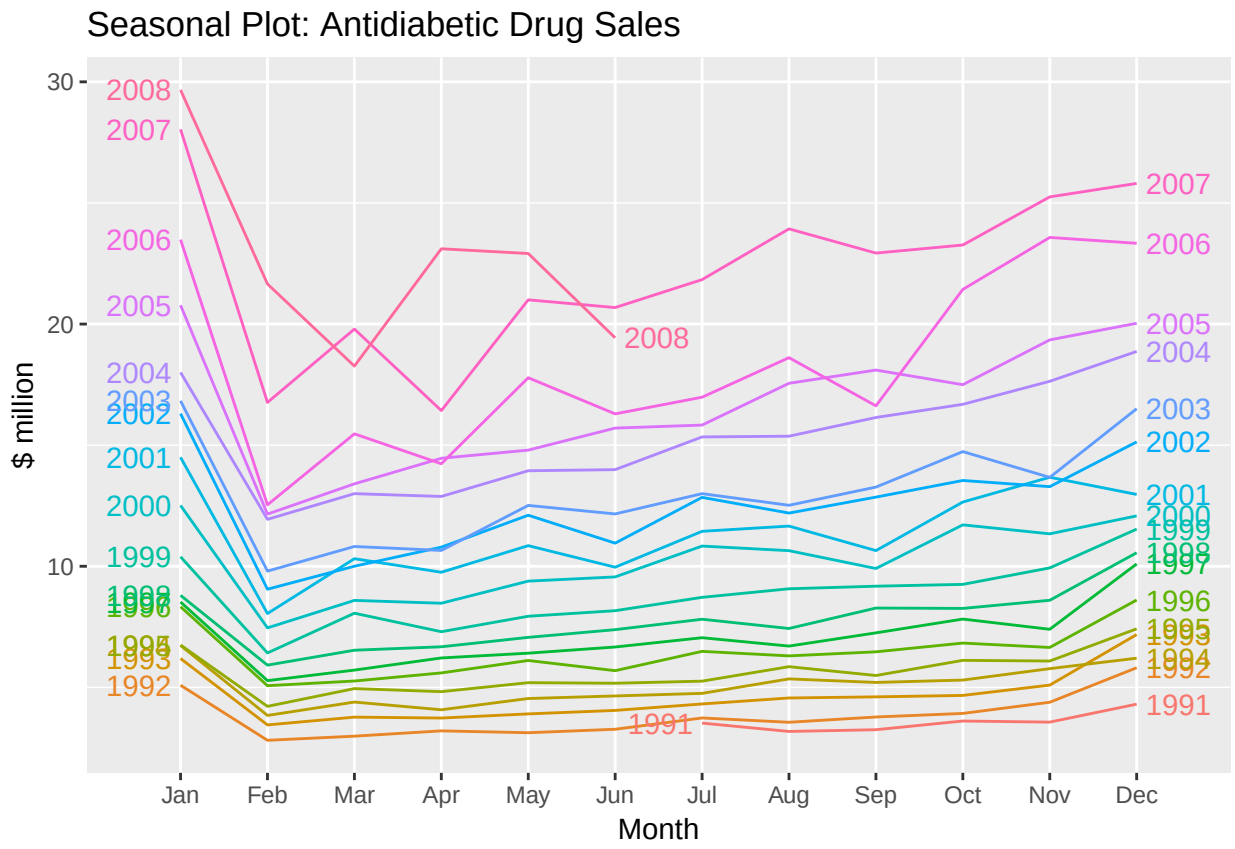
A *seasonal* pattern occurs when a time series is affected by seasonal factors such as the time of the year or day of the week. Seasonality is always of a fixed and known frequency.

Cyclic

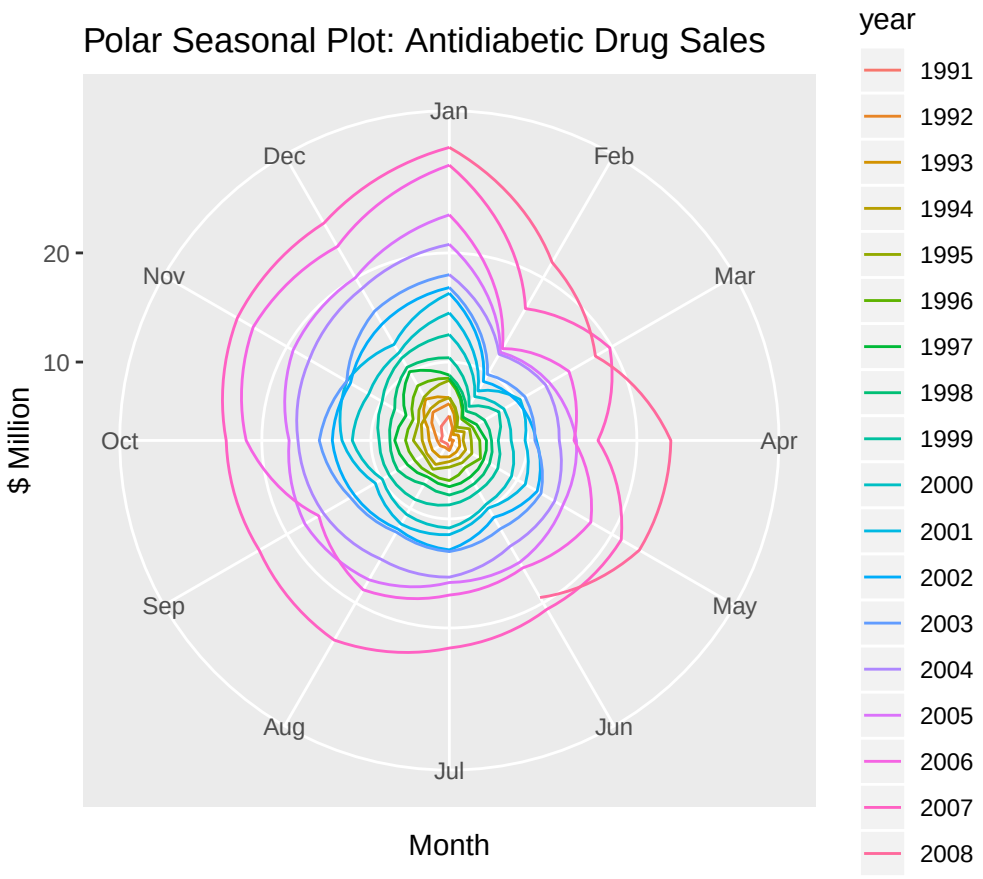
A *cycle* occurs when the data exhibit rises and falls that are not of a fixed frequency. These fluctuations are usually due to economic conditions, and are often related to the business cycle.

2.4 | Seasonal Plots

```
ggseasonplot(a10, year.labels = TRUE, year.labels.left = TRUE) +
  ylab("$ million") +
  ggtitle("Seasonal Plot: Antidiabetic Drug Sales")
```




```
ggseasonplot(a10, polar=TRUE) +
  ylab("$ Million") +
  ggtitle("Polar Seasonal Plot: Antidiabetic Drug Sales")
```


Polar Seasonal Plot: Antidiabetic Drug Sales
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20
10
$ Million
Month
year
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008