Monthly Airline Passenger Decomposition

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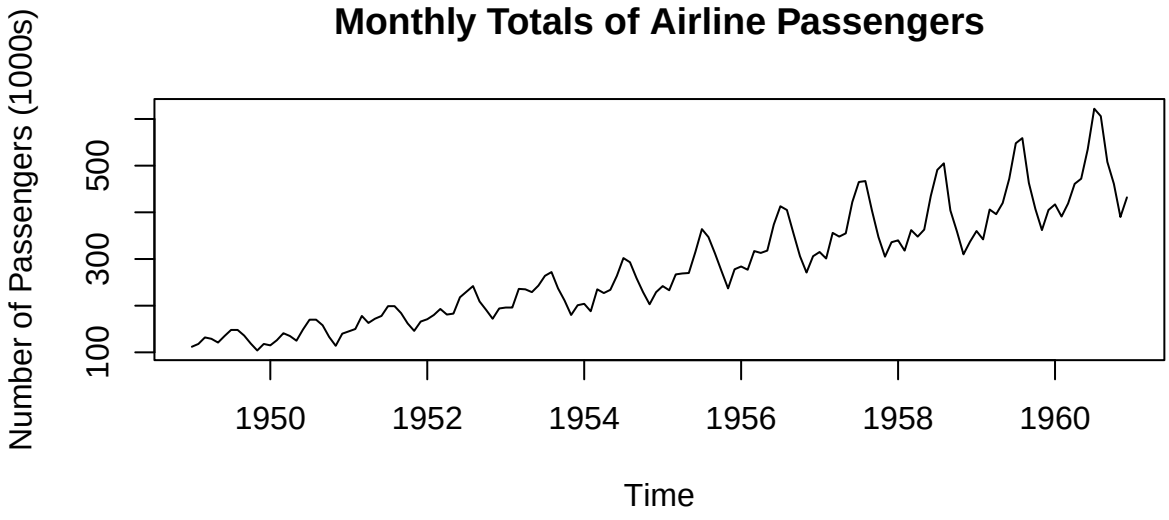
Contents

1 Historical Plot

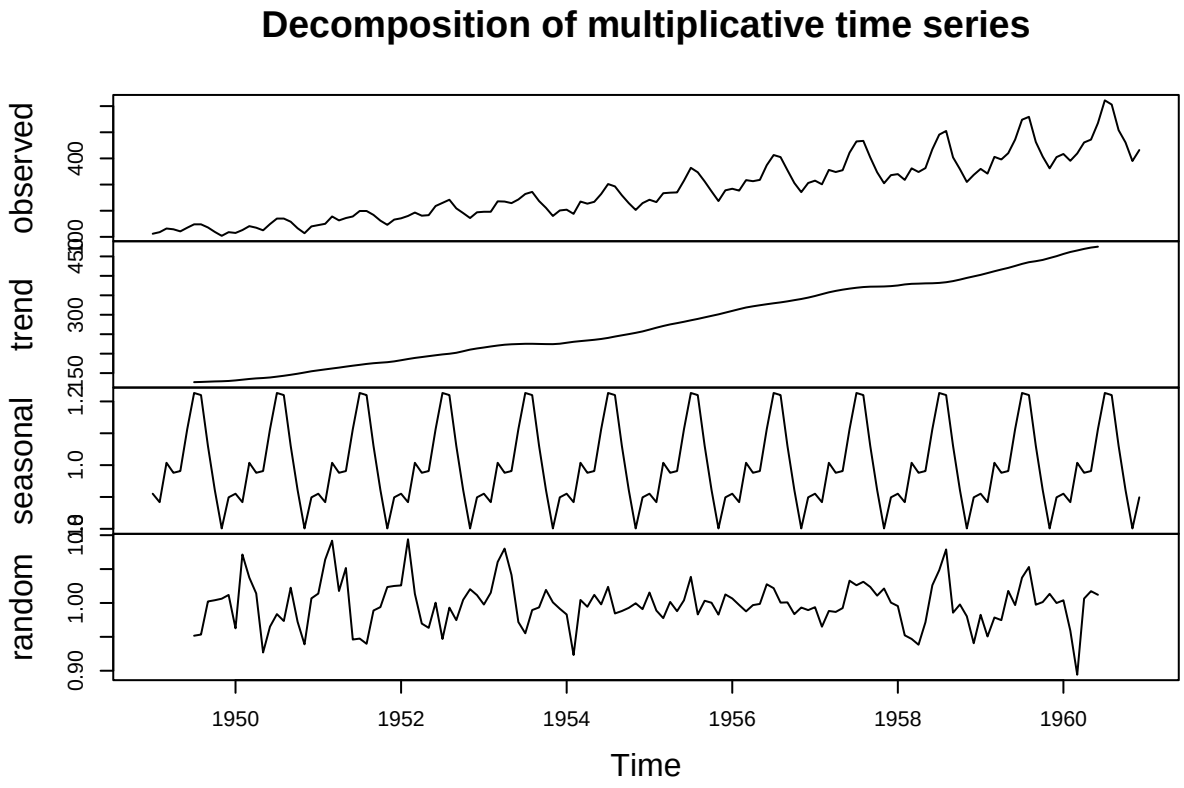
```
plot(AirPassengers, main ="Monthly Totals of Airline Passengers",
     ylab = "Number of Passengers (1000s)")
```



2 Decomposition

To have a better understanding of how these components relate to the observed dataset, decompose the data down into its trend, seasonality, and random error components.

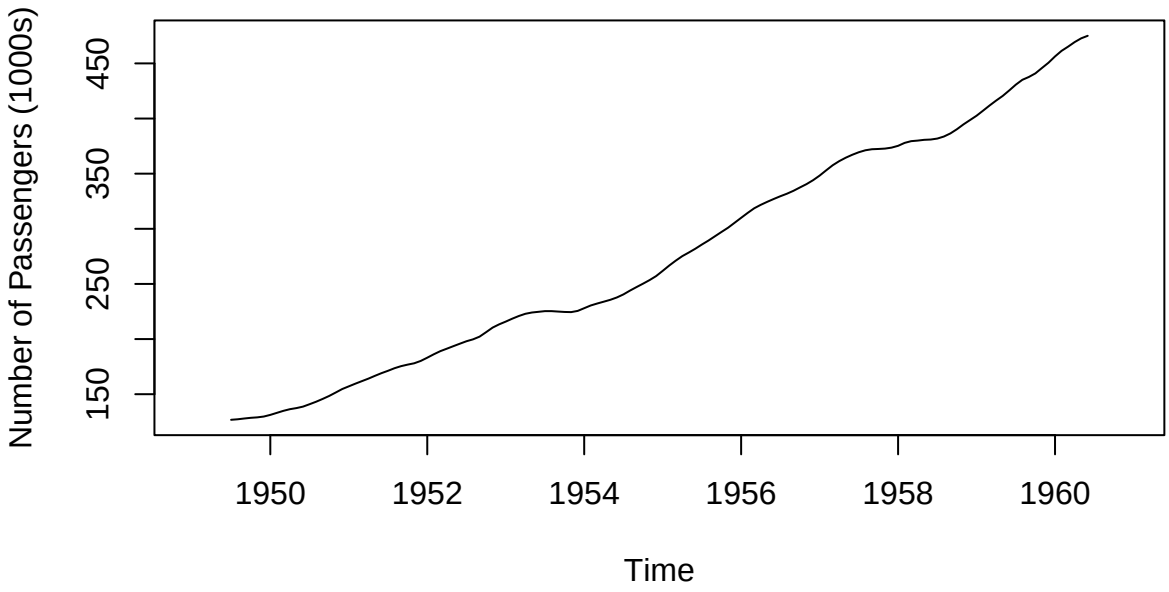
```
plot(decompose(AirPassengers, type = "multiplicative"))
```



3 Components

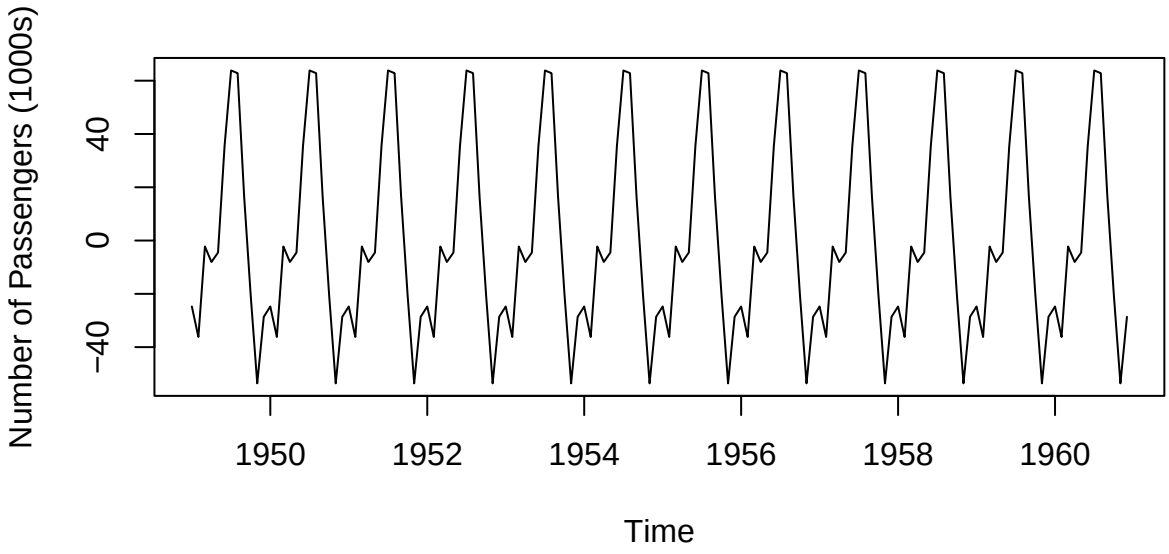
3.1 Trend

```
plot(decompose(AirPassengers)$trend, ylab = "Number of Passengers (1000s)")
```



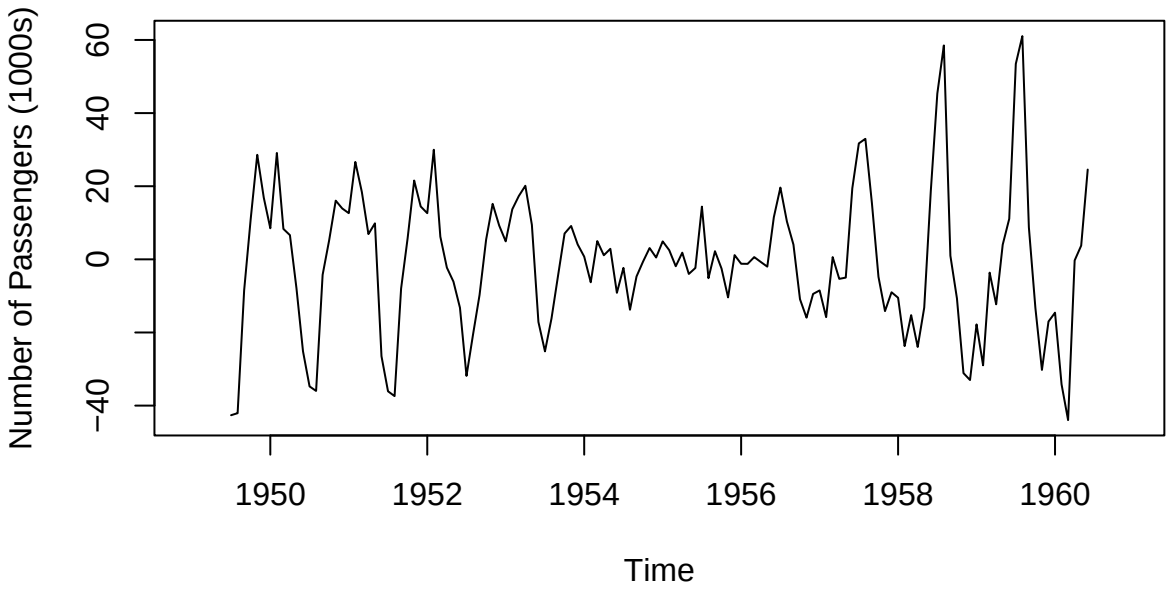
3.2 Seasonal

```
plot(decompose(AirPassengers)$season, ylab = "Number of Passengers (1000s)")
```



3.3 Irregular or Random

```
plot(decompose(AirPassengers)$random, ylab = "Number of Passengers (1000s)")
```

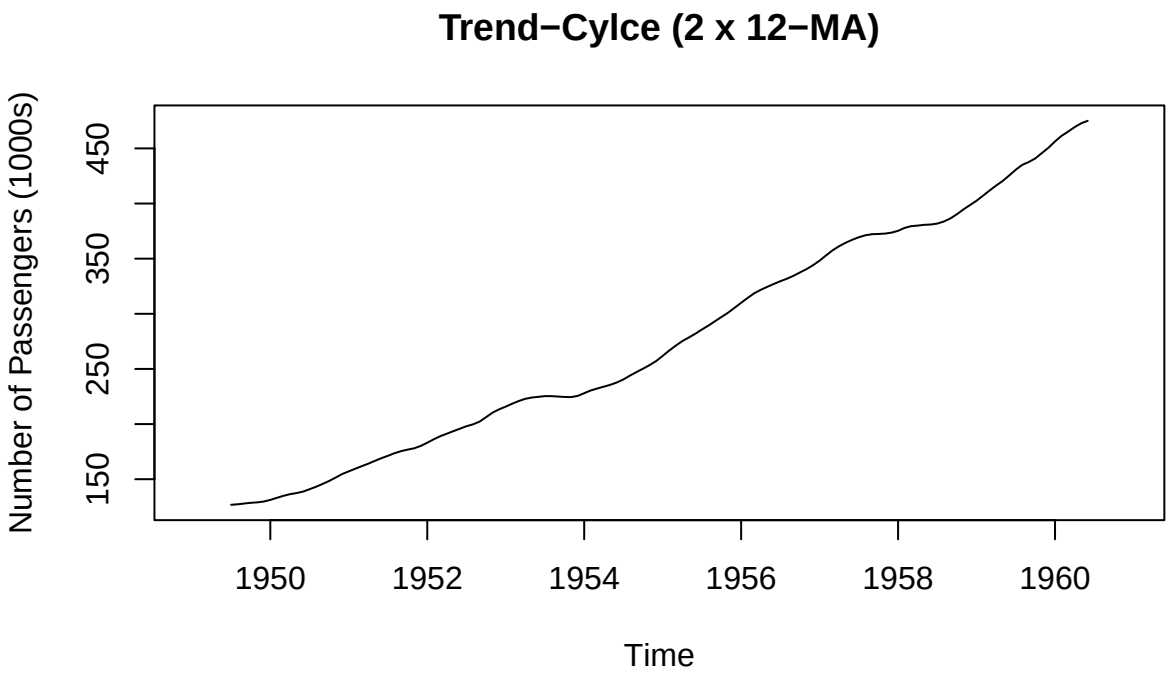


4 Seasonal Effect

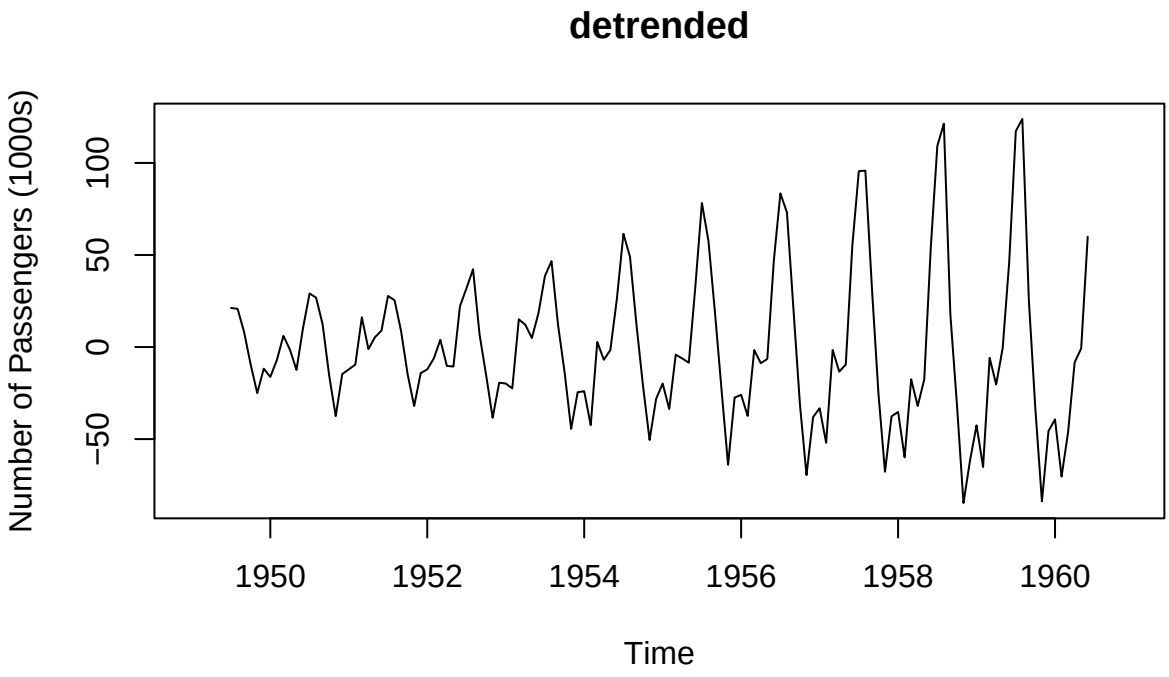
```
#trend cycle
# in R, when n is even, it automatically compute also the 2-(n-ma)

tc = forecast::ma(AirPassengers,12)
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
plot(tc, main="Trend-Cylce (2 x 12-MA)",ylab="Number of Passengers (1000s)")
```




```
# using the additive model
dt = AirPassengers-tc
plot(dt,main="detrended",ylab="Number of Passengers (1000s)")
```

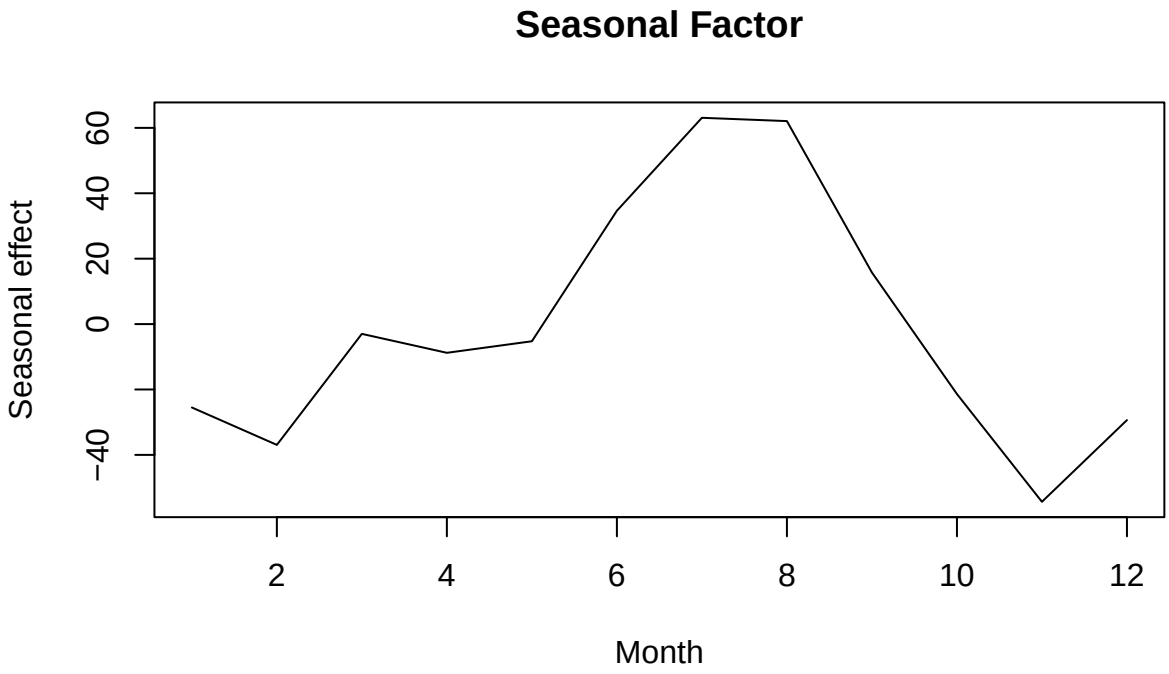


```r
# Seasonal Factor
## length of ts
L <- length(dt)
## frequency (ie, 12)
ff <- 12
## number of periods (years); %/% is integer division
periods <- L%/%ff
## index of cumulative month
index <- seq(1, L, by = ff) - 1
## get mean by month
sf <- numeric(ff)
for (i in 1:ff) {
sf[i] <- mean(dt[index + i], na.rm = TRUE)
}
month = c("January", "February","March","April","May",
"June","July","August","September","October",
"November","December")
season_data = data.frame("Month"= month, "Seasonal.Factor"=sf )
knitr::kable(season_data,caption = "Seasonal Factor for each Seasonal Indices (Months)",
digits = 4)
```

Table 1: Seasonal Factor for each Seasonal Indices (Months)

Month	Seasonal.Factor
January	-25.5000
February	-36.9394
March	-2.9924
April	-8.7879
May	-5.2576
June	34.6515
July	63.0795
August	62.0720
September	15.7689
October	-21.3939
November	-54.3447
December	-29.3712

```r
## plot the monthly seasonal effects
plot.ts(sf, ylab = "Seasonal effect", xlab = "Month", cex = 1,main="Seasonal Factor")
```




```
## seasonal component estimate
season_comp <- ts(rep(sf, periods + 1)[seq(L)], start = start(dt),frequency = ff)
plot(season_comp,main="Seasonal Component Estimates",ylab="Number of Passengers (1000s)" )
```