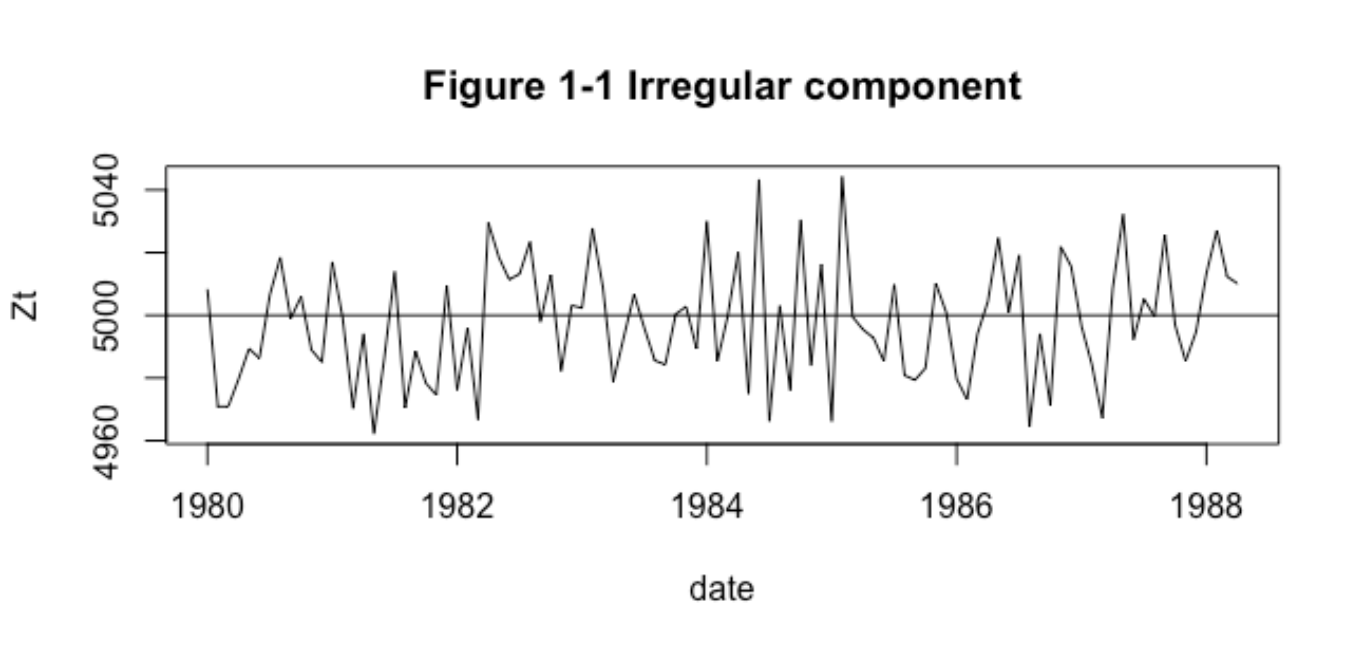
HW 01

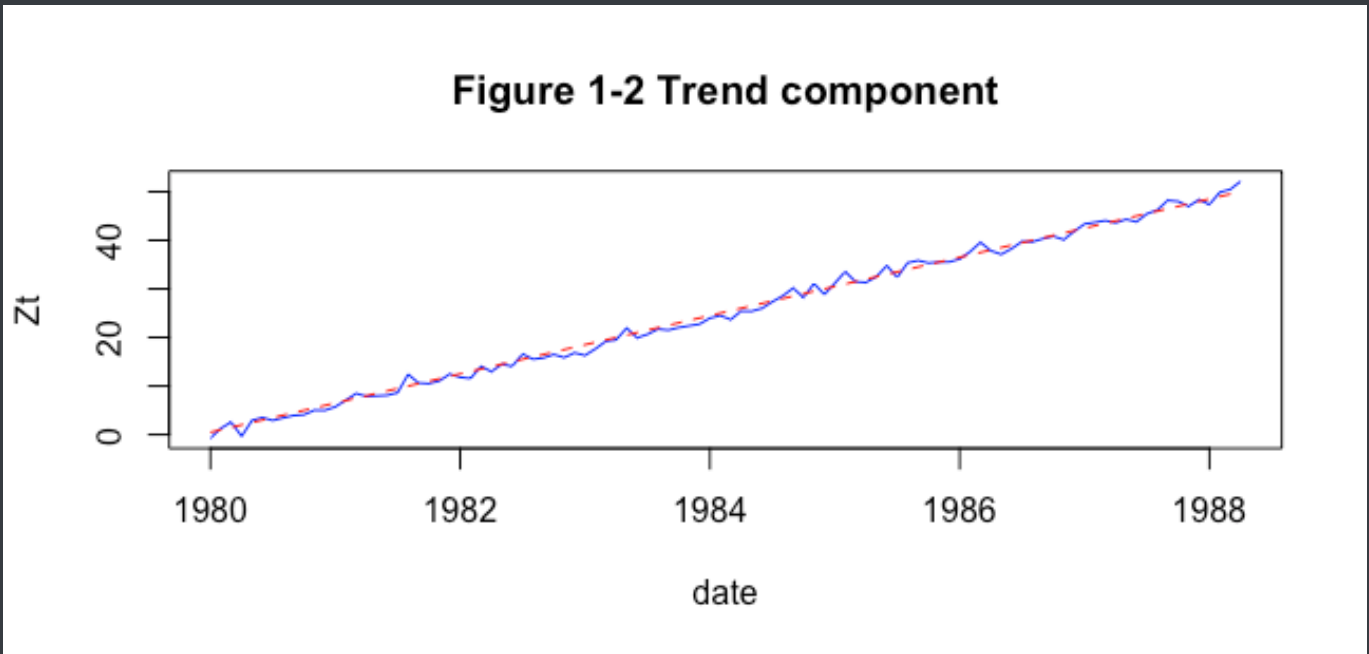
2021234640 이종현

Figure 1-1



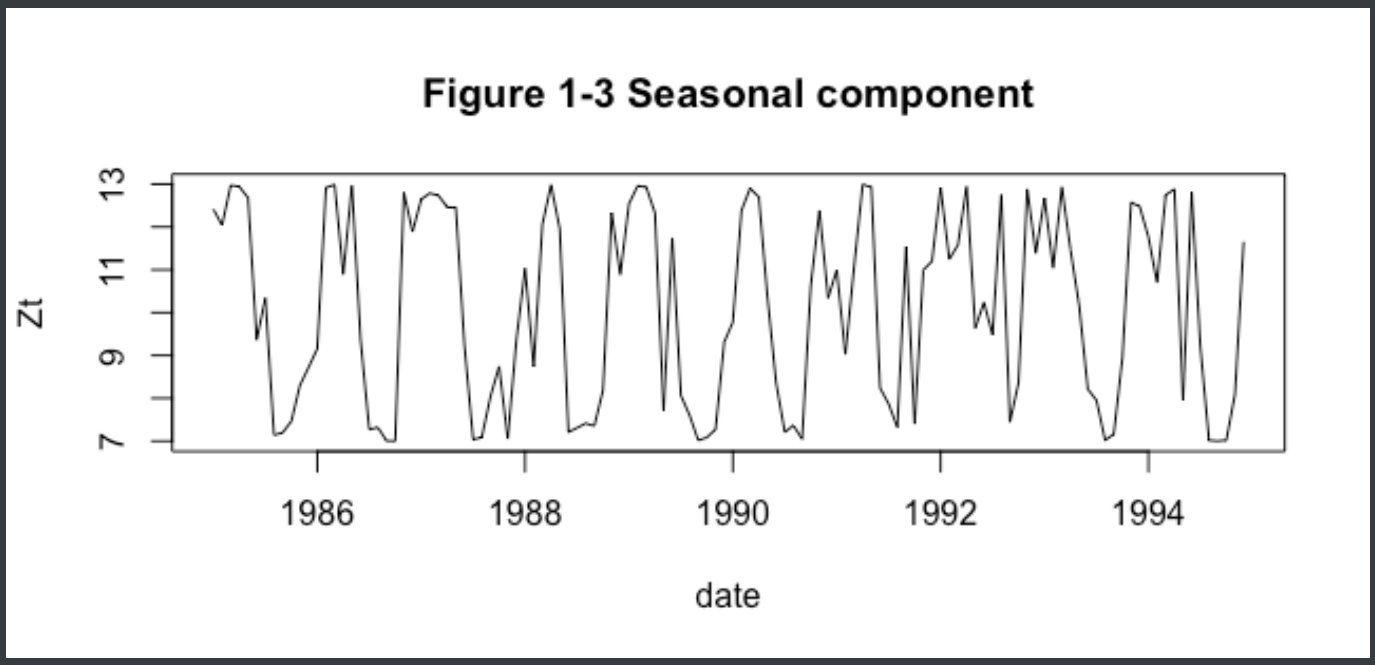

```
set.seed(1245)
n = 100
z = 5000 + 20 * rnorm(n)
z_ts = ts(z, start=c(1980, 1), frequency=12)
ts.plot(z_ts, xlab="date", ylab="Zt", main="Figure 1-1 Irregular
component")
abline(h=5000)
```

Figure 1–2



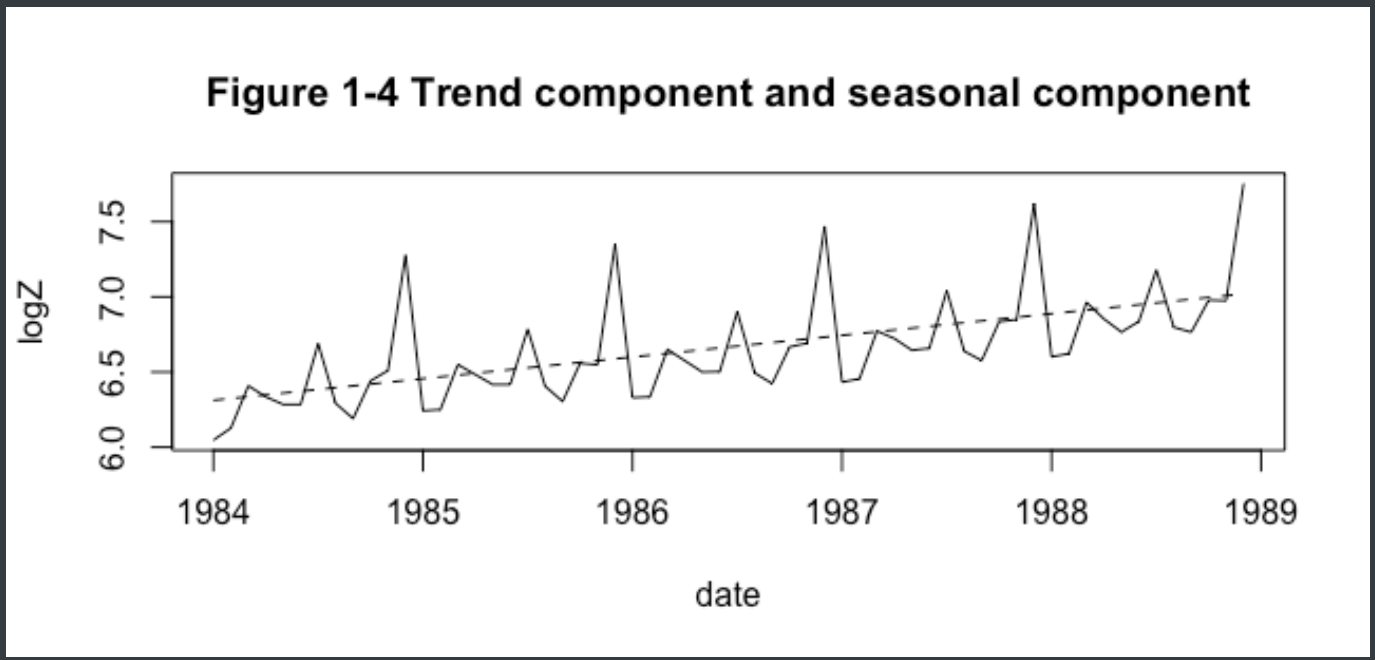

```
set.seed(1234)
n = 100
t = 1:n
x = 0.5 * t
z = 0.5 * t + rnorm(n)
z_ts = ts(z,  start=c(1980, 1), frequency=12)
x_ts = ts(x, start=c(1980, 1), frequency=12)
ts.plot(z_ts, x_ts, col=c("blue", "red"), lty=1:2,
        xlab="date", ylab="Zt", main="Figure 1-2 Trend component")
```

Figure 1–3



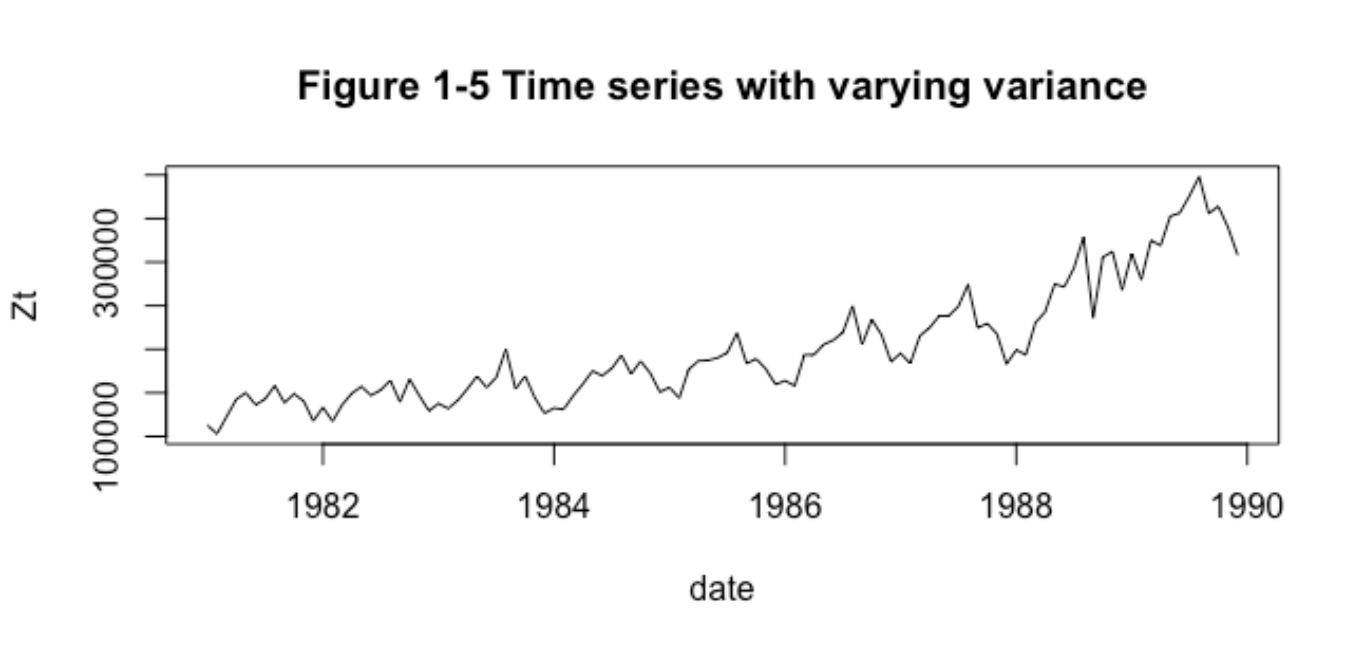

```r
n = 120
t = 1:n
a = rnorm(n, 0.1)
z = 10 + 3 * sin((2 * pi * t) / 12 + 0.8 * a)
z_ts = ts(z, start=c(1985, 1), frequency=12)
plot(z_ts, xlab="date", ylab="Zt", main="Figure 1-3 Seasonal component")
```

Figure 1–4



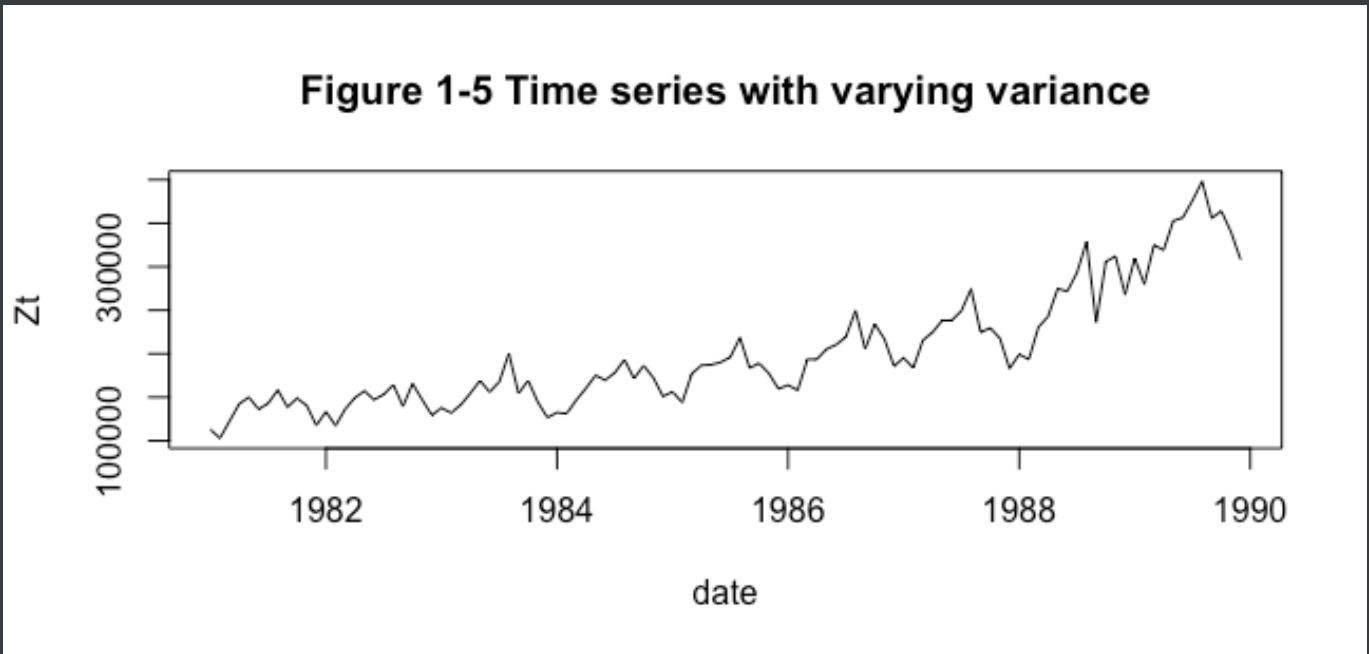
```
z = scan("data/depart.txt")
lz = log(z)
t = 1:length(z)
x = 6.3 + 0.012 * t
fig = data.frame(lz, x)
z_ts = ts(fig, start=c(1984, 1), frequency=12)
ts.plot(z_ts, lty=1:2, xlab="date", ylab="logZ",
        main="Figure 1-4 Trend component and seasonal component")
```

Figure 1-5



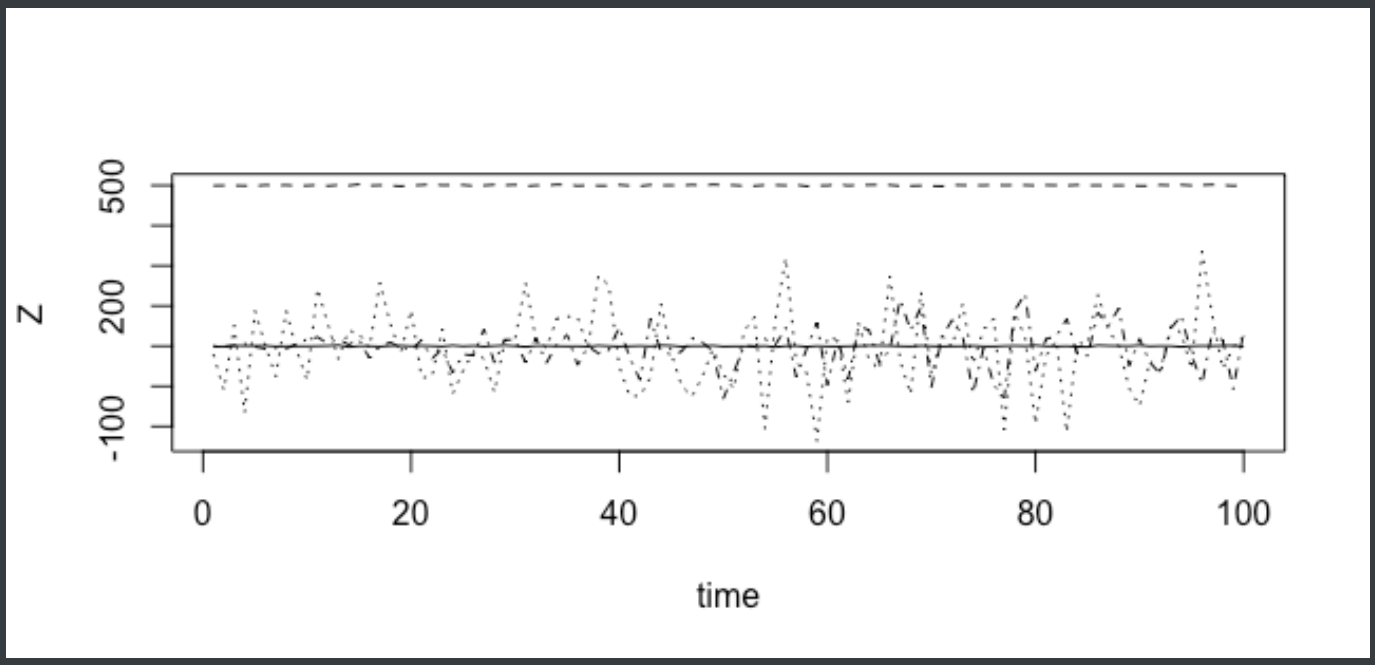

```
z = scan("data/koreapass.txt")
z_ts = ts(z, start=c(1981, 1), frequency=12)
ts.plot(z_ts, xlab="date", ylab="Zt",
        main="Figure 1-5 Time series with varying variance")
```

Figure 1-6




```r
set.seed(4321)
n = 120
t = 1:n
a = rnorm(n)
x = 3 * (t - 46)
x[t <= 60] = 0.5 * t[t <= 60]
z = x + a
z_ts = ts(z, frequency=12, start=c(1985, 1))
ts.plot(z_ts, xlab="date", ylab="Zt",
        main="Figure 1-6 Time series with varying trend")
abline(v=1990)
```

Ex 1-5




```
n = 100
t = 1:n
z1 = 100 + rnorm(n)
z2 = 500 + rnorm(n)
z3 = 100 + 100 * rnorm(n)
z4 = 100 + t * rnorm(n)

fig = data.frame(z1, z2, z3, z4)
ts.plot(fig, lty=1:4, xlab="time", ylab="Z")

print(paste("Mean:", round(mean(z1), 4), "Var:", round(var(z1), 4)))
print(paste("Mean:", round(mean(z2), 4), "Var:", round(var(z2), 4)))
print(paste("Mean:", round(mean(z3), 4), "Var:", round(var(z3), 4)))
print(paste("Mean:", round(mean(z4), 4), "Var:", round(var(z4), 4)))
```

z1, z2 의 분산은 상대적으로 작은 반면, z3, z4는 분산이 크다.

z1: "Mean: 100.0131 Var: 0.7407"

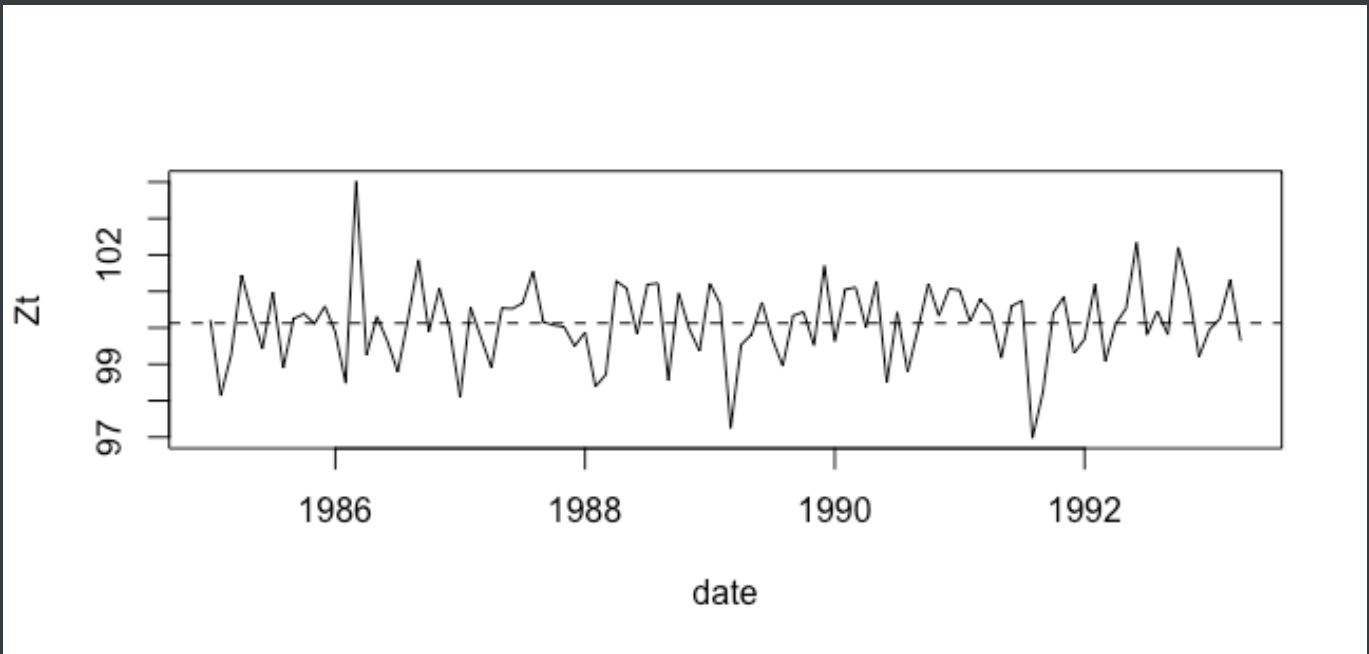
z2: "Mean: 500.0859 Var: 0.8128"

z3: "Mean: 105.979 Var: 9089.6653"

z4: "Mean: 93.6157 Var: 4080.3848"

Ex 1-6

Ex 1-6-1

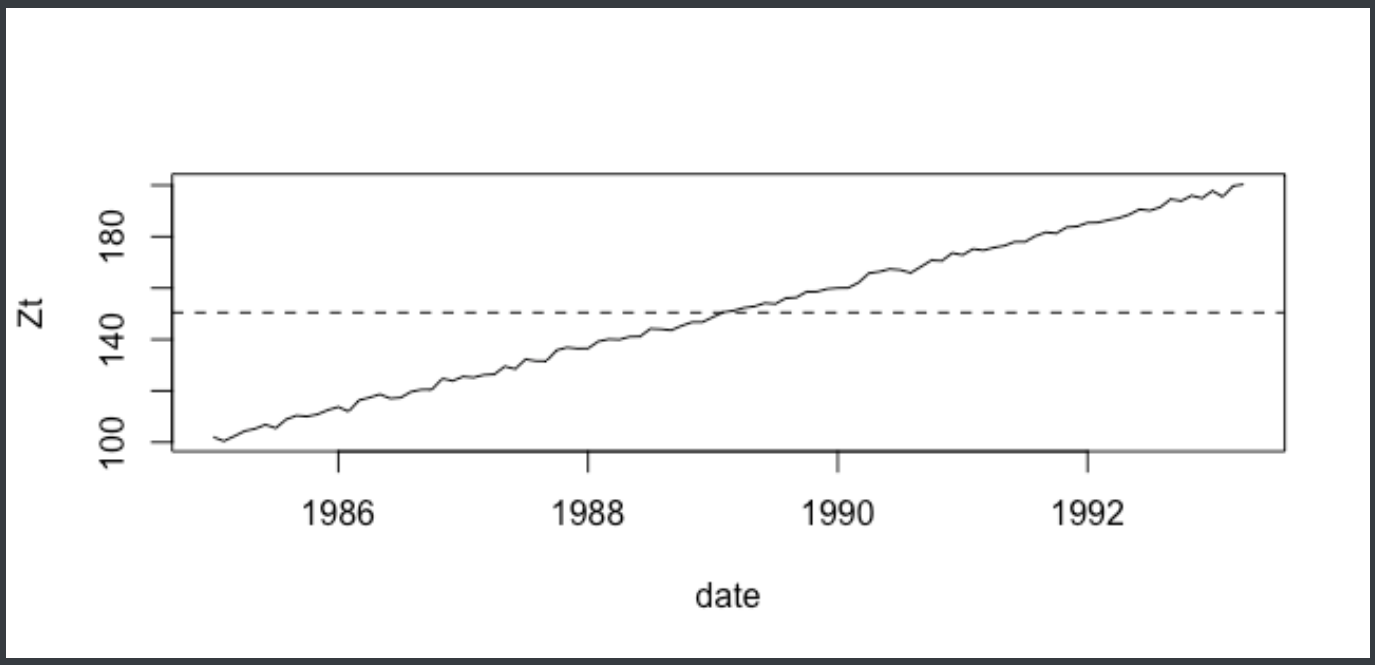



```
n = 100
t = 1:n

z1 = 100 + rnorm(n)
z1_ts = ts(z1, frequency=12, start=c(1985, 1))
ts.plot(z1_ts, xlab="date", ylab="Zt")
abline(h=mean(z1), lty=2)
```

별다른 특징이 보이지 않는다. T 시점에 무관한 불규칙 성분으로 보인다.

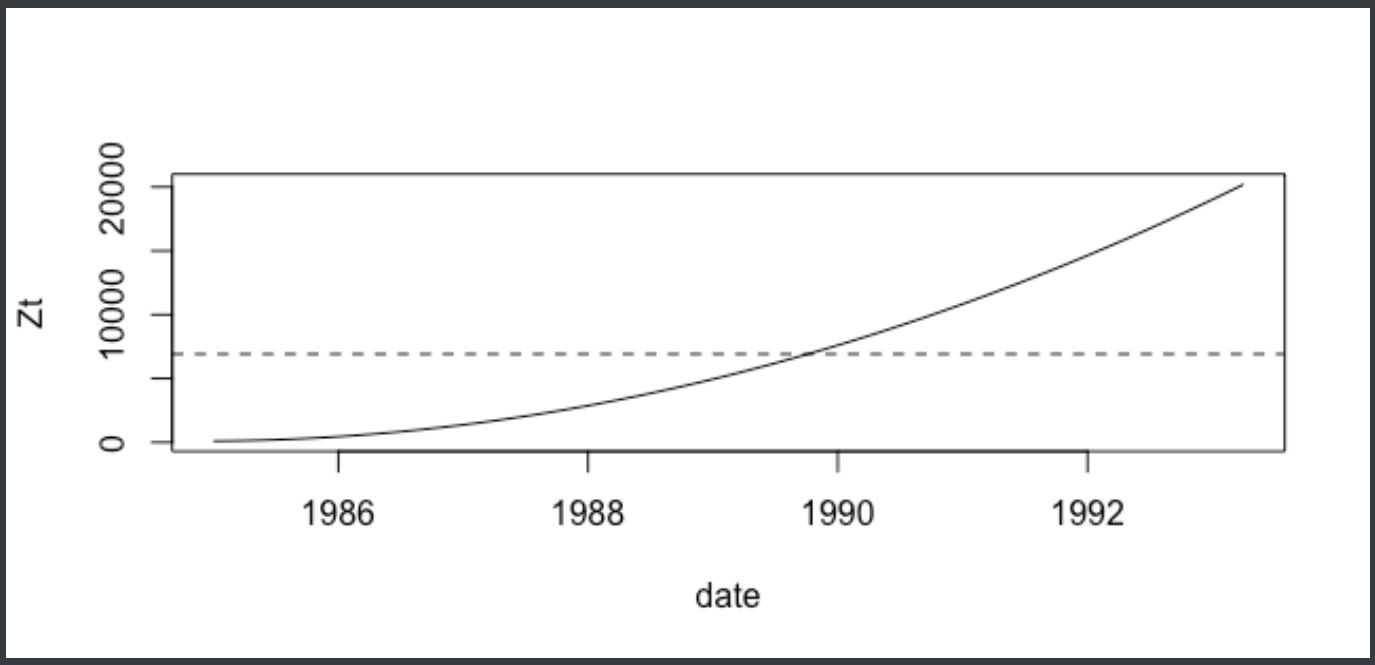
Ex 1-6-2




```
z2 = 100 + t + rnorm(n)
z2_ts = ts(z2, frequency=12, start=c(1985, 1))
ts.plot(z2_ts, xlab="date", ylab="Zt")
abline(h=mean(z2), lty=2)
```

강한 선형 추세 성분이 보인다.

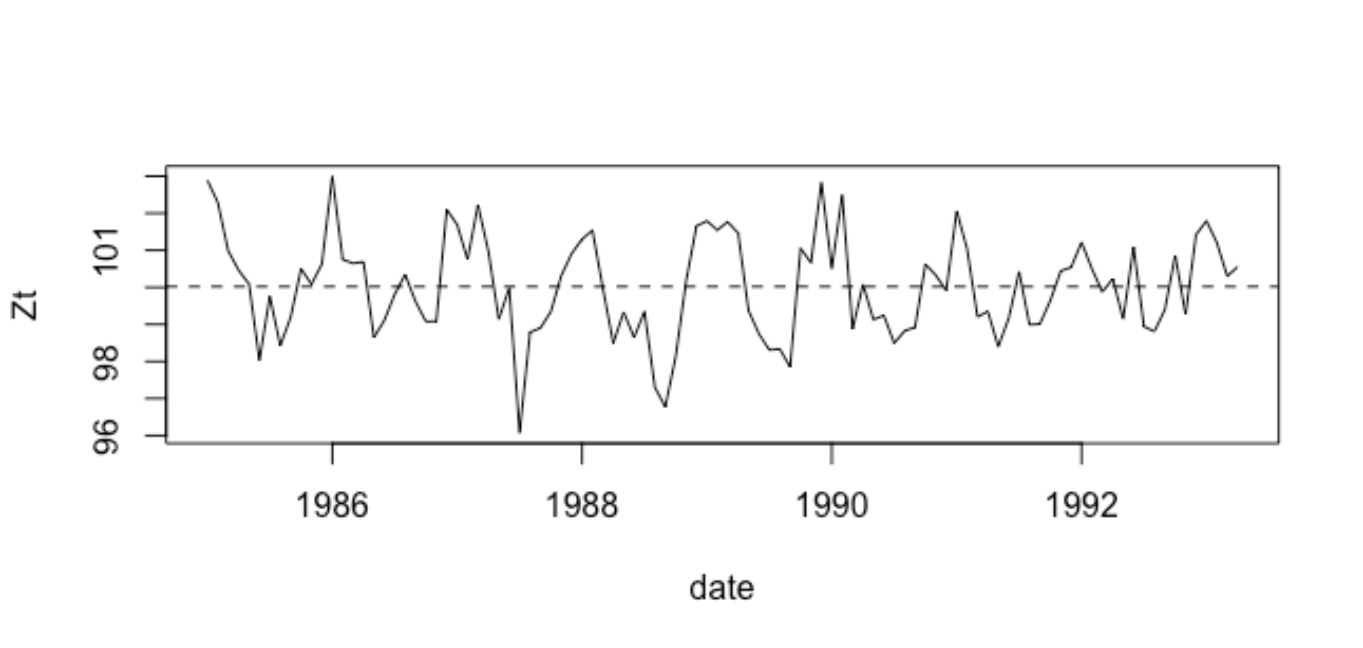
Ex 1-6-3



```
z3 = 100 + t + 2 * t^2 + rnorm(n)
z3_ts = ts(z3, frequency=12, start=c(1985, 1))
ts.plot(z3_ts, xlab="date", ylab="Zt")
abline(h=mean(z3), lty=2)
```

강한 비선형 추세가 보인다.

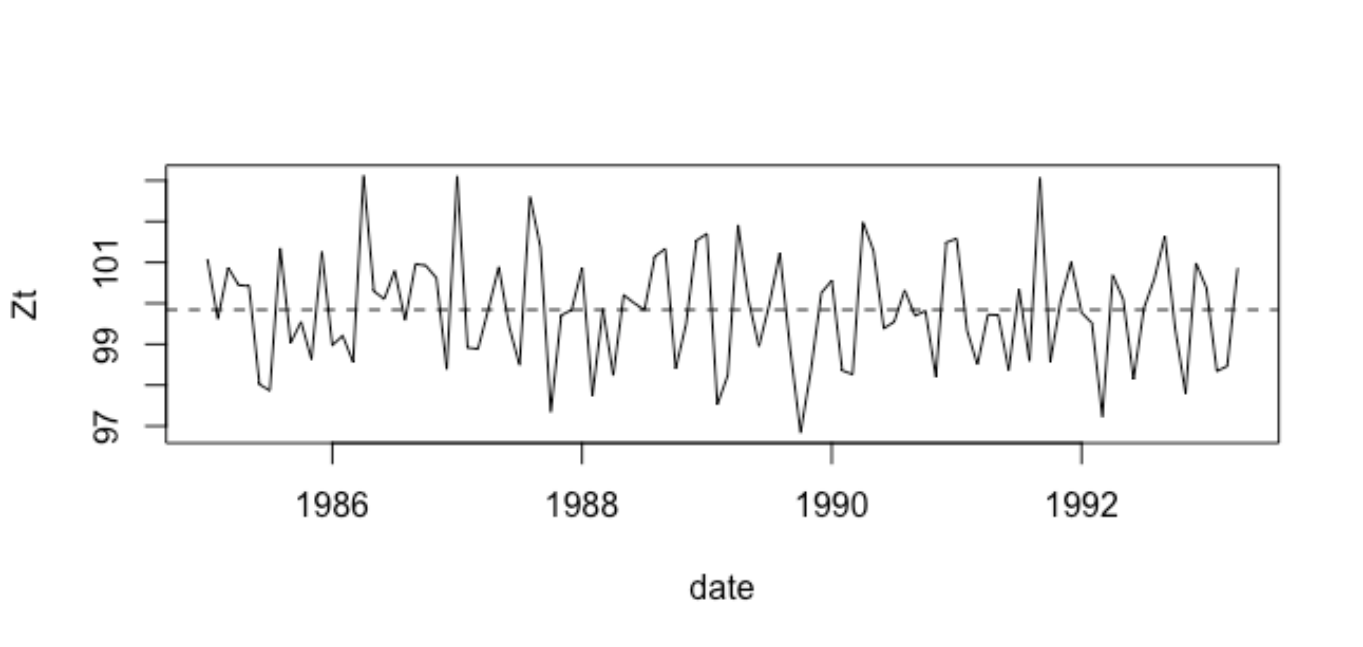
Ex 1-6-4




```
z4 = 100 + sin((2 * pi * t) / 12) + cos((2 * pi * t) / 12) + rnorm(n)
z4_ts = ts(z4, frequency=12, start=c(1985, 1))
ts.plot(z4_ts, xlab="date", ylab="Zt")
abline(h=mean(z4), lty=2)
```

약한 주기성이 보인다. 물론 코드를 보아서 알고 있지만, frourier transform 등을 취하면 확실히 분리되어 단순 분석하는 것보다는 큰 이점을 줄 것으로 보인다.

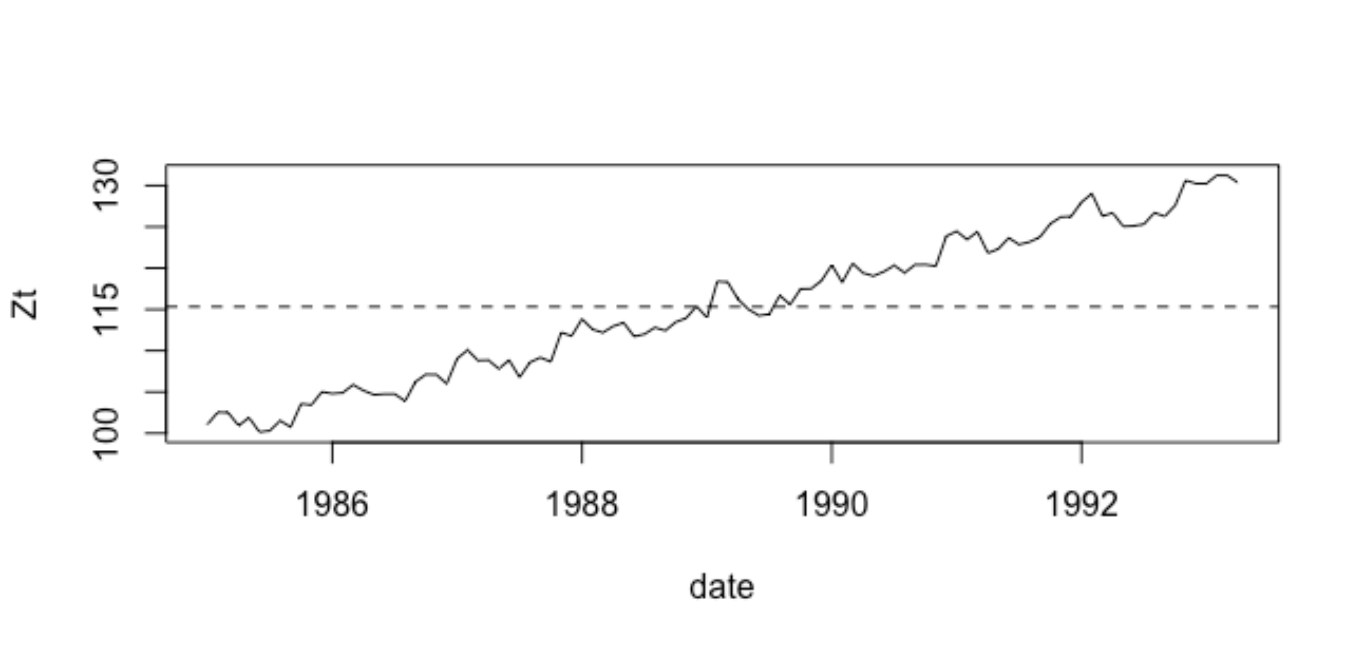
Ex 1-6-5




```
z5 = 100 + sin((2 * pi * t) / 4) + cos((2 * pi * t) / 4) + rnorm(n)
z5_ts = ts(z5, frequency=12, start=c(1985, 1))
ts.plot(z5_ts, xlab="date", ylab="Zt")
abline(h=mean(z5), lty=2)
```

1988년 전, 1990년 전, 1992년 후에 낮은 값을 보이는 약한 주기 성분이 발견된다. 다만 Ex 1-6-1 과 큰 차이가 있어 보이지는 않아서 육안으로 식별하기에는 다소 어려움이 있다.

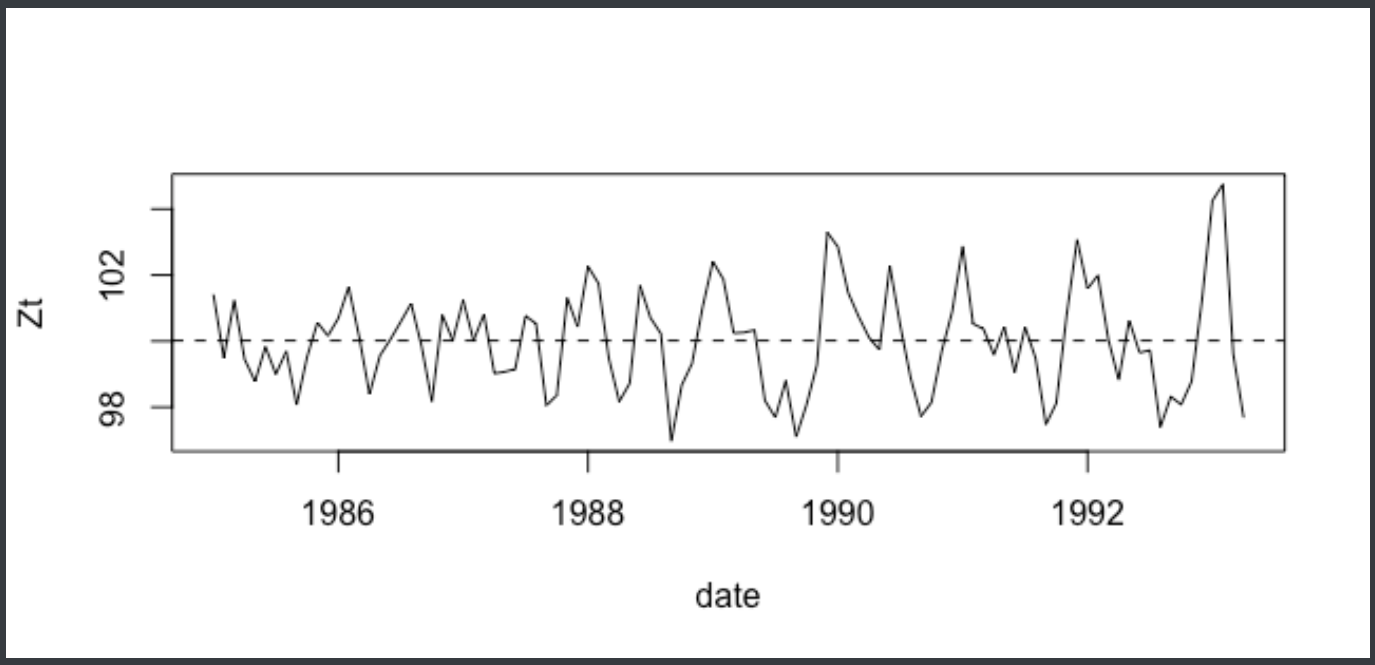
Ex 1-6-6




```
z6 = 100 + 0.3 * t + sin((2 * pi * t) / 12) + cos((2 * pi * t) / 12) +
rnorm(n)
z6_ts = ts(z6, frequency=12, start=c(1985, 1))
ts.plot(z6_ts, xlab="date", ylab="Zt")
abline(h=mean(z6), lty=2)
```

강한 선형 추세 성분과 주기 성분이 발견된다.

Ex 1-6-7

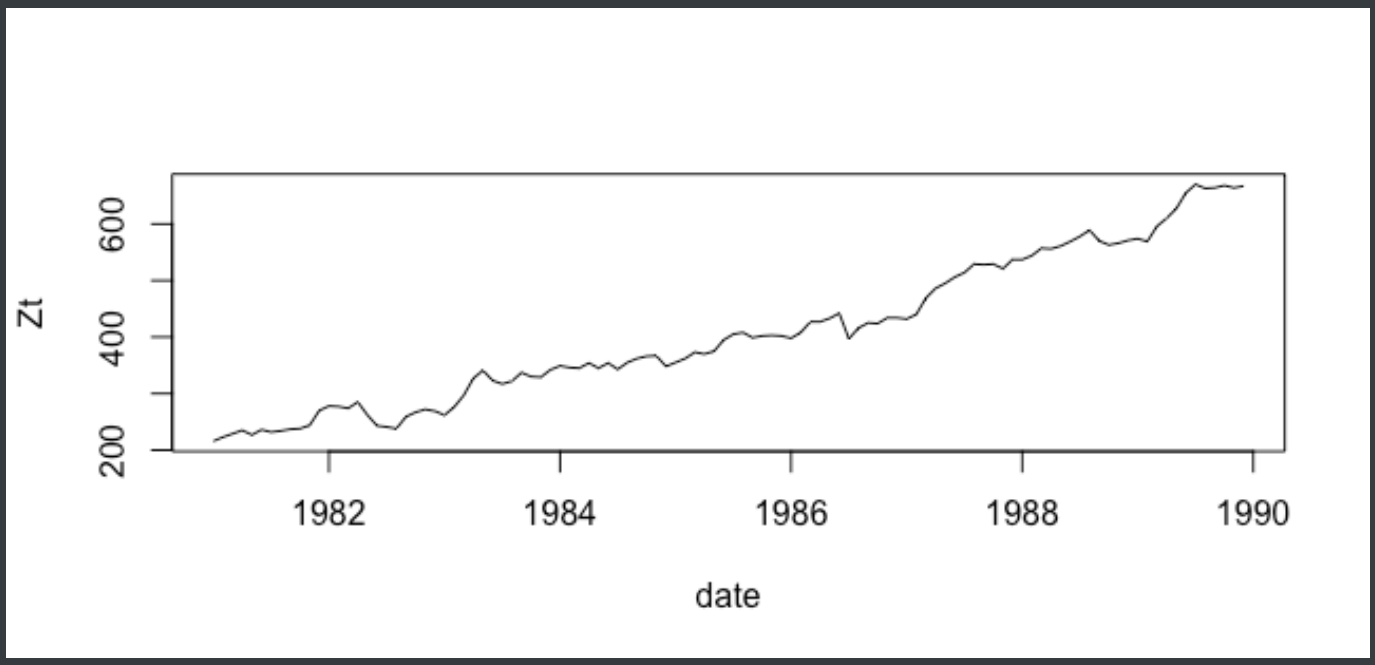



```
z7 = 100 + sin((2 * pi * t) / 12) + cos((2 * pi * t) / 12) + 0.8 *
sin((2 * pi * t) / 6) + 0.7 * cos((2 * pi * t) / 6) + rnorm(n)
z7_ts = ts(z7, frequency=12, start=c(1985, 1))
ts.plot(z7_ts, xlab="date", ylab="Zt")
abline(h=mean(z7), lty=2)
```

강한 주기 성분이 발견된다. 주기 성분이 시간이 흐름에 따라 커지는 경향도 보인다.

Ex 1-7

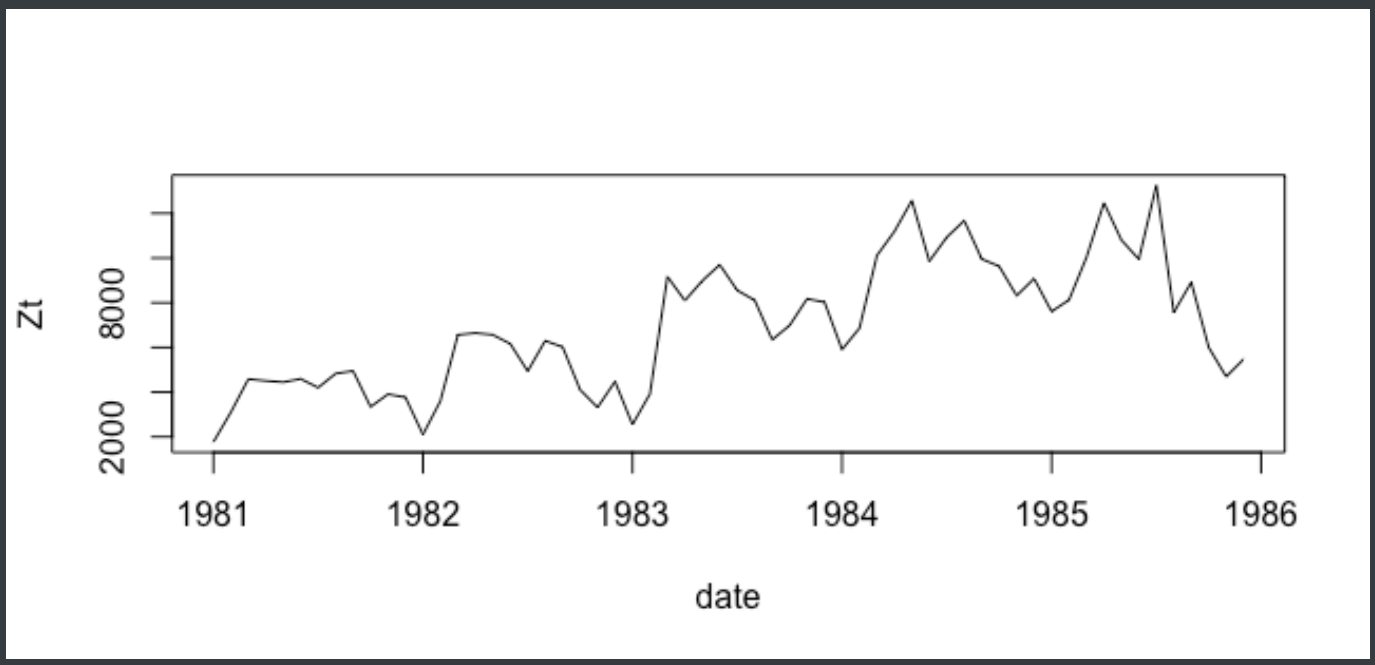
Ex 1-7-1




```
z1 = scan("data/female.txt")
z1_ts = ts(z1, start=c(1981, 1), frequency=12)
ts.plot(z1_ts, xlab="date", ylab="Zt")
```

선형 추세 성분이 발견된다. 또한1983년 1987년, 1989년에 감소하는 주기 성분도 보인다.

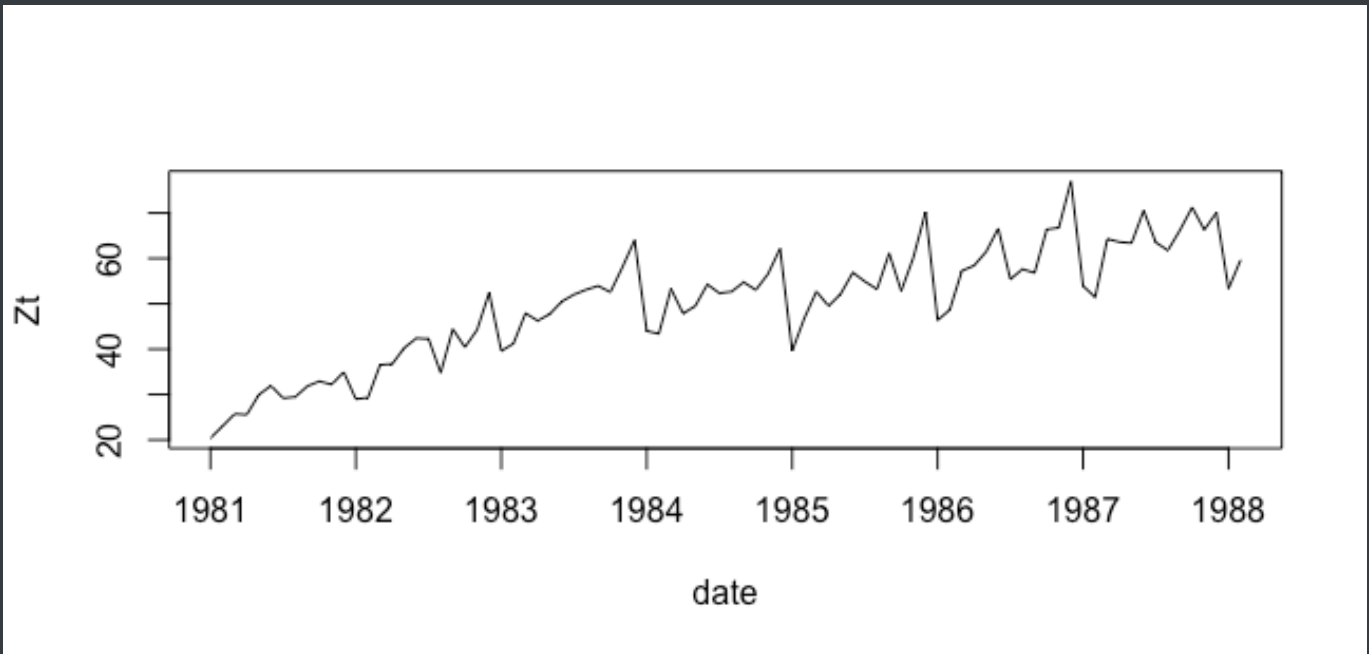
Ex 1-7-2



```
z2 = scan("data/build.txt")
z2_ts = ts(z2, start=c(1981, 1), frequency=12)
ts.plot(z2_ts, xlab="date", ylab="Zt")
```

연 중간에 값이 증가하는 주기 성분과 선형 추세 성분이 발견된다.

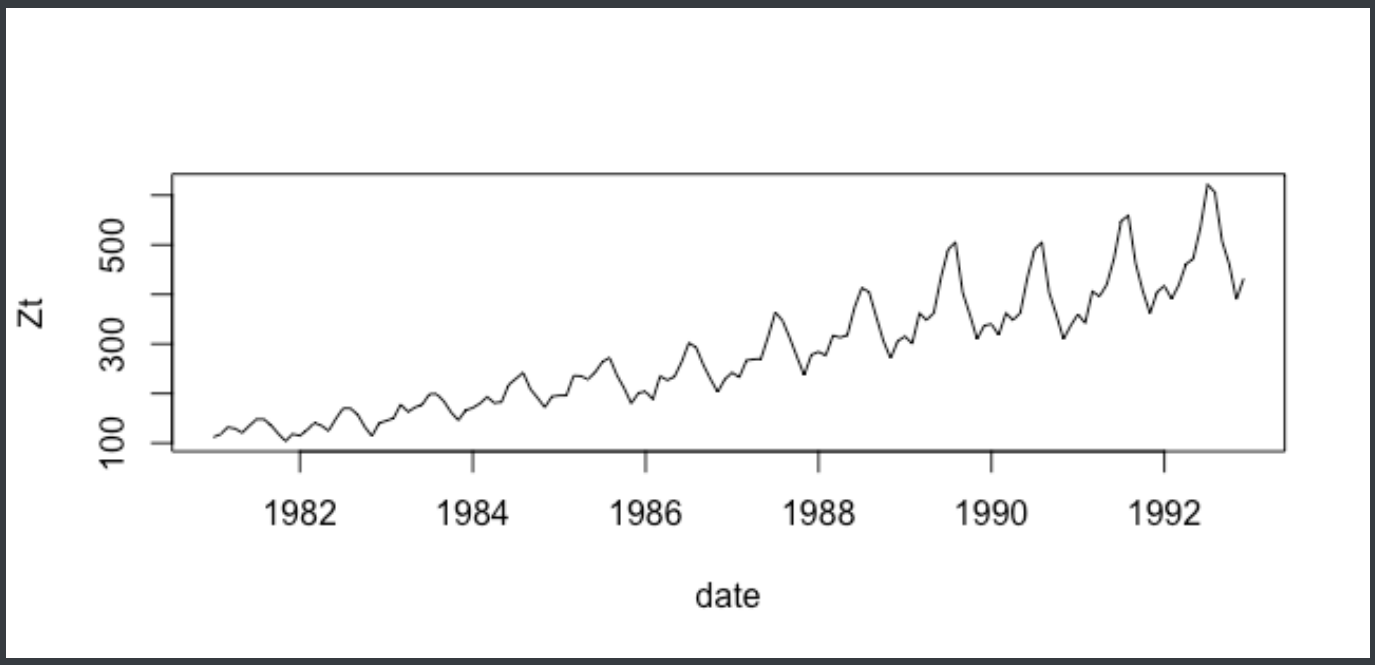
Ex 1-7-3




```
z3 = scan("data/export.txt")
z3_ts = ts(z3, start=c(1981, 1), frequency=12)
ts.plot(z3_ts, xlab="date", ylab="Zt")
```

10 월 정도에 가장 높은 값을 보이는 주기 성분이 발견된다. 비선형의 추세 성분이 발견된다.

Ex 1-7-4




```
z4 = scan("data/usapass.txt")
z4_ts = ts(z4, start=c(1981, 1), frequency=12)
ts.plot(z4_ts, xlab="date", ylab="Zt")
```

강한 선형 추세 성분과 시간이 흐름에 따라 주기 성분이 강해지는 패턴이 발견된다.