시계열자료분석HW03

Ch 05,06

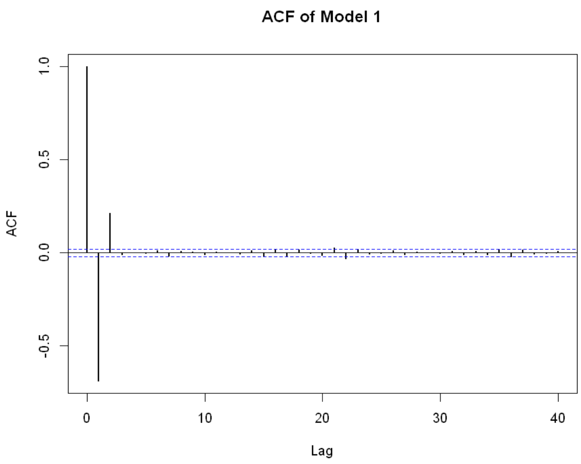
In [1]:
```
options(repr.plot.width = 15, repr.plot.height = 6)
```

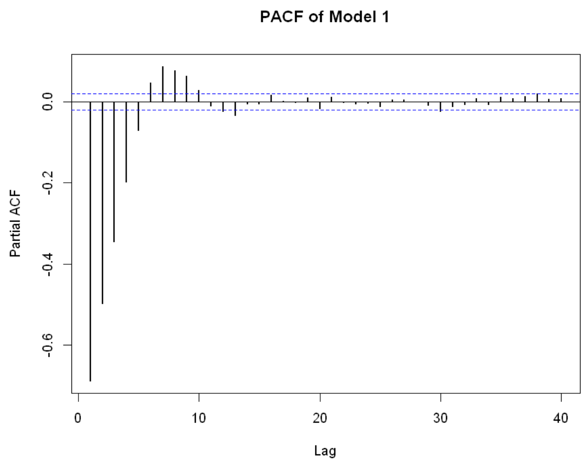
5번

모형1 : $Z_t - 9.5 = \varepsilon_t - 1.3\varepsilon_{t-1} + 0.6\varepsilon_{t-2}$

$(Z_t - 9.5) = (1 - 1.3B + 0.6B^2)\varepsilon_t,\ \ MA(2)$

In [2]:
```
z <- arima.sim(n=10000, list(ma=c(-1.3, 0.6))) + 9.5
par(mfrow=c(1,2))
acf_z <- acf(z, lwd=2, main="ACF of Model 1", )
pacf_z <- pacf(z, lwd=2, main = "PACF of Model 1")
```





In [3]:
```
acf_z[1:10]
```

```
Autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
-0.688  0.211 -0.012  0.002 -0.001  0.010 -0.016  0.008  0.005 -0.011 
```

In [4]:
```
pacf_z[1:10]
```

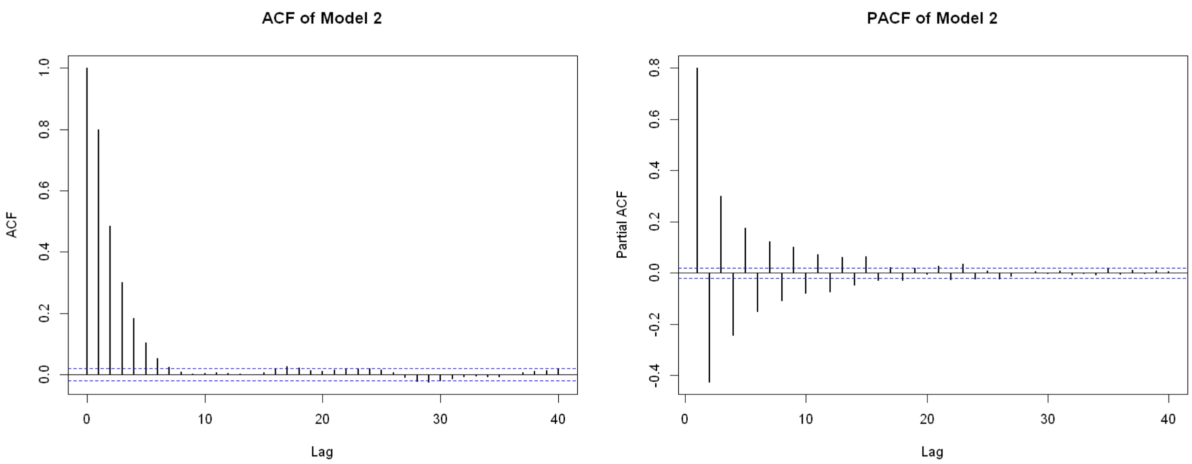
```
Partial autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
-0.688 -0.498 -0.345 -0.198 -0.071  0.047  0.086  0.076  0.064  0.028 
```

모형2 : $Z_t - 0.6Z_{t-1} = 38 + \varepsilon_t + 0.9\varepsilon_{t-1}$

$(1 - 0.6B)(Z_t - 95) = (1 + 0.9B)\varepsilon_t : ARMA(1,1)$

In [5]:
```
z <- arima.sim(n=10000, list(ar=0.6, ma=0.9)) + 95
par(mfrow=c(1,2))
acf_z <- acf(z, lwd=2, main="ACF of Model 2", )
pacf_z <- pacf(z, lwd=2, main = "PACF of Model 2")
```



In [6]:
```
acf_z[1:10]
```

```
Autocorrelations of series 'z', by lag

    1     2     3     4     5     6     7     8     9    10 
0.799 0.486 0.302 0.184 0.104 0.054 0.026 0.009 0.003 0.004 
```

In [7]:
```
pacf_z[1:10]
```

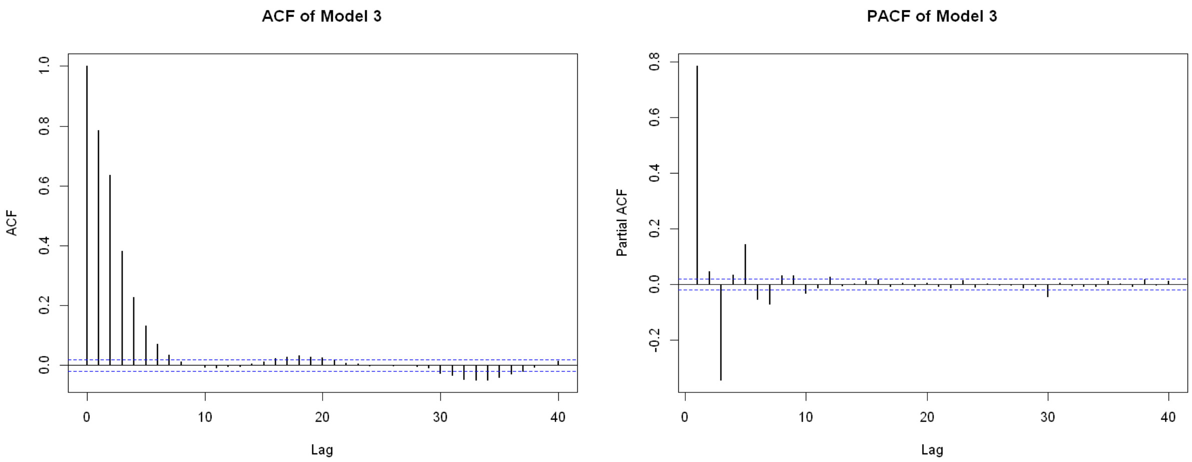
```
Partial autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
 0.799 -0.425  0.299 -0.244  0.176 -0.150  0.123 -0.109  0.102 -0.078 
```

모형3 : $Z_t = 26 + 0.6Z_{t-1} + \varepsilon_t + 0.2\varepsilon_{t-1} + 0.5\varepsilon_{t-2}$

$(1 - 0.6B)(Z_t - 65) = (1 + 0.2B + 0.5B^2)\varepsilon_t : ARMA(1, 2)$

In [8]:
```
z <- arima.sim(n=10000, list(ar=0.6, ma=c(0.2,0.5))) + 65
par(mfrow=c(1,2))
acf_z <- acf(z, lwd=2, main="ACF of Model 3", )
pacf_z <- pacf(z, lwd=2, main = "PACF of Model 3")
```



In [9]:
```
acf_z[1:10]
```

```
Autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
 0.785  0.635  0.381  0.227  0.131  0.071  0.034  0.011  0.001 -0.006 
```

In [10]:
```
pacf_z[1:10]
```

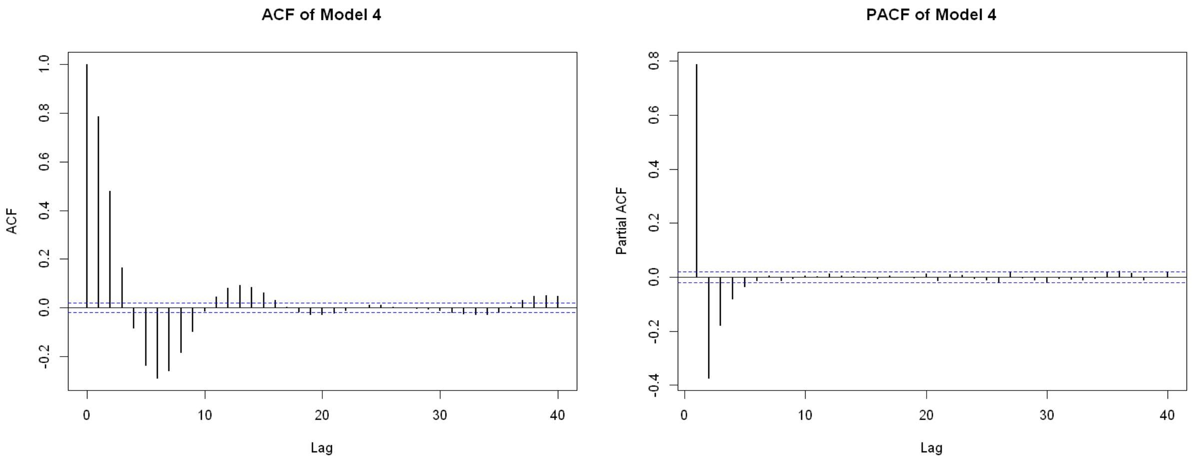
```
Partial autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
 0.785  0.047 -0.342  0.036  0.146 -0.052 -0.069  0.032  0.033 -0.031 
```

모형4 : $Z_t - 1.5Z_{t-1} + 0.7Z_{t-2} = 100 + \varepsilon_t - 0.5\varepsilon_{t-1}$

$(1 - 1.5B + 0.7B^2)(Z_t - 500) = (1 - 0.5B)\varepsilon_t : ARMA(2,1)$

In [11]:
```
z <- arima.sim(n=10000, list(ar=c(1.5,-0.7), ma=-0.5)) + 500
par(mfrow=c(1,2))
acf_z <- acf(z, lwd=2, main="ACF of Model 4", )
pacf_z <- pacf(z, lwd=2, main = "PACF of Model 4")
```



In [12]:
```
acf_z[1:10]
```

```
Autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
 0.788  0.479  0.166 -0.083 -0.236 -0.289 -0.260 -0.185 -0.096 -0.014 
```

In [13]:
```
pacf_z[1:10]
```

```
Partial autocorrelations of series 'z', by lag

     1      2      3      4      5      6      7      8      9     10 
 0.788 -0.373 -0.177 -0.080 -0.036 -0.012  0.004 -0.012 -0.004  0.005 
```

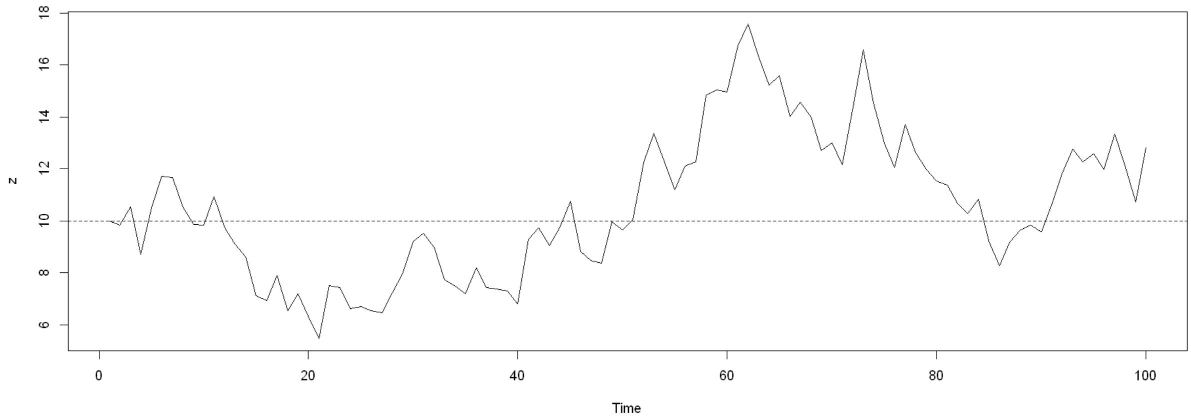
문제 7

확률과정 $Z_t = 1 + 0.9Z_{t-1} + \varepsilon_t, t = 1, 2, \ldots, 100$으로부터 시계열 자료를 생성한 후 다음을 수행하라. 단 $Z_0 = 10$의 값을 주고 는 $\varepsilon_t \sim_{i.i.d.} N(0,1)$이다.

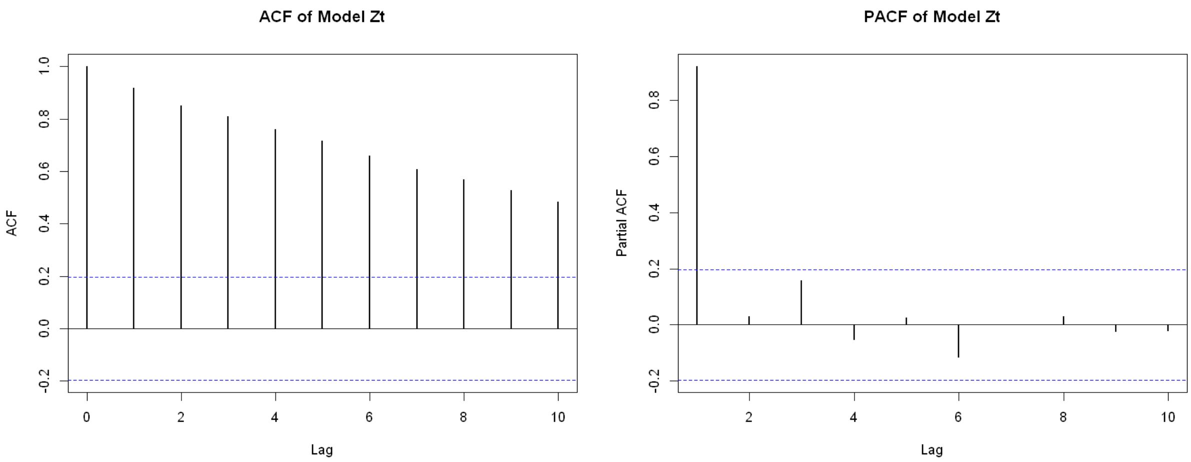
$\mu = \delta/(1 - 0.9) = 1/0.1 = 10 \;\Rightarrow\; (1 - 0.9B)(Z_t - 10) = \varepsilon_t$

In [14]:
```
ar_sim <- function(n, phi, mu, z0, sigma){
    z <- c(z0)
    for (k in 2:n){
        z[k] = (1-phi)*mu + phi * z[k-1] + rnorm(1,0,sigma)
    }
    return(z)
}
```

In [15]:
```
z <- ar_sim(100, 0.9, 10, 10, 1)
plot.ts(z)
abline(h=10, lty=2)
```



In [16]:
```
par(mfrow=c(1,2))
acf_z <- acf(z, lwd=2, main="ACF of Model Zt", lag.max=10)
pacf_z <- pacf(z, lwd=2, main = "PACF of Model Zt", lag.max=10)
```

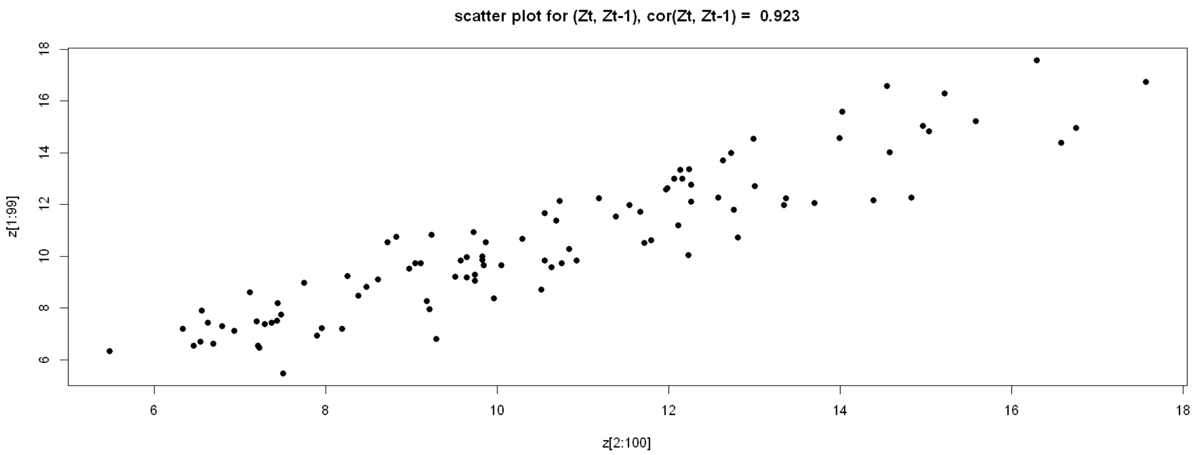


In [17]:
```
acf_z[1:2]
```

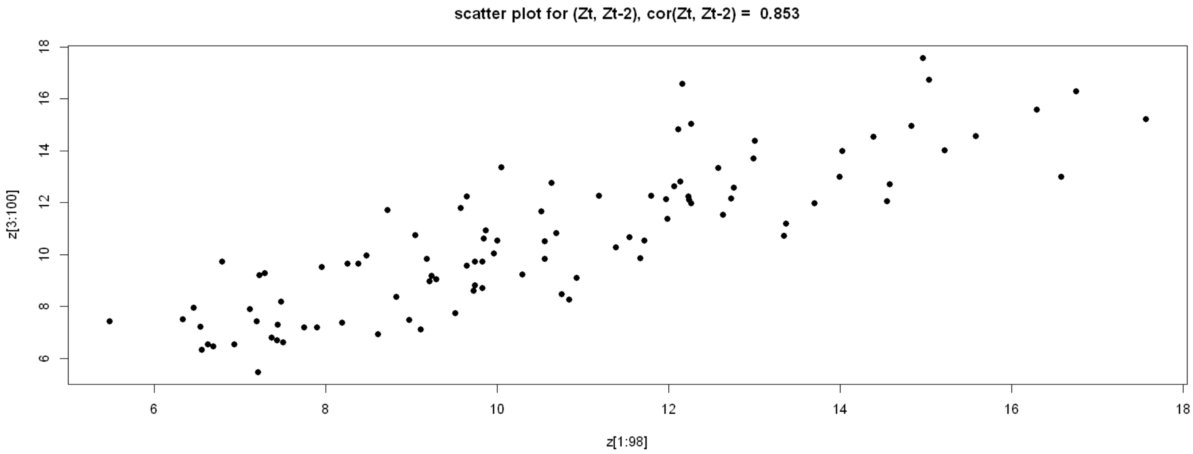
```
Autocorrelations of series 'z', by lag

    1     2 
0.919 0.850 
```

In [18]:
```
plot(z[2:100], z[1:99], pch=16,
     main = paste("scatter plot for (Zt, Zt-1), cor(Zt, Zt-1) = ", round(cor(z[2:100], z[1:99]),3)))
```



In [19]:
```
plot(z[1:98], z[3:100], pch=16, main = paste("scatter plot for (Zt, Zt-2), cor(Zt, Zt-2) = ", round(cor(
```


scatter plot for (Zt, Zt-2), cor(Zt, Zt-2) = 0.853
z[3:100]
z[1:98]
6
8
10
12
14
16
18

In [ ]: