pstat274_lab03_aoxu

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1.(a)

Solution: $(1 - 0.8B + 0.12B^2)X_t = Z_t$

(b)

Solution:

```
polyroot(c(1,-0.8,0.12))
```

```
## [1] 1.666667+0i 5.000000+0i
```

Since the roots are outside of the unit circle, then we could get that it's a casual AR(2), and also invertible since AR model is invertible.

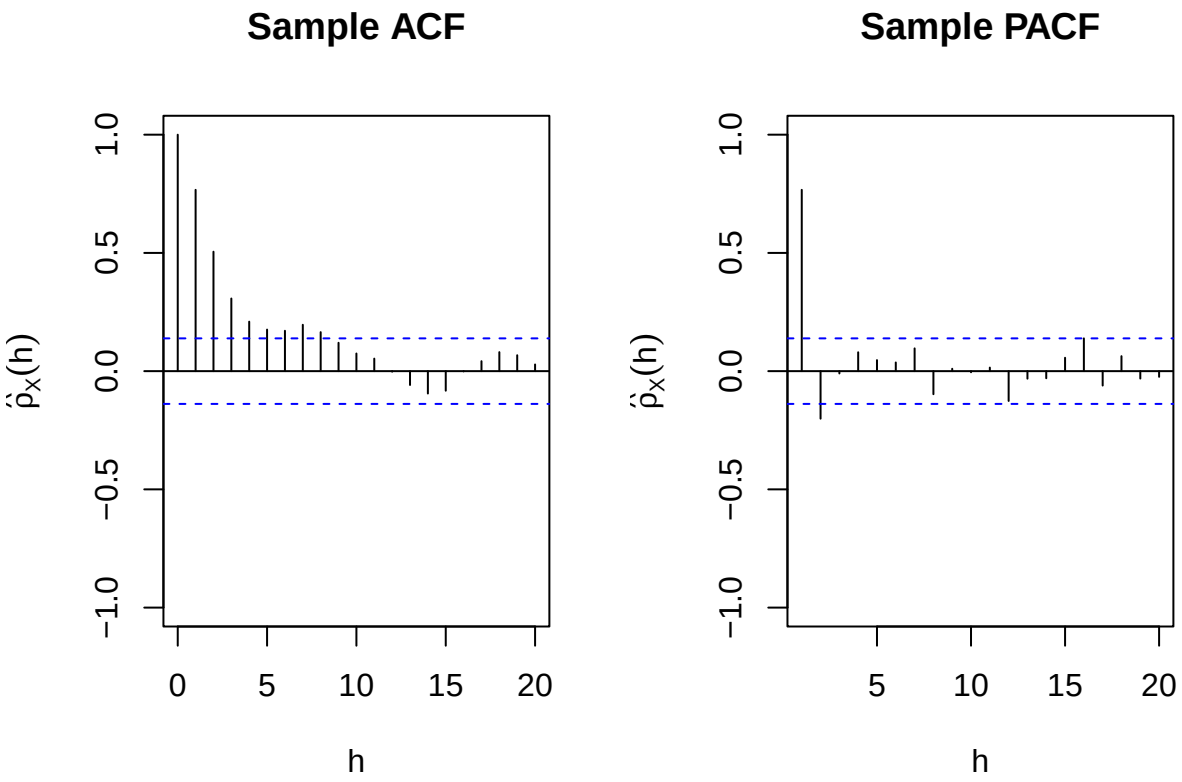
(c)

Solution:

```
set.seed(1234)
ar2 <- arima.sim(model = list(ar = c(0.8,-0.12),sd=1),n=200)

?ARMAacf
theo_acf <- ARMAacf(ar = c(0.8,-0.12),lag.max = 20, pacf = FALSE)
op <- par(mfrow = c(1,2))

acf(ar2,lag.max = 20,
        main = "Sample ACF",
        ylim = c(-1,1),
        xlab = "h",
        ylab = expression(hat(rho)[X](h)))
pacf(ar2,lag.max = 20,
        main = "Sample PACF",
        ylim = c(-1,1),
        xlab = "h",
        ylab = expression(hat(rho)[X](h)))
```



(d)

Solution:

```
acv_ar <- acf(ar2,type = "covariance",main = "Sample ACF",plot = F)
Rho <- toeplitz(acv_ar$acf[c(1,2)]/acv_ar$acf[1])
rho <- acv_ar$acf[c(2,3)]/acv_ar$acf[1]
phi_hat <- solve(Rho)%*%rho
phi_hat
```

```
##            [,1]
## [1,]  0.9210879
## [2,] -0.2011451
```

```
sigma_z <- acv_ar$acf[1]*(1-t(rho)%*%solve(Rho)%*%rho)
sigma_z
```

```
##          [,1]
## [1,] 1.024407
```

```
# parameter estimates
ar.yw(ar2)
```

```
##
## Call:
## ar.yw.default(x = ar2)
##
## Coefficients:
##       1        2
##  0.9211  -0.2011
##
## Order selected 2  sigma^2 estimated as  1.04
```

Therefore, $\hat{\phi_1}$ = 0.9210879, $\hat{\phi_2}$ = -0.2011451, $\hat{\sigma_z}^2$ = 1.024407, and predictor estimators are 0.9210879, -0.2011451, and 1.040007.