STAT 443: Lab 6

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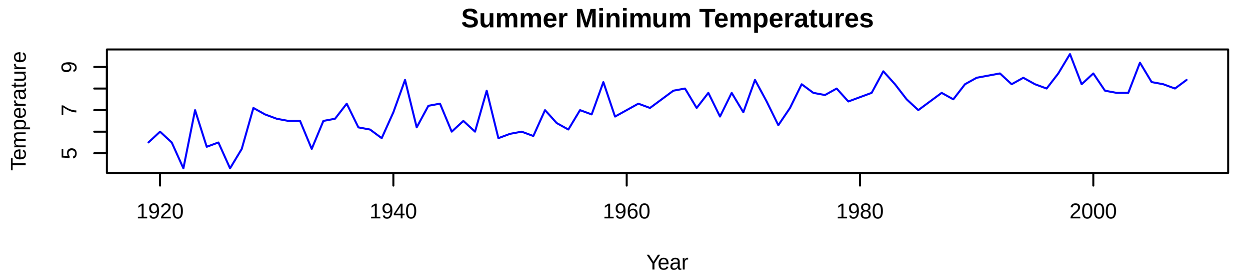
Question 1

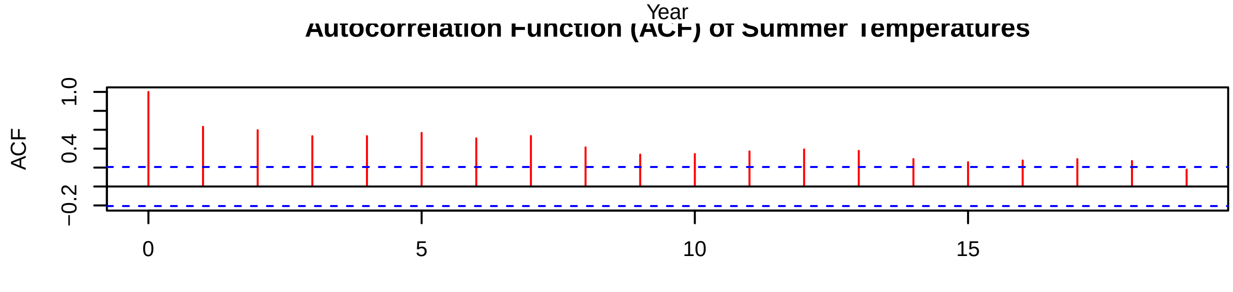
(a)

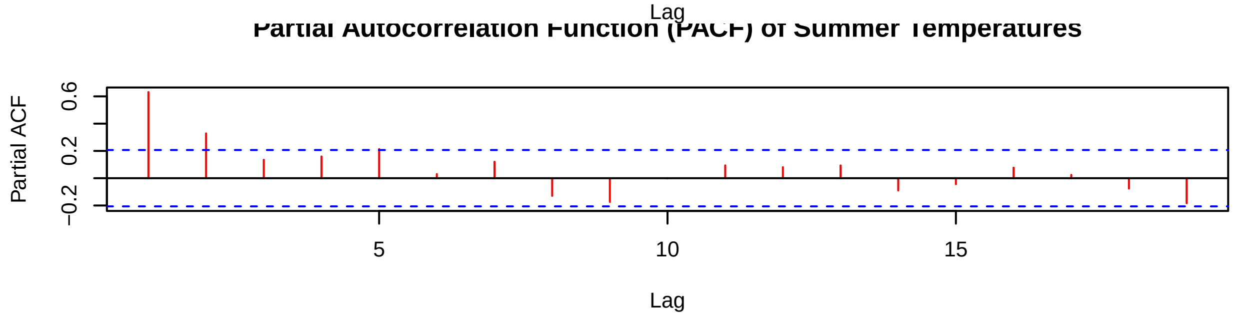
```
# this is where your R code goes

# a) Extract data & make into time series object
temp <- read.csv("TempPG.csv")

summer <- temp[, c("Year", "Summer")]

summer_ts <- ts(summer$Summer,
                start = min(summer$Year),
                frequency = 1)
```

(b)

```
# this is where your R code goes
fig.height=8
par(mfrow = c(3, 1), mar = c(4, 4, 2.5, 1))

# Time series plot
plot(summer_ts,
     main = "Summer Minimum Temperatures",
     ylab = "Temperature",
     xlab = "Year",
     col = "blue")

# sample acf
acf(summer_ts,
    main = "Autocorrelation Function (ACF) of Summer Temperatures",      col = "red")

# sample pacf
pacf(summer_ts,
     main = "Partial Autocorrelation Function (PACF) of Summer Temperatures",
     col = "red")
```







(c) For our time series plot, we see an noticable increasing trend over time from 1920 to 2000 meaning that there is a general increase in summer minimum temperature over the years.

For the ACF plot, we can observe slowly decaying positive autocorrelation at lags 0-15, suggesting a strong trend in the time series.

For the PACF plot, we see significant autocorrelation at lag 1, 2, and 5 while the other lags seem to stay within the boundary line.

(d) In our ACF function, we see patterns throughout with no cut off in patterns, therefore q = 0. In our PACF function, we observe a cut off at lag 2, therefore p =2

Hence, I believe an ideal model would be ARMA(2,0)

Question 2

(a)

```
# this is where your R code goes
fit <- arima(summer_ts, order = c(2, 0, 0))
fit
```

```
##
## Call:
## arima(x = summer_ts, order = c(2, 0, 0))
##
```

```
## Coefficients:
##          ar1     ar2  intercept
##       0.4297  0.3466     7.1615
## s.e.  0.0986  0.0994     0.3482
##
## sigma^2 estimated as 0.607:  log likelihood = -105.65,  aic = 219.3
```

X_t = 7.1615 + 0.4297X_t-1 + 0.3466X_t-2 + Z_t

Question 3

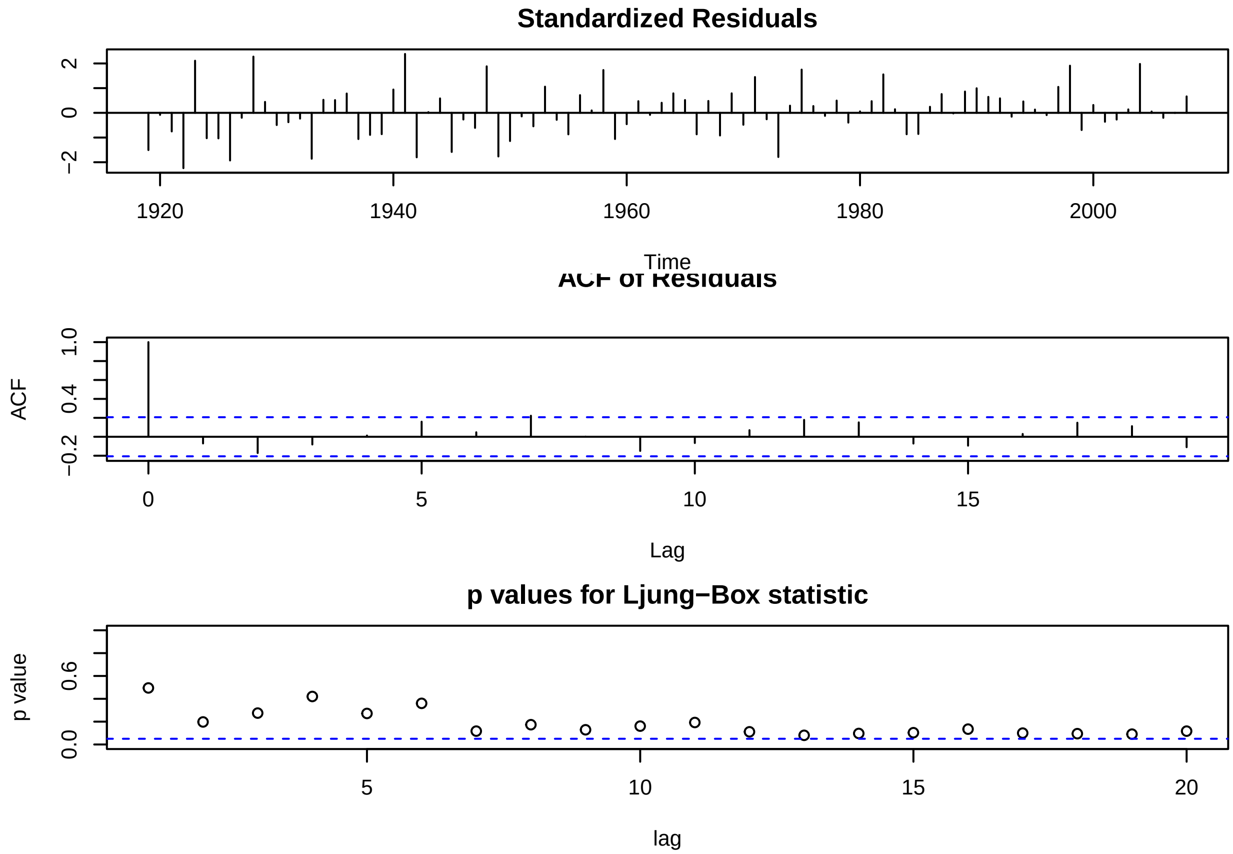
```r
# this is where your R code goes
confint(fit)
```

```
##                2.5 %    97.5 %
## ar1       0.2364843 0.6228622
## ar2       0.1517571 0.5413514
## intercept 6.4789359 7.8439979
```

We can observe the true values of ar1, ar2, and the true mean to be between the values given above.

Question 4

```r
# this is where your R code goes
fig.height= 20
# fig.width = 20

par(mfrow = c(3, 1), mar = c(4, 4, 2.5, 1))
par(fin = c(10, 10))

tsdiag(fit,
       gof.lag = 20)
```



We observe fluctuations and osciliations from 2 to -2 for our standardized residual plot.

For our ACF plot, we can see an osciliation within the boundary for all lags starting lag = 1. Mo significant autocorrelation at any lag suggests that our model captures the temporal dependence in our data well.

For our p values, we see most p-values are well above 0.05 across different lags which indicates that we fail to reject the null hypothesis of no autocorrelation.

Overall, I believe my ARMA(2,0) model fits well because there are no significant autocorrelation in our residuals and it does not exhibit any patterns.