**October Challenge – Group 6 - Yike Liu**

Forecast Question: What will be the annual rate of housing starts for April 2021?

https://www.gjopen.com/questions/1799-what-will-be-the-annual-rate-of-housing-starts-for-april-2021

Database: Housing Starts: Total: New Privately Owned Housing Units Started (not seasonally adjusted)

https://fred.stlouisfed.org/series/HOUSTNSA

First, I take a look at the time series. As we can see in the plot, there is a huge drop from 2007 due to financial crisis. Just like the same issue occurs in Problem Set 3, The 'trend' we see in the 1990's was a bubble that sharply fell after the 2008 sub-prime mortgage collapse.
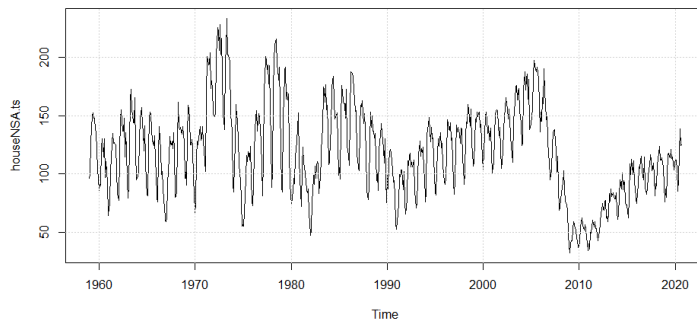
Therefore, I decide to use the data after 2008.12 to forecast this question. As we can observe from the following plot, this time series has an obvious seasonality and a positive trend.
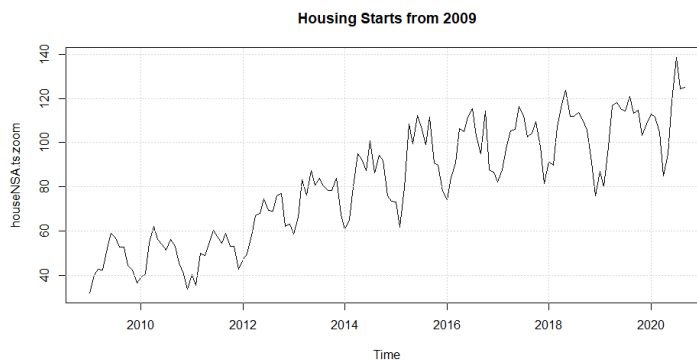
Therefore, I try to use Holt/Winters seasonal filter model to forecast. To a certain extent, the model predicts more accurately (compared to the plan included 2008 in training period and the plan included in validation period, we will not elaborate here)
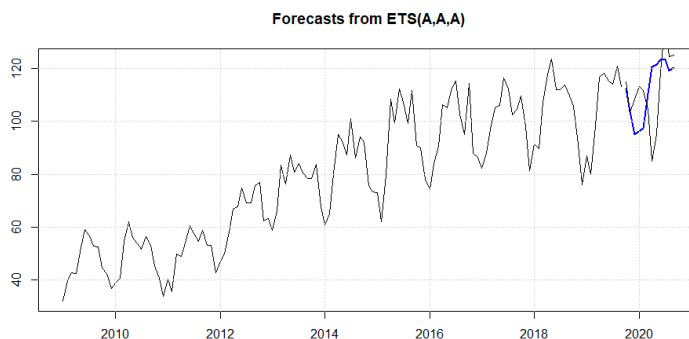
Therefore, the forecast house starting for April 2021 is 127.2795 thousands of units, which falls within the range of 【**More than 1.2 million but less than 1.4 million**】. However, considering the covid impact, I personally think this number might be a little lower than the forecast. Therefore, my final forecast would be:

25%: 【**Between 1.0 million and 1.2 million, inclusive**】
75%: 【**More than 1.2 million but less than 1.4 million**】

R Script:

```
library(forecast)
houseNSA <- read.csv("C:/Users/yikel/Desktop/Forcasting/data/HOUSTNSA.csv")

#to have a general look at this time series
houseNSA.ts <- ts(houseNSA$HOUSTNSA, start=c(1959,1), freq=12)
plot(houseNSA.ts)
#observe data after 2008.12
houseNSA.ts.zoom <- window(houseNSA.ts,start=c(2009,1))
plot(houseNSA.ts.zoom, main = "Housing Starts from 2009")
grid()
#use Holt/Winters seasonal filter model
train.ts <- window (houseNSA.ts.zoom,end=c(2019,9))
valid.ts <- window (houseNSA.ts.zoom,start=c(2019,10),end=c(2020,9))
nValid <- length (valid.ts)
nTest <- 12
#see the model validation
ses.1 <- ets(train.ts, model = "AAA" )
ses.1.pred <- forecast(ses.1, h = nValid, level =0.0)
plot(ses.1.pred)
lines(valid.ts)
grid()
#find the forecast
ses.2 <- ets(houseNSA.ts.zoom, model = "AAA" )
ses.2.pred <- forecast(ses.2, h = nTest, level =0.0)
ses.2.pred$mean
```