

ISYE 6501 HW 4

Question 7.2

```
> setwd("~/Desktop/ISYE 6501/ISYE HW 3/temps")
```

```
temps <- read.table("temps.txt", stringsAsFactors = FALSE, header = T)
```

```
head(temps)
```

	DAY	X1996	X1997	X1998	X1999	X2000	X2001	X2002	X2003	X2004	X2005	X2006	X2007	X2008	X2009	X2010	X2011	X2012	X2013	X2014	X2015
1	1-Jul	98	86	91	84	89	84	90	73	82	91	93	95	85	95	87	92	105	82	90	85
2	2-Jul	97	90	88	82	91	87	90	81	81	89	93	85	87	90	84	94	93	85	93	87
3	3-Jul	97	93	91	87	93	87	87	87	86	86	93	82	91	89	83	95	99	76	87	79
4	4-Jul	90	91	91	88	95	84	89	86	88	86	91	86	90	91	85	92	98	77	84	85
5	5-Jul	89	84	91	90	96	86	93	80	90	89	90	88	88	80	88	90	100	83	86	84
6	6-Jul	93	84	89	91	96	87	93	84	90	82	81	87	82	87	89	90	98	83	87	84

Plotting Time Series

I created a time series plot first, I set the data equal to the temps, frequency to 123 (observations of 20 variables), and starting point at 1996 because it's the first year. Time series shows a visual of the data and see how its trending over time, and also to see if there's any patterns or randomness

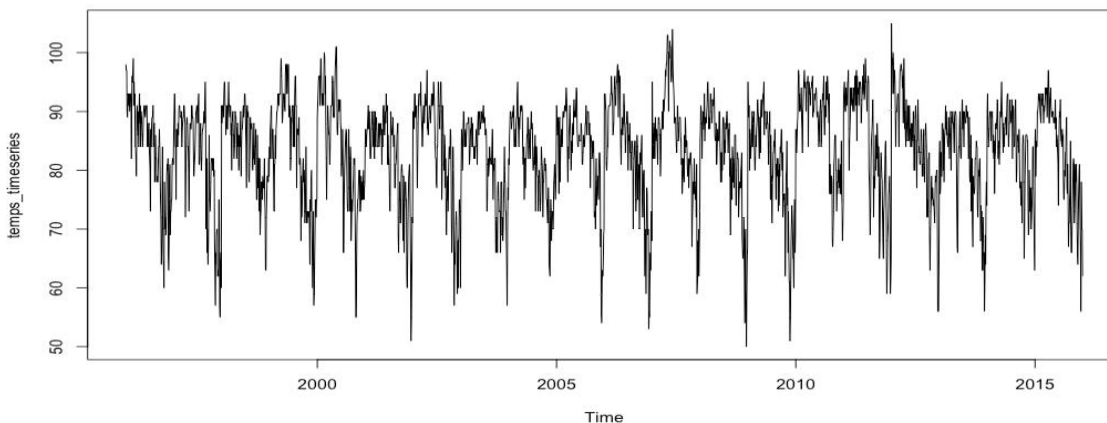
```
temps_vector <- as.vector(unlist(temps[,2:21]))
```

```
temps_timeseries <- ts(data = temps_vector, frequency=123, start=1996)
```

```
summary(temps_timeseries)
```

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
50.00	79.00	85.00	83.34	90.00	105.00

```
ts.plot(temps_timeseries)
```



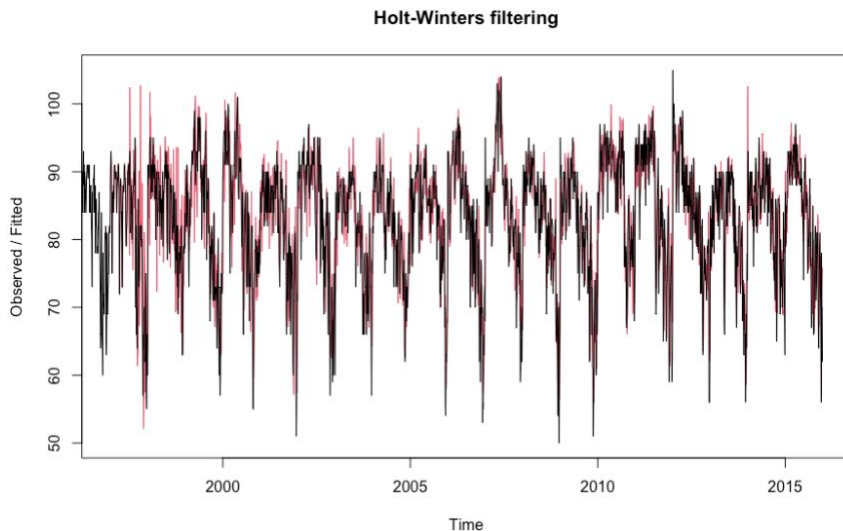
Plotting Holt Winters

Next, I plotted Holt-Winters model, which takes trend and seasonality into account. I set parameters alpha, beta, and gamma to NULL as default values so that the model calculates the. Alpha is for level smoothing beta is for trend smoothing, and gamma is for seasonal smoothing. At calculation, all are equal to 1- alpha being 1 means theres less randomness so the current data holds more weight. Beta and gamma being 1 means there's also seasonality and trends.

```
temps_holtwinters <- HoltWinters(temps_timeseries, alpha=NULL, beta=NULL,
gamma=NULL, seasonal = "multiplicative")
```

```
summary(temps_holtwinters)
```

```
plot(temps_holtwinters)
```



	Length	Class	Mode
fitted	9348	mts	numeric
x	2460	ts	numeric
alpha	1	-none-	numeric
beta	1	-none-	numeric
gamma	1	-none-	numeric
coefficients	125	-none-	numeric
seasonal	1	-none-	character
SSE	1	-none-	numeric
call	6	-none-	call

Plotting Forecast

Next, I used forecast to visualize the data from 2016 to 2019, the confidence in data decreases as time for prediction increases, it becomes less relevant to the forecast and the confidence interval bounds become wider as time increases. Based on the previous plots and this one, there is lack of evidence to support that summer has gotten longer and hotter in Atlanta.

```
temps_fc = stats::predict(temps_hw, n.ahead = 365, prediction.interval = TRUE)
```

```
plot(temps_fc)
```

