**Question 6.2**

1. Using July through October daily-high-temperature data for Atlanta for 1996 through 2015, use a CUSUM approach to identify when unofficial summer ends (i.e., when the weather starts cooling off) each year. You can get the data that you need from the file temps.txt or online, for example at <http://www.iweathernet.com/atlanta-weather-records> or <https://www.wunderground.com/history/airport/KFTY/2015/7/1/CustomHistory.html> . You can use R if you’d like, but it’s straightforward enough that an Excel spreadsheet can easily do the job too.
2. Use a CUSUM approach to make a judgment of whether Atlanta’s summer climate has gotten warmer in that time (and if so, when).

Answer 2 :

Based on the yearly summary. The weather actually colling down in October and there is no evidence that any year has long summer.

In year of 1996 the day Summer actually started is: 6-Oct

In year of 1997 the day Summer actually started is: 19-Oct

In year of 1998 the day Summer actually started is: 22-Oct

In year of 1999 the day Summer actually started is: 23-Oct

In year of 2000 the day Summer actually started is: 9-Oct

In year of 2001 the day Summer actually started is: 28-Oct

In year of 2002 the day Summer actually started is: 18-Oct

In year of 2003 the day Summer actually started is: 11-Oct

In year of 2004 the day Summer actually started is: 14-Oct

In year of 2005 the day Summer actually started is: 25-Oct

In year of 2006 the day Summer actually started is: 23-Oct

In year of 2007 the day Summer actually started is: 26-Oct

In year of 2008 the day Summer actually started is: 23-Oct

In year of 2009 the day Summer actually started is: 17-Oct

In year of 2010 the day Summer actually started is: 4-Oct

In year of 2011 the day Summer actually started is: 23-Oct

In year of 2012 the day Summer actually started is: 29-Oct

In year of 2013 the day Summer actually started is: 23-Oct

In year of 2014 the day Summer actually started is: 22-Oct

In year of 2015 the day Summer actually started is: 29-Oct

**R – Query**

#Data frame to store the CUSUM values for each year

cusum\_df<-data.frame(matrix(nrow=nrow(temps),ncol=length(1996:2015)+1))

#Assign columns names to CUSUM data frame

colnames(cusum\_df)<-colnames(temps[,1:21])

# converting to Date

print(cusum\_df$DAY<-temps$DAY)

#using Zero start method ,calculating cusum values for each year

for(y in 2:ncol(cusum\_df)){

cusum\_df[1,y]<-0

mu<-mean(temps[,y])

std<-sd(temps[,y])

threshold<-5\*std

change<-NULL

for(i in 2:nrow(cusum\_df)){

cusum\_df[i,y]<-max(0,cusum\_df[i-1,y]+(mu-temps[i,y]-std))

if (cusum\_df[i,y]>=threshold){

change<-append(change,cusum\_df[i,y])}}

cat("In year of",colnames(cusum\_df[y]),"the day Summer actually started is:",

cusum\_df[which(cusum\_df[,y]==change[1]),"DAY"],"\n")

}