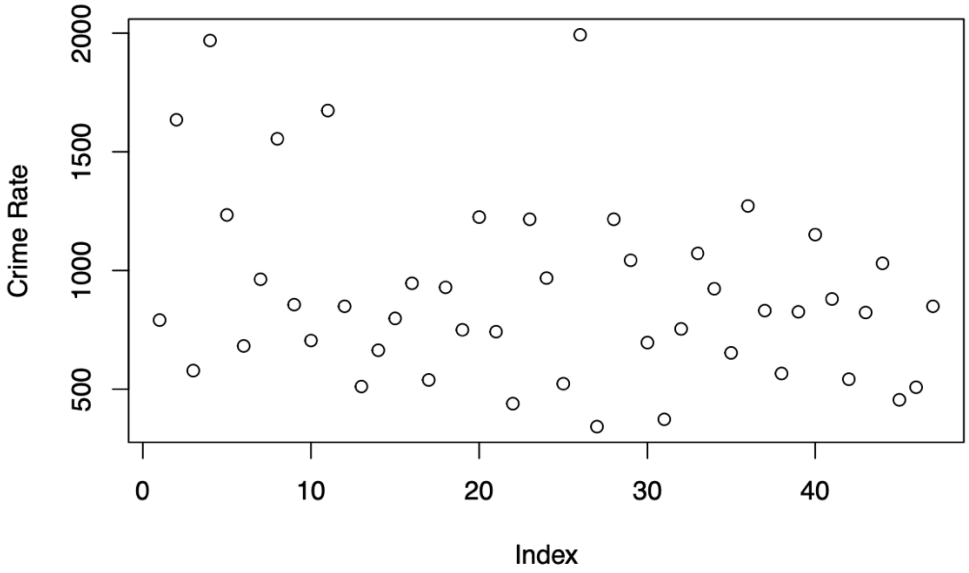
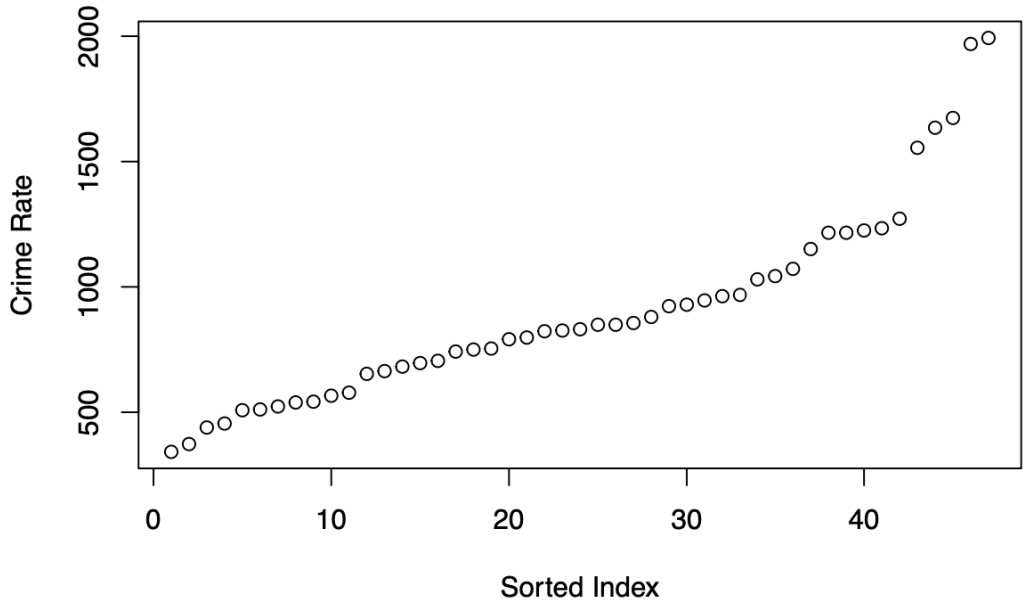
Question 5.1



At first, I plotted the data, and then the data was arranged in ascending order and plotted to visually check for outliers.



We see from the second graph that a straight line appeared on the Q-Q plot for totally normal data. On the right tail, this Line departs from a straight line quite a bit. We'll conduct a test to ensure normality. Using the *grubbs.test* I analyzed the lowest and the highest value to verify if they are outliers. From the graph above, although it is unclear just which outliers exist at the highest crime rates, it certainly appears that there are some.

The highest-crime city might be an outlier(p=0.079), and if we remove it, the second-
The highest-crime city also appears to be an outlier(p=0.028). therefore, we conclude that there are outliers within this data set and they are located the near the highest values.

Meanwhile, the lowest crime rate does not seem to be an outlier based on this figure. The two points with the highest crime rates are 1969 and 1993, which are much above the cluster. Based on the *grubbs.test, a* p-value of 1 indicates, according to the findings of this test, that the lowest values in the "Crime" column are not outliers and fall within the predicted standard deviation.

The box-and-whisker plot below shows the data more clearly.

Question 6.1

An example of where Change Detection may be applied is for farmers to decide when will be the best time of the year to harvest their products based on environmental changes. Having the ability to weed out extreme climates of the year, the growers may harvest when the fruits are at their ideal sugar level based on temperature readings (or outliers).

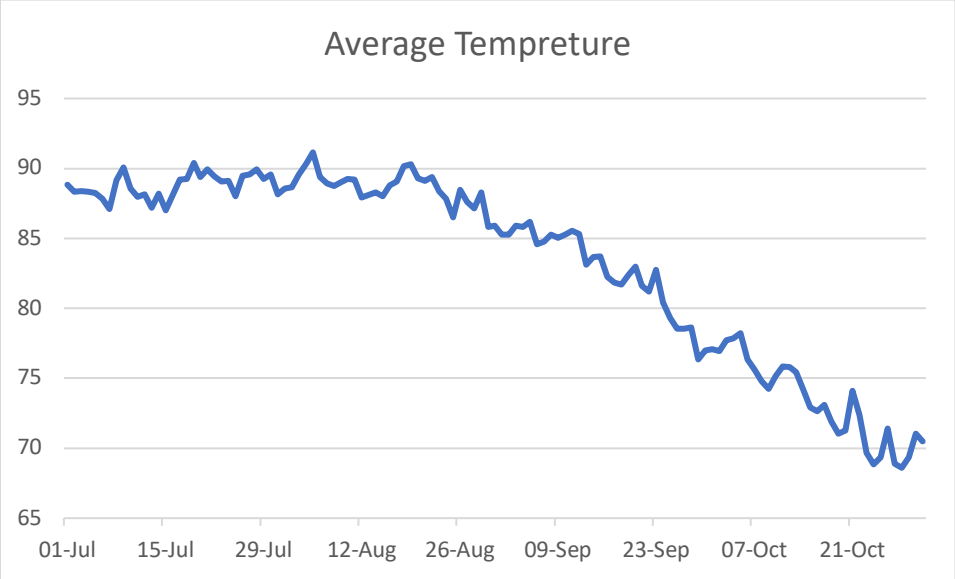
Average temperatures from previous years that were recorded would make a reasonable threshold. The optimal sugar concentration for the month and year can be detected between the highest and lowest limits to endure outliers are spotted.

The ideal harvesting time can be determined by choosing a large critical value, which helps avoid readings with extensive temperature variations. On the other hand, if there are no extreme outliers from the previous years, we could apply a lower C value to calculate the data.

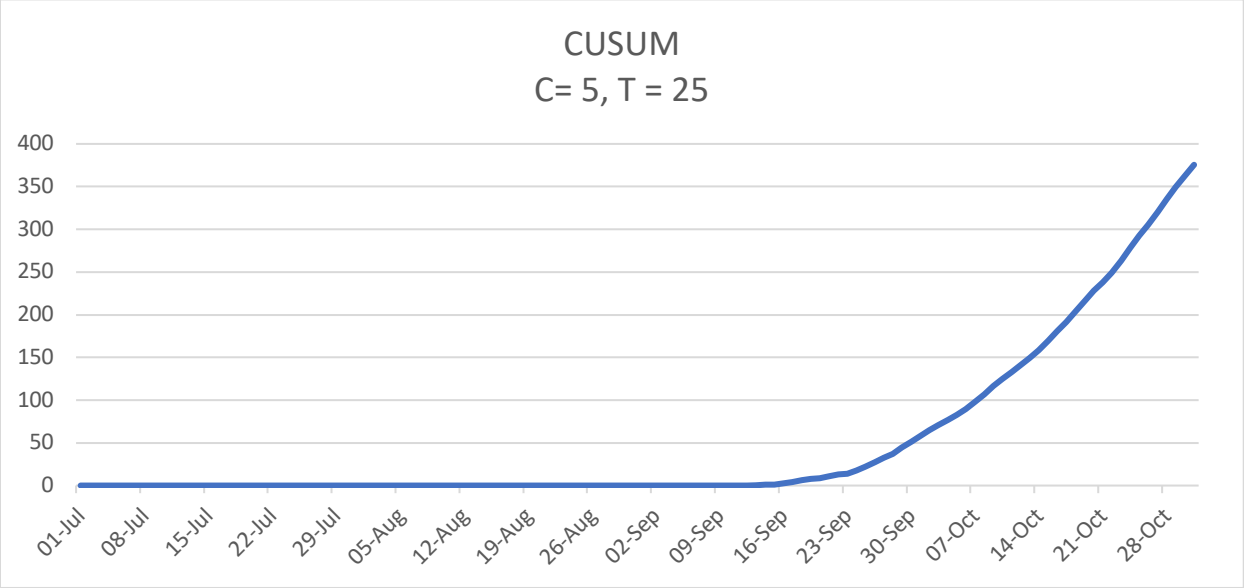
Question 6.2.1

The first step to solving this question is to import the data into Excel. When you import temps.txt into an Excel worksheet, you get a spreadsheet containing 124 rows for the days between July 1 and October 31 and 21 columns for day labels and 20 years' worth of Fahrenheit temperature readings.

After loading the data, I calculated the average temperature each year over the 20-year period 1996-2015 by applying the average function in Excel and plotted the line graph as follows:

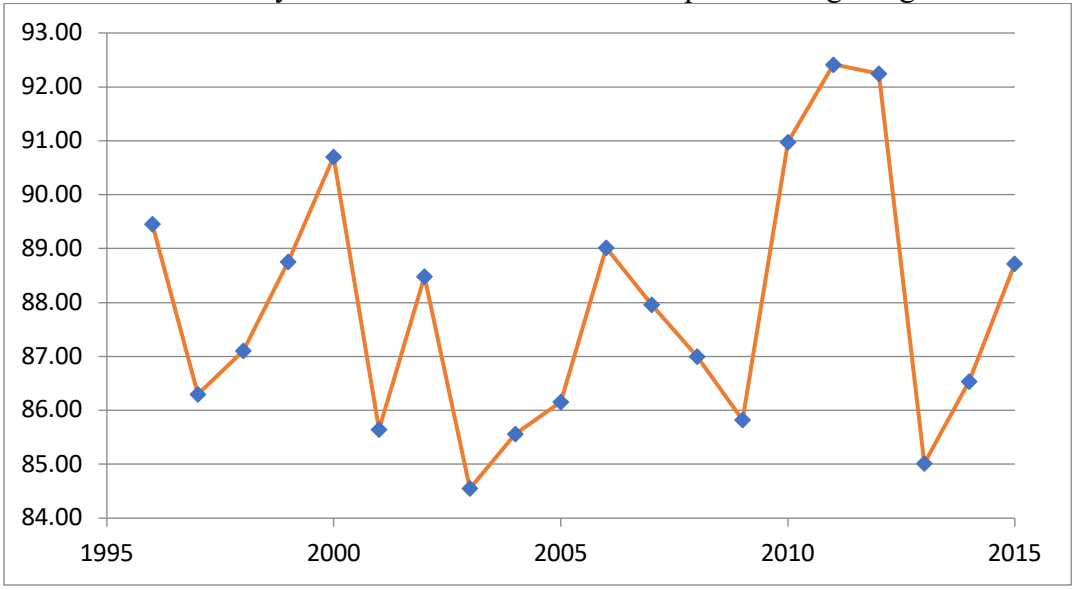


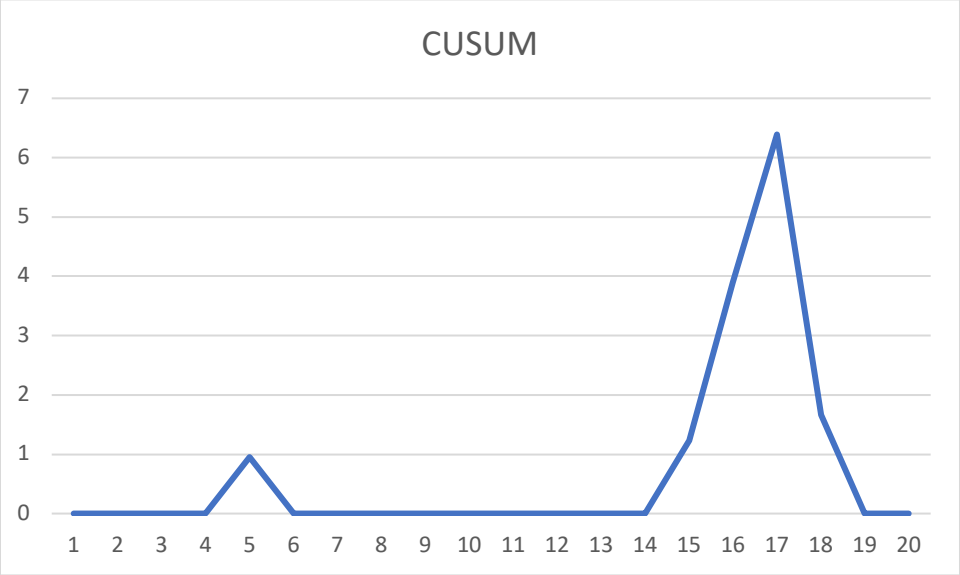
Further, I calculated the max of July averages, min of July averages, and standard deviation of July averages. I used the average July temperature as the Mu. The C value and T value were determined as C = 5 and T = 25. I calculated the CUSUM using the formula (St = MAX(0,St(previous day)+([temp on day(x)/year(y)] - Mu - C))) and is plotted as follows. I would conclude that based on the two graphs, the temperature seems to be dropping around the beginning of September and then drastically decreasing.



Question 6.2.2

For this question, we are essentially trying to figure out how long is summer and are those days getting hotter. Based on the previous question, we can determine the change date of each year and then calculate the average year temperature until that date as shown below. I have also plotted the CUSUM graph to show the difference. We can see that there are fluctuations in between each year and there are significant changes in 2011-2013, however, we also see that temperature drops back in 2014. Therefore, we can conclude that summer temperature changes and it is hard to firmly conclude that the summer temperature is getting warmer.



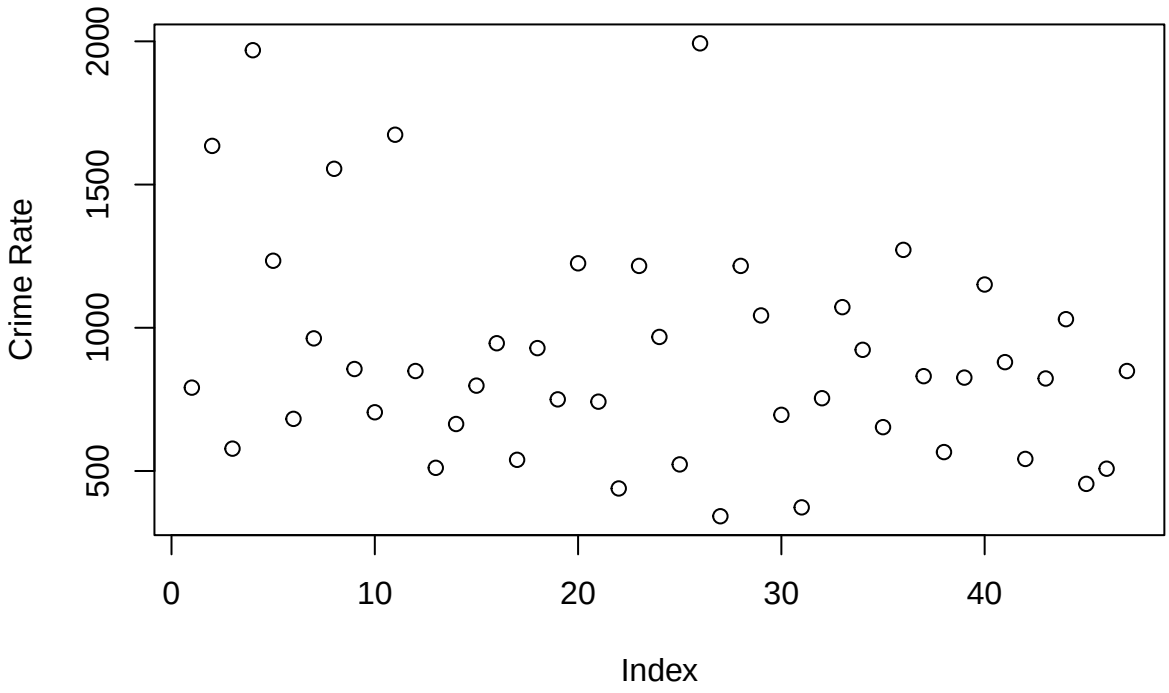

CUSUM
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

HW3

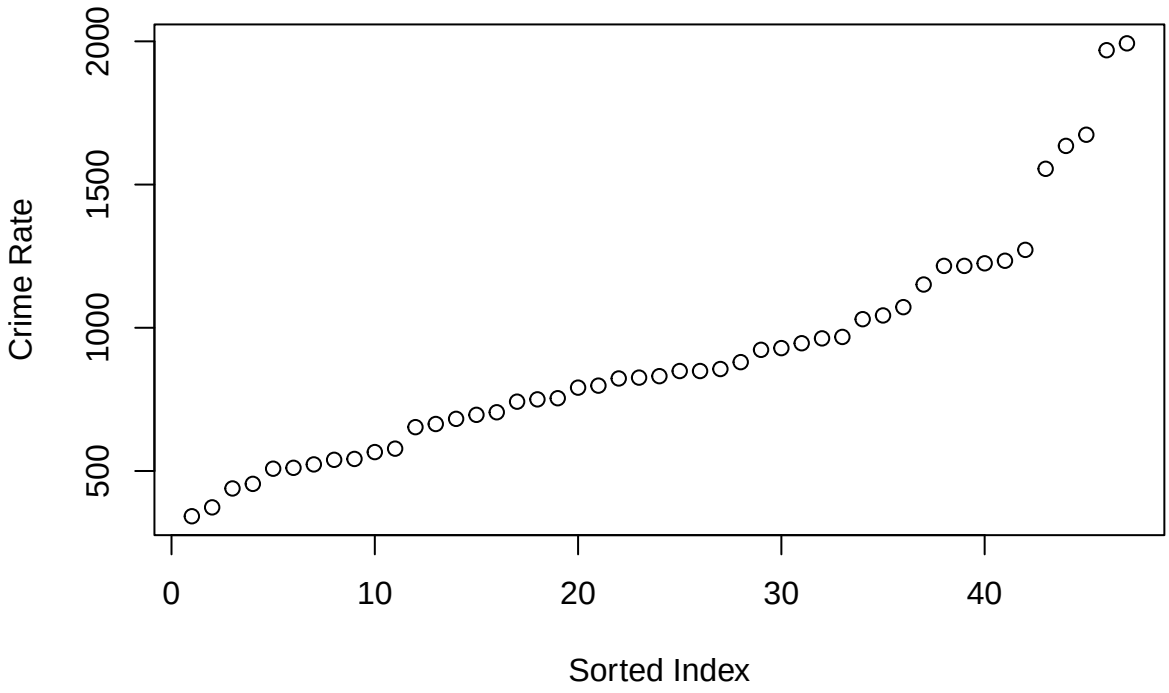
2022-09-13

Question 5.1

```
library(outliers)

# Clear the enviroment
rm(list = ls())

# Comment in set.seed(33) to repeat results across different values of k
set.seed(33)
library(outliers)


# Load crime data into a data frame
uscrime_df <- read.table("/Users/xiaofanjiao/Desktop/uscrime.txt", header=TRUE)
sort = t(uscrime_df$Crime[order(uscrime_df$Crime)]) #sort the Crime data for easier plotting

plot(seq(1:length(uscrime_df$Crime)),
     uscrime_df$Crime,
     xlab = "Index",
     ylab = "Crime Rate") #Plots the crime data
```




```
plot(seq(1:length(sort)), sort, xlab = "Sorted Index", ylab = "Crime Rate") #Plots the sorted crime dat
```




```
# Use grubbs.test to check if lowest and highest value are two outliers on opposite tails of sample
grubbs.test(uscrime_df$Crime, type = 11, opposite = FALSE, two.sided = TRUE)
```

```
##
##  Grubbs test for two opposite outliers
##
## data:  uscrime_df$Crime
## G = 4.26877, U = 0.78103, p-value < 2.2e-16
## alternative hypothesis: 342 and 1993 are outliers
```

```
# Use grubbs.test to check if highest value is an outlier
grubbs.test(uscrime_df$Crime, type = 10, opposite = FALSE, two.sided = FALSE)
```

```
##
##  Grubbs test for one outlier
##
## data:  uscrime_df$Crime
## G = 2.81287, U = 0.82426, p-value = 0.07887
## alternative hypothesis: highest value 1993 is an outlier
```

```
# Use grubbs.test to check if lowest value is an outlier
grubbs.test(uscrime_df$Crime, type = 10, opposite = TRUE, two.sided = FALSE)
```

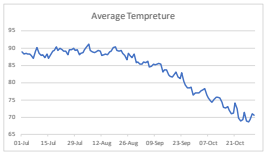
```
##
```

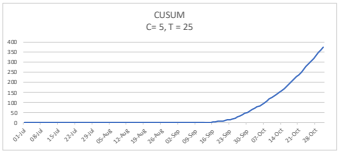
```
##  Grubbs test for one outlier
##
## data:  uscrime_df$Crime
## G = 1.45589, U = 0.95292, p-value = 1
## alternative hypothesis: lowest value 342 is an outlier
```

```
# Plot usdata_df$crime as a boxplot
boxplot(uscrime_df$Crime,data=uscrime_df$Crime, main="US Crime Rate per 100k")
```

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average	CUSUM
01-Jul	98	86	91	84	89	84	90	73	82	91	93	95	85	95	87	92	105	82	90	85	88.85	0
02-Jul	97	90	88	82	91	87	90	81	81	89	93	85	87	90	84	94	93	85	93	87	88.35	0
03-Jul	97	93	91	87	93	87	87	87	86	86	93	82	91	89	83	95	99	76	87	79	88.4	0
04-Jul	90	91	91	88	95	84	89	86	88	86	91	86	90	91	85	92	98	77	84	85	88.35	0
05-Jul	89	84	91	90	96	86	93	80	90	89	90	88	88	80	88	90	100	83	86	84	88.25	0
06-Jul	93	84	89	91	96	87	93	84	90	82	81	87	82	87	89	90	98	83	87	84	87.85	0
07-Jul	93	75	93	82	96	87	89	87	89	76	80	82	88	86	94	94	93	79	89	90	87.1	0
08-Jul	91	87	95	86	91	89	89	90	87	88	82	82	90	82	97	94	95	88	90	90	89.15	0
09-Jul	93	84	95	87	96	91	90	89	88	89	84	89	89	84	96	91	97	88	90	91	90.05	0
10-Jul	93	87	91	87	99	87	91	84	89	78	84	86	87	84	90	92	95	87	87	93	88.55	0
11-Jul	90	84	91	82	96	90	84	84	90	83	90	85	89	86	93	95	90	80	85	92	87.95	0
12-Jul	91	88	86	77	93	90	77	86	89	86	91	87	93	90	90	95	84	87	90	93	88.15	0
13-Jul	93	86	88	73	91	86	82	87	91	84	91	86	85	84	91	97	90	78	89	92	87.2	0
14-Jul	93	90	87	81	93	82	88	84	91	87	91	84	88	89	91	90	90	85	90	90	88.2	0
15-Jul	82	91	91	81	93	82	91	86	84	84	91	81	89	89	94	80	90	86	86	89	87	0
16-Jul	91	91	87	86	93	84	93	88	84	85	91	86	89	90	89	85	92	87	83	88	88.1	0
17-Jul	96	89	90	82	91	87	93	88	84	89	93	89	88	88	87	87	93	91	86	93	89.2	0
18-Jul	95	89	91	87	97	88	93	88	87	90	93	89	90	82	83	89	93	87	82	92	89.25	0
19-Jul	96	89	95	88	100	90	93	88	84	89	96	88	91	80	90	94	91	90	85	91	90.4	0
20-Jul	99	90	91	90	99	87	91	88	88	89	93	86	94	82	91	91	84	86	76	93	89.4	0
21-Jul	91	89	91	90	93	84	95	89	89	90	93	86	95	86	94	92	90	87	82	93	89.95	0
22-Jul	95	84	89	91	96	87	91	86	89	91	91	79	92	84	95	94	95	85	83	92	89.45	0
23-Jul	91	87	91	93	87	90	89	81	93	91	86	82	87	87	97	92	97	84	88	88	89.05	0
24-Jul	93	88	91	93	82	84	87	82	95	90	87	87	88	88	94	92	97	86	87	91	89.1	0
25-Jul	84	89	86	91	75	82	84	84	89	92	88	87	89	90	95	90	98	89	88	90	88	0
26-Jul	84	89	88	93	82	88	86	87	87	94	93	87	87	92	95	94	98	86	89	91	89.5	0
27-Jul	82	91	80	93	88	90	89	87	84	92	95	90	90	90	93	94	97	82	92	92	89.55	0
28-Jul	79	91	88	93	91	84	91	89	89	90	96	89	93	89	90	90	97	86	90	94	89.95	0
29-Jul	90	89	89	93	89	89	91	88	87	83	91	87	92	85	94	93	94	86	82	93	89.25	0
30-Jul	91	88	90	97	87	89	88	84	89	78	91	92	90	82	95	96	96	90	84	94	89.55	0
31-Jul	87	72	86	99	86	87	90	88	90	84	94	90	88	85	95	96	88	80	85	93	88.15	0
01-Aug	86	80	86	96	86	84	93	84	91	82	95	92	89	89	96	91	94	87	81	89	88.55	0
02-Aug	90	84	82	93	81	84	91	84	90	86	95	92	92	83	84	96	99	89	84	94	88.65	0
03-Aug	84	88	84	88	84	84	91	84	91	88	97	94	91	90	92	97	94	88	88	94	89.55	0
04-Aug	91	89	86	89	88	86	91	82	91	91	98	97	91	92	95	85	87	90	90	97	90.3	0
05-Aug	93	88	90	91	91	88	93	84	90	88	96	96	92	92	93	96	90	88	89	95	91.15	0
06-Aug	88	84	89	93	91	84	97	82	84	86	89	98	94	89	93	93	86	88	92	88	89.4	0
07-Aug	91	84	89	93	91	86	87	84	81	80	97	98	90	91	91	93	84	86	95	88	88.95	0
08-Aug	84	80	86	93	91	88	87	84	82	82	96	100	86	92	93	94	92	90	87	92	88.75	0
09-Aug	90	73	82	91	96	87	86	86	84	85	95	103	85	93	94	91	88	89	89	93	89	0
10-Aug	89	80	87	90	95	88	88	87	75	83	96	103	85	93	94	95	87	90	86	94	89.25	0
11-Aug	88	86	88	96	89	86	89	84	82	87	88	100	88	95	95	94	85	90	83	91	89.2	0
12-Aug	86	88	84	98	89	86	91	81	80	88	84	90	81	86	95	95	88	90	88	90	87.9	0
13-Aug	84	88	86	97	89	81	91	87	77	86	81	100	81	90	96	95	91	89	84	89	88.1	0
14-Aug	86	87	80	98	89	87	89	89	82	90	87	99	84	90	89	94	88	83	85	90	88.3	0
15-Aug	89	88	82	93	94	84	88	90	82	92	86	102	87	90	90	88	85	73	87	90	88	0
16-Aug	90	91	86	93	97	90	90	86	84	89	89	101	86	88	90	90	91	67	88	90	88.8	0
17-Aug	91	91	84	96	99	91	91	89	86	90	86	101	85	87	91	92	87	66	89	89	89.05	0
18-Aug	91	89	87	98	101	91	93	90	86	90	88	97	86	88	93	94	87	77	89	88	90.15	0
19-Aug	90	89	90	98	101	87	91	90	89	89	88	95	90	90	92	96	84	82	86	89	90.3	0
20-Aug	89	88	79	89	97	86	93	87	88	92	93	96	90	88	93	93	84	84	89	88	89.3	0
21-Aug	90	82	84	91	87	88	93	88	82	94	91	99	85	88	93	94	88	84	92	89	89.1	0
22-Aug	91	79	87	91	86	90	91	88	84	93	88	104	82	85	94	98	84	88	93	92	89.4	0
23-Aug	91	81	87	90	88	88	95	90	84	87	87	98	78	81	93	92	88	90	93	87	88.4	0
24-Aug	91	82	88	80	92	93	93	89	87	85	83	95	83	86	90	93	86	84	88	89	87.85	0
25-Aug	84	84	90	82	92	90	91	88	82	84	85	94	78	87	89	95	85	82	84	84	86.5	0
26-Aug	88	87	91	89	90	91	88	89	86	84	88	92	83	90	90	99	90	82	86	86	88.45	0
27-Aug	84	90	89	88	90	91	84	90	88	86	88	88	80	83	89	95	90	86	88	85	87.6	0
28-Aug	86	90	90	90	92	81	82	91	90	86	90	88	86	75	87	95	80	90	91	83	87.15	0
29-Aug	88	91	93	91	92	86	82	89	87	85	90	89	89	86	84	93	86	92	92	81	88.3	0
30-Aug	84	91	93	91	88	81	78	88	88	85	88	89	89	79	85	90	80	87	88	74	85.8	0
31-Aug	82	88	91	84	87	82	77	89	87	85	80	86	88	79	89	92	89	90	89	84	85.9	0
01-Sep	80	88	87	88	79	80	84	88	82	85	85	84	81	71	90	95	91	90	90	87	85.25	0
02-Sep	73	91	84	91	81	75	84	86	80	88	86	83	85	78	91	96	89	84	90	90	85.25	0
03-Sep	87	93	77	84	82	73	89	87	81	87	85	88	83	79	92	95	85	90	92	89	85.9	0
04-Sep	84	81	90	93	87	81	95	87	82	85	88	91	85	83	84	80	77	89	82	92	85.8	0
05-Sep	87	81	91	96	81	90	93	84	84	81	83	89	88	83	85	78	85	89	89	87	86.2	0
06-Sep	89	82	89	96	66	88	91	73	81	81	85	85	87	85	90	75	85	88	91	85	84.6	0
07-Sep	89	86	90	91	66	87	88	75	86	83	80	86	89	84	91	69	92	88	90	85	84.75	0
08-Sep	89	88	89	91	75	86	87	81	73	85	83	88	90	87	93	73	88	91	84	84	85.25	0
09-Sep	91	84	79	77	80	86	91	82	84	86	83	89	88	84	92	81	83	90	84	87	85.05	0
10-Sep	84	80	78	87	82	89	95	79	84	84	85	89	87	80	94	84	84	89	86	85	85.25	0
11-Sep	86	82	81	87	84	87	95	80	84	84	84	89	83	75	96	86	83	89	90	86	85.55	0
12-Sep	88	86	84	87	86	84	90	81	81	86	82	86	87	81	89	87	81	90	92	78	85.3	0
13-Sep	78	87	89	86	87	84	75	84	79	88	70	85	86	80	86	89	81	87	86	75	83.1	0.65
14-Sep	79	87	87	87	86	86	78	82	79	88	80	81	88	82	91	92	83	82	78	77	83.65	0.75
15-Sep	86	88	87	89	80	77	91	82	73	91	82	82	79	79	91	86	87	84	80	80	83.7	0.8
16-Sep	82	88	88	81	75	77	88	81	75	88	83	76	80	82	89	72	86	89	86	79	82.25	2.3
17-Sep	82	90	87	81	73	81	86	81	80	86	85	78	69	73	95	79	83	79	86	83	81.85	4.2
18-Sep	78	88	82	82	73	81	81	81	79	88	85	79	82	80	93	77	79	78	85	83	81.7	6.25
19-Sep	79	91	80	79	84	82	80	84	78	90	79	82	81	74	92	77	81	84	84	87	82.4	7.6
20-Sep	79	95	82	68	87	84	86	87	73	90	73	81	79	81	96	82	79	86	83	89	83	8.35
21-Sep	78	89	82	79	77	86	84	82	75	90	75	78	75	79	95	86	85	73	87	77	81.6	10.5
22-Sep	81	70	88	72	73	87	77	75	80	86	82	86	84	84	92	80	87	82	82	76	81.2	13.05
23-Sep	84	80	84	75	81	88	82	81	84	87	86	83	82	83	91	83	81	82	77	81	82.75	14.05
24-Sep	84	82	81	78	84	69	73	80	82	88	84	89	78	85	88	82	78	71	78	74	80.4	17.4
25-Sep	87	66	82	81	82	66	69	82	81	85	75	87	82	87	93	88	82	67	77	67	79.3	21.85
26-Sep	84	70	84	82	68	72	75	82	79	77	78	84	80	85	76	86	86	78	74	71	78.55	27.05
27-Sep	79	64	87	78	71	75	75	82	72	86	79	85	77	80	81	84	88	79	78	71	78.55	32.25
28-Sep	75	68	80	80	75	78	79	73	78	85	81	85	86	83	76	79	86	77	74	75	78.65	37.35
29-Sep	72	77	75	77	73	71	73	66	78	85	70	81	86	72	79	84	84	76	71	77	76.35	44.75
30-Sep	64	86	75	71	75	71	79	71	80	82	75	79	86	74	76	78	72	77	84	85	77	51.5
01-Oct	66	75	86	73	77	75	82	72	82	83	83	80	74	76	79	65	75	82	86	71	77.1	58.15
02-Oct	72	73	78	75	79	80	84	68	82	85	81	82	74	75	78	68	72	82	85	66	76.95	64.95
03-Oct	84	75	77	84	82	81	84	66	80	83	82	77	80	76	68	75	74	82	78	66	77.7	71
04-Oct	70	78	82	71	81	80	82	77	81	85	84	80	83	74	67	80	82	85	65	70	77.85	76.9
05-Oct	66	81	82	73	82	79	87	78	80	81	86	81	83	62	70	83	82	84	71	73	78.2	82.45
06-Oct	64	82	73	71	73	70	86	75	75	72	76	82	82	71	73	81	83	84	78	76	76.35	89.85
07-Oct	60	82	82	73	66	68	80	73	75	72	72	83	82	79	81	79	68	74	82	81	75.6	98
08-Oct	78	82	69	73	55	79	71	73	73	73	72	83	72	80	82	78	63	72	86	82	74.8	106.95
09-Oct	70	80	72	72	55	66	66	73	71	70	79	81	75	85	85	72	70	76	86	81	74.25	116.45
10-Oct	72	82	73	72	64	73	70	73	71	77	80	81	77	74	86	68	73	80	86	71	75.15	125.05
11-Oct	69	82	78	73	71	75	78	66	77	82	80	67	78	77	86	65	75	79	86	73	75.85	132.95
12-Oct	69	79	78	70	73	78	84	78	73	74	71	72	77	66	80	73	79	81	85	76	75.8	140.9
13-Oct	73	80	78	64	75	78	79	78	64	77	62	74	77	73	80	74	75	82	85	81	75.45	149.2
14-Oct	79	68	75	75	75	75	68	78	63	78	69	78	80	66	73	77	77	77	75	78	74.2	158.75
15-Oct	81	63	79	73	77	75	57	69	62	79	70	78	81	61	78	80	77	68	69	81	72.9	169.6
16-Oct	80	57	78	77	80	62	66	72	71	76	59	76	83	61	76	84	74	74	70	77	72.65	180.7
17-Oct	82	66	77	80	80	64	68	75	75	71	82	69	51	80	85	75	72	80	70	70	73.1	191.35
18-Oct	66	64	78	71	80	64	68	70	73	81	77	77	67	55	78	80	74	73	76	66	71.9	203.2
19-Oct	63	69	82	66	73	71	71	75	68	83	76	76	65	61	82	67	73	63	73	64	71.05	215.9
20-Oct	68	70	75	60	73	75	73	78	71	83	69	75	66	68	77	59	71	70	73	71	71.25	228.4
21-Oct	79	70	73	64	75	79	71	84	73	80	69	78	72	71	80	63	76	72	77	76	74.1	238.05
22-Oct	81	62	63	73	79	80	64	78	73	67	70	72	68	74	78	68	79	69	70	79	72.35	249.45
23-Oct	69	63	63	57	75	81	59	78	70	70	53	81	62	72	76	70	78	63	72	81	69.65	263.55
24-Oct	73	62	72	59	75	79	68	73	73	56	56	59	54	69	81	73	79	66	74	76	68.85	278.45
25-Oct	73	75	75	64	78	73	60	73	78	54	55	61	67	65	76	76	80	56	77	71	69.35	292.85
26-Oct	75	71	79	69	75	64	68	68	79	61	62	68	70	65	85	77	80	61	84	67	71.4	305.2
27-Oct	75	57	79	75	78	51	69	64	81	63	66	67	59	60	76	79	70	69	84	56	68.9	320.05
28-Oct	81	55	79	73	80	55	75	57	78	62	63	70	50	71	74	74	56	64	77	78	68.6	335.2
29-Oct	82	64	78	72	75	63	75	70	75	64	72	62	59	75	68	59	56	75	73	70	69.35	349.6
30-Oct	82	66	82	75	77	72	68	77	78	69	73	67	65	66	71	61	56	78	68	70	71.05	362.3
31-Oct	81	60	79	75	78	71	60	75	82	70	68	71	67	69	75	65	65	74	63	62	70.5	375.55

max of July averages	90.4
min of July averages	87
sd of July averages	0.88
Mu	88.75
C	5
T	25





	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
01-Jul	98	86	91	84	89	84	90	73	82	91	93	95	85	95	87	92	105	82	90	85
02-Jul	97	90	88	82	91	87	90	81	81	89	93	85	87	90	84	94	93	85	93	87
03-Jul	97	93	91	87	93	87	87	87	86	86	93	82	91	89	83	95	99	76	87	79
04-Jul	90	91	91	88	95	84	89	86	88	86	91	86	90	91	85	92	98	77	84	85
05-Jul	89	84	91	90	96	86	93	80	90	89	90	88	88	80	88	90	100	83	86	84
06-Jul	93	84	89	91	96	87	93	84	90	82	81	87	82	87	89	90	98	83	87	84
07-Jul	93	75	93	82	96	87	89	87	89	76	80	82	88	86	94	94	93	79	89	90
08-Jul	91	87	95	86	91	89	89	90	87	88	82	82	90	82	97	94	95	88	90	90
09-Jul	93	84	95	87	96	91	90	89	88	89	84	89	89	84	96	91	97	88	90	91
10-Jul	93	87	91	87	99	87	91	84	89	78	84	86	87	84	90	92	95	87	87	93
11-Jul	90	84	91	82	96	90	84	84	90	83	90	85	89	86	93	95	90	80	85	92
12-Jul	91	88	86	77	93	90	77	86	89	86	91	87	93	90	90	95	84	87	90	93
13-Jul	93	86	88	73	91	86	82	87	91	84	91	86	85	84	91	97	90	78	89	92
14-Jul	93	90	87	81	93	82	88	84	91	87	91	84	88	89	91	90	90	85	90	90
15-Jul	82	91	91	81	93	82	91	86	84	84	91	81	89	89	94	80	90	86	86	89
16-Jul	91	87	86	93	84	93	88	84	85	91	86	89	90	89	85	92	87	83	88	88
17-Jul	96	89	90	82	91	87	93	88	84	89	93	89	88	88	87	87	93	91	86	93
18-Jul	95	89	91	87	97	88	93	88	87	90	93	89	90	82	83	89	93	87	82	92
19-Jul	96	89	95	88	100	90	93	88	84	89	96	88	91	80	90	94	91	90	85	91
20-Jul	99	90	91	90	99	87	91	88	88	89	93	86	94	82	91	91	84	86	76	93
21-Jul	91	89	91	90	93	84	95	89	89	90	93	86	95	86	94	92	90	87	82	93
22-Jul	95	84	89	91	96	87	91	86	89	91	91	79	92	84	95	94	95	85	83	92
23-Jul	91	87	91	93	87	90	89	81	93	91	86	82	87	87	97	92	97	84	88	88
24-Jul	93	88	91	93	82	84	87	82	95	90	87	87	88	88	94	92	97	86	87	91
25-Jul	84	89	86	91	75	82	84	84	89	92	88	87	89	90	95	90	98	89	88	90
26-Jul	84	89	88	93	82	88	86	87	87	94	93	87	87	92	95	94	98	86	89	91
27-Jul	82	91	80	93	88	90	89	87	84	92	95	90	90	90	93	94	97	82	92	92
28-Jul	79	91	88	93	91	84	91	89	89	90	96	89	93	89	90	90	97	86	90	94
29-Jul	90	89	89	93	89	89	91	88	87	83	91	87	92	85	94	93	94	86	82	93
30-Jul	91	88	90	97	87	89	88	84	89	78	91	92	90	82	95	96	96	90	84	94
31-Jul	87	72	86	99	86	87	90	88	90	84	94	90	88	85	95	96	88	80	85	93
01-Aug	86	80	86	96	86	84	93	84	91	82	95	92	89	89	96	91	94	87	81	89
02-Aug	90	84	82	93	81	84	91	84	90	86	95	92	92	83	84	96	99	89	84	94
03-Aug	84	88	84	88	84	84	91	84	91	88	97	94	91	90	92	97	94	88	88	94
04-Aug	91	89	86	89	88	86	93	82	91	91	98	97	91	92	95	85	87	90	90	97
05-Aug	93	88	90	91	91	88	93	84	90	88	96	96	92	92	93	96	90	88	89	95
06-Aug	88	84	89	93	91	84	97	82	84	86	89	98	94	89	93	93	86	88	92	88
07-Aug	91	84	89	93	91	86	87	84	81	80	97	98	90	91	91	93	84	86	95	88
08-Aug	84	80	86	93	91	88	87	84	82	82	96	100	86	92	93	94	92	83	90	92
09-Aug	90	73	82	91	96	87	86	86	84	85	95	103	85	93	94	91	88	89	89	93
10-Aug	89	80	87	90	95	88	88	87	75	83	96	103	85	93	94	95	87	90	86	94
11-Aug	88	86	88	96	89	86	89	84	82	87	88	100	88	95	95	94	85	90	83	91
12-Aug	86	88	84	98	89	86	91	81	80	88	84	90	81	86	95	95	88	90	88	90
13-Aug	84	88	86	97	89	81	91	87	77	86	81	100	81	90	96	95	91	89	84	89
14-Aug	86	87	80	98	89	87	89	82	90	87	99	84	90	89	94	88	83	85	90	90
15-Aug	89	88	82	93	94	84	88	90	82	92	86	102	87	90	90	88	85	73	87	90
16-Aug	90	91	86	93	97	90	90	86	84	89	89	101	86	88	90	90	91	87	88	90
17-Aug	91	91	84	96	99	91	91	89	86	90	86	101	85	87	91	92	87	66	89	89
18-Aug	91	89	87	98	101	91	93	90	86	90	88	97	86	88	93	94	87	77	89	88
19-Aug	90	89	90	98	101	87	91	90	89	89	88	95	90	90	92	96	84	82	86	89
20-Aug	89	88	79	89	97	86	93	87	88	92	93	96	90	88	93	93	84	84	89	88
21-Aug	90	82	84	91	87	88	93	88	82	94	91	99	85	88	93	94	91	84	92	89
22-Aug	91	79	87	91	86	90	91	88	84	93	88	104	82	85	94	98	84	88	93	92
23-Aug	91	81	87	90	88	88	95	90	84	87	87	98	78	81	93	92	88	90	93	87
24-Aug	91	82	88	80	92	93	93	87	85	85	88	100	88	95	95	94	85	90	84	88
25-Aug	84	84	90	82	92	90	91	88	82	84	85	94	78	87	89	95	85	82	84	84
26-Aug	88	87	91	89	90	91	88	89	86	84	88	92	83	90	90	99	90	82	86	86
27-Aug	84	90	89	88	90	91	84	90	88	86	88	88	80	83	89	95	90	86	88	85
28-Aug	86	90	90	90	92	81	82	91	90	86	90	88	86	75	87	95	80	90	91	83
29-Aug	88	91	93	91	92	86	82	89	87	85	90	89	89	86	84	93	86	92	92	81
30-Aug	84	91	93	91	88	81	78	88	88	85	88	89	89	79	85	90	80	87	88	74
31-Aug	82	88	91	84	87	82	77	89	87	85	80	86	88	79	89	92	89	90	89	84
01-Sep	80	88	87	88	79	80	84	88	82	85	85	84	81	71	90	95	91	90	90	87
02-Sep	73	91	84	91	81	75	84	86	80	88	86	83	85	78	91	96	89	84	90	90
03-Sep	87	93	77	84	82	73	90	87	81	87	85	88	83	79	92	95	85	90	92	89
04-Sep	84	81	90	93	87	81	95	87	82	85	88	91	85	83	84	80	77	89	82	92
05-Sep	87	81	91	96	81	90	93	84	84	81	83	89	88	83	85	78	85	89	89	87
06-Sep	89	82	89	96	66	88	91	73	81	81	85	85	87	85	90	75	85	88	91	85
07-Sep	89	86	90	91	66	87	88	75	86	83	80	86	89	84	91	69	92	88	90	85
08-Sep	88	88	89	91	75	86	87	81	73	85	83	88	90	87	93	73	88	91	84	84
09-Sep	91	84	79	77	80	86	91	82	84	86	83	89	88	84	92	81	83	90	84	87
10-Sep	84	80	78	87	82	89	95	79	84	84	85	89	87	80	94	84	84	89	86	85
11-Sep	86	82	81	87	84	87	95	80	84	84	84	89	83	75	96	86	83	89	90	86
12-Sep	88	86	84	87	86	84	90	81	81	86	82	86	87	81	89	87	81	90	92	78
13-Sep	78	87	89	86	87	84	75	84	79	88	70	85	86	80	86	89	81	87	86	75
14-Sep	79	87	87	87	86	86	78	82	79	88	80	81	88	82	91	92	83	82	78	77
15-Sep	86	88	87	89	80	77	91	82	73	91	82	82	79	79	93	86	87	84	80	80
16-Sep	82	88	88	81	75	77	88	81	75	88	83	76	80	82	89	72	86	89	86	79
17-Sep	82	90	87	81	73	81	86	81	80	86	85	78	69	73	95	79	83	79	86	83
18-Sep	78	88	82	82	73	81	81	81	79	88	85	79	82	80	93	77	79	78	85	83
19-Sep	79	91	80	79	84	82	80	84	78	90	79	82	81	74	92	77	81	84	84	87
20-Sep	79	95	82	68	87	84	86	87	73	90	73	81	79	81	96	82	79	86	83	89
21-Sep	78	89	82	79	77	86	84	82	75	90	75	78	75	79	95	86	85	73	87	77
22-Sep	81	70	88	72	73	87	77	75	80	86	82	86	84	84	92	80	87	82	82	76
23-Sep	84	80	84	75	81	88	82	81	84	87	86	83	82	83	91	83	81	82	77	81
24-Sep	84	82	81	78	84	69	73	80	82	88	84	89	78	85	88	82	78	71	78	74
25-Sep	87	66	82	81	82	66	69	82	81	85	75	87	82	87	93	88	82	67	77	67
26-Sep	84	70	84	82	68	72	75	82	79	77	78	84	80	85	76	86	86	78	74	71
27-Sep	79	64	87	78	71	75	75	82	72	86	79	85	77	80	81	84	88	79	78	71
28-Sep	75	68	80	80	75	78	79	73	78	85	81	85	86	83	76	79	86	77	74	75
29-Sep	72	77	75	77	73	71	73	66	78	85	70	81	86	72	79	84	84	76	71	77
30-Sep	64	86	75	71	75	71	79	71	80	82	75	79	86	74	76	78	72	77	84	85
01-Oct	66	75	86	73	77	75	82	72	82	83	83	80	74	76	79	65	75	82	86	71
02-Oct	72	73	78	75	79	80	84	68	82	85	81	82	74	75	78	68	72	82	85	66
03-Oct	84	75	77	84	82	81	84	66	80	83	82	77	80	76	68	75	74	82	78	66
04-Oct	70	78	82	71	81	80	82	77	81	85	84	80	83	74	67	80	82	85	65	70
05-Oct	66	81	82	73	82	79	87	78	80	81	86	81	83	82	70	83	82	84	71	73
06-Oct	64	82	73	71	73	70	86	75	75	72	76	82	82	71	73	81	83	84	78	76
07-Oct	60	82	82	73	66	68	80	73	75	72	72	83	82	79	81	79	68	74	82	81
08-Oct	78	82	69	73	55	79	71	73	73	73	72	83	72	80	82	78	63	72	86	82
09-Oct	70	80	72	72	55	66	66	73	71	70	79	81	75	85	85	72	70	76	86	81
10-Oct	72	82	73	72	64	73	70	73	71	77	80	81	77	74	86	68	73	80	86	71
11-Oct	69	82	78	73	71	75	78	66	77	82	80	67	78	77	86	65	75	79	86	73
12-Oct	69	79	78	70	73	78	84	78	73	74	71	72	77	66	80	73	79	81	85	76
13-Oct	73	80	78	64	75	78	79	78	64	77	62	74	77	73	80	74	75	82	85	81
14-Oct	79	68	75	75	75	75	68	78	63	78	69	78	80	66	73	77	77	77	75	78
15-Oct	81	63	79	73	77	75	57	69	62	79	70	78	81	61	78	80	77	68	69	81
16-Oct	80	57	78	77	80	62	66	72	71	76	59	76	83	61	76	84	74	74	70	77
17-Oct	82	66	77	80	80	60	64	68	75	75	71	82	69	51	80	85	75	72	80	70
18-Oct	66	64	78	71	80	64	68	70	73	81	77	77	67	55	78	80	74	73	76	66
19-Oct	63	69	82	66	73	71	71	75	68	83	76	76	65	61	82	67	73	63	73	64
20-Oct	68	70	75	60	73	75	73	78	71	83	69	75	66	68	77	59	71	70	73	71
21-Oct	79	70	73	64	75	79	71	84	73	80	69	78	72	71	80	63	76	72	77	76
22-Oct	81	62	63	73	79	80	64	78	73	67	70	72	68	74	78	68	79	69	70	79
23-Oct	69	63	63	57	75	81	59	78	70	70	53	81	62	72	76	70	78	63	72	81
24-Oct	73	62	72	59	75	79	68	73	73	56	56	59	54	69	81	73	79	66	74	76
25-Oct	73	75	75	64	78	73	60	73	78	54	55	61	67	65	76	76	80	56	77	71
26-Oct	75	71	79	69	75	64	68	68	79	61	62	68	70	65	85	77	80	61	84	67
27-Oct	75	57	79	75	78	51	69	64	81	63	66	67	59	60	76	79	70	69	84	56
28-Oct	81	55	79	73	80	55	75	57	78	62	63	70	50	71	74	74	56	64	77	78
29-Oct	82	64	78	72	75	63	75	70	75	64	72	62	59	75	68	59	56	75	73	70
30-Oct	82	66	82	75	77	72	68	77	78	69	73	67	65	66	71	61	56	78	68	70
31-Oct	81	60	79	75	78	71	60	75	82	70	68	71	67	69	75	65	65	74	63	62

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jul avg	91.2	87.3	89.7	87.6	91.7	86.7	89.3	85.6	87.8	86.9	90.2	86.4	89.2	86.6	91.3	91.9	94.1	84.7	86.6	90.1
Jul max	99	93	95	99	100	91	95	90	95	94	96	95	95	95	97	97	105	91	93	94
Jul min	79	72	80	73	75	82	77	80	81	76	80	79	82	80	83	80	84	76	76	79
Jul sd	4.7	4.6	3.4	5.9	5.9	2.7	3.8	2.5	2.7	4.4	4.4	3.3	2.6	3.4	4.1	3.5	4.2	3.9	3.5	3.5
C	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
T	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
mu	91.2	87.3	89.7	87.6	91.7	86.7	89.3	85.6	87.8	86.9	90.2	86.4	89.2	86.6	91.3	91.9	94.1	84.7	86.6	90.1
YEAR	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
CHANGE	02-Sep	25-Sep	29-Sep	21-Sep	06-Sep	25-Sep	24-Sep	30-Sep	15-Sep	08-Oct	13-Sep	12-Oct	18-Sep	17-Sep	28-Sep	06-Sep	19-Aug	17-Aug	28-Sep	14-Sep
CH-DAY	64	87	91	83	68	87	86	92	77	100	75	104	80	79	90	68	50	48	90	76
Avg temp. till this day	**89.46**	**86.30**	**87.11**	**88.76**	**90.70**	**85.65**	**88.48**	**84.55**	**85.57**	**86.15**	**89.01**	**87.96**	**87.00**	**85.82**	**90.98**	**92.42**	**92.24**	**85.02**	**86.54**	**88.72**
St	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	3.90	6.39	1.66	0.00	0.00