Climate Change Strike Solutions

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1. Use read.table() to read the temperature change dataset from NASA's webpage: https://data.giss.nasa.gov/gistemp/graphs/graph_data/Global_Mean_Estimates_based_on_Land_and_Ocean_Data/graph.txt

```
library(dplyr)
Temp = read.table("https://data.giss.nasa.gov/gistemp/graphs/graph_data/Global_Mean_Estimates_based_on_
                  ,skip=2,header=T, sep="", fill=T)
#skip - skips the first 2 rows of the txt file since they are meaningless
#header uses the 3rd row(since you skipped the first 2 rows) as the column names
#Table is saved as Temp


Temp2= Temp[-c(1), ]
#Removes the first row since it is meaningless.. it has ----- .
#It then saves the new dataframe to Temp2

Temp3 = Temp2%>%mutate(Year=as.numeric(as.character(Year)))
#mutate changes the column Year from Factor to numeric
#It then saves the new dataset with facor as numeric as Temp3
```

2. Try out the `round()` function in R. It takes the parameters `round(x, digits)` where `x` is the vector of numbers to be rounded and positive digits refer to rounding in decimal places and negative digits refer to rounding in whole numbers. Specifically, do:

    a. round the Year variable from the dataset to the nearest hundredth (0.01), i.e. digits = 2

```
round(Temp3$Year,2)
```

```
##   [1] 1880 1881 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893
##  [15] 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907
##  [29] 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921
##  [43] 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935
##  [57] 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949
##  [71] 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963
##  [85] 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977
##  [99] 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
## [113] 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
## [127] 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
```

b. round the Year variable from the dataset to the nearest ten (10) , i.e, digits= -1

```
round(Temp3$Year,-1)
```

```
##   [1] 1880 1880 1880 1880 1880 1880 1890 1890 1890 1890 1890 1890 1890 1890
##  [15] 1890 1900 1900 1900 1900 1900 1900 1900 1900 1900 1900 1900 1910 1910
```

```
##  [29] 1910 1910 1910 1910 1910 1910 1910 1920 1920 1920 1920 1920 1920 1920
##  [43] 1920 1920 1920 1920 1930 1930 1930 1930 1930 1930 1930 1930 1930 1940
##  [57] 1940 1940 1940 1940 1940 1940 1940 1940 1940 1940 1950 1950 1950 1950
##  [71] 1950 1950 1950 1950 1950 1960 1960 1960 1960 1960 1960 1960 1960 1960
##  [85] 1960 1960 1970 1970 1970 1970 1970 1970 1970 1970 1970 1980 1980 1980
##  [99] 1980 1980 1980 1980 1980 1980 1980 1980 1990 1990 1990 1990 1990 1990
## [113] 1990 1990 1990 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
## [127] 2010 2010 2010 2010 2010 2010 2010 2010 2010 2020 2020 2020 2020
```

c. now try subtracting 4.5 from the Year and then round to the nearest ten. What is the difference betwe

```
round(Temp3$Year-4.5,-1)
```

```
##   [1] 1880 1880 1880 1880 1880 1880 1880 1880 1880 1880 1890 1890 1890 1890
##  [15] 1890 1890 1890 1890 1890 1890 1900 1900 1900 1900 1900 1900 1900 1900
##  [29] 1900 1900 1910 1910 1910 1910 1910 1910 1910 1910 1910 1910 1910 1920 1920
##  [43] 1920 1920 1920 1920 1920 1920 1920 1920 1930 1930 1930 1930 1930 1930
##  [57] 1930 1930 1930 1930 1940 1940 1940 1940 1940 1940 1940 1940 1940 1940
##  [71] 1950 1950 1950 1950 1950 1950 1950 1950 1950 1950 1960 1960 1960 1960
##  [85] 1960 1960 1960 1960 1960 1960 1970 1970 1970 1970 1970 1970 1970 1970
##  [99] 1970 1970 1980 1980 1980 1980 1980 1980 1980 1980 1980 1980 1990 1990
## [113] 1990 1990 1990 1990 1990 1990 1990 1990 2000 2000 2000 2000 2000 2000
## [127] 2000 2000 2000 2000 2010 2010 2010 2010 2010 2010 2010 2010 2010
```

3. Add a column called `Decade` to the dataset. `Decade` will be defined as the Year minus 4.5 and then rounded to the nearest tens. Name this new dataframe `Temp_dec`. (Hint: Use the `mutate()` function along with the `round()` function. Also use %>% from `{dplyr}`)

```
Temp_dec<-Temp3%>%mutate(Decade=round(Year-4.5, -1))
head(Temp_dec)
```

```
##   Year No_Smoothing Lowess.5. Decade
## 1 1880        -0.17     -0.09   1880
## 2 1881        -0.08     -0.13   1880
## 3 1882        -0.11     -0.17   1880
## 4 1883        -0.18     -0.20   1880
## 5 1884        -0.28     -0.24   1880
## 6 1885        -0.33     -0.26   1880
```

3. Summarize the temperature change (referred to as `No_Smoothing`) by decades. Count the number of observations (`n()`), find the average temperature `mean()` and the standard deviation of the temperature (`sd()`) per decade. Hint: Use %>% from `{dplyr}` along with `summarize()` and `group_by()`

    a. Summarize temperature by `Decade`.

```
dat<-Temp_dec%>%group_by(Decade)%>%
  summarize(n=n(), Average_temp=mean(No_Smoothing), Variability_temp=sd(No_Smoothing))
head(dat)
```

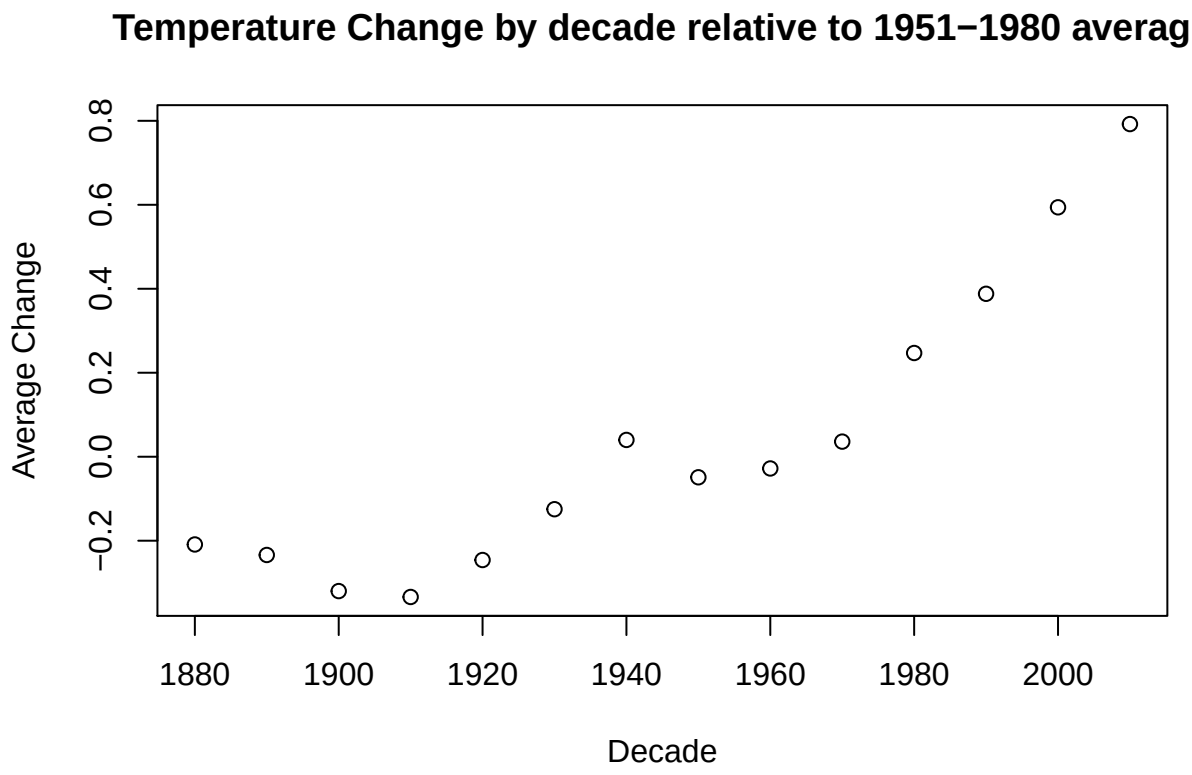
```
## # A tibble: 6 x 4
##   Decade     n Average_temp Variability_temp
```

```
##    <dbl> <int>        <dbl>            <dbl>
## 1   1880    10       -0.209           0.103
## 2   1890    10       -0.234           0.0818
## 3   1900    10       -0.32            0.138
## 4   1910    10       -0.334           0.112
## 5   1920    10       -0.246           0.0664
## 6   1930    10       -0.125           0.0871
```

b. Plot a scatterplot of decade on x axis against the everage temperature on the y axis.

(Hint: Use the dataset created in part a above. Be sure to add labels to your plot.)

```
plot(dat$Decade, dat$Average_temp,
     main="Temperature Change by decade relative to 1951-1980 average", xlab="Decade",
     ylab="Average Change")
```



4. Make your observations in context to the problem. Visit https://climate.nasa.gov/vital-signs/global-temperature/ for more information on what the variables mean and for more information.