Lab1
Exercise 3

Irimie Fabio

Contents

A

Load the sunspot.year dataset from the datasets package. Use data("sunspot.year") and then sunspot.year to load it in the workspace.

```
data("sunspot.year")
sunspot.year
```

```
## Time Series:
## Start = 1700
## End = 1988
## Frequency = 1
##   [1]    5.0   11.0   16.0   23.0   36.0   58.0   29.0   20.0   10.0    8.0    3.0    0.0
##  [13]    0.0    2.0   11.0   27.0   47.0   63.0   60.0   39.0   28.0   26.0   22.0   11.0
##  [25]   21.0   40.0   78.0  122.0  103.0   73.0   47.0   35.0   11.0    5.0   16.0   34.0
##  [37]   70.0   81.0  111.0  101.0   73.0   40.0   20.0   16.0    5.0   11.0   22.0   40.0
##  [49]   60.0   80.9   83.4   47.7   47.8   30.7   12.2    9.6   10.2   32.4   47.6   54.0
##  [61]   62.9   85.9   61.2   45.1   36.4   20.9   11.4   37.8   69.8  106.1  100.8   81.6
##  [73]   66.5   34.8   30.6    7.0   19.8   92.5  154.4  125.9   84.8   68.1   38.5   22.8
##  [85]   10.2   24.1   82.9  132.0  130.9  118.1   89.9   66.6   60.0   46.9   41.0   21.3
##  [97]   16.0    6.4    4.1    6.8   14.5   34.0   45.0   43.1   47.5   42.2   28.1   10.1
## [109]    8.1    2.5    0.0    1.4    5.0   12.2   13.9   35.4   45.8   41.1   30.1   23.9
## [121]   15.6    6.6    4.0    1.8    8.5   16.6   36.3   49.6   64.2   67.0   70.9   47.8
## [133]   27.5    8.5   13.2   56.9  121.5  138.3  103.2   85.7   64.6   36.7   24.2   10.7
## [145]   15.0   40.1   61.5   98.5  124.7   96.3   66.6   64.5   54.1   39.0   20.6    6.7
## [157]    4.3   22.7   54.8   93.8   95.8   77.2   59.1   44.0   47.0   30.5   16.3    7.3
## [169]   37.6   74.0  139.0  111.2  101.6   66.2   44.7   17.0   11.3   12.4    3.4    6.0
## [181]   32.3   54.3   59.7   63.7   63.5   52.2   25.4   13.1    6.8    6.3    7.1   35.6
## [193]   73.0   85.1   78.0   64.0   41.8   26.2   26.7   12.1    9.5    2.7    5.0   24.4
## [205]   42.0   63.5   53.8   62.0   48.5   43.9   18.6    5.7    3.6    1.4    9.6   47.4
## [217]   57.1  103.9   80.6   63.6   37.6   26.1   14.2    5.8   16.7   44.3   63.9   69.0
```

```
## [229]  77.8  64.9  35.7  21.2  11.1    5.7    8.7  36.1   79.7 114.4 109.6   88.8
## [241]  67.8  47.5  30.6  16.3    9.6  33.2  92.6 151.6 136.3 134.7   83.9   69.4
## [253]  31.5  13.9    4.4  38.0 141.7 190.2 184.8 159.0 112.3   53.9   37.5   27.9
## [265]  10.2  15.1  47.0  93.8 105.9 105.5 104.5  66.6  68.9  38.0   34.5   15.5
## [277]  12.6  27.5  92.5 155.4 154.7 140.5 115.9  66.6  45.9  17.9   13.4   29.2
## [289] 100.2
```

B

See the documentation to obtain information about the dataset and create a sequence vector corresponding to the years. Call this variable year.

```
data <- sunspot.year
year <- seq(start(data)[1], end(data)[1], 1)
year
```

```
##    [1] 1700 1701 1702 1703 1704 1705 1706 1707 1708 1709 1710 1711 1712 1713
##   [15] 1714 1715 1716 1717 1718 1719 1720 1721 1722 1723 1724 1725 1726 1727
##   [29] 1728 1729 1730 1731 1732 1733 1734 1735 1736 1737 1738 1739 1740 1741
##   [43] 1742 1743 1744 1745 1746 1747 1748 1749 1750 1751 1752 1753 1754 1755
##   [57] 1756 1757 1758 1759 1760 1761 1762 1763 1764 1765 1766 1767 1768 1769
##   [71] 1770 1771 1772 1773 1774 1775 1776 1777 1778 1779 1780 1781 1782 1783
##   [85] 1784 1785 1786 1787 1788 1789 1790 1791 1792 1793 1794 1795 1796 1797
##   [99] 1798 1799 1800 1801 1802 1803 1804 1805 1806 1807 1808 1809 1810 1811
##  [113] 1812 1813 1814 1815 1816 1817 1818 1819 1820 1821 1822 1823 1824 1825
##  [127] 1826 1827 1828 1829 1830 1831 1832 1833 1834 1835 1836 1837 1838 1839
##  [141] 1840 1841 1842 1843 1844 1845 1846 1847 1848 1849 1850 1851 1852 1853
##  [155] 1854 1855 1856 1857 1858 1859 1860 1861 1862 1863 1864 1865 1866 1867
##  [169] 1868 1869 1870 1871 1872 1873 1874 1875 1876 1877 1878 1879 1880 1881
##  [183] 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893 1894 1895
##  [197] 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909
##  [211] 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
##  [225] 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937
##  [239] 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951
##  [253] 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965
##  [267] 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979
##  [281] 1980 1981 1982 1983 1984 1985 1986 1987 1988
```

C

Create a variable called sunspot, containing the values from the dataset

```
sunspot <- c(data)
sunspot
```

```
##    [1]    5.0  11.0  16.0  23.0  36.0  58.0  29.0  20.0  10.0    8.0    3.0    0.0
##   [13]    0.0    2.0  11.0  27.0  47.0  63.0  60.0  39.0  28.0  26.0  22.0  11.0
##   [25]  21.0  40.0  78.0 122.0 103.0  73.0  47.0  35.0  11.0    5.0  16.0  34.0
##   [37]  70.0  81.0 111.0 101.0  73.0  40.0  20.0  16.0    5.0  11.0  22.0  40.0
##   [49]  60.0  80.9  83.4  47.7  47.8  30.7  12.2    9.6  10.2  32.4  47.6  54.0
##   [61]  62.9  85.9  61.2  45.1  36.4  20.9  11.4  37.8  69.8 106.1 100.8  81.6
##   [73]  66.5  34.8  30.6    7.0  19.8  92.5 154.4 125.9  84.8  68.1  38.5  22.8
##   [85]  10.2  24.1  82.9 132.0 130.9 118.1  89.9  66.6  60.0  46.9  41.0  21.3
##   [97]  16.0    6.4    4.1    6.8  14.5  34.0  45.0  43.1  47.5  42.2  28.1  10.1
##  [109]    8.1    2.5    0.0    1.4    5.0  12.2  13.9  35.4  45.8  41.1  30.1  23.9
##  [121]  15.6    6.6    4.0    1.8    8.5  16.6  36.3  49.6  64.2  67.0  70.9  47.8
```

2

```
## [133]   27.5    8.5   13.2   56.9 121.5 138.3 103.2   85.7   64.6   36.7   24.2   10.7
## [145]   15.0   40.1   61.5   98.5 124.7   96.3   66.6   64.5   54.1   39.0   20.6    6.7
## [157]    4.3   22.7   54.8   93.8   95.8   77.2   59.1   44.0   47.0   30.5   16.3    7.3
## [169]   37.6   74.0 139.0 111.2 101.6   66.2   44.7   17.0   11.3   12.4    3.4    6.0
## [181]   32.3   54.3   59.7   63.7   63.5   52.2   25.4   13.1    6.8    6.3    7.1   35.6
## [193]   73.0   85.1   78.0   64.0   41.8   26.2   26.7   12.1    9.5    2.7    5.0   24.4
## [205]   42.0   63.5   53.8   62.0   48.5   43.9   18.6    5.7    3.6    1.4    9.6   47.4
## [217]   57.1 103.9   80.6   63.6   37.6   26.1   14.2    5.8   16.7   44.3   63.9   69.0
## [229]   77.8   64.9   35.7   21.2   11.1    5.7    8.7   36.1   79.7 114.4 109.6   88.8
## [241]   67.8   47.5   30.6   16.3    9.6   33.2   92.6 151.6 136.3 134.7   83.9   69.4
## [253]   31.5   13.9    4.4   38.0 141.7 190.2 184.8 159.0 112.3   53.9   37.5   27.9
## [265]   10.2   15.1   47.0   93.8 105.9 105.5 104.5   66.6   68.9   38.0   34.5   15.5
## [277]   12.6   27.5   92.5 155.4 154.7 140.5 115.9   66.6   45.9   17.9   13.4   29.2
## [289] 100.2
```

D

Put together the variables into a data.frame object.

```
x <- data.frame(
  Year = year,
  Sunspots = sunspot
)
x
```

```
##      Year Sunspots
## 1    1700      5.0
## 2    1701     11.0
## 3    1702     16.0
## 4    1703     23.0
## 5    1704     36.0
## 6    1705     58.0
## 7    1706     29.0
## 8    1707     20.0
## 9    1708     10.0
## 10   1709      8.0
## 11   1710      3.0
## 12   1711      0.0
## 13   1712      0.0
## 14   1713      2.0
## 15   1714     11.0
## 16   1715     27.0
## 17   1716     47.0
## 18   1717     63.0
## 19   1718     60.0
## 20   1719     39.0
## 21   1720     28.0
## 22   1721     26.0
## 23   1722     22.0
## 24   1723     11.0
## 25   1724     21.0
## 26   1725     40.0
## 27   1726     78.0
## 28   1727    122.0
## 29   1728    103.0
```

```
## 30   1729     73.0
## 31   1730     47.0
## 32   1731     35.0
## 33   1732     11.0
## 34   1733      5.0
## 35   1734     16.0
## 36   1735     34.0
## 37   1736     70.0
## 38   1737     81.0
## 39   1738    111.0
## 40   1739    101.0
## 41   1740     73.0
## 42   1741     40.0
## 43   1742     20.0
## 44   1743     16.0
## 45   1744      5.0
## 46   1745     11.0
## 47   1746     22.0
## 48   1747     40.0
## 49   1748     60.0
## 50   1749     80.9
## 51   1750     83.4
## 52   1751     47.7
## 53   1752     47.8
## 54   1753     30.7
## 55   1754     12.2
## 56   1755      9.6
## 57   1756     10.2
## 58   1757     32.4
## 59   1758     47.6
## 60   1759     54.0
## 61   1760     62.9
## 62   1761     85.9
## 63   1762     61.2
## 64   1763     45.1
## 65   1764     36.4
## 66   1765     20.9
## 67   1766     11.4
## 68   1767     37.8
## 69   1768     69.8
## 70   1769    106.1
## 71   1770    100.8
## 72   1771     81.6
## 73   1772     66.5
## 74   1773     34.8
## 75   1774     30.6
## 76   1775      7.0
## 77   1776     19.8
## 78   1777     92.5
## 79   1778    154.4
## 80   1779    125.9
## 81   1780     84.8
## 82   1781     68.1
## 83   1782     38.5
```

```
## 84  1783    22.8
## 85  1784    10.2
## 86  1785    24.1
## 87  1786    82.9
## 88  1787   132.0
## 89  1788   130.9
## 90  1789   118.1
## 91  1790    89.9
## 92  1791    66.6
## 93  1792    60.0
## 94  1793    46.9
## 95  1794    41.0
## 96  1795    21.3
## 97  1796    16.0
## 98  1797     6.4
## 99  1798     4.1
## 100 1799     6.8
## 101 1800    14.5
## 102 1801    34.0
## 103 1802    45.0
## 104 1803    43.1
## 105 1804    47.5
## 106 1805    42.2
## 107 1806    28.1
## 108 1807    10.1
## 109 1808     8.1
## 110 1809     2.5
## 111 1810     0.0
## 112 1811     1.4
## 113 1812     5.0
## 114 1813    12.2
## 115 1814    13.9
## 116 1815    35.4
## 117 1816    45.8
## 118 1817    41.1
## 119 1818    30.1
## 120 1819    23.9
## 121 1820    15.6
## 122 1821     6.6
## 123 1822     4.0
## 124 1823     1.8
## 125 1824     8.5
## 126 1825    16.6
## 127 1826    36.3
## 128 1827    49.6
## 129 1828    64.2
## 130 1829    67.0
## 131 1830    70.9
## 132 1831    47.8
## 133 1832    27.5
## 134 1833     8.5
## 135 1834    13.2
## 136 1835    56.9
## 137 1836   121.5
```

```
## 138 1837    138.3
## 139 1838    103.2
## 140 1839     85.7
## 141 1840     64.6
## 142 1841     36.7
## 143 1842     24.2
## 144 1843     10.7
## 145 1844     15.0
## 146 1845     40.1
## 147 1846     61.5
## 148 1847     98.5
## 149 1848    124.7
## 150 1849     96.3
## 151 1850     66.6
## 152 1851     64.5
## 153 1852     54.1
## 154 1853     39.0
## 155 1854     20.6
## 156 1855      6.7
## 157 1856      4.3
## 158 1857     22.7
## 159 1858     54.8
## 160 1859     93.8
## 161 1860     95.8
## 162 1861     77.2
## 163 1862     59.1
## 164 1863     44.0
## 165 1864     47.0
## 166 1865     30.5
## 167 1866     16.3
## 168 1867      7.3
## 169 1868     37.6
## 170 1869     74.0
## 171 1870    139.0
## 172 1871    111.2
## 173 1872    101.6
## 174 1873     66.2
## 175 1874     44.7
## 176 1875     17.0
## 177 1876     11.3
## 178 1877     12.4
## 179 1878      3.4
## 180 1879      6.0
## 181 1880     32.3
## 182 1881     54.3
## 183 1882     59.7
## 184 1883     63.7
## 185 1884     63.5
## 186 1885     52.2
## 187 1886     25.4
## 188 1887     13.1
## 189 1888      6.8
## 190 1889      6.3
## 191 1890      7.1
```

```
## 192 1891    35.6
## 193 1892    73.0
## 194 1893    85.1
## 195 1894    78.0
## 196 1895    64.0
## 197 1896    41.8
## 198 1897    26.2
## 199 1898    26.7
## 200 1899    12.1
## 201 1900     9.5
## 202 1901     2.7
## 203 1902     5.0
## 204 1903    24.4
## 205 1904    42.0
## 206 1905    63.5
## 207 1906    53.8
## 208 1907    62.0
## 209 1908    48.5
## 210 1909    43.9
## 211 1910    18.6
## 212 1911     5.7
## 213 1912     3.6
## 214 1913     1.4
## 215 1914     9.6
## 216 1915    47.4
## 217 1916    57.1
## 218 1917   103.9
## 219 1918    80.6
## 220 1919    63.6
## 221 1920    37.6
## 222 1921    26.1
## 223 1922    14.2
## 224 1923     5.8
## 225 1924    16.7
## 226 1925    44.3
## 227 1926    63.9
## 228 1927    69.0
## 229 1928    77.8
## 230 1929    64.9
## 231 1930    35.7
## 232 1931    21.2
## 233 1932    11.1
## 234 1933     5.7
## 235 1934     8.7
## 236 1935    36.1
## 237 1936    79.7
## 238 1937   114.4
## 239 1938   109.6
## 240 1939    88.8
## 241 1940    67.8
## 242 1941    47.5
## 243 1942    30.6
## 244 1943    16.3
## 245 1944     9.6
```

```
## 246 1945     33.2
## 247 1946     92.6
## 248 1947    151.6
## 249 1948    136.3
## 250 1949    134.7
## 251 1950     83.9
## 252 1951     69.4
## 253 1952     31.5
## 254 1953     13.9
## 255 1954      4.4
## 256 1955     38.0
## 257 1956    141.7
## 258 1957    190.2
## 259 1958    184.8
## 260 1959    159.0
## 261 1960    112.3
## 262 1961     53.9
## 263 1962     37.5
## 264 1963     27.9
## 265 1964     10.2
## 266 1965     15.1
## 267 1966     47.0
## 268 1967     93.8
## 269 1968    105.9
## 270 1969    105.5
## 271 1970    104.5
## 272 1971     66.6
## 273 1972     68.9
## 274 1973     38.0
## 275 1974     34.5
## 276 1975     15.5
## 277 1976     12.6
## 278 1977     27.5
## 279 1978     92.5
## 280 1979    155.4
## 281 1980    154.7
## 282 1981    140.5
## 283 1982    115.9
## 284 1983     66.6
## 285 1984     45.9
## 286 1985     17.9
## 287 1986     13.4
## 288 1987     29.2
## 289 1988    100.2
```
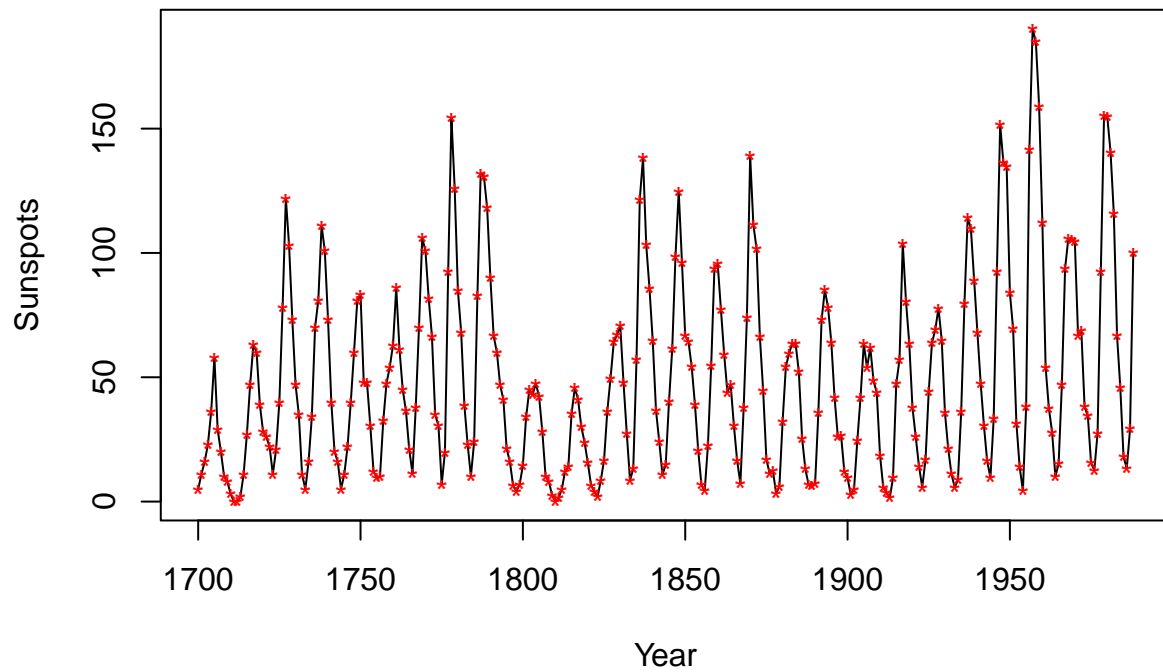
E

Make a line plot of sunspots vs. year.
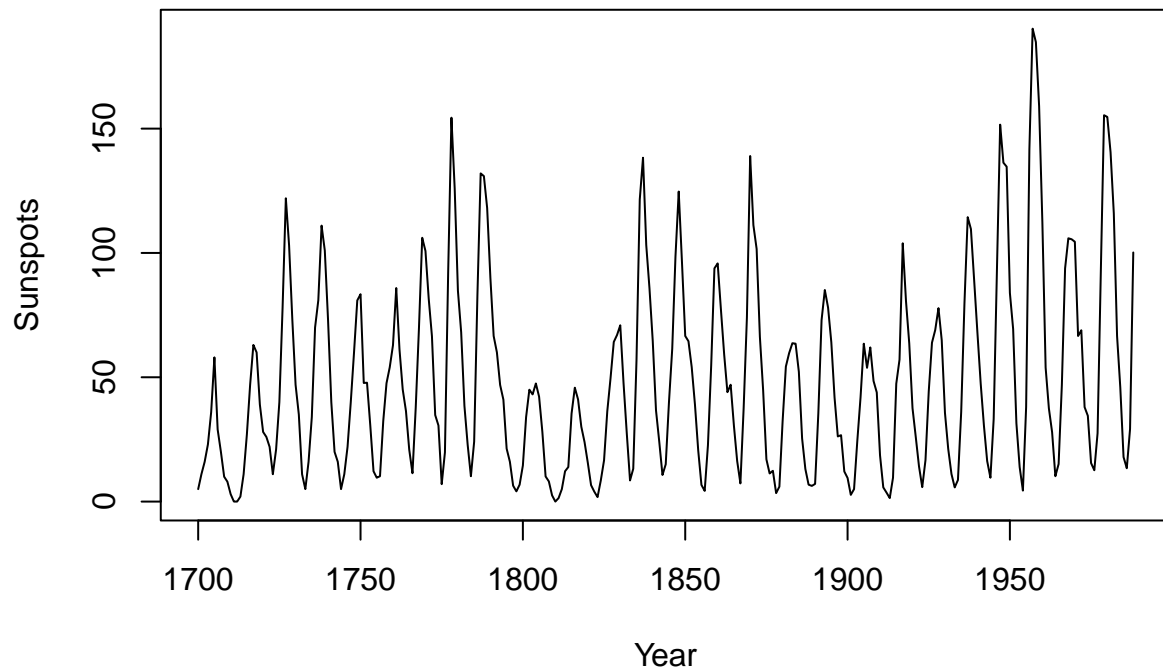
F

Superimpose data points as red asterisks. Add a second layer to the plot by using the points() function. Use pch = "*" and col = "red" in the points() arguments.
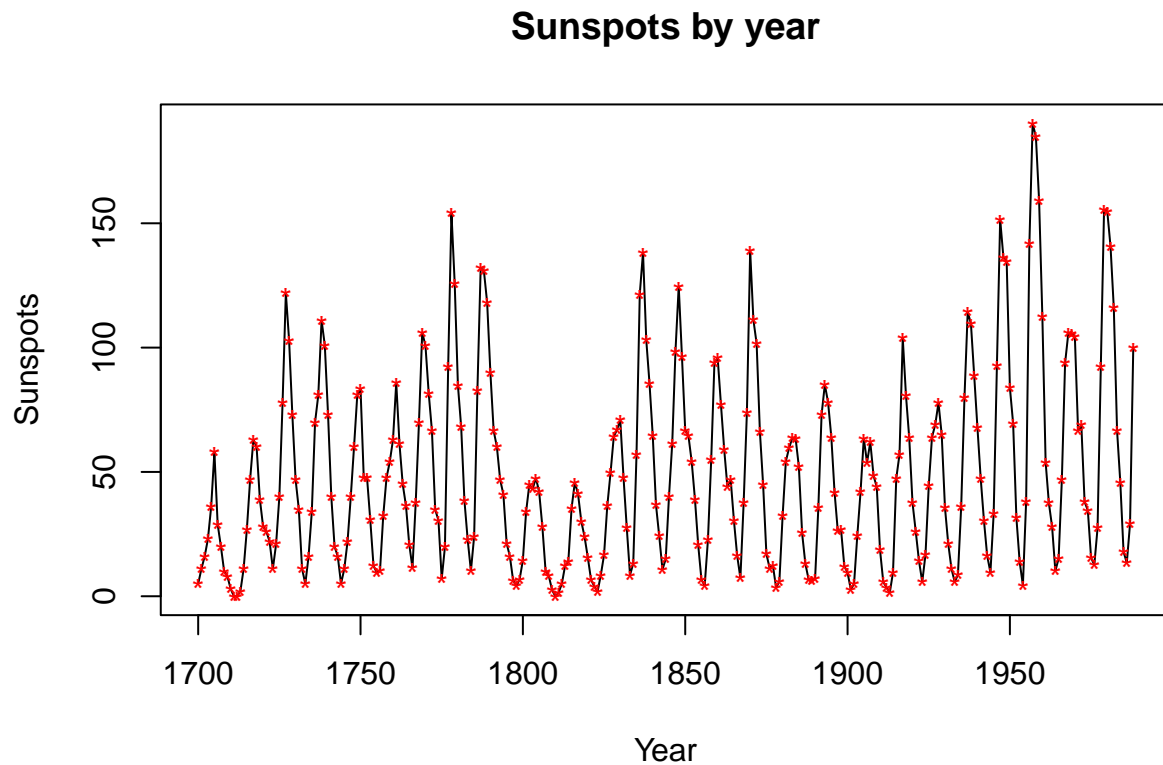
```
plot(
  year,
  sunspot,
  type = "l",
  xlab = "Year",
  ylab = "Sunspots"
)
points(year, sunspot, pch = "*", col = "red")
```

G

Create a title 'Sunspots by year'.

```
plot(
  year,
  sunspot,
  type = "l",
  xlab = "Year",
  ylab = "Sunspots",
  main = "Sunspots by year"
)
points(year, sunspot, pch = "*", col = "red")
```
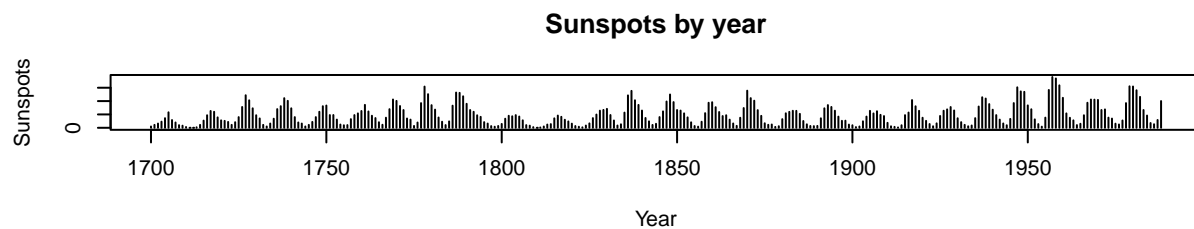
Sunspots by year

H

Make a column with 3 panels for the plot created in G., a barplot of sunspots (you can use the as.vector() function to convert a a data type to a vector data type), and a histogram of sunspots.

```r
par(mfrow = c(3, 1))

plot(
  year,
  sunspot,
  type = "l",
  xlab = "Year",
  ylab = "Sunspots",
  main = "Sunspots by year"
)
points(year, sunspot, pch = "*", col = "red")

barplot(
  year,
  sunspot,
  xlab = "Year",
  ylab = "Sunspots",
  main = "Sunspots by year"
)

plot(
  year,
  sunspot,
  type = "h",
  xlab = "Year",
```
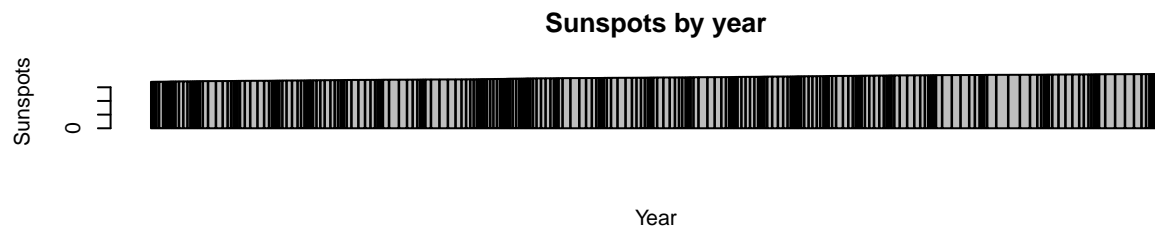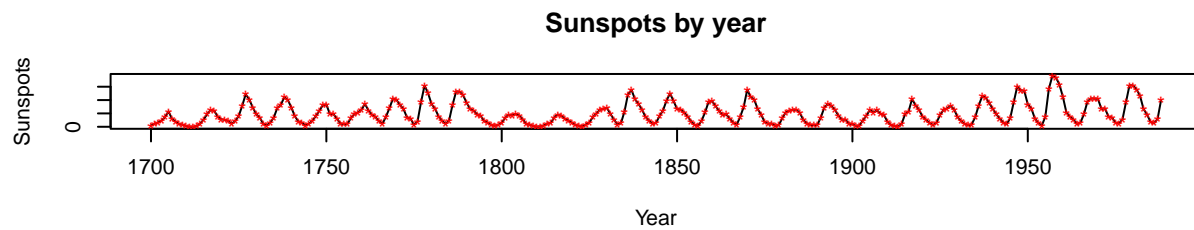
```
  ylab = "Sunspots",
  main = "Sunspots by year"
)
```

Sunspots by year

Year

Sunspots by year

Year

Sunspots by year

Year   ##

I Save the plot in the ./plots directory of the project as a .png file.

```
png("./plots/sunspots.png")
plot(
  year,
  sunspot,
  type = "l",
  xlab = "Year",
  ylab = "Sunspots",
  main = "Sunspots by year"
)
points(year, sunspot, pch = "*", col = "red")
dev.off()
```

```
## png
##   2
```

J

Save the data frame as a .csv file in the ./data directory of the project.

```
write.csv(x, "./data/data.csv")
```