In [1]:

```
#
#  File:
#    bar1.py
#
#  Synopsis:
#    Illustrates how to draw bar charts.
#
#  Categories:
#    xy plots
#    bar charts
#    polygons
#    polylines
#    text
#
#  Author:
#    Mary Haley
#
#  Date of initial publication:
#    March 2008
#
#  Description:
#    This example shows how to generate bar charts, using polylines and
#    polygons.
#
#  Effects illustrated:
#    o  Drawing primitives on a plot.
#    o  Drawing text on a plot.
#    o  Using indexed color.
#
#  Output:
#     This example produces two frames.
#
#  Notes:
#
from __future__ import print_function
import numpy
import Ngl

#
# This script plots, as a series of bars, the number of times US
# baseball teams have won or lost the World Series.
#

#
# Function that returns coordinates of a bar, given the x,y values,
# the dx (between bars), the width of the bar as a percentage of the
# distance between x values (bar_width_perc), and the minimum y to
# start the bar from.
#
def get_bar(x,y,dx,ymin,bar_width_perc=0.6):
  dxp = (dx * bar_width_perc)/2.
  xbar = numpy.array([x-dxp,x+dxp,x+dxp,x-dxp,x-dxp])
  ybar = numpy.array([ ymin, ymin,    y,    y, ymin])
  return xbar,ybar

#
# Main program
#

#
# Define long and short name of baseball teams, along with their
# colors in RGB percentages. Note that some of these teams became
# other teams, but the original and the new names are both included.
#
teams = {
     "Anaheim Angels"       : {"abbrev" : "AA",  "colors" : [  73,  0, 13]}, \
     "Arizona Diamondbacks" : {"abbrev" : "AD",  "colors" : [  39, 21, 63]}, \
     "Atlanta Braves"       : {"abbrev" : "AB",  "colors" : [  69,  1, 22]}, \
     "Baltimore Orioles"    : {"abbrev" : "BO",  "colors" : [  82, 35,  4]}, \
     "Boston Braves"        : {"abbrev" : "BB",  "colors" : [  66, 13, 24]}, \
     "Boston Red Sox"       : {"abbrev" : "BRS", "colors" : [ 73, 19, 24]}, \
     "Brooklyn Dodgers"     : {"abbrev" : "BD",  "colors" : [   5, 18, 52]}, \
     "Brooklyn Robins"      : {"abbrev" : "BR",  "colors" : [   3, 16, 52]}, \
     "Chicago Cubs"         : {"abbrev" : "CC",  "colors" : [   6, 20, 53]}, \
     "Chicago White Sox"    : {"abbrev" : "CWS", "colors" : [  0,  0,  0]}, \
     "Cincinnati Reds"      : {"abbrev" : "CRe", "colors" : [ 78,  0, 12]}, \
     "Cleveland Indians"    : {"abbrev" : "CI",  "colors" : [   1, 20, 40]}, \
```

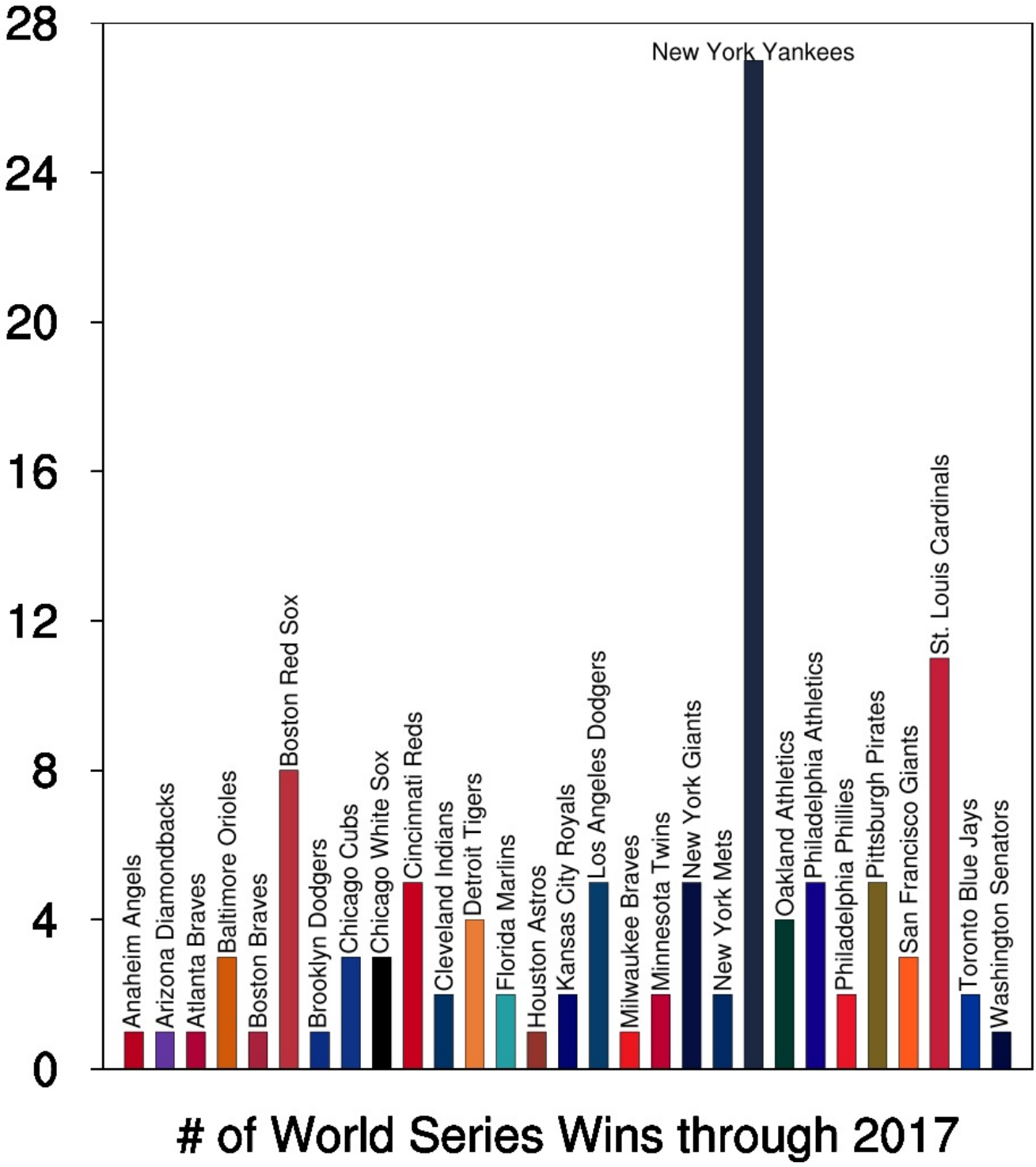
```
    "Cleveland Indians"    : {"abbrev" : "CI",  "colors" : [  1, 20, 40]}, \
    "Colorado Rockies"     : {"abbrev" : "CRo", "colors" : [ 20, 20, 40]}, \
    "Detroit Tigers"       : {"abbrev" : "DT",  "colors" : [  92, 49, 22]}, \
    "Florida Marlins"      : {"abbrev" : "FM",  "colors" : [  14, 62, 64]}, \
    "Houston Astros"       : {"abbrev" : "HA",  "colors" : [  58, 20, 17]}, \
    "Kansas City Royals"   : {"abbrev" : "KCR", "colors" : [  0,  2, 45]}, \
    "Los Angeles Dodgers"  : {"abbrev" : "LAD", "colors" : [  3, 24, 42]}, \
    "Milwaukee Braves"     : {"abbrev" : "MBa", "colors" : [ 93,  9, 12]}, \
    "Milwaukee Brewers"    : {"abbrev" : "MBe", "colors" : [  4, 13, 32]}, \
    "Minnesota Twins"      : {"abbrev" : "MT",  "colors" : [  74,  0, 20]}, \
    "New York Giants"      : {"abbrev" : "NYG", "colors" : [  2,  6, 26]}, \
    "New York Mets"        : {"abbrev" : "NYM", "colors" : [  1, 17, 40]}, \
    "New York Yankees"     : {"abbrev" : "NYY", "colors" : [ 11, 16, 26]}, \
    "Oakland Athletics"    : {"abbrev" : "OA",  "colors" : [   0, 22, 19]}, \
    "Philadelphia Athletics": {"abbrev" : "PA", "colors" : [   7,  0, 55]}, \
    "Philadelphia Phillies": {"abbrev" : "PPh", "colors" : [ 91,  9, 16]}, \
    "Pittsburgh Pirates"   : {"abbrev" : "PPi", "colors" : [ 46, 38, 13]}, \
    "San Diego Padres"     : {"abbrev" : "SDP", "colors" : [  2,  8, 25]}, \
    "San Francisco Giants" : {"abbrev" : "SFG", "colors" : [100, 35, 12]}, \
    "Seattle Mariners"     : {"abbrev" : "SM",  "colors" : [   5, 17, 34]}, \
    "St. Louis Browns"     : {"abbrev" : "SLB", "colors" : [ 81, 32, 14]}, \
    "St. Louis Cardinals"  : {"abbrev" : "SLC", "colors" : [ 77, 12, 23]}, \
    "Tampa Bay Devil Rays" : {"abbrev" : "TBDR","colors" : [ 0, 43, 24]}, \
    "Texas Rangers"        : {"abbrev" : "TR",  "colors" : [   0, 20, 48]}, \
    "Toronto Blue Jays"    : {"abbrev" : "TBJ", "colors" : [  0, 20, 60]}, \
    "Washington Senators"  : {"abbrev" : "WS",  "colors" : [   0,  4, 25]}, \
    "Washington Nationals" : {"abbrev" : "WN",  "colors" : [   7, 13, 36]}  \
      }
#
# Special notes:
#
#  - No world series in 1904 (boycotted by New York Giants)
#    or 1994 (strike).
#
#  - Boston Red Sox first won their first WS as the Boston Americans.
#    I didn't include a separate entry for the Americans because the
#    bars were getting too thin.
#
#  - Brooklyn Robins became the Brooklyn Dodgers became the LA Dodgers.
#
#  - Boston Braves became the Milwaukee Braves became the Atlanta Braves.
#
#  - St. Louis Browns became the Baltimore Orioles.
#
#  - Washington Senators became the Minnesota Twins.
#
#  - New York Giants became the San Francisco Giants.
#
#  - Philadelphia Athletics became the Oakland Athletics.

#
# List each world series results as {year, [winning team, losing team]}.
#
world_series = {
                1903 : ["BRS", "PPi"] ,\
                1904 : ["",    ""], \
                1905 : ["NYG", "PA"], \
                1906 : ["CWS", "CC"], \
                1907 : ["CC",  "DT"], \
                1908 : ["CC",  "DT"], \
                1909 : ["PPi", "DT"], \
                1910 : ["PA",  "CC"], \
                1911 : ["PA",  "NYG"], \
                1912 : ["BRS", "NYG"], \
                1913 : ["PA",  "NYG"], \
                1914 : ["BB",  "PA"], \
                1915 : ["BRS", "PPh"], \
                1916 : ["BRS", "BR"], \
                1917 : ["CWS", "NYG"], \
                1918 : ["BRS", "CC"], \
                1919 : ["CRe", "CWS"], \
                1920 : ["CI",  "BR"], \
                1921 : ["NYG", "NYY"], \
                1922 : ["NYG", "NYY"], \
                1923 : ["NYY", "NYG"], \
                1924 : ["WS",  "NYG"], \
                1925 : ["PPi", "WS"], \
                1926 : ["SLC", "NYY"], \
                1927 : ["NYY", "PPi"], \
                1928 : ["NYY", "SLC"], \
                1929 : ["PA",  "CC"], \
```

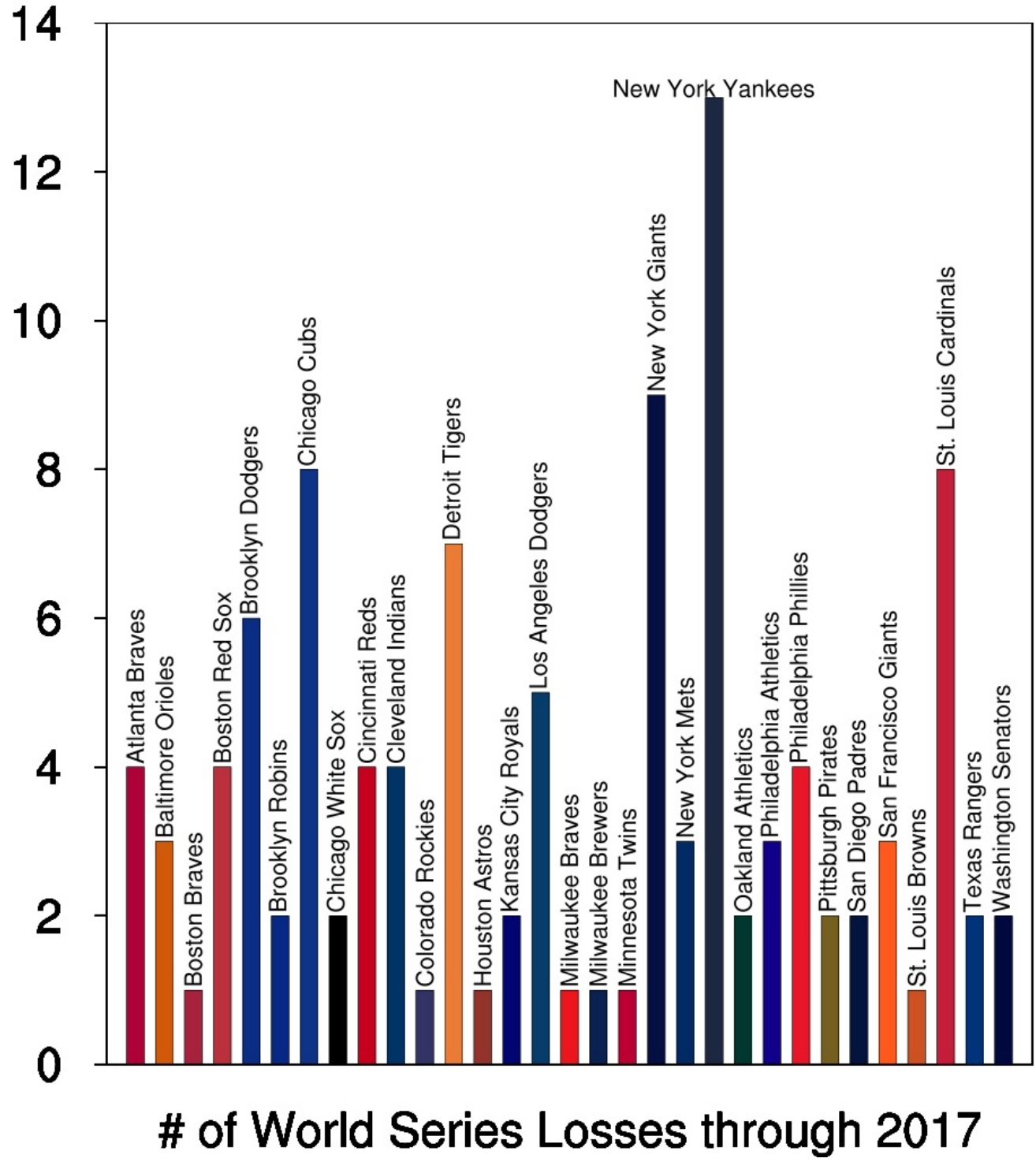
```
1930 : ["PA",  "SLC"], \

1931 : ["SLC", "PA"], \
1932 : ["NYY", "CC"], \
1933 : ["NYG", "WS"], \
1934 : ["SLC", "DT"], \
1935 : ["DT",  "CC"], \
1936 : ["NYY", "NYG"], \
1937 : ["NYY", "NYG"], \
1938 : ["NYY", "CC"], \
1939 : ["NYY", "CRe"], \
1940 : ["CRe", "DT"], \
1941 : ["NYY", "BD"], \
1942 : ["SLC", "NYY"], \
1943 : ["NYY", "SLC"], \
1944 : ["SLC", "SLB"], \
1945 : ["DT",  "CC"], \
1946 : ["SLC", "BRS"], \
1947 : ["NYY", "BD"], \
1948 : ["CI",  "BB"], \
1949 : ["NYY", "BD"], \
1950 : ["NYY", "PPh"], \
1951 : ["NYY", "NYG"], \
1952 : ["NYY", "BD"], \
1953 : ["NYY", "BD"], \
1954 : ["NYG", "CI"], \
1955 : ["BD",  "NYY"], \
1956 : ["NYY", "BD"], \
1957 : ["MBa", "NYY"], \
1958 : ["NYY", "MBa"], \
1959 : ["LAD", "CWS"], \
1960 : ["PPi", "NYY"], \
1961 : ["NYY", "CRe"], \
1962 : ["NYY", "SFG"], \
1963 : ["LAD", "NYY"], \
1964 : ["SLC", "NYY"], \
1965 : ["LAD", "MT"], \
1966 : ["BO",  "LAD"], \
1967 : ["SLC", "BRS"], \
1968 : ["DT",  "SLC"], \
1969 : ["NYM", "BO"], \
1970 : ["BO",  "CRe"], \
1971 : ["PPi", "BO"], \
1972 : ["OA",  "CRe"], \
1973 : ["OA",  "NYM"], \
1974 : ["OA",  "LAD"], \
1975 : ["CRe", "BRS"], \
1976 : ["CRe", "NYY"], \
1977 : ["NYY", "LAD"], \
1978 : ["NYY", "LAD"], \
1979 : ["PPi", "BO"], \
1980 : ["PPh", "KCR"], \
1981 : ["LAD", "NYY"], \
1982 : ["SLC", "MBe"], \
1983 : ["BO",  "PPh"], \
1984 : ["DT",  "SDP"], \
1985 : ["KCR", "SLC"], \
1986 : ["NYM", "BRS"], \
1987 : ["MT",  "SLC"], \
1988 : ["LAD", "OA"], \
1989 : ["OA",  "SFG"], \
1990 : ["CRe", "OA"], \
1991 : ["MT",  "AB"], \
1992 : ["TBJ", "AB"], \
1993 : ["TBJ", "PPh"], \
1994 : ["",    ""], \
1995 : ["AB",  "CI"], \
1996 : ["NYY", "AB"], \
1997 : ["FM",  "CI"], \
1998 : ["NYY", "SDP"], \
1999 : ["NYY", "AB"], \
2000 : ["NYY", "NYM"], \
2001 : ["AD",  "NYY"], \
2002 : ["AA",  "SFG"], \
2003 : ["FM",  "NYY"], \
2004 : ["BRS", "SLC"], \
2005 : ["CWS", "HA"], \
2006 : ["SLC", "DT"], \
2007 : ["BRS", "CRo"], \
2008 : ["PPh", "TBR"], \
2009 : ["NYY", "Pph"], \
```

```
                2010 : ["SFG", "TR"], \
                2011 : ["SLC", "TR"], \
                2012 : ["SFG", "DT"], \
                2013 : ["BRS", "SLC"], \
                2014 : ["SFG", "KCR"], \
                2015 : ["KCR", "NYM"], \
                2016 : ["CC", "CI"],  \
                2017 : ["HA", "LAD"]  \
            }

#
# Count the number of times each team has won or lost and store
# in an array.
#
nteams = len(teams)               # Number of teams
max_year = max(world_series.keys())
values = numpy.array(list(world_series.values()))
won    = values[:,0].tolist()     # Index 0 = winning teams
lost   = values[:,1].tolist()     # Index 1 = losing teams
ngames = len(won)                 # Number of games

#
# Set up arrays to Define colors for each winning/losing team.
#
winning_colors      = numpy.zeros((ngames+1,3),'f')
losing_colors       = numpy.zeros((ngames+1,3),'f')
winning_colors[0,:] = [1.,1.,1.]
winning_colors[1,:] = [0.,0.,0.]
winning_colors[ngames,:] = [0.9,0.9,0.9]    # Gray
losing_colors[0,:]  = [1.,1.,1.]
losing_colors[1,:]  = [0.,0.,0.]
losing_colors[ngames,:] = [0.9,0.9,0.9]    # Gray

#
# Loop through each team and count the number of teams it won and/or
# lost the world series. If this number is > 0, then store in an
# array.
#
winning_teams_ct = []
winning_teams_nm = []
losing_teams_ct  = []
losing_teams_nm  = []
nw = 2                     # color index counter for winning team
nl = 2                     # color index counter for losing team

sorted_teams = list(teams.keys())
sorted_teams.sort()           # Sort the team names
for team in sorted_teams:
    steam = teams[team]["abbrev"]
    if won.count(steam) > 0:
        winning_teams_ct.append(won.count(steam))   # Here's the count
        winning_teams_nm.append(team)               # Name of winning team
        winning_colors[nw,:] = numpy.array(teams[team]["colors"])/100.
        nw += 1

    if lost.count(steam) > 0:
        losing_teams_ct.append(lost.count(steam))   # Here's the count
        losing_teams_nm.append(team)                # Name of losing team
        losing_colors[nl,:] = numpy.array(teams[team]["colors"])/100.
        nl += 1

# Store the winning and losing counts in numpy arrays.
y_win  = numpy.array(winning_teams_ct)
x_win  = numpy.array(list(range(1,y_win.shape[0]+1)))
y_lose = numpy.array(losing_teams_ct)
x_lose = numpy.array(list(range(1,y_lose.shape[0]+1)))

#
# Start the graphics portion of the script.
#
wks_type = "png"
wks = Ngl.open_wks(wks_type,"bar1")
Ngl.define_colormap(wks,winning_colors)

res = Ngl.Resources()

res.nglMaximize           = False       # Need to set to False if using
                                        # vp resources.

res.vpXF                  = 0.12        # Move plot to left a little.
```

```
res.vpYF                = 0.98        # Move plot up a little.

res.vpHeightF           = 0.90        # Make plot higher than
res.vpWidthF            = 0.80        # it is wide.

res.tmXBOn              = False       # Turn off bottom tickmarks & labes
res.tmXTOn              = False       # Turn off top tickmarks & labes
res.tmYROn              = False       # Turn off right tickmarks & labes
res.tmYLMinorOn         = False       # Turn off left minor tickmarks
res.tmEqualizeXYSizes   = False       # Don't try to equalize the lengths
                                      # of the tickmarks.

res.tmYLMajorLengthF          = 0.01      # Total length
res.tmYLMajorOutwardLengthF   = 0.01      # Outward length

res.trYMinF             = 0             # Minimum value on Y axis
res.trXMinF             = 0             # Minimum value on X axis.
res.trYMaxF             = max(y_win)+1  # Maximum value on Y axis.
res.trXMaxF             = max(x_win)+1  # Maximum value on X axis.

res.tiXAxisString        = "# of World Series Wins through {}".format(max_year)
res.tiXAxisFontHeightF   = 0.03

res.nglFrame            = False         # Don't advance frame.

ymin           = 0.                                 # For bar plot.
dx             = min(x_win[1:-1]-x_win[0:-2])       # Distance between X values.
bar_width_perc = 0.6
bar_width      = bar_width_perc * dx                # Bar width.

txres               = Ngl.Resources()    # Resource list for text strings.
txres.txFontHeightF = 0.015

gsres = Ngl.Resources()                  # Resource list for bars.
#
# Plot results for winning teams.
#
# Loop through each value, and create and draw a bar for it.
#
imax = numpy.where(y_win == max(y_win))[0]
for i in range(len(y_win)):
    xbar,ybar = get_bar(x_win[i],y_win[i],dx,ymin)
    plot = Ngl.xy(wks,xbar,ybar,res)

    gsres.gsFillColor = [i+2]               # Set color for bar.
    Ngl.polygon(wks,plot,xbar,ybar,gsres)   # Fill the bar.
    Ngl.polyline(wks,plot,xbar,ybar)        # Outline the bar.
    xbar,ybar = get_bar(x_win[i],y_win[i],dx,ymin)
#
# Put names of teams vertically above the bar. Have to treat the team
# with the most wins (NY Yankees as of 2008) special because
# the text runs off the screen otherwise.
#
    if i == imax:
        txres.txJust   = "BottomCenter"
        txres.txAngleF = 0.
        Ngl.text(wks,plot,winning_teams_nm[i],x_win[i],y_win[i],txres)
    else:
        txres.txJust   = "CenterLeft"
        txres.txAngleF = 90.
        Ngl.text(wks,plot," {}".format(winning_teams_nm[i]),x_win[i],y_win[i],txres)

Ngl.frame(wks)

#
# Now plot losing team results.
#
Ngl.define_colormap(wks,losing_colors)

dx        = min(x_lose[1:-1]-x_lose[0:-2])    # Distance between X values.
bar_width = bar_width_perc * dx               # Bar width.

res.trYMaxF             = max(y_lose)+1   # Maximum value on Y axis.
res.trXMaxF             = max(x_lose)+1   # Maximum value on X axis.
res.tiXAxisString       = "# of World Series Losses through {}".format(max_year)

#
# Loop through each value, and create and draw a bar for it.
#
imax = numpy.where(y_lose == max(y_lose))[0]
```

```
for i in range(len(y_lose)):
    xbar,ybar = get_bar(x_lose[i],y_lose[i],dx,ymin)
    plot = Ngl.xy(wks,xbar,ybar,res)

    gsres.gsFillColor = [i+2]               # Set color for bar.
    Ngl.polygon(wks,plot,xbar,ybar,gsres)   # Fill the bar.
    Ngl.polyline(wks,plot,xbar,ybar)        # Outline the bar.
#
# Put names of teams vertically above the bar. Have to treat the team
# with the most losses (NY Yankees as of 2008) special because
# the text runs off the screen otherwise.
#
    if i == imax:
        txres.txJust   = "BottomCenter"
        txres.txAngleF = 0.
        Ngl.text(wks,plot,losing_teams_nm[i],x_lose[i],y_lose[i],txres)
    else:
        txres.txJust   = "CenterLeft"
        txres.txAngleF = 90.
        Ngl.text(wks,plot," {}".format(losing_teams_nm[i]),x_lose[i],y_lose[i],txres)

Ngl.frame(wks)

Ngl.end()
```


28
24
20
16
12
8
4
0
New York Yankees
Anaheim Angels
Arizona Diamondbacks
Atlanta Braves
Baltimore Orioles
Boston Braves
Boston Red Sox
Brooklyn Dodgers
Chicago Cubs
Chicago White Sox
Cincinnati Reds
Cleveland Indians
Detroit Tigers
Florida Marlins
Houston Astros
Kansas City Royals
Los Angeles Dodgers
Milwaukee Braves
Minnesota Twins
New York Giants
New York Mets
Oakland Athletics
Philadelphia Athletics
Philadelphia Phillies
Pittsburgh Pirates
San Francisco Giants
St. Louis Cardinals
Toronto Blue Jays
Washington Senators
# of World Series Wins through 2017


14
12
10
8
6
4
2
0
New York Yankees
Atlanta Braves
Baltimore Orioles
Boston Braves
Boston Red Sox
Brooklyn Dodgers
Brooklyn Robins
Chicago Cubs
Chicago White Sox
Cincinnati Reds
Cleveland Indians
Colorado Rockies
Detroit Tigers
Houston Astros
Kansas City Royals
Los Angeles Dodgers
Milwaukee Braves
Milwaukee Brewers
Minnesota Twins
New York Giants
New York Mets
Oakland Athletics
Philadelphia Athletics
Philadelphia Phillies
Pittsburgh Pirates
San Diego Padres
San Francisco Giants
St. Louis Browns
St. Louis Cardinals
Texas Rangers
Washington Senators
# of World Series Losses through 2017

In [ ]: