In [10]:
```
#to create a matrix #L11 and L12
```

In [11]:
```
import numpy as np
np.reshape(*,*,'C') #like C language. first row then column
np.reshape(*,*,'F') #like R or Fortran language. first column then row
```

```
  File "<ipython-input-11-c28b659a4de8>", line 2
    np.reshape(*,*,'C') #like C language. first row then column
                ^
SyntaxError: invalid syntax
```

In [12]:
```
np.array() #it combines data elementsinto matrix
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-12-48ae2534db40> in <module>()
----> 1 np.array() #it combines data elementsinto matrix

NameError: name 'np' is not defined
```

In [13]:
```
#Dear Student,
#
#Welcome to the world of Basketball Data!
#I'm sure you will enjoy this section of the Python Programming course.
#
#Instructions for this dataset:
# Simply copy ALL the lines in this script by pressing
# CTRL+A on Windows or CMND+A on Mac and run the Jupyter cell
# Once you have executed the commands the following objects
# will be created:
# Matrices:
# - Salary
# - Games
# - MinutesPlayed
# - FieldGoals
# - FieldGoalAttempts
# - Points
# Lists:
# - Players
# - Seasons
# Dictionaries:
# - Sdict
# - Pdict
#We will understand these inside the course.
#
#Sincerely,
#Kirill Eremenko
#www.superdatascience.com

#Copyright: These datasets were prepared using publicly available data.
#           However, theses scripts are subject to Copyright Laws.
#           If you wish to use these Python scripts outside of the Python Programm
#           by Kirill Eremenko, you may do so by referencing www.superdatascience

#Comments:
#Seasons are labeled based on the first year in the season
#E.g. the 2012-2013 season is preseneted as simply 2012

#Notes and Corrections to the data:
#Kevin Durant: 2006 - College Data Used
#Kevin Durant: 2005 - Proxied With 2006 Data
#Derrick Rose: 2012 - Did Not Play
#Derrick Rose: 2007 - College Data Used
#Derrick Rose: 2006 - Proxied With 2007 Data
#Derrick Rose: 2005 - Proxied With 2007 Data

#Import numpy
import numpy as np

#Seasons
Seasons = ["2005","2006","2007","2008","2009","2010","2011","2012","2013","2014"]
Sdict = {"2005":0,"2006":1,"2007":2,"2008":3,"2009":4,"2010":5,"2011":6,"2012":7,

#Players
Players = ["KobeBryant","JoeJohnson","LeBronJames","CarmeloAnthony","DwightHoward
Pdict = {"KobeBryant":0,"JoeJohnson":1,"LeBronJames":2,"CarmeloAnthony":3,"Dwight
```

```
#Salaries
KobeBryant_Salary = [15946875,17718750,19490625,21262500,23034375,24806250,252444
JoeJohnson_Salary = [12000000,12744189,13488377,14232567,14976754,16324500,180385
LeBronJames_Salary = [4621800,5828090,13041250,14410581,15779912,14500000,160225
CarmeloAnthony_Salary = [3713640,4694041,13041250,14410581,15779912,17149243,1851
DwightHoward_Salary = [4493160,4806720,6061274,13758000,15202590,16647180,180917
ChrisBosh_Salary = [3348000,4235220,12455000,14410581,15779912,14500000,16022500,
ChrisPaul_Salary = [3144240,3380160,3615960,4574189,13520500,14940153,16359805,17
KevinDurant_Salary = [0,0,4171200,4484040,4796880,6053663,15506632,16669630,17832
DerrickRose_Salary = [0,0,0,4822800,5184480,5546160,6993708,16402500,17632688,188
DwayneWade_Salary = [3031920,3841443,13041250,14410581,15779912,14200000,15691000
#Matrix
Salary = np.array([KobeBryant_Salary, JoeJohnson_Salary, LeBronJames_Salary, Carm

#Games
KobeBryant_G = [80,77,82,82,73,82,58,78,6,35]
JoeJohnson_G = [82,57,82,79,76,72,60,72,79,80]
LeBronJames_G = [79,78,75,81,76,79,62,76,77,69]
CarmeloAnthony_G = [80,65,77,66,69,77,55,67,77,40]
DwightHoward_G = [82,82,82,79,82,78,54,76,71,41]
ChrisBosh_G = [70,69,67,77,70,77,57,74,79,44]
ChrisPaul_G = [78,64,80,78,45,80,60,70,62,82]
KevinDurant_G = [35,35,80,74,82,78,66,81,81,27]
DerrickRose_G = [40,40,40,81,78,81,39,0,10,51]
DwayneWade_G = [75,51,51,79,77,76,49,69,54,62]
#Matrix
Games = np.array([KobeBryant_G, JoeJohnson_G, LeBronJames_G, CarmeloAnthony_G, Dw

#Minutes Played
KobeBryant_MP = [3277,3140,3192,2960,2835,2779,2232,3013,177,1207]
JoeJohnson_MP = [3340,2359,3343,3124,2886,2554,2127,2642,2575,2791]
LeBronJames_MP = [3361,3190,3027,3054,2966,3063,2326,2877,2902,2493]
CarmeloAnthony_MP = [2941,2486,2806,2277,2634,2751,1876,2482,2982,1428]
DwightHoward_MP = [3021,3023,3088,2821,2843,2935,2070,2722,2396,1223]
ChrisBosh_MP = [2751,2658,2425,2928,2526,2795,2007,2454,2531,1556]
ChrisPaul_MP = [2808,2353,3006,3002,1712,2880,2181,2335,2171,2857]
KevinDurant_MP = [1255,1255,2768,2885,3239,3038,2546,3119,3122,913]
DerrickRose_MP = [1168,1168,1168,3000,2871,3026,1375,0,311,1530]
DwayneWade_MP = [2892,1931,1954,3048,2792,2823,1625,2391,1775,1971]
#Matrix
MinutesPlayed = np.array([KobeBryant_MP, JoeJohnson_MP, LeBronJames_MP, CarmeloAn

#Field Goals
KobeBryant_FG = [978,813,775,800,716,740,574,738,31,266]
JoeJohnson_FG = [632,536,647,620,635,514,423,445,462,446]
LeBronJames_FG = [875,772,794,789,768,758,621,765,767,624]
CarmeloAnthony_FG = [756,691,728,535,688,684,441,669,743,358]
DwightHoward_FG = [468,526,583,560,510,619,416,470,473,251]
ChrisBosh_FG = [549,543,507,615,600,524,393,485,492,343]
ChrisPaul_FG = [407,381,630,631,314,430,425,412,406,568]
KevinDurant_FG = [306,306,587,661,794,711,643,731,849,238]
DerrickRose_FG = [208,208,208,574,672,711,302,0,58,338]
DwayneWade_FG = [699,472,439,854,719,692,416,569,415,509]
#Matrix
FieldGoals  = np.array([KobeBryant_FG, JoeJohnson_FG, LeBronJames_FG, CarmeloAnth
```

```
#Field Goal Attempts
KobeBryant_FGA = [2173,1757,1690,1712,1569,1639,1336,1595,73,713]
JoeJohnson_FGA = [1395,1139,1497,1420,1386,1161,931,1052,1018,1025]
LeBronJames_FGA = [1823,1621,1642,1613,1528,1485,1169,1354,1353,1279]
CarmeloAnthony_FGA = [1572,1453,1481,1207,1502,1503,1025,1489,1643,806]
DwightHoward_FGA = [881,873,974,979,834,1044,726,813,800,423]
ChrisBosh_FGA = [1087,1094,1027,1263,1158,1056,807,907,953,745]
ChrisPaul_FGA = [947,871,1291,1255,637,928,890,856,870,1170]
KevinDurant_FGA = [647,647,1366,1390,1668,1538,1297,1433,1688,467]
DerrickRose_FGA = [436,436,436,1208,1373,1597,695,0,164,835]
DwayneWade_FGA = [1413,962,937,1739,1511,1384,837,1093,761,1084]
#Matrix
FieldGoalAttempts = np.array([KobeBryant_FGA, JoeJohnson_FGA, LeBronJames_FGA, Ca

#Points
KobeBryant_PTS = [2832,2430,2323,2201,1970,2078,1616,2133,83,782]
JoeJohnson_PTS = [1653,1426,1779,1688,1619,1312,1129,1170,1245,1154]
LeBronJames_PTS = [2478,2132,2250,2304,2258,2111,1683,2036,2089,1743]
CarmeloAnthony_PTS = [2122,1881,1978,1504,1943,1970,1245,1920,2112,966]
DwightHoward_PTS = [1292,1443,1695,1624,1503,1784,1113,1296,1297,646]
ChrisBosh_PTS = [1572,1561,1496,1746,1678,1438,1025,1232,1281,928]
ChrisPaul_PTS = [1258,1104,1684,1781,841,1268,1189,1186,1185,1564]
KevinDurant_PTS = [903,903,1624,1871,2472,2161,1850,2280,2593,686]
DerrickRose_PTS = [597,597,597,1361,1619,2026,852,0,159,904]
DwayneWade_PTS = [2040,1397,1254,2386,2045,1941,1082,1463,1028,1331]
#Matrix
Points = np.array([KobeBryant_PTS, JoeJohnson_PTS, LeBronJames_PTS, CarmeloAnthon
```

In [14]:
```
Salary
```

Out[14]:
```
array([[15946875, 17718750, 19490625, 21262500, 23034375, 24806250,
        25244493, 27849149, 30453805, 23500000],
       [12000000, 12744189, 13488377, 14232567, 14976754, 16324500,
        18038573, 19752645, 21466718, 23180790],
       [ 4621800,  5828090, 13041250, 14410581, 15779912, 14500000,
        16022500, 17545000, 19067500, 20644400],
       [ 3713640,  4694041, 13041250, 14410581, 15779912, 17149243,
        18518574, 19450000, 22407474, 22458000],
       [ 4493160,  4806720,  6061274, 13758000, 15202590, 16647180,
        18091770, 19536360, 20513178, 21436271],
       [ 3348000,  4235220, 12455000, 14410581, 15779912, 14500000,
        16022500, 17545000, 19067500, 20644400],
       [ 3144240,  3380160,  3615960,  4574189, 13520500, 14940153,
        16359805, 17779458, 18668431, 20068563],
       [       0,        0,  4171200,  4484040,  4796880,  6053663,
        15506632, 16669630, 17832627, 18995624],
       [       0,        0,        0,  4822800,  5184480,  5546160,
         6993708, 16402500, 17632688, 18862875],
       [ 3031920,  3841443, 13041250, 14410581, 15779912, 14200000,
        15691000, 17182000, 18673000, 15000000]])
```

In [15]:
```
mydata=np.arange(0,20)
```

In [16]:
```
mydata
```

Out[16]:
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [17]:
```
np.reshape(mydata,(5,4)) #parameters are passed in the form of tuples. First row
```

Out[17]:
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [18]:
```
y=np.reshape(mydata,(5,4),order='F')
```

In [19]:
```
x=np.reshape(mydata,(5,4),order='C')
```

In [20]:
```
x[2,2]
```

Out[20]:
```
10
```

In [21]:
```
x[3][2]
```

Out[21]:
```
14
```

In [22]:
```
y[3,1]
```

Out[22]:
```
8
```

In [23]:
```
type(mydata)
```

Out[23]:
```
numpy.ndarray
```

In [24]:
```
#since my data is an array and in OOPS concept it is a object
#HEnce instead of using np.reshape we can also use - mydata.reshape(dimension)
```

In [25]:
```
mydata.reshape((10,2))
```

Out[25]:
```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15],
       [16, 17],
       [18, 19]])
```

In [28]:
```
r1=[1,2,3,34,5]
r2=["jejrg","fuwrg","jfb"]
r3=[1,2,3,"fgg"]
```

In [29]:
```
l=[r1,r2,r3]
```

In [30]:
```
l[2][2]
```

Out[30]:
```
3
```

In [31]:
```
l
```

Out[31]:
```
[[1, 2, 3, 34, 5], ['jejrg', 'fuwrg', 'jfb'], [1, 2, 3, 'fgg']]
```

In [32]:
```
l[2][1]
```

Out[32]:
```
2
```

In [33]:
```
p=np.array([r1,r2,r3])
```

In [34]:
```
p
```

Out[34]:
```
array([list([1, 2, 3, 34, 5]), list(['jejrg', 'fuwrg', 'jfb']),
       list([1, 2, 3, 'fgg'])], dtype=object)
```

In [35]:
```
print(p)
```

```
[list([1, 2, 3, 34, 5]) list(['jejrg', 'fuwrg', 'jfb'])
 list([1, 2, 3, 'fgg'])]
```

In [64]:
```
#Dictionaries start here #L13
```

Games

In [65]:
```
Games
```

Out[65]:
```
array([[80, 77, 82, 82, 73, 82, 58, 78,  6, 35],
       [82, 57, 82, 79, 76, 72, 60, 72, 79, 80],
       [79, 78, 75, 81, 76, 79, 62, 76, 77, 69],
       [80, 65, 77, 66, 69, 77, 55, 67, 77, 40],
       [82, 82, 82, 79, 82, 78, 54, 76, 71, 41],
       [70, 69, 67, 77, 70, 77, 57, 74, 79, 44],
       [78, 64, 80, 78, 45, 80, 60, 70, 62, 82],
       [35, 35, 80, 74, 82, 78, 66, 81, 81, 27],
       [40, 40, 40, 81, 78, 81, 39,  0, 10, 51],
       [75, 51, 51, 79, 77, 76, 49, 69, 54, 62]])
```

In [66]:
```
Games[2]
```

Out[66]:
```
array([79, 78, 75, 81, 76, 79, 62, 76, 77, 69])
```

In [67]:
```
Games[2,-1]
```

Out[67]:
```
69
```

In [68]:
```
Points[6]
```

Out[68]:
```
array([1258, 1104, 1684, 1781,  841, 1268, 1189, 1186, 1185, 1564])
```

In [69]:
```
Points[6,1]
```

Out[69]:
```
1104
```

In [70]:
```
dict1={'key1':'b=valu1','key2':'value2'} #key is like a label for each value
```

In [71]:
```
dict1
```

Out[71]:
```
{'key1': 'b=valu1', 'key2': 'value2'}
```

In [72]:
```
dict1.keys()
```

Out[72]:
```
dict_keys(['key1', 'key2'])
```

In [73]:
```
dict1.values()
```

Out[73]:
```
dict_values(['b=valu1', 'value2'])
```

In [74]:
```
dict1.itername()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-74-dde26b72f6d5> in <module>()
----> 1 dict1.itername()

AttributeError: 'dict' object has no attribute 'itername'
```

In [75]:
```
dict1['key2'] #accessing through keys
```

Out[75]:
```
'value2'
```

In [76]:
```
dict2={'germany':'sgvy','france':2,'spain':True}
```

In [77]:
```
dict2 #order doesnt matter cause accessing is done through keys
```

Out[77]:
```
{'france': 2, 'germany': 'sgvy', 'spain': True}
```

In [78]:
```
Pdict
```

Out[78]:
```
{'CarmeloAnthony': 3,
 'ChrisBosh': 5,
 'ChrisPaul': 6,
 'DerrickRose': 8,
 'DwayneWade': 9,
 'DwightHoward': 4,
 'JoeJohnson': 1,
 'KevinDurant': 7,
 'KobeBryant': 0,
 'LeBronJames': 2}
```

In [79]:
```
Games
```

Out[79]:
```
array([[80, 77, 82, 82, 73, 82, 58, 78,  6, 35],
       [82, 57, 82, 79, 76, 72, 60, 72, 79, 80],
       [79, 78, 75, 81, 76, 79, 62, 76, 77, 69],
       [80, 65, 77, 66, 69, 77, 55, 67, 77, 40],
       [82, 82, 82, 79, 82, 78, 54, 76, 71, 41],
       [70, 69, 67, 77, 70, 77, 57, 74, 79, 44],
       [78, 64, 80, 78, 45, 80, 60, 70, 62, 82],
       [35, 35, 80, 74, 82, 78, 66, 81, 81, 27],
       [40, 40, 40, 81, 78, 81, 39,  0, 10, 51],
       [75, 51, 51, 79, 77, 76, 49, 69, 54, 62]])
```

In [80]:
```
Pdict['KobeBryant']
```

Out[80]:
```
0
```

In [81]:
```
Games[Pdict['KobeBryant']] #Use of dictionary to fing data related to a player by
```

Out[81]:
```
array([80, 77, 82, 82, 73, 82, 58, 78,  6, 35])
```

In [82]:
```
Games[Pdict['KobeBryant']][Sdict['2012']]
```

Out[82]:
```
78
```

In [83]:
```
#Matrix Operations starts here #L14
```

In [84]:
```
Salary
```

Out[84]:
```
array([[15946875, 17718750, 19490625, 21262500, 23034375, 24806250,
        25244493, 27849149, 30453805, 23500000],
       [12000000, 12744189, 13488377, 14232567, 14976754, 16324500,
        18038573, 19752645, 21466718, 23180790],
       [ 4621800,  5828090, 13041250, 14410581, 15779912, 14500000,
        16022500, 17545000, 19067500, 20644400],
       [ 3713640,  4694041, 13041250, 14410581, 15779912, 17149243,
        18518574, 19450000, 22407474, 22458000],
       [ 4493160,  4806720,  6061274, 13758000, 15202590, 16647180,
        18091770, 19536360, 20513178, 21436271],
       [ 3348000,  4235220, 12455000, 14410581, 15779912, 14500000,
        16022500, 17545000, 19067500, 20644400],
       [ 3144240,  3380160,  3615960,  4574189, 13520500, 14940153,
        16359805, 17779458, 18668431, 20068563],
       [       0,        0,  4171200,  4484040,  4796880,  6053663,
        15506632, 16669630, 17832627, 18995624],
       [       0,        0,        0,  4822800,  5184480,  5546160,
         6993708, 16402500, 17632688, 18862875],
       [ 3031920,  3841443, 13041250, 14410581, 15779912, 14200000,
        15691000, 17182000, 18673000, 15000000]])
```

In [98]:
```
Salary
```

Out[98]:
```
array([[15946875, 17718750, 19490625, 21262500, 23034375, 24806250,
         25244493, 27849149, 30453805, 23500000],
       [12000000, 12744189, 13488377, 14232567, 14976754, 16324500,
         18038573, 19752645, 21466718, 23180790],
       [ 4621800,  5828090, 13041250, 14410581, 15779912, 14500000,
         16022500, 17545000, 19067500, 20644400],
       [ 3713640,  4694041, 13041250, 14410581, 15779912, 17149243,
         18518574, 19450000, 22407474, 22458000],
       [ 4493160,  4806720,  6061274, 13758000, 15202590, 16647180,
         18091770, 19536360, 20513178, 21436271],
       [ 3348000,  4235220, 12455000, 14410581, 15779912, 14500000,
         16022500, 17545000, 19067500, 20644400],
       [ 3144240,  3380160,  3615960,  4574189, 13520500, 14940153,
         16359805, 17779458, 18668431, 20068563],
       [       0,        0,  4171200,  4484040,  4796880,  6053663,
         15506632, 16669630, 17832627, 18995624],
       [       0,        0,        0,  4822800,  5184480,  5546160,
          6993708, 16402500, 17632688, 18862875],
       [ 3031920,  3841443, 13041250, 14410581, 15779912, 14200000,
         15691000, 17182000, 18673000, 15000000]])
```

In [99]:
```
FieldGoals
```

Out[99]:
```
array([[978, 813, 775, 800, 716, 740, 574, 738,  31, 266],
       [632, 536, 647, 620, 635, 514, 423, 445, 462, 446],
       [875, 772, 794, 789, 768, 758, 621, 765, 767, 624],
       [756, 691, 728, 535, 688, 684, 441, 669, 743, 358],
       [468, 526, 583, 560, 510, 619, 416, 470, 473, 251],
       [549, 543, 507, 615, 600, 524, 393, 485, 492, 343],
       [407, 381, 630, 631, 314, 430, 425, 412, 406, 568],
       [306, 306, 587, 661, 794, 711, 643, 731, 849, 238],
       [208, 208, 208, 574, 672, 711, 302,   0,  58, 338],
       [699, 472, 439, 854, 719, 692, 416, 569, 415, 509]])
```

In [100]:
```
Games
```

Out[100]:
```
array([[80, 77, 82, 82, 73, 82, 58, 78,  6, 35],
       [82, 57, 82, 79, 76, 72, 60, 72, 79, 80],
       [79, 78, 75, 81, 76, 79, 62, 76, 77, 69],
       [80, 65, 77, 66, 69, 77, 55, 67, 77, 40],
       [82, 82, 82, 79, 82, 78, 54, 76, 71, 41],
       [70, 69, 67, 77, 70, 77, 57, 74, 79, 44],
       [78, 64, 80, 78, 45, 80, 60, 70, 62, 82],
       [35, 35, 80, 74, 82, 78, 66, 81, 81, 27],
       [40, 40, 40, 81, 78, 81, 39,  0, 10, 51],
       [75, 51, 51, 79, 77, 76, 49, 69, 54, 62]])
```

In [101]:
```
import warnings
warnings.filterwarnings('ignore')
c=np.matrix.round(FieldGoals/Games)
```

In [102]:
```
c
```

Out[102]:
```
array([[ 12.,  11.,   9.,  10.,  10.,   9.,  10.,   9.,   5.,   8.],
       [  8.,   9.,   8.,   8.,   8.,   7.,   7.,   6.,   6.,   6.],
       [ 11.,  10.,  11.,  10.,  10.,  10.,  10.,  10.,  10.,   9.],
       [  9.,  11.,   9.,   8.,  10.,   9.,   8.,  10.,  10.,   9.],
       [  6.,   6.,   7.,   7.,   6.,   8.,   8.,   6.,   7.,   6.],
       [  8.,   8.,   8.,   8.,   9.,   7.,   7.,   7.,   6.,   8.],
       [  5.,   6.,   8.,   8.,   7.,   5.,   7.,   6.,   7.,   7.],
       [  9.,   9.,   7.,   9.,  10.,   9.,  10.,   9.,  10.,   9.],
       [  5.,   5.,   5.,   7.,   9.,   9.,   8.,  nan,   6.,   7.],
       [  9.,   9.,   9.,  11.,   9.,   9.,   8.,   8.,   8.,   8.]])
```

In [103]:
```
c[Pdict['KobeBryant']][Sdict['2012']]
```

Out[103]:
```
9.0
```

In [104]:
```
x=np.matrix.round(MinutesPlayed/Games)
```

In [105]:
```
x
```

Out[105]:
```
array([[ 41.,  41.,  39.,  36.,  39.,  34.,  38.,  39.,  30.,  34.],
       [ 41.,  41.,  41.,  40.,  38.,  35.,  35.,  37.,  33.,  35.],
       [ 43.,  41.,  40.,  38.,  39.,  39.,  38.,  38.,  38.,  36.],
       [ 37.,  38.,  36.,  34.,  38.,  36.,  34.,  37.,  39.,  36.],
       [ 37.,  37.,  38.,  36.,  35.,  38.,  38.,  36.,  34.,  30.],
       [ 39.,  39.,  36.,  38.,  36.,  36.,  35.,  33.,  32.,  35.],
       [ 36.,  37.,  38.,  38.,  38.,  36.,  36.,  33.,  35.,  35.],
       [ 36.,  36.,  35.,  39.,  40.,  39.,  39.,  39.,  39.,  34.],
       [ 29.,  29.,  29.,  37.,  37.,  37.,  35.,  nan,  31.,  30.],
       [ 39.,  38.,  38.,  39.,  36.,  37.,  33.,  35.,  33.,  32.]])
```

In [112]:
```
z=np.matrix.round(FieldGoals/FieldGoalAttempts,2)*100
```

In [113]:
```
z
```

Out[113]:
```
array([[ 45.,  46.,  46.,  47.,  46.,  45.,  43.,  46.,  42.,  37.],
       [ 45.,  47.,  43.,  44.,  46.,  44.,  45.,  42.,  45.,  44.],
       [ 48.,  48.,  48.,  49.,  50.,  51.,  53.,  56.,  57.,  49.],
       [ 48.,  48.,  49.,  44.,  46.,  46.,  43.,  45.,  45.,  44.],
       [ 53.,  60.,  60.,  57.,  61.,  59.,  57.,  58.,  59.,  59.],
       [ 51.,  50.,  49.,  49.,  52.,  50.,  49.,  53.,  52.,  46.],
       [ 43.,  44.,  49.,  50.,  49.,  46.,  48.,  48.,  47.,  49.],
       [ 47.,  47.,  43.,  48.,  48.,  46.,  50.,  51.,  50.,  51.],
       [ 48.,  48.,  48.,  48.,  49.,  45.,  43.,  nan,  35.,  40.],
       [ 49.,  49.,  47.,  49.,  48.,  50.,  50.,  52.,  55.,  47.]])
```

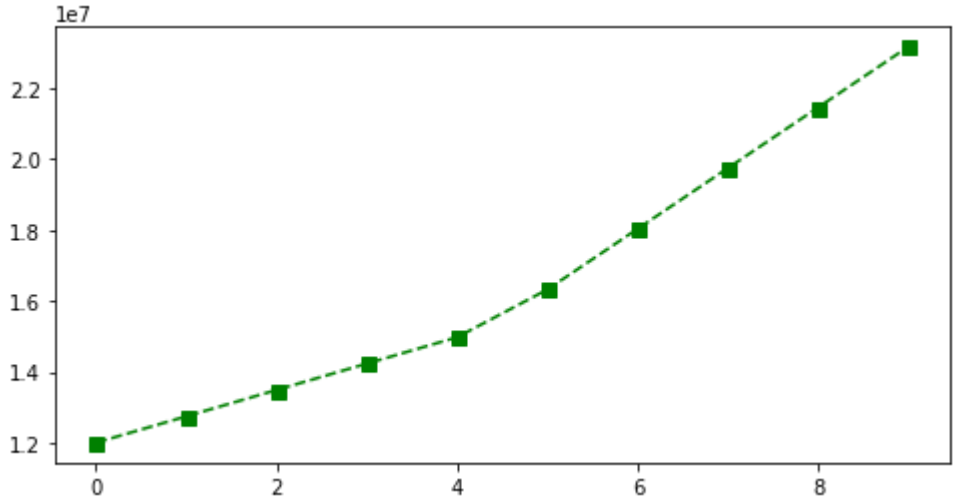
In [114]:
```
#Visualization #L15
```

In [115]:
```
import numpy as np
```

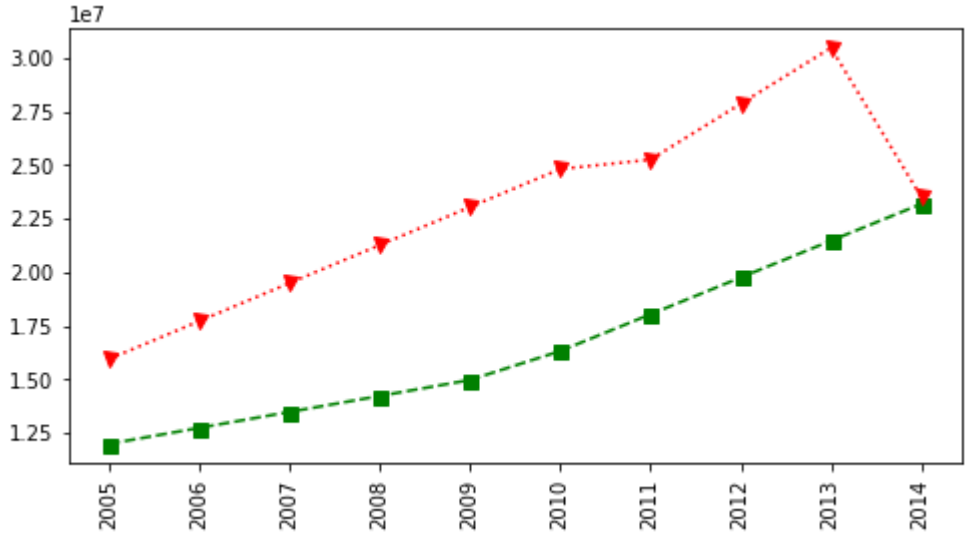
In [116]:
```
import matplotlib.pyplot as plt
```

In [132]:
```
%matplotlib inline
plt.rcParams['figure.figsize']=8,4
```

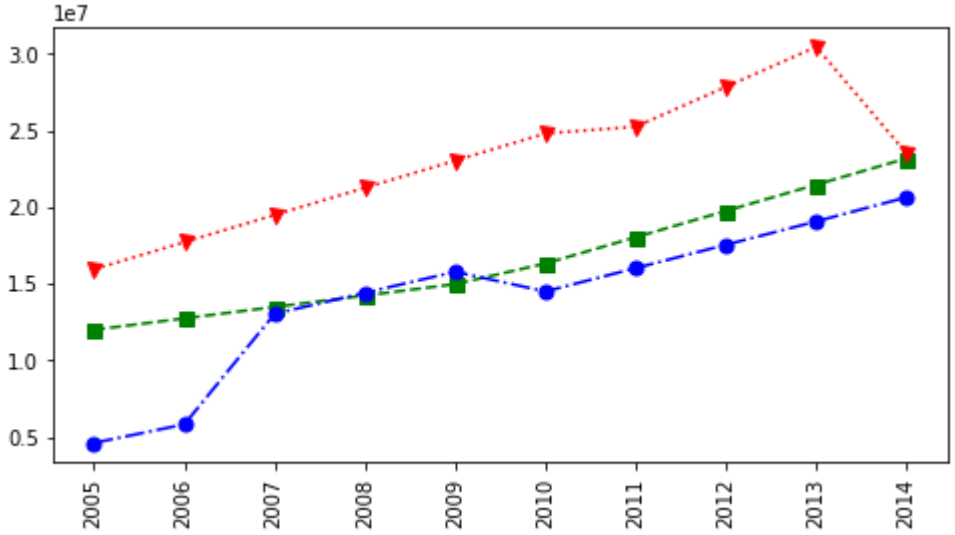
In [133]:
```
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7)
plt.show() #to display plots
```



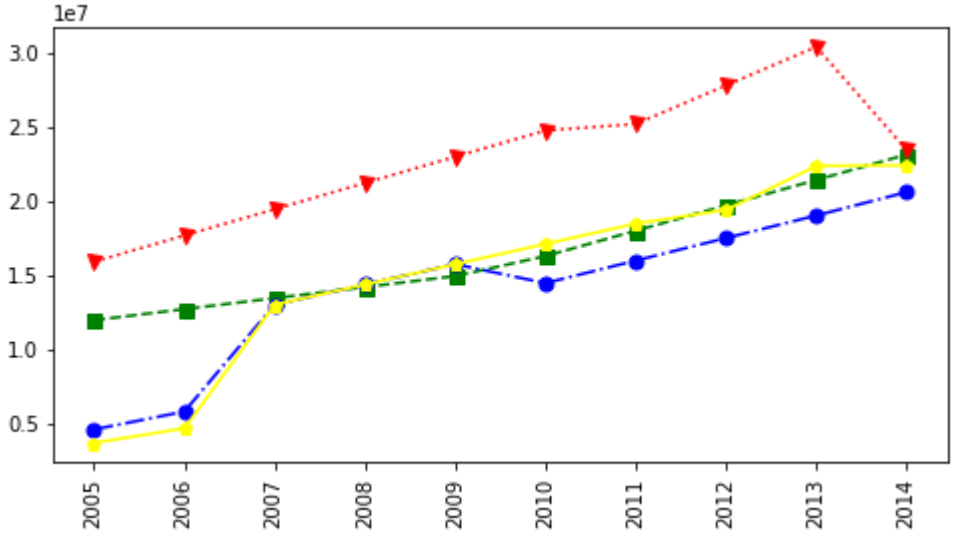
In [145]:
```
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Salary[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



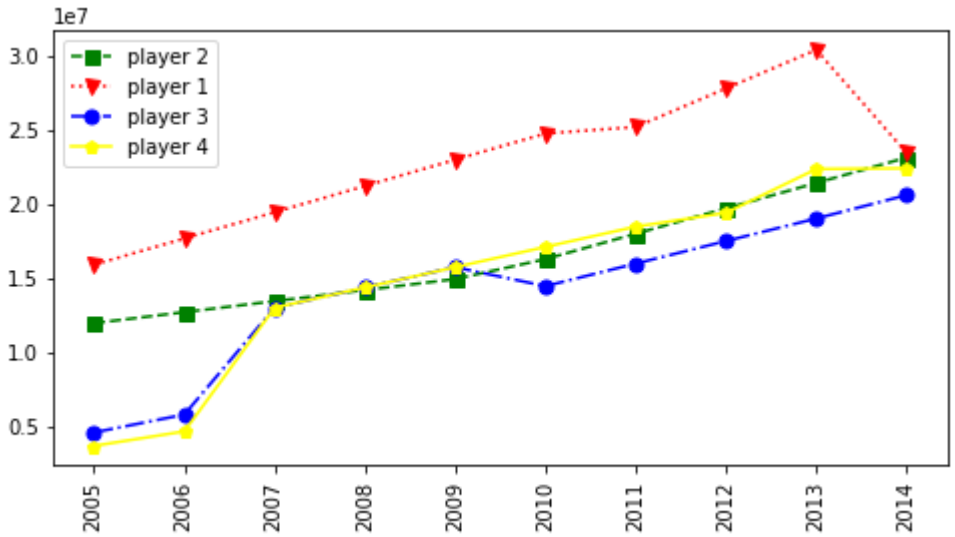
In [146]:
```
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Salary[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Salary[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



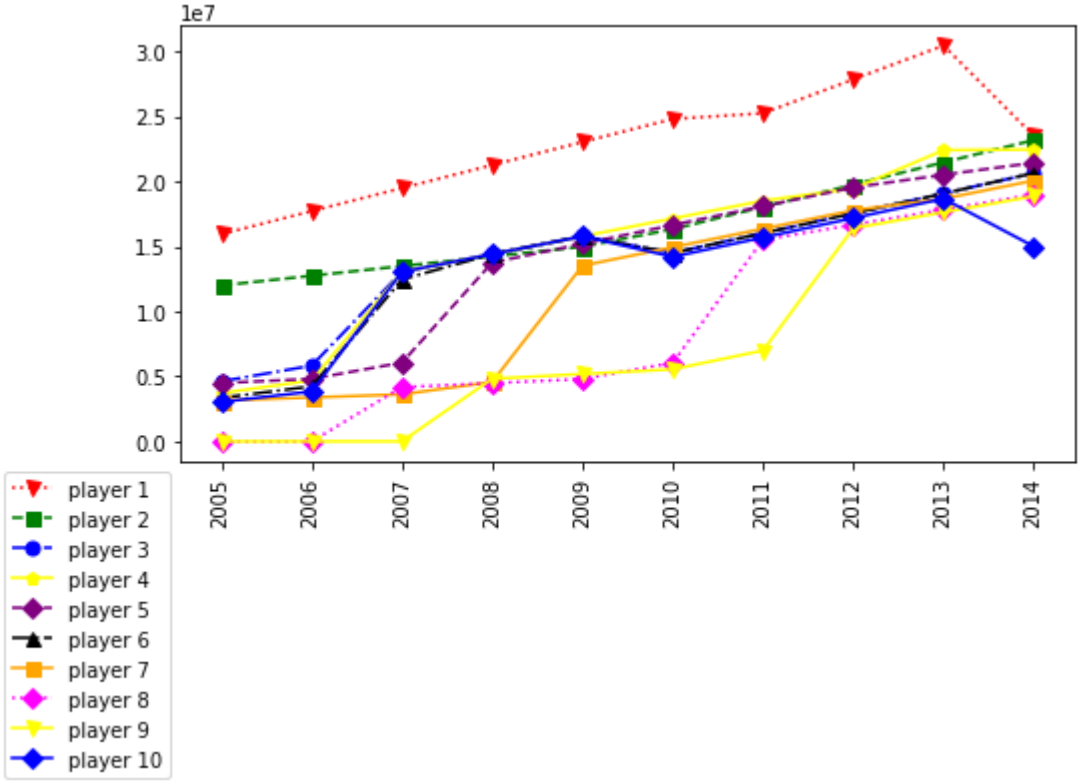
In [147]:
```
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Salary[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Salary[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(Salary[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



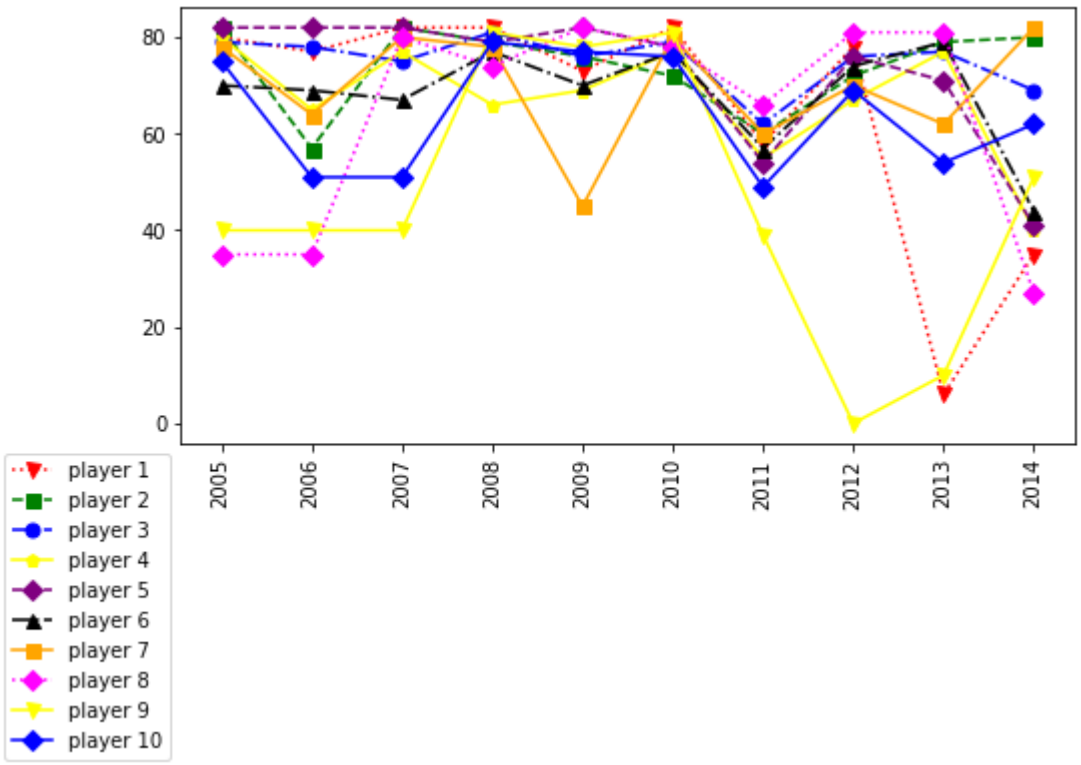
In [148]:
```
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Salary[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Salary[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(Salary[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.legend()
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



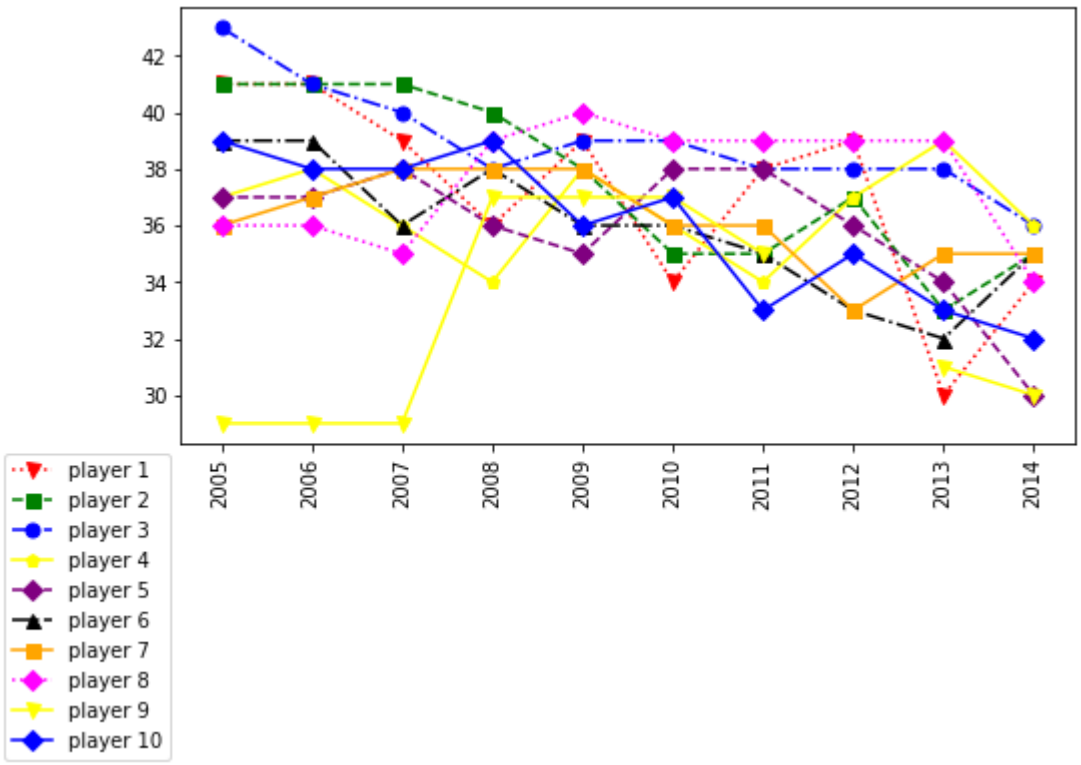
In [163]:
```
#Adding Legends
plt.plot(Salary[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Salary[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Salary[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(Salary[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.plot(Salary[4],c='Purple',ls='--',marker='D',ms=7,label="player 5")
plt.plot(Salary[5],c='Black',ls='-.',marker='^',ms=7,label="player 6")
plt.plot(Salary[6],c='Orange',ls='-',marker='s',ms=7,label="player 7")
plt.plot(Salary[7],c='Magenta',ls=':',marker='D',ms=7,label="player 8")
plt.plot(Salary[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(Salary[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the box
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



In [164]:
```
#Adding Legends
plt.plot(Games[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Games[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(Games[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(Games[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.plot(Games[4],c='Purple',ls='--',marker='D',ms=7,label="player 5")
plt.plot(Games[5],c='Black',ls='-.',marker='^',ms=7,label="player 6")
plt.plot(Games[6],c='Orange',ls='-',marker='s',ms=7,label="player 7")
plt.plot(Games[7],c='Magenta',ls=':',marker='D',ms=7,label="player 8")
plt.plot(Games[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(Games[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the box
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```

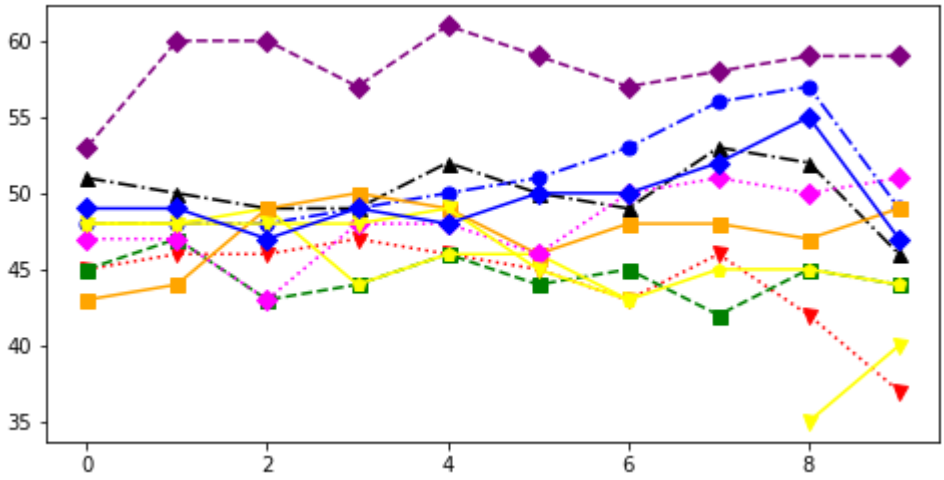


In [165]:
```
#Adding Legends
plt.plot(x[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(x[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(x[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(x[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.plot(x[4],c='Purple',ls='--',marker='D',ms=7,label="player 5")
plt.plot(x[5],c='Black',ls='-.',marker='^',ms=7,label="player 6")
plt.plot(x[6],c='Orange',ls='-',marker='s',ms=7,label="player 7")
plt.plot(x[7],c='Magenta',ls=':',marker='D',ms=7,label="player 8")
plt.plot(x[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(x[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the box
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



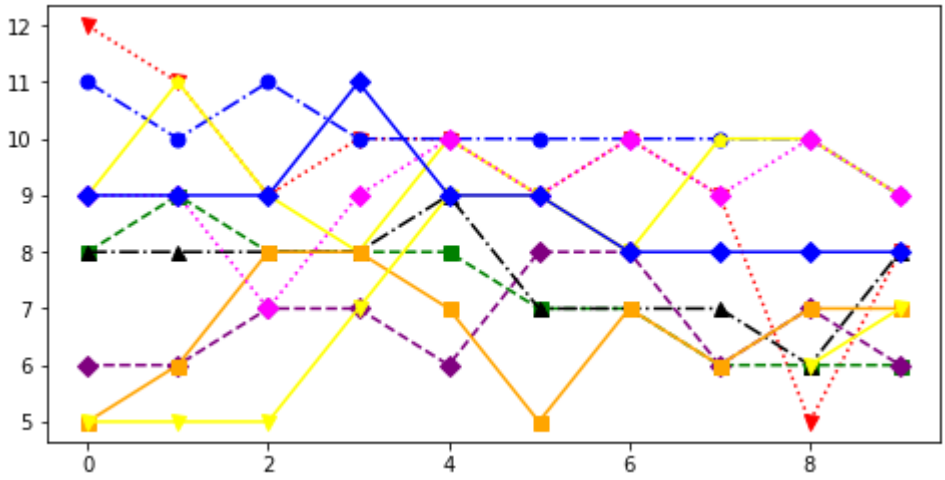
In [166]:
```
#Adding Legends
plt.plot(z[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(z[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(z[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(z[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.plot(z[4],c='Purple',ls='--',marker='D',ms=7,label="player 5")
plt.plot(z[5],c='Black',ls='-.',marker='^',ms=7,label="player 6")
plt.plot(z[6],c='Orange',ls='-',marker='s',ms=7,label="player 7")
plt.plot(z[7],c='Magenta',ls=':',marker='D',ms=7,label="player 8")
plt.plot(z[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(z[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bboz_to_anchor=(0,0)) #location of plot to the boz
plt.zticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-166-34cdb5c41607> in <module>()
     10 plt.plot(z[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
     11 plt.plot(z[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
---> 12 plt.legend(loc='bottom right', bboz_to_anchor=(0,0)) #location of plot
 to the boz and pass as tuple
     13 plt.zticks(list(range(0,10)),Seasons,rotation='vertical')
     14 plt.show

G:\PYTHON\AnacondaPython\lib\site-packages\matplotlib\pyplot.py in legend(*arg
s, **kwargs)
   3721 @docstring.copy_dedent(Axes.legend)
   3722 def legend(*args, **kwargs):
-> 3723     ret = gca().legend(*args, **kwargs)
   3724     return ret
   3725

G:\PYTHON\AnacondaPython\lib\site-packages\matplotlib\axes\_axes.py in legend(s
elf, *args, **kwargs)
    563             raise TypeError('Invalid arguments to legend.')
    564
--> 565         self.legend_ = mlegend.Legend(self, handles, labels, **kwargs)
    566         self.legend_._remove_method = lambda h: setattr(self, 'legend_'
, None)
    567         return self.legend_

TypeError: __init__() got an unexpected keyword argument 'bboz_to_anchor'
```


60
55
50
45
40
35
0
2
4
6
8

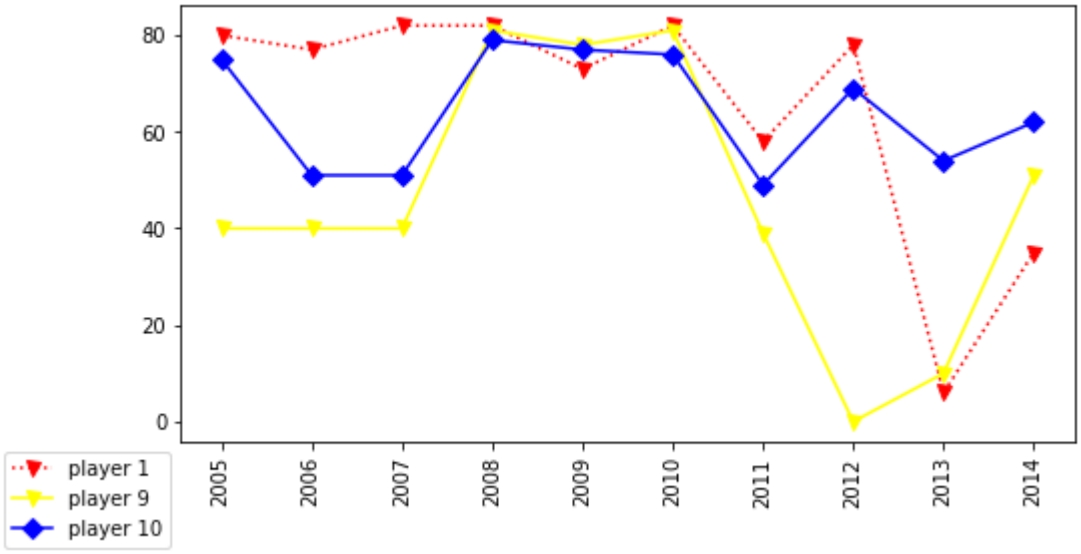
In [167]:
```
#Adding Legends
plt.plot(c[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(c[1],c='Green',ls='--',marker='s',ms=7,label="player 2")
plt.plot(c[2],c='Blue',ls='-.',marker='o',ms=7,label="player 3")
plt.plot(c[3],c='Yellow',ls='-',marker='p',ms=7,label="player 4")
plt.plot(c[4],c='Purple',ls='--',marker='D',ms=7,label="player 5")
plt.plot(c[5],c='Black',ls='-.',marker='^',ms=7,label="player 6")
plt.plot(c[6],c='Orange',ls='-',marker='s',ms=7,label="player 7")
plt.plot(c[7],c='Magenta',ls=':',marker='D',ms=7,label="player 8")
plt.plot(c[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(c[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bboc_to_anchor=(0,0)) #location of plot to the boc
plt.cticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-167-e451bdbce296> in <module>()
     10 plt.plot(c[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
     11 plt.plot(c[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
---> 12 plt.legend(loc='bottom right', bboc_to_anchor=(0,0)) #location of plot
 to the boc and pass as tuple
     13 plt.cticks(list(range(0,10)),Seasons,rotation='vertical')
     14 plt.show

G:\PYTHON\AnacondaPython\lib\site-packages\matplotlib\pyplot.py in legend(*arg
s, **kwargs)
   3721 @docstring.copy_dedent(Axes.legend)
   3722 def legend(*args, **kwargs):
-> 3723     ret = gca().legend(*args, **kwargs)
   3724     return ret
   3725

G:\PYTHON\AnacondaPython\lib\site-packages\matplotlib\axes\_axes.py in legend(s
elf, *args, **kwargs)
    563             raise TypeError('Invalid arguments to legend.')
    564
--> 565         self.legend_ = mlegend.Legend(self, handles, labels, **kwargs)
    566         self.legend_._remove_method = lambda h: setattr(self, 'legend_'
, None)
    567         return self.legend_

TypeError: __init__() got an unexpected keyword argument 'bboc_to_anchor'
```



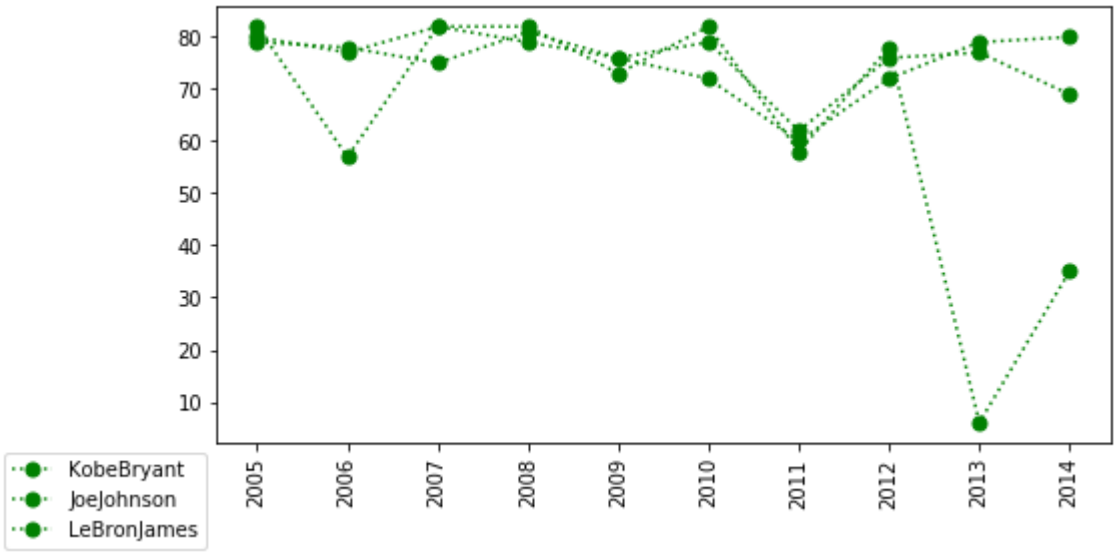
In [168]:
```
#Creating our own Function #L16
```

In [169]:
```
#Adding legends
plt.plot(Games[0],c='Red',ls=':',marker='v',ms=7,label="player 1")
plt.plot(Games[8],c='Yellow',ls='-',marker='v',ms=7,label="player 9")
plt.plot(Games[9],c='Blue',ls='-',marker='D',ms=7,label="player 10")
plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the box
plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
plt.show()
```



In [178]:
```
def myplot(playerlist):
    for i in playerlist:
        plt.plot(Games[Pdict[i]],c='Green',ls=':',marker='o',ms=7,label=Players[P
    plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the
    plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
    plt.show()
```

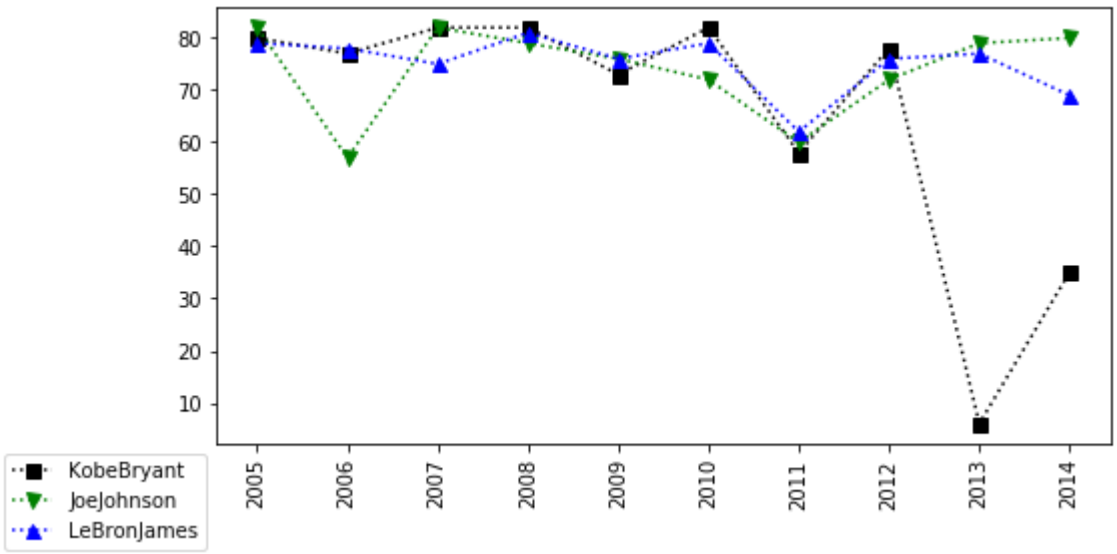
In [179]:
```
myplot(["KobeBryant","JoeJohnson","LeBronJames"])
```



In [180]:
```
#Advanced Function Design #L17
```

In [191]:
```
def myplot(playerlist):
    Col = {"KobeBryant":"Black","JoeJohnson":"Green","LeBronJames":"Blue","Carmel
    Mark = {"KobeBryant":"s","JoeJohnson":"v","LeBronJames":"^","CarmeloAnthony":
    for i in playerlist:
        plt.plot(Games[Pdict[i]],c=Col[i],ls=':',marker=Mark[i],ms=7,label=Player
    plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #Location of plot to the
    plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
    plt.show()
```

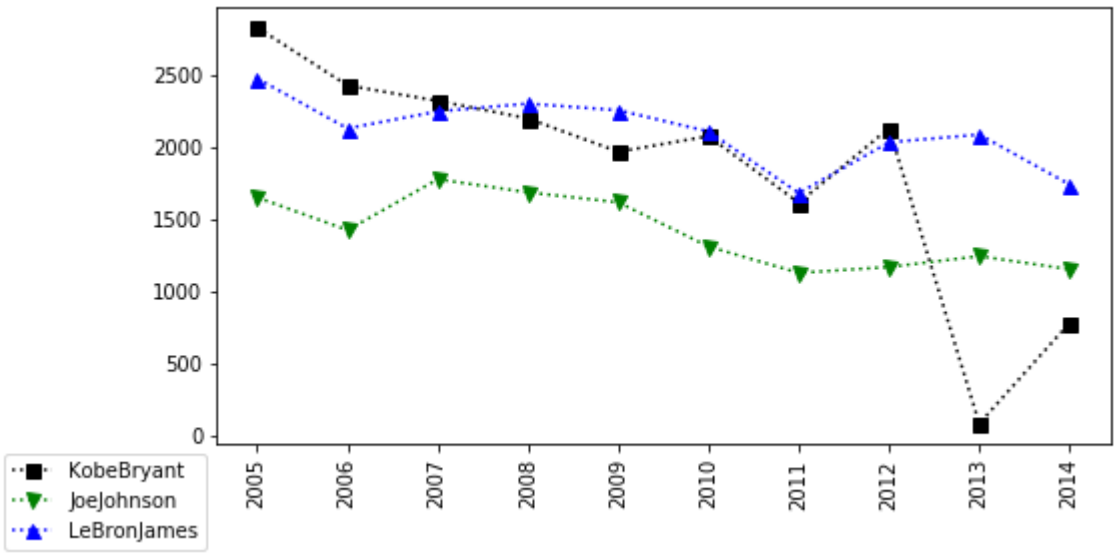
In [192]:
```
myplot(["KobeBryant","JoeJohnson","LeBronJames"])
```



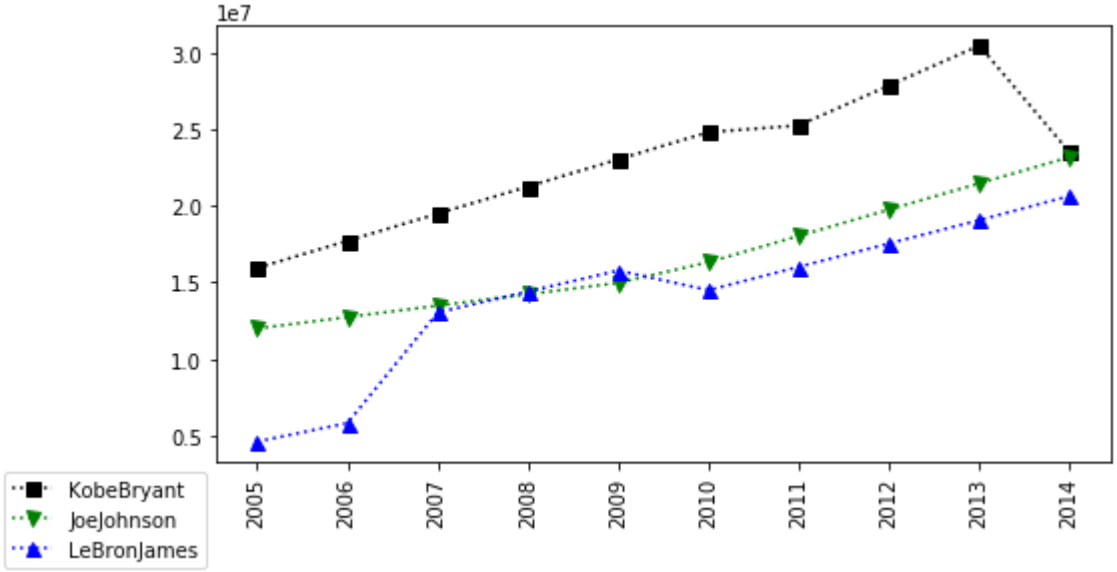
In [193]:
```
#Fix up the inputs
```

In [195]:
```
def myplot(data,playerlist):
    Col = {"KobeBryant":"Black","JoeJohnson":"Green","LeBronJames":"Blue","Carmel
    Mark = {"KobeBryant":"s","JoeJohnson":"v","LeBronJames":"^","CarmeloAnthony":
    for i in playerlist:
        plt.plot(data[Pdict[i]],c=Col[i],ls=':',marker=Mark[i],ms=7,label=Players
    plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the
    plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
    plt.show()
```

In [196]:
```
myplot(Points,["KobeBryant","JoeJohnson","LeBronJames"])
```

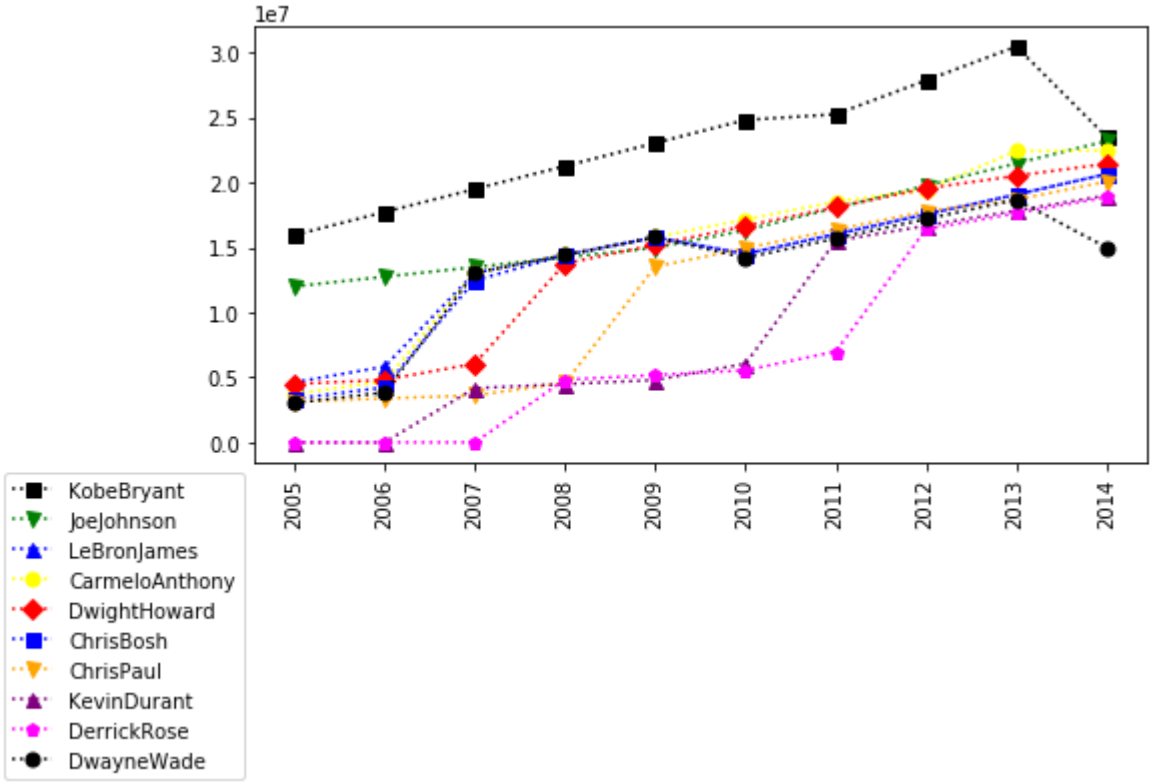


In [197]:
```
myplot(Salary,["KobeBryant","JoeJohnson","LeBronJames"])
```



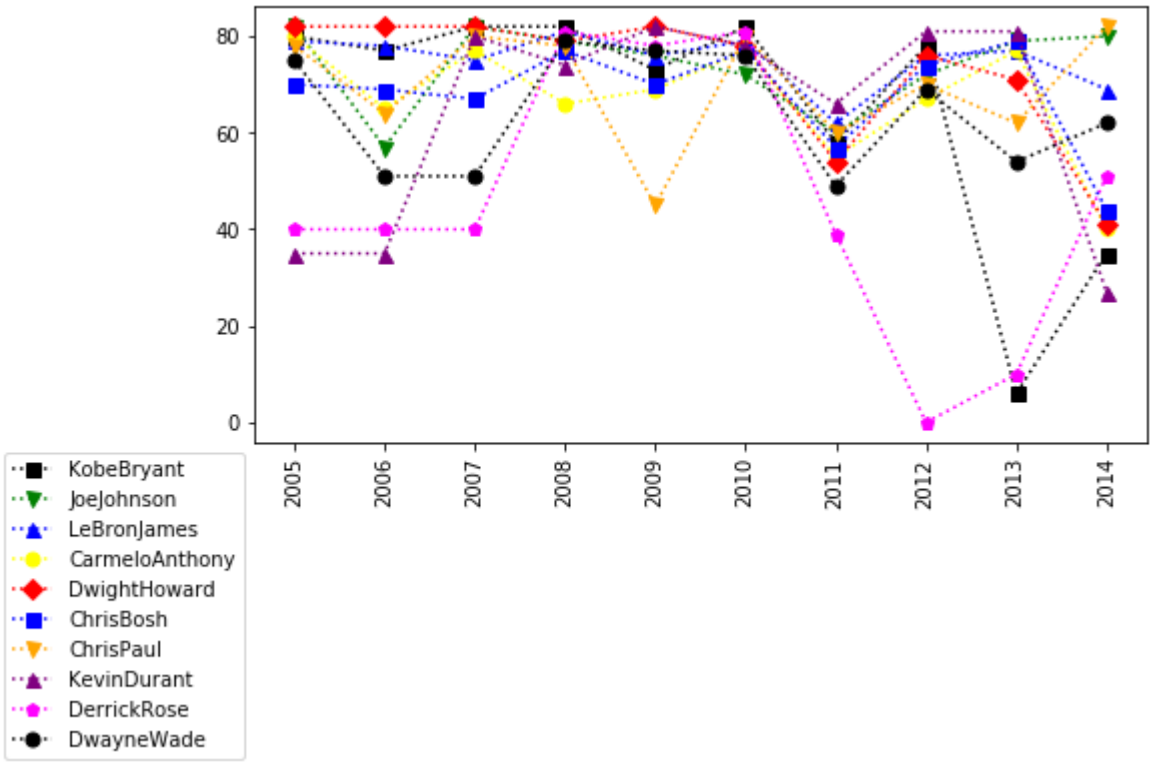
In [198]:
```
def myplot(data,playerlist=Players): #setting up the default value
    Col = {"KobeBryant":"Black","JoeJohnson":"Green","LeBronJames":"Blue","Carmel
    Mark = {"KobeBryant":"s","JoeJohnson":"v","LeBronJames":"^","CarmeloAnthony":
    for i in playerlist:
        plt.plot(data[Pdict[i]],c=Col[i],ls=':',marker=Mark[i],ms=7,label=Players
    plt.legend(loc='bottom right', bbox_to_anchor=(0,0)) #location of plot to the
    plt.xticks(list(range(0,10)),Seasons,rotation='vertical')
    plt.show()
```

In [199]:
```
myplot(Salary)
```

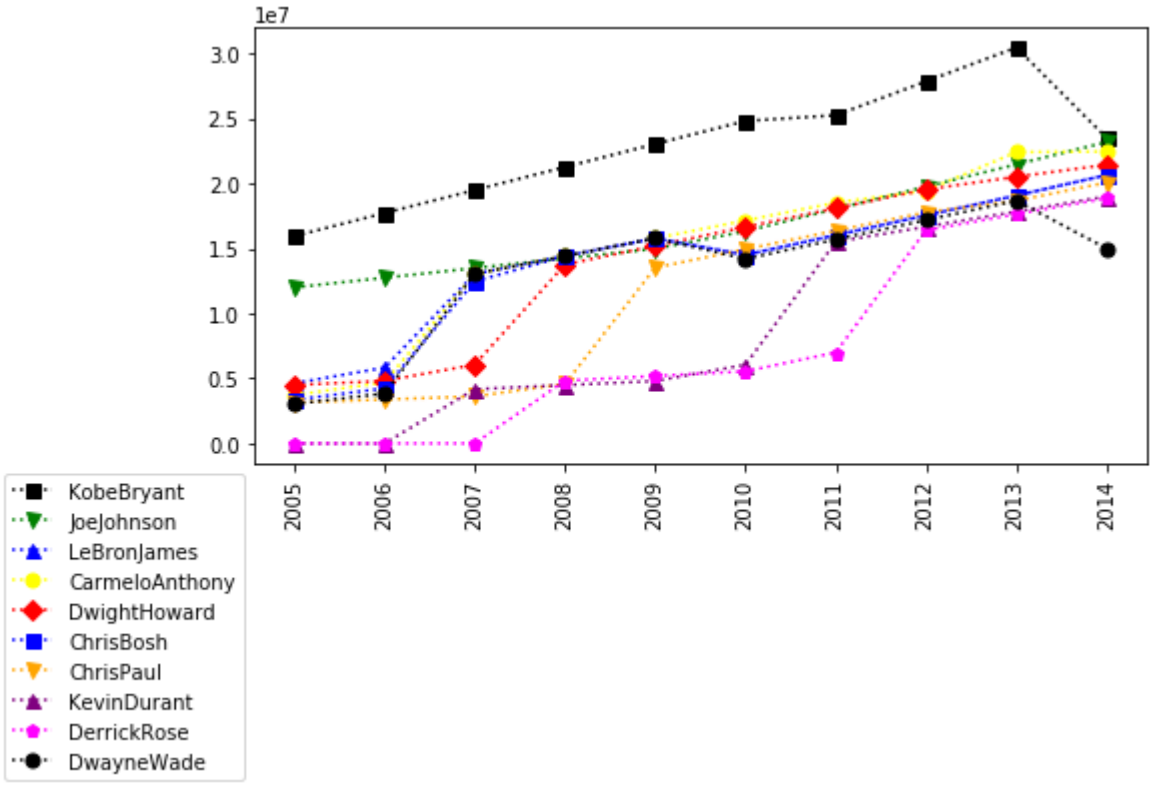


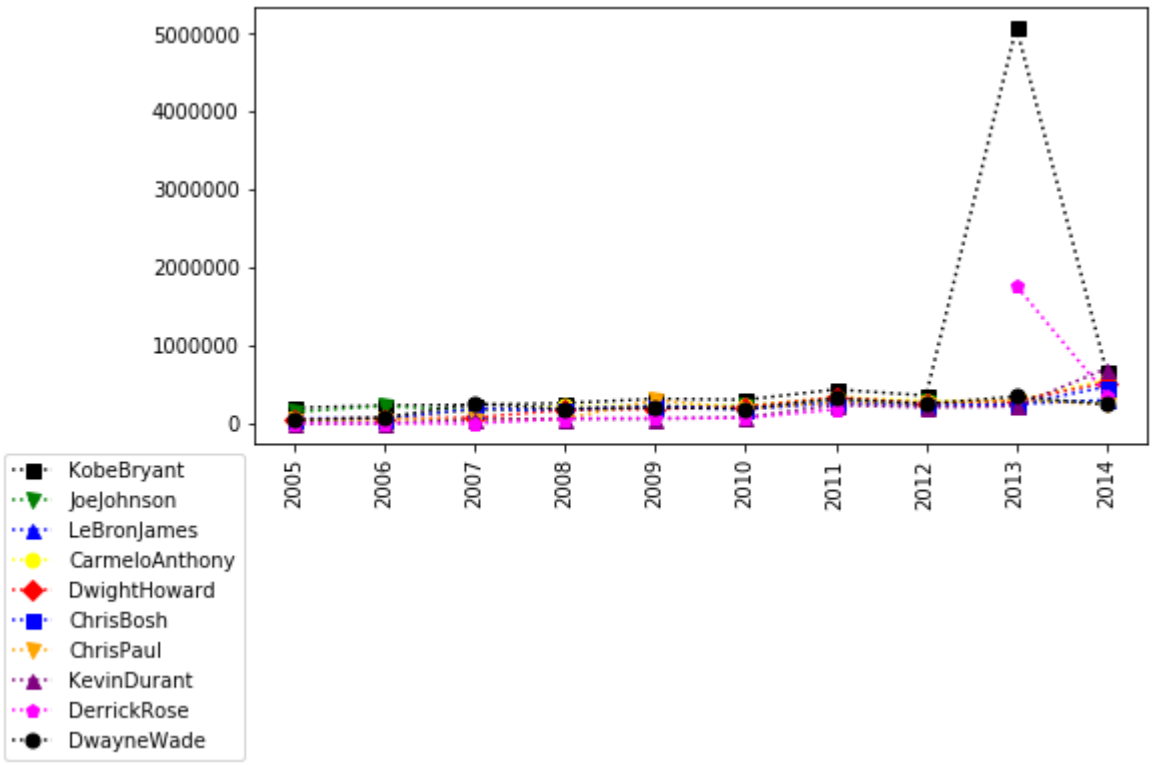
In [200]:
```
#Insights
```

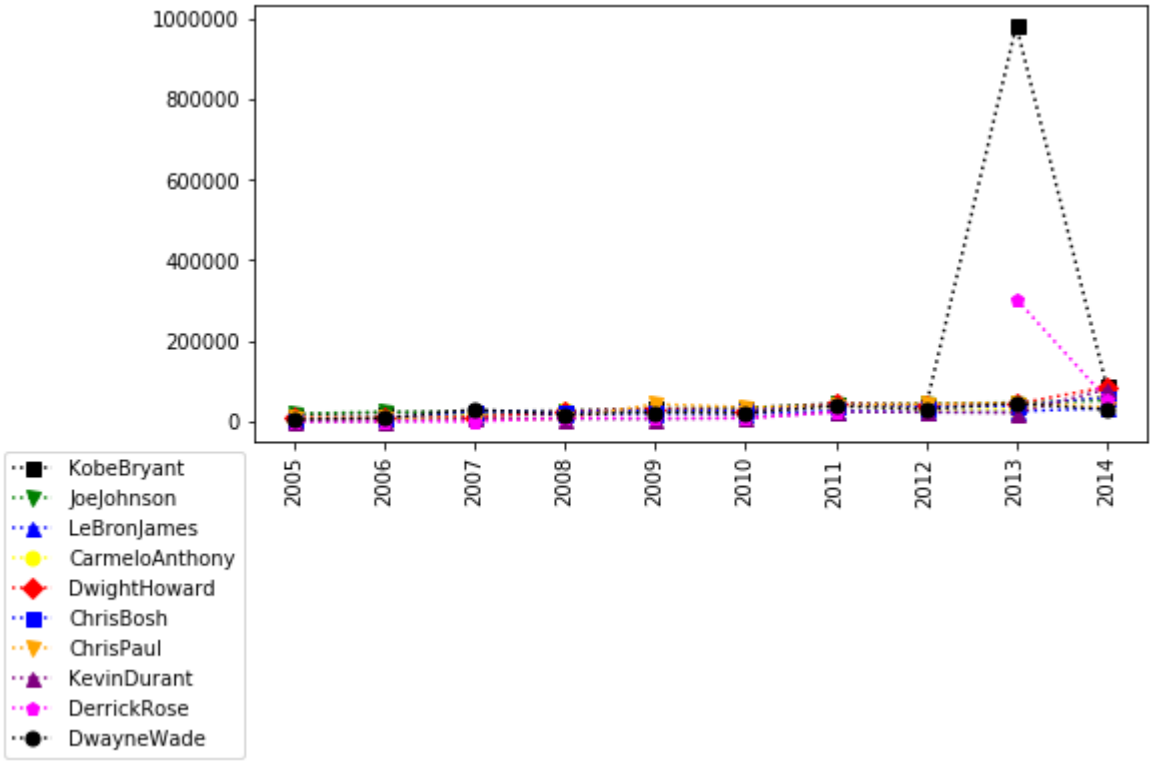
In [201]:
```
myplot(Games)
```



In [206]:
```
myplot(Salary)
myplot(Salary/Games) #Salary per game
myplot(Salary/FieldGoals) #Salary per Goal
```



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800000
600000
400000
200000
0
2005
2006
2007
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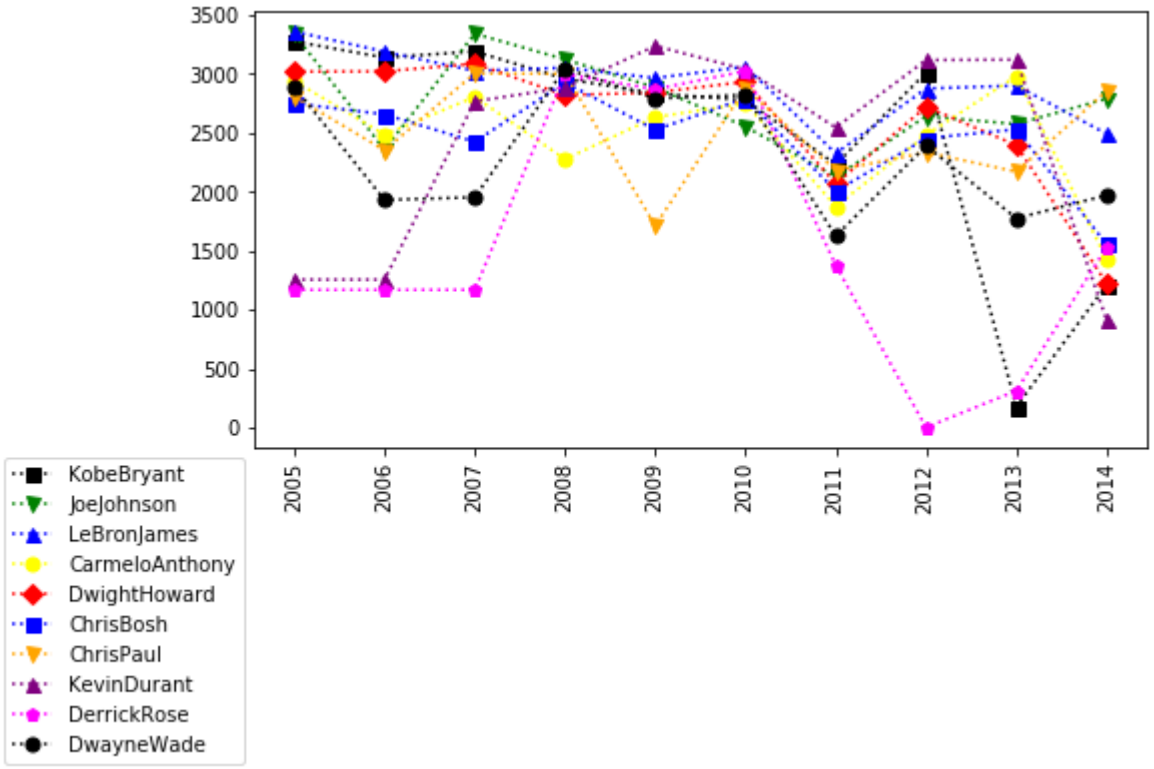
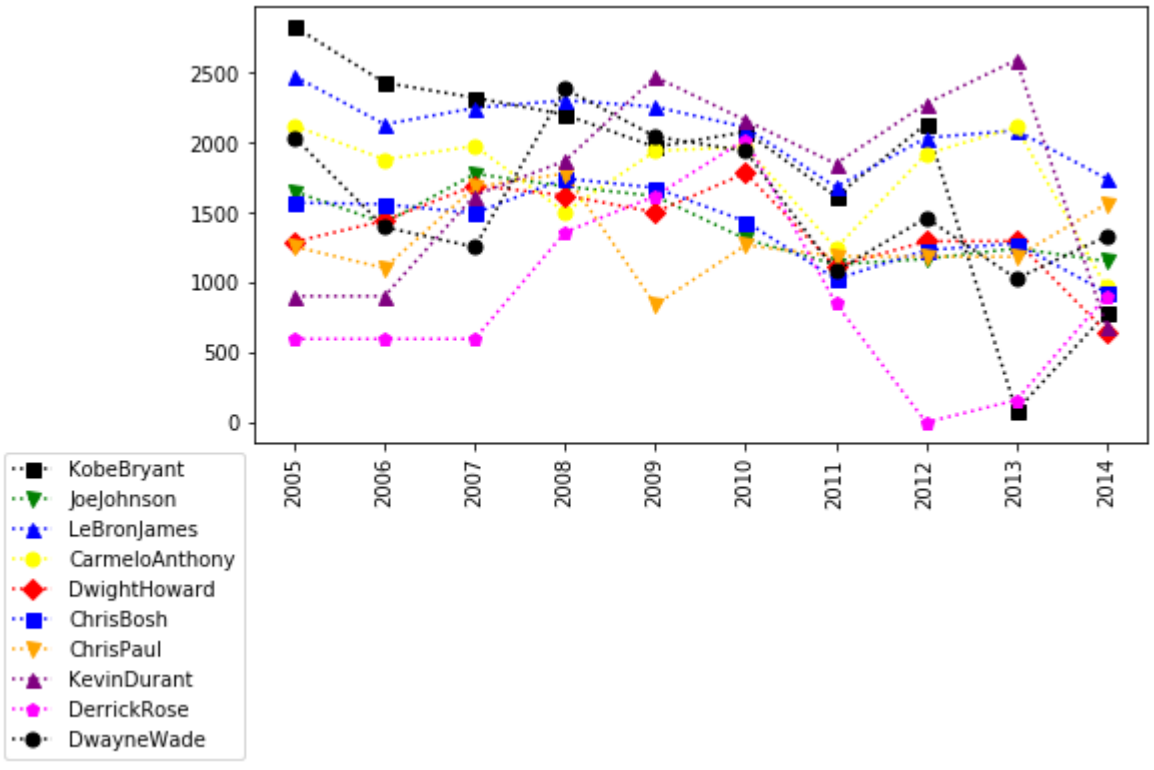
2012
2013
2014
KobeBryant
JoeJohnson
LeBronJames
CarmeloAnthony
DwightHoward
ChrisBosh
ChrisPaul
KevinDurant
DerrickRose
DwayneWade

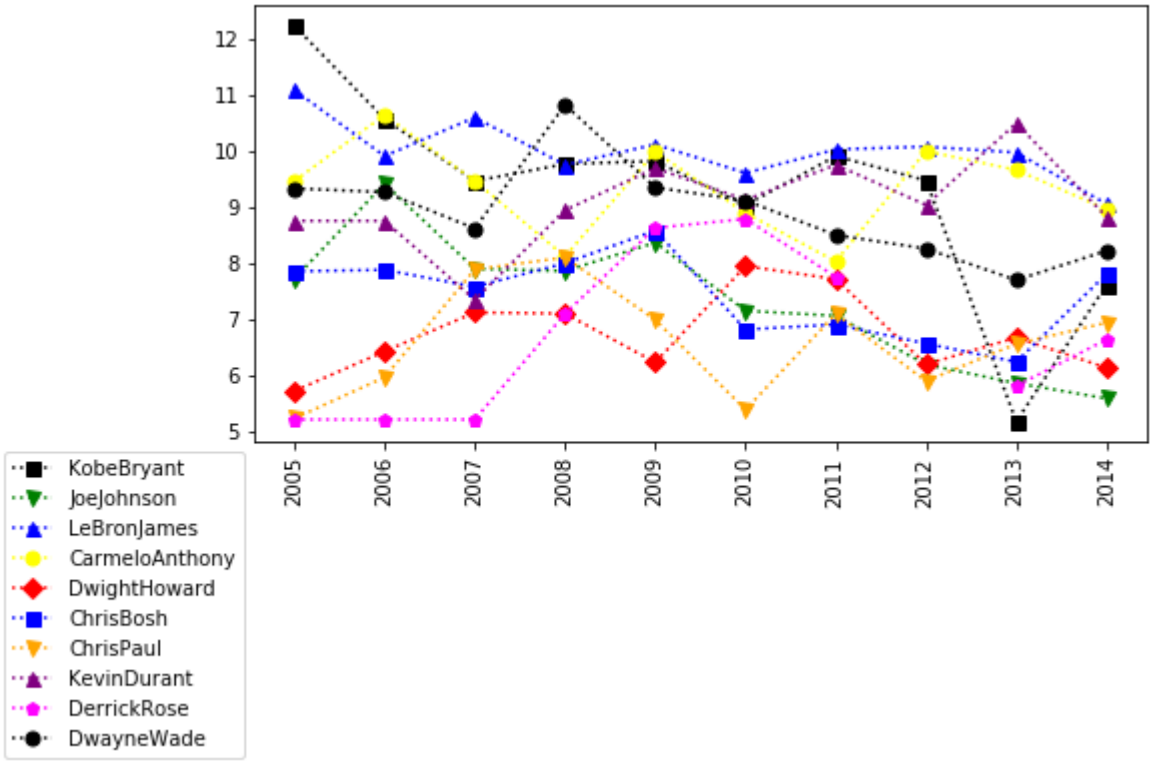
In [207]:
```
#InGameMatrix
myplot(MinutesPlayed)
myplot(Points)
```

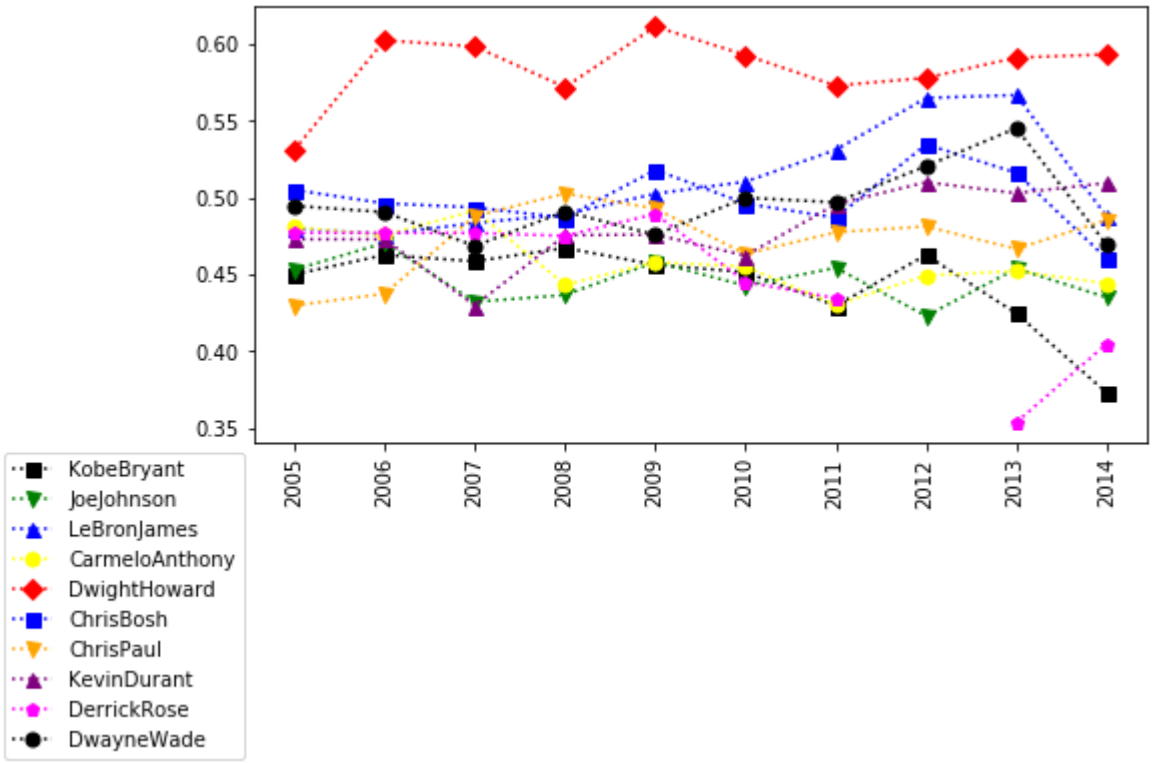


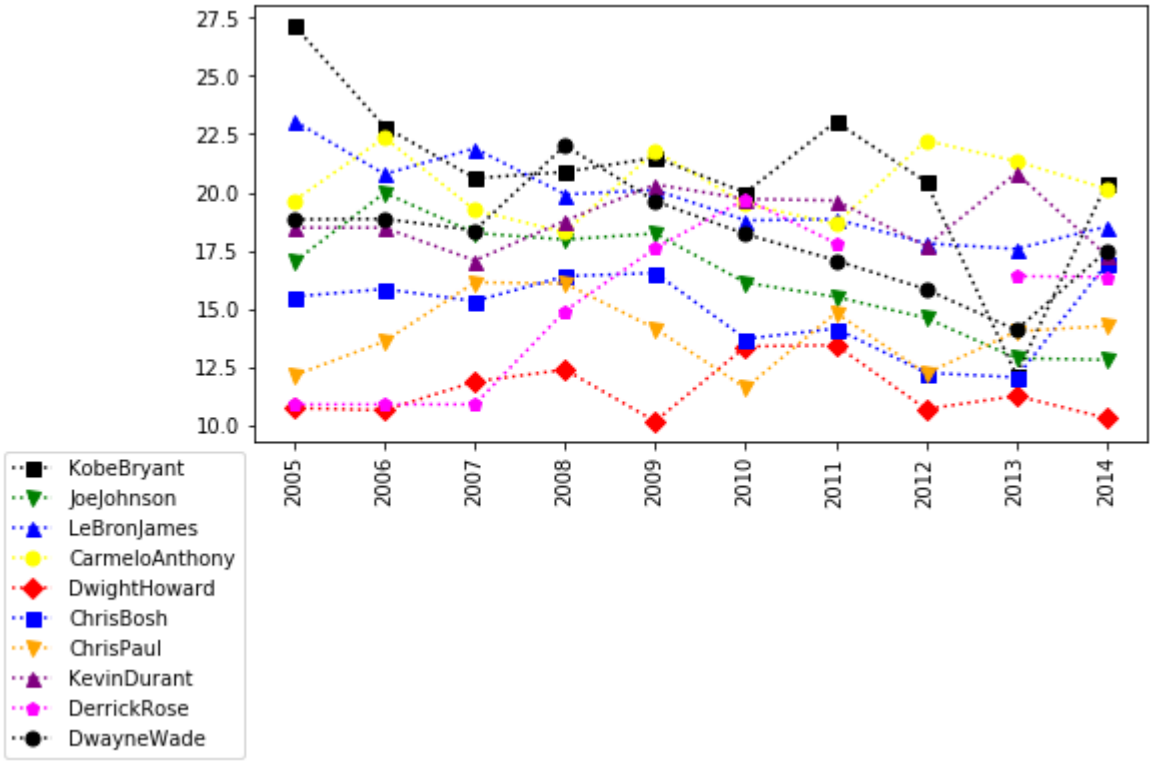


In [208]:
```
#Normalizing InGame Matrix
```

In [209]:
```
myplot(FieldGoals/Games)
myplot(FieldGoals/FieldGoalAttempts)
myplot(FieldGoalAttempts/Games)
myplot(Points/Games)
```






27.5
25.0
22.5
20.0
17.5
15.0
12.5
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2005
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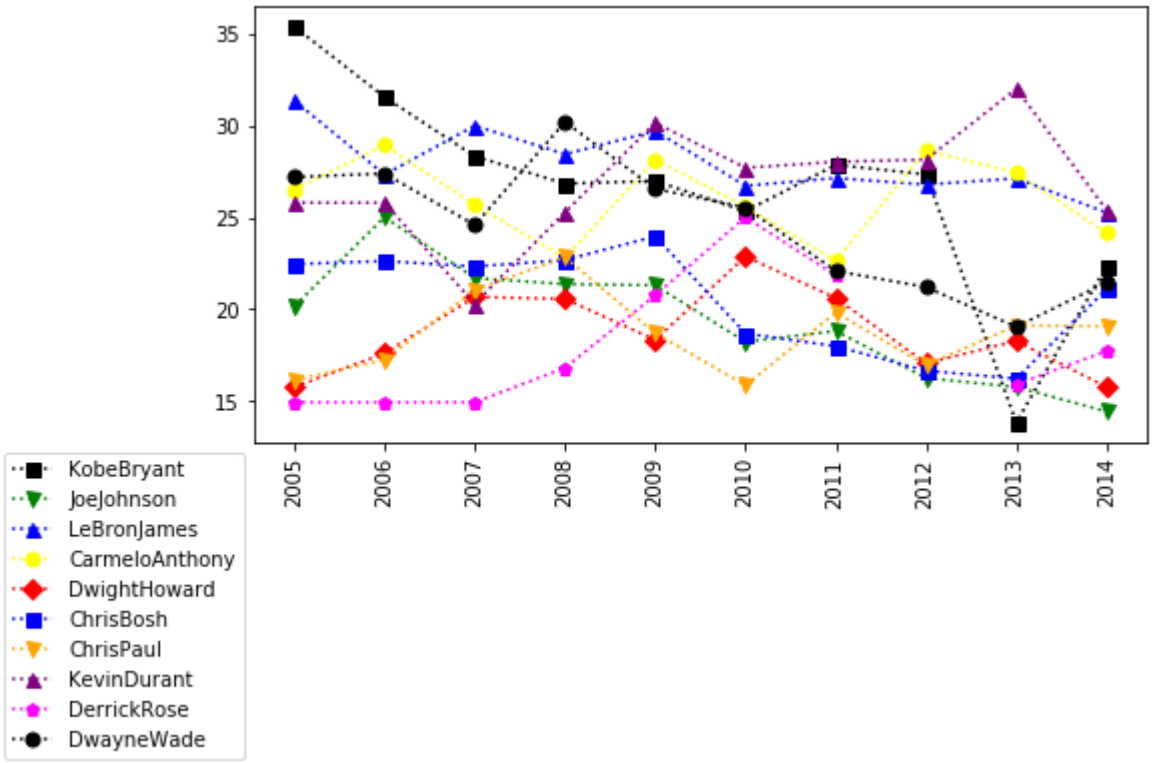
KobeBryant
JoeJohnson
LeBronJames
CarmeloAnthony
DwightHoward
ChrisBosh
ChrisPaul
KevinDurant
DerrickRose
DwayneWade


35
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2005
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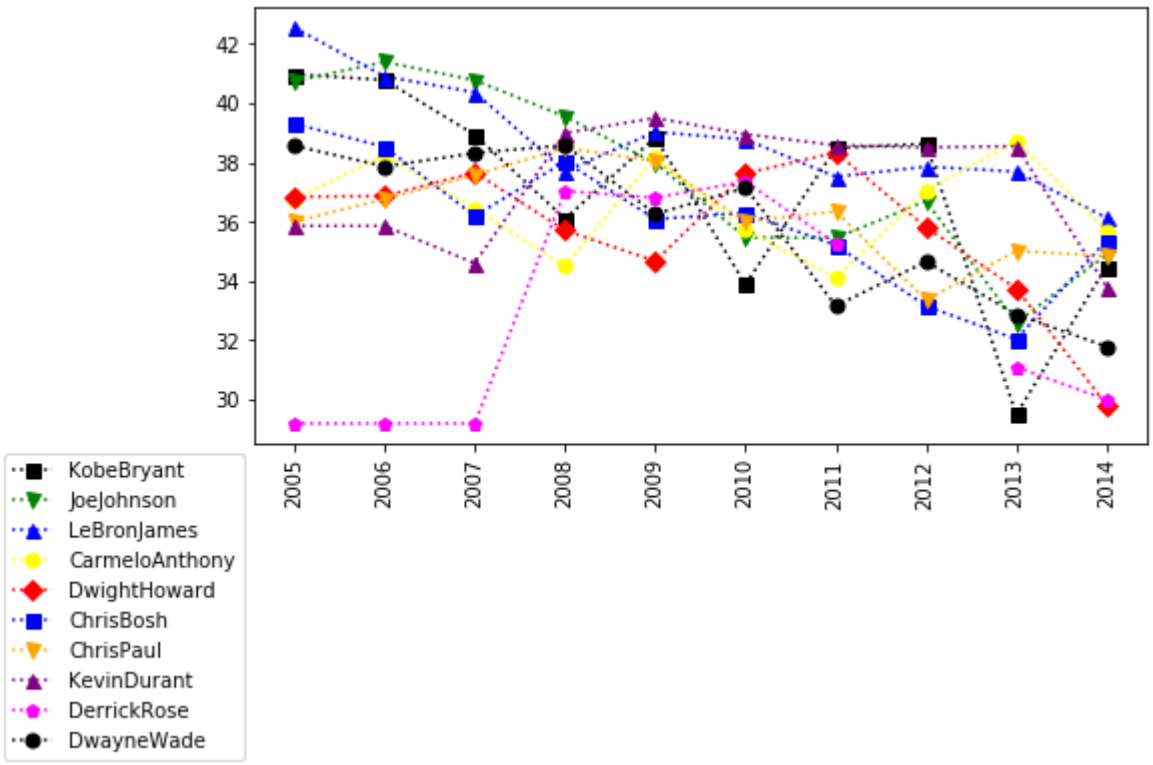
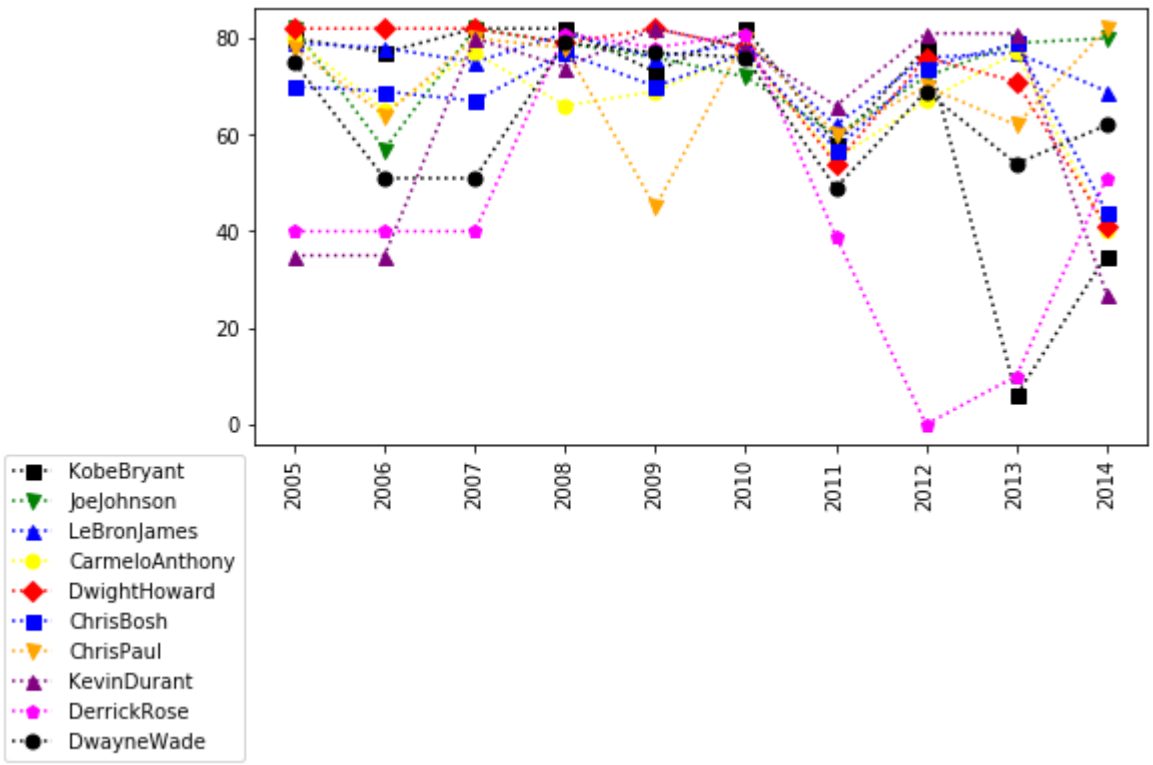
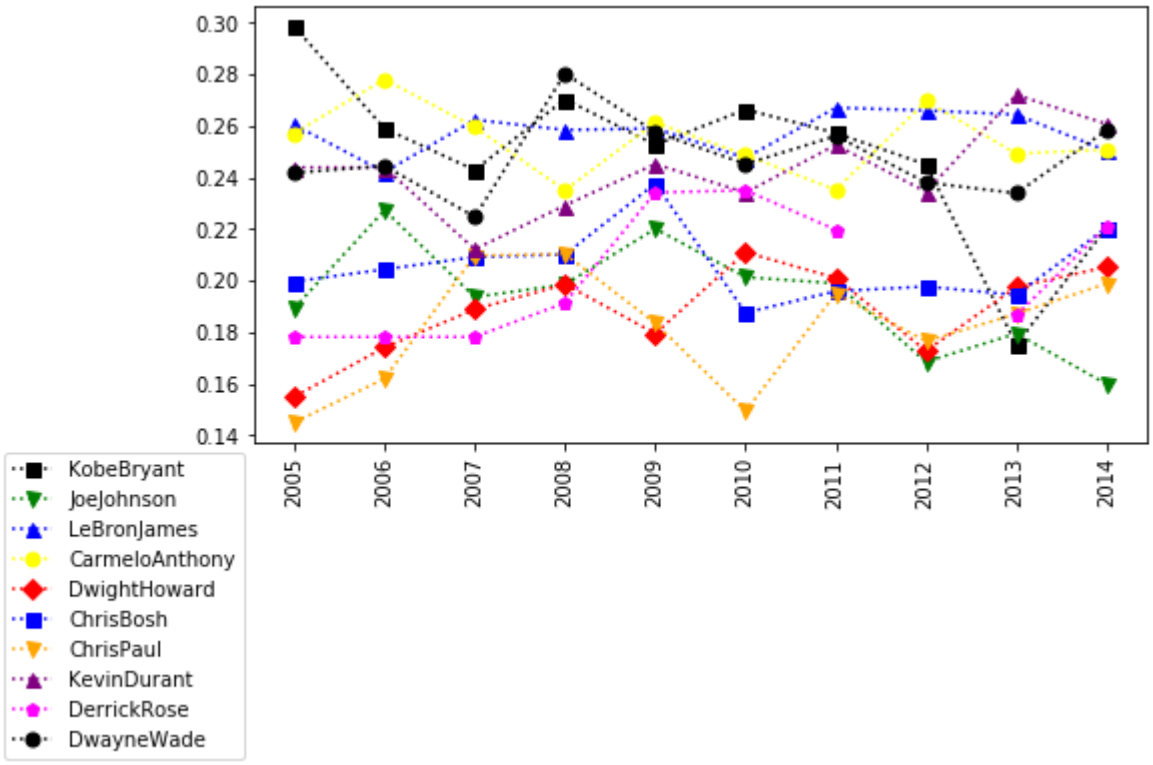
2011
2012
2013
2014
KobeBryant
JoeJohnson
LeBronJames
CarmeloAnthony
DwightHoward
ChrisBosh
ChrisPaul
KevinDurant
DerrickRose
DwayneWade

In [211]:
```
#Interesting Observation
import warnings
warnings.filterwarnings('ignore')
myplot(MinutesPlayed/Games)
myplot(Games)
```

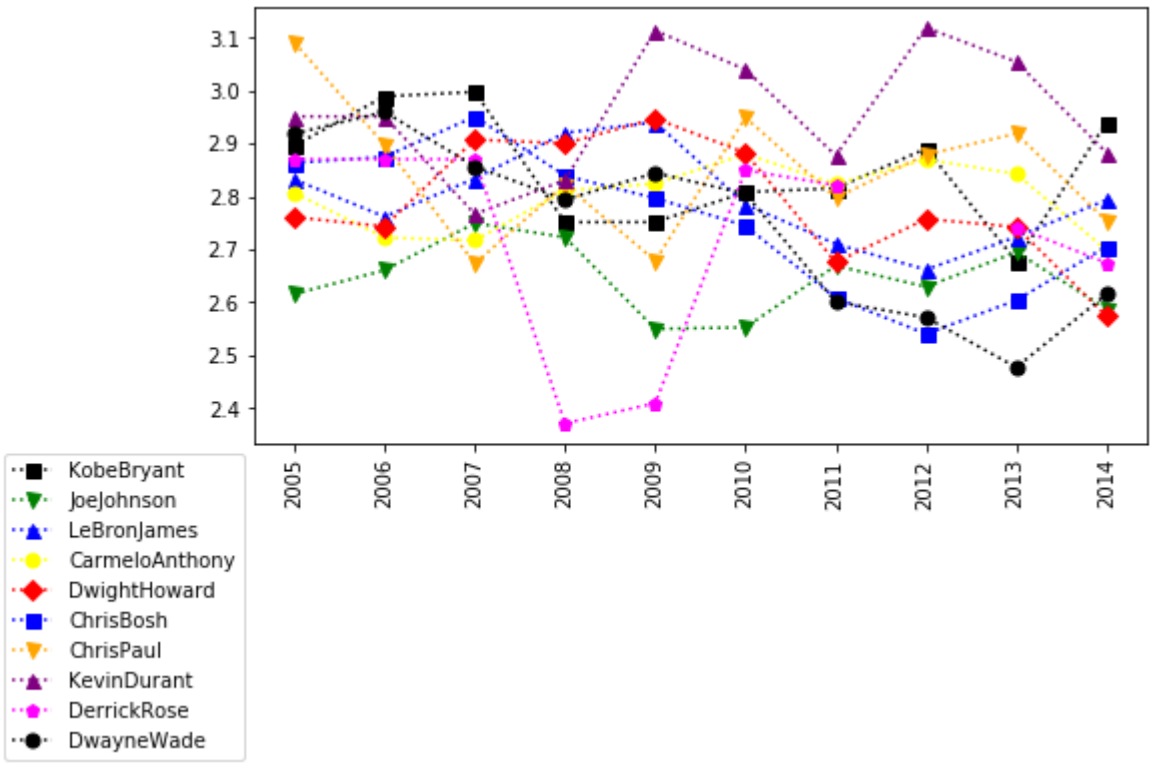




In [213]:
```
myplot(FieldGoals/MinutesPlayed) #Time is Valuable
```



In [214]:
```
myplot(Points/FieldGoals) #Player Style
```



In [ ]:
```

```