7-FINAL

November 26, 2018

1 Assignment is below.

```
In [8]: from sklearn.svm import LinearSVC
        from sklearn.linear_model import LogisticRegression
        import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        %matplotlib inline
        sns.set(font_scale=1.5)
        import numpy as np
        from pylab import rcParams
        rcParams['figure.figsize'] = 20, 10
        from sklearn.linear_model import LogisticRegression as Model
  Read in the Kobe Bryant shooting data [https://www.kaggle.com/c/kobe-bryant-shot-
selection]
In [11]: kobe = pd.read_csv('../data/kobe.csv')
         kobe.dropna(inplace=True)
In [10]: list(kobe.columns)
Out[10]: ['action_type',
          'combined_shot_type',
          'game_event_id',
          'game_id',
          'lat',
          'loc_x',
          'loc_y',
          'lon',
          'minutes_remaining',
          'period',
          'playoffs',
          'season',
          'seconds_remaining',
```

```
'shot_zone_basic',
          'shot_zone_range',
          'team_id',
          'team_name',
          'game_date',
          'matchup',
          'opponent',
          'shot_id']
   For now, use just the numerical datatypes. They are below as num_columns
In [12]: kobe.shot_zone_area.value_counts()
Out[12]: Center(C)
                                   11289
         Right Side Center(RC)
                                    3981
         Right Side(R)
                                    3859
         Left Side Center(LC)
                                    3364
         Left Side(L)
                                    3132
         Back Court(BC)
                                      72
         Name: shot_zone_area, dtype: int64
In [13]: kobe.shot_zone_range.value_counts()
Out[13]: Less Than 8 ft.
                             7857
         16-24 ft.
                             6907
         8-16 ft.
                             5580
         24+ ft.
                             5281
         Back Court Shot
         Name: shot_zone_range, dtype: int64
In [14]: kobe.shot_zone_basic.value_counts()
Out[14]: Mid-Range
                                   10532
         Restricted Area
                                    5932
         Above the Break 3
                                    4720
         In The Paint (Non-RA)
                                    3880
         Right Corner 3
                                     333
                                     240
         Left Corner 3
         Backcourt
                                      60
         Name: shot_zone_basic, dtype: int64
In [15]: kobe
                       action_type combined_shot_type game_event_id
                                                                          game_id \
                          Jump Shot
                                             Jump Shot
         1
                                                                    12 20000012
```

'shot_distance', 'shot_made_flag', 'shot_type', 'shot_zone_area',

Out[15]:

2	Tumn	Cho+	Jump Cho+	35	20000012
3	-	Shot	Jump Shot	43	
4	_	Shot	Jump Shot Dunk	155	20000012 20000012
5	Driving Dunk				
	-	Shot	Jump Shot	244	20000012
6	Layup		Layup	251	20000012
8	_	Shot	Jump Shot	265	20000012
9	Running Jump		Jump Shot	294	20000012
10	-	Shot	Jump Shot	309	20000012
11	-	Shot	Jump Shot	4	20000019
12	Running Jump		Jump Shot	27	20000019
13	-	Shot	Jump Shot	66	20000019
14	-	Shot	Jump Shot	80	20000019
15	-	Shot	Jump Shot	86	20000019
17	-	Shot	Jump Shot	138	20000019
18	-	Shot	Jump Shot	244	20000019
20	-	Shot	Jump Shot	255	20000019
21	Jump	Shot	Jump Shot	265	20000019
22	Running Jump	Shot	Jump Shot	274	20000019
23	Running Jump	Shot	Jump Shot	299	20000019
24	Running Jump	Shot	Jump Shot	307	20000019
25	Layup	Shot	Layup	332	20000019
26	Jump	Shot	Jump Shot	345	20000019
27	Jump	Shot	Jump Shot	369	20000019
28	Jump	Shot	Jump Shot	400	20000019
29	Jump	Shot	Jump Shot	429	20000019
30	Running Jump	Shot	Jump Shot	488	20000019
31	Jump	Shot	Jump Shot	499	20000019
38	Jump	Shot	Jump Shot	184	20000047
39	Jump	Shot	Jump Shot	202	20000047
	_				
30661	Slam Dunk	Shot	Dunk	245	49900087
30662	Jump	Shot	Jump Shot	259	49900087
30663	Jump	Shot	Jump Shot	270	49900087
30665	Layup		Layup	280	49900087
30666		Shot	Jump Shot	295	49900087
30667	-	Shot	Jump Shot	368	49900087
30669	-	Shot	Jump Shot	425	49900087
30670	Running Jump		Jump Shot	15	49900088
30671	Driving Layup		Layup	25	49900088
30672		Shot	Jump Shot	29	49900088
30673	_	Shot	Jump Shot	36	49900088
30674	_	Shot	Jump Shot	81	49900088
30675	-	Shot	Jump Shot	84	49900088
30676	Running Jump		Jump Shot	98	49900088
30677	-	Shot	Jump Shot	101	49900088
30678	Driving Layup		Layup	181	49900088
30679	Layup		· -	212	49900088
	• -		Layup	212	
30681	Jump	Shot	Jump Shot	218	49900088

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Jump Shot
30683
                                                                 228
                                                                       49900088
                   Jump Shot
30684
                   Jump Shot
                                         Jump Shot
                                                                 231
                                                                       49900088
                                                                 249
30685
                   Jump Shot
                                         Jump Shot
                                                                       49900088
30687
                   Jump Shot
                                         Jump Shot
                                                                 284
                                                                       49900088
30688
                   Jump Shot
                                         Jump Shot
                                                                 308
                                                                       49900088
                                                                 326
30689
                   Jump Shot
                                         Jump Shot
                                                                       49900088
30690
                   Jump Shot
                                         Jump Shot
                                                                 331
                                                                       49900088
30691
        Driving Layup Shot
                                             Layup
                                                                 382
                                                                       49900088
30692
                   Jump Shot
                                         Jump Shot
                                                                 397
                                                                       49900088
30694
         Running Jump Shot
                                         Jump Shot
                                                                 426
                                                                       49900088
30695
                                                                 448
                                                                       49900088
                   Jump Shot
                                         Jump Shot
30696
                   Jump Shot
                                         Jump Shot
                                                                 471
                                                                       49900088
                                              minutes_remaining
            lat
                  loc_x
                          loc_y
                                                                     period
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                                         lon
1
        34.0443
                    -157
                               0 -118.4268
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                             135 -118.3708
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3
        33.8693
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                             175 -118.1318
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8
        33.9363
                     -65
                             108 -118.3348
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9
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        33.9193
                     -33
                             125 -118.3028
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10
        33.8063
                     -94
                             238 -118.3638
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11
        33.9173
                     121
                             127 -118.1488
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12
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        33.9343
                             110 -118.3368
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13
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        34.0403
                               4 -118.3638
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14
        33.9973
                              47 -118.2928
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15
        33.8523
                      62
                             192 -118.2078
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17
        33.8183
                    -117
                             226 -118.3868
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18
        33.9473
                    -132
                              97 -118.4018
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        33.9003
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                             127 -118.1358
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                             110 -118.2858
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                             150 -118.3788
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                     -46
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                              63 -118.3158
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25
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26
        33.8483
                     -58
                             196 -118.3278
27
        33.8583
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                             186 -118.4528
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28
        33.8713
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                             173 -118.1848
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        34.0103
                              34 -118.1428
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38
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        33.8603
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                             184 -118.1788
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39
        33.7723
                     -27
                             272 -118.2968
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30662
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                              53 -118.2778
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30663
        34.0193
                              25 -118.1638
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30665
       34.0263
                    -14
                             18 -118.2838
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30666
       33.8733
                    -81
                            171 -118.3508
       33.7943
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                            250 -118.2298
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30667
                    171
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30669
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30670
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                             16 -118.3438
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30671
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30672
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                             55 -118.1808
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30673
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30674
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30675
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                            216 -118.4038
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30676
       34.0443
                   -141
                              0 -118.4108
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30677
       33.9013
                   -113
                            143 -118.3828
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30678
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                             16 -118.2558
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30679
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30681
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                             89 -118.3658
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30685
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                            250 -118.1888
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30687
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                            100 -118.2298
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30688
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30689
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30690
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                   -113
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30691
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30692
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       33.9963
                      1
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30694
       33.8783
                   -134
                            166 -118.4038
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30695
                     31
                            267 -118.2388
       33.7773
                                                                            . . .
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30696
       33.9723
                      1
                             72 -118.2688
             shot_type
                                 shot_zone_area
                                                          shot_zone_basic
1
       2PT Field Goal
                                   Left Side(L)
                                                                 Mid-Range
                           Left Side Center(LC)
2
       2PT Field Goal
                                                                 Mid-Range
3
       2PT Field Goal
                         Right Side Center(RC)
                                                                 Mid-Range
                                                          Restricted Area
4
       2PT Field Goal
                                       Center(C)
5
       2PT Field Goal
                                   Left Side(L)
                                                                 Mid-Range
6
       2PT Field Goal
                                       Center(C)
                                                          Restricted Area
8
       2PT Field Goal
                                   Left Side(L)
                                                   In The Paint (Non-RA)
9
       2PT Field Goal
                                       Center(C)
                                                   In The Paint (Non-RA)
10
       3PT Field Goal
                          Left Side Center(LC)
                                                        Above the Break 3
                         Right Side Center(RC)
11
       2PT Field Goal
                                                                 Mid-Range
12
       2PT Field Goal
                                   Left Side(L)
                                                   In The Paint (Non-RA)
13
       2PT Field Goal
                                   Left Side(L)
                                                                 Mid-Range
14
       2PT Field Goal
                                       Center(C)
                                                   In The Paint (Non-RA)
15
       2PT Field Goal
                                       Center(C)
                                                                 Mid-Range
17
       3PT Field Goal
                           Left Side Center(LC)
                                                        Above the Break 3
18
       2PT Field Goal
                           Left Side Center(LC)
                                                                 Mid-Range
20
       2PT Field Goal
                                       Center(C)
                                                                 Mid-Range
21
       2PT Field Goal
                         Right Side Center(RC)
                                                                 Mid-Range
22
       2PT Field Goal
                                       Center(C)
                                                   In The Paint (Non-RA)
```

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23
       2PT Field Goal
                         Left Side Center(LC)
                                                             Mid-Range
       2PT Field Goal
                                    Center(C)
                                                In The Paint (Non-RA)
24
25
       2PT Field Goal
                                    Center(C)
                                                      Restricted Area
26
       2PT Field Goal
                                    Center(C)
                                                             Mid-Range
       3PT Field Goal
27
                         Left Side Center(LC)
                                                    Above the Break 3
       2PT Field Goal
28
                        Right Side Center(RC)
                                                             Mid-Range
29
       2PT Field Goal
                                    Center(C)
                                                In The Paint (Non-RA)
30
       2PT Field Goal
                                Right Side(R)
                                                             Mid-Range
       2PT Field Goal
                                Right Side(R)
31
                                                             Mid-Range
       2PT Field Goal
38
                        Right Side Center(RC)
                                                             Mid-Range
       3PT Field Goal
39
                                    Center(C)
                                                    Above the Break 3
30661
       2PT Field Goal
                                     Center(C)
                                                      Restricted Area
       2PT Field Goal
                                                In The Paint (Non-RA)
30662
                                    Center(C)
30663
       2PT Field Goal
                                Right Side(R)
                                                             Mid-Range
30665
       2PT Field Goal
                                    Center(C)
                                                      Restricted Area
30666
       2PT Field Goal
                         Left Side Center(LC)
                                                             Mid-Range
30667
       3PT Field Goal
                                    Center(C)
                                                    Above the Break 3
       2PT Field Goal
                                Right Side(R)
                                                             Mid-Range
30669
30670
       2PT Field Goal
                                    Center(C)
                                                In The Paint (Non-RA)
       2PT Field Goal
30671
                                    Center(C)
                                                      Restricted Area
       2PT Field Goal
30672
                                Right Side(R)
                                                             Mid-Range
30673
       2PT Field Goal
                                Right Side(R)
                                                             Mid-Range
30674
       3PT Field Goal
                        Right Side Center(RC)
                                                    Above the Break 3
30675
       3PT Field Goal
                         Left Side Center(LC)
                                                    Above the Break 3
       2PT Field Goal
                                 Left Side(L)
30676
                                                             Mid-Range
30677
       2PT Field Goal
                         Left Side Center(LC)
                                                             Mid-Range
       2PT Field Goal
30678
                                    Center(C)
                                                      Restricted Area
       2PT Field Goal
                                                      Restricted Area
30679
                                    Center(C)
30681
       3PT Field Goal
                                    Center(C)
                                                    Above the Break 3
30683
       2PT Field Goal
                                    Center(C)
                                                             Mid-Range
30684
       2PT Field Goal
                                 Left Side(L)
                                                             Mid-Range
30685
       3PT Field Goal
                                    Center(C)
                                                    Above the Break 3
30687
       2PT Field Goal
                                    Center(C)
                                                In The Paint (Non-RA)
       2PT Field Goal
                                 Left Side(L)
30688
                                                             Mid-Range
       3PT Field Goal
30689
                               Back Court (BC)
                                                             Backcourt
       2PT Field Goal
30690
                                 Left Side(L)
                                                             Mid-Range
30691
       2PT Field Goal
                                    Center(C)
                                                      Restricted Area
30692
       2PT Field Goal
                                    Center(C)
                                                In The Paint (Non-RA)
       2PT Field Goal
                         Left Side Center(LC)
30694
                                                             Mid-Range
30695
       3PT Field Goal
                                    Center(C)
                                                    Above the Break 3
       2PT Field Goal
                                                In The Paint (Non-RA)
30696
                                    Center(C)
       shot_zone_range
                            team_id
                                               team name
                                                            game_date
1
              8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                           2000-10-31
2
             16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                           2000-10-31
             16-24 ft.
3
                         1610612747
                                     Los Angeles Lakers
                                                           2000-10-31
       Less Than 8 ft.
                         1610612747 Los Angeles Lakers
                                                           2000-10-31
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5
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-10-31
6
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-10-31
8
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-10-31
9
               8-16 ft.
                                      Los Angeles Lakers
                         1610612747
                                                            2000-10-31
                                      Los Angeles Lakers
10
                24+ ft.
                         1610612747
                                                            2000-10-31
              16-24 ft.
                                      Los Angeles Lakers
11
                         1610612747
                                                            2000-11-01
12
              8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
13
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
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       Less Than 8 ft.
                                      Los Angeles Lakers
14
                         1610612747
                                                            2000-11-01
              16-24 ft.
15
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
17
                24+ ft.
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                                      Los Angeles Lakers
                                                            2000-11-01
              16-24 ft.
                                      Los Angeles Lakers
18
                         1610612747
                                                            2000-11-01
20
              8-16 ft.
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                                      Los Angeles Lakers
                                                            2000-11-01
                                      Los Angeles Lakers
21
              16-24 ft.
                         1610612747
                                                            2000-11-01
22
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
23
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
24
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
25
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
26
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
27
                24+ ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
28
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-01
                                      Los Angeles Lakers
29
              8-16 ft.
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                                                            2000-11-01
                                                            2000-11-01
30
              8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                         1610612747
              8-16 ft.
                                      Los Angeles Lakers
31
                                                            2000-11-01
38
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-11-04
                                      Los Angeles Lakers
39
                24+ ft.
                         1610612747
                                                            2000-11-04
30661
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-16
       Less Than 8 ft.
                                      Los Angeles Lakers
30662
                         1610612747
                                                            2000-06-16
30663
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-16
30665
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-16
30666
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-16
30667
                24+ ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-16
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
30669
                                                            2000-06-16
       Less Than 8 ft.
                                      Los Angeles Lakers
30670
                         1610612747
                                                            2000-06-19
30671
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
                                      Los Angeles Lakers
30672
               8-16 ft.
                         1610612747
                                                            2000-06-19
30673
               8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
                         1610612747
                24+ ft.
                                      Los Angeles Lakers
30674
                                                            2000-06-19
30675
                24+ ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
30676
              8-16 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
              16-24 ft.
                                      Los Angeles Lakers
30677
                         1610612747
                                                            2000-06-19
       Less Than 8 ft.
                         1610612747
                                      Los Angeles Lakers
30678
                                                            2000-06-19
       Less Than 8 ft.
                                      Los Angeles Lakers
30679
                         1610612747
                                                            2000-06-19
                                      Los Angeles Lakers
30681
                24+ ft.
                         1610612747
                                                            2000-06-19
30683
              16-24 ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
                                      Los Angeles Lakers
30684
               8-16 ft.
                         1610612747
                                                            2000-06-19
30685
                24+ ft.
                         1610612747
                                      Los Angeles Lakers
                                                            2000-06-19
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30687
               8-16 ft.
                          1610612747
                                       Los Angeles Lakers
                                                              2000-06-19
30688
               8-16 ft.
                          1610612747
                                       Los Angeles Lakers
                                                              2000-06-19
30689
       Back Court Shot
                          1610612747
                                       Los Angeles Lakers
                                                              2000-06-19
                                       Los Angeles Lakers
30690
               8-16 ft.
                          1610612747
                                                              2000-06-19
                                       Los Angeles Lakers
30691
       Less Than 8 ft.
                          1610612747
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       Less Than 8 ft.
                          1610612747
                                       Los Angeles Lakers
30692
                                                              2000-06-19
30694
              16-24 ft.
                          1610612747
                                       Los Angeles Lakers
                                                              2000-06-19
30695
                24+ ft.
                          1610612747
                                       Los Angeles Lakers
                                                              2000-06-19
       Less Than 8 ft.
                          1610612747
                                       Los Angeles Lakers
30696
                                                              2000-06-19
            matchup opponent
                                shot_id
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          LAL @ POR
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2
                                       3
          LAL @ POR
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          LAL @ POR
                          POR
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                                       5
          LAL @ POR
                          POR
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         LAL @ POR
                          POR
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6
         LAL @ POR
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         LAL @ POR
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9
         LAL @ POR
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10
         LAL @ POR
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11
       LAL vs. UTA
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       LAL vs. UTA
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       LAL vs. UTA
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14
       LAL vs. UTA
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17
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29
       LAL vs. UTA
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30
       LAL vs. UTA
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31
       LAL vs. UTA
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          LAL @ VAN
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30661
          LAL @ IND
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          LAL @ IND
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```

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30670 LAL vs. IND
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                LAL vs. IND
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         30672 LAL vs. IND
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                LAL vs. IND
         30681
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         30683
                LAL vs. IND
                                  IND
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                LAL vs. IND
                                  IND
                                         30685
                LAL vs. IND
         30685
                                  IND
                                         30686
         30687
                LAL vs. IND
                                  IND
                                         30688
         30688
                LAL vs. IND
                                  IND
                                         30689
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                LAL vs. IND
                                  IND
                                         30690
         30690
                LAL vs. IND
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         30694 LAL vs. IND
                                  IND
                                         30695
         30695 LAL vs. IND
                                  IND
                                         30696
         30696
               LAL vs. IND
                                  IND
                                         30697
         [25697 rows x 25 columns]
In [16]: kobe.shot_made_flag.value_counts(normalize=True)
Out[16]: 0.0
                0.553839
         1.0
                0.446161
         Name: shot_made_flag, dtype: float64
In [17]: kobe.shot_made_flag.value_counts(normalize=False)
Out[17]: 0.0
                14232
         1.0
                11465
         Name: shot_made_flag, dtype: int64
In [18]: num_columns = [col for col, dtype in zip(kobe.columns, kobe.dtypes) if dtype != 'obje
         num_columns
Out[18]: ['game_event_id',
          'game_id',
          'lat',
          'loc_x',
          'loc_y',
          'lon',
          'minutes_remaining',
```

30669

LAL @ IND

IND

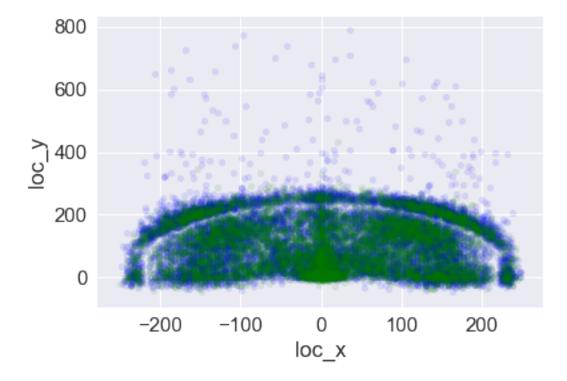
30670

```
'period',
'playoffs',
'seconds_remaining',
'shot_distance',
'shot_made_flag',
'team_id',
'shot_id']
```

1.1 The shot_made_flag is the result (0 or 1) of the shot that Kobe took. Some of the values are missing (e.g. NaN) but we dropped them.

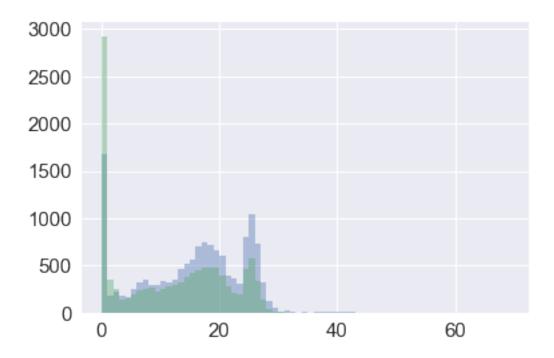
```
In [19]: fig, ax = plt.subplots()
    kobe[kobe.shot_made_flag==0].plot(kind='scatter', x='loc_x', y='loc_y', color='blue',
    kobe[kobe.shot_made_flag==1].plot(kind='scatter', x='loc_x', y='loc_y', color='green'
    # plt.scatter(kobe.loc_x, kobe.loc_y, alpha=0.2)
```

Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x1a9654b2ba8>



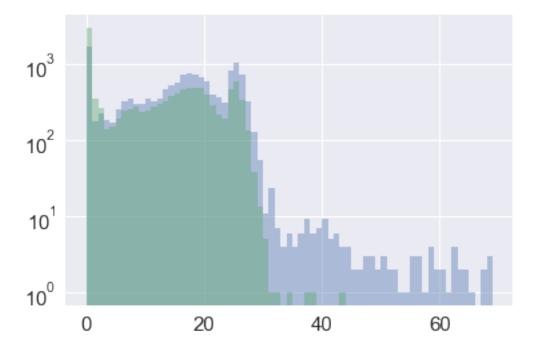
```
In [20]: kobe[kobe.shot_made_flag==0].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4)
     kobe[kobe.shot_made_flag==1].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4)
```

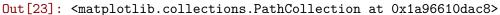
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x1a96563aef0>

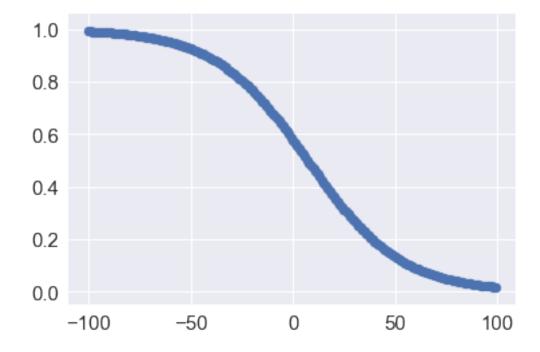


In [21]: kobe[kobe.shot_made_flag==0].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4, log
kobe[kobe.shot_made_flag==1].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4, log

Out[21]: <matplotlib.axes._subplots.AxesSubplot at 0x1a9640bb470>

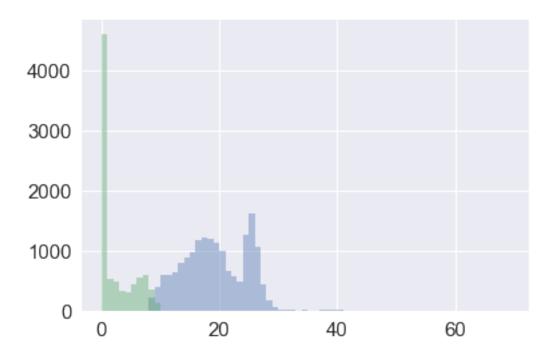




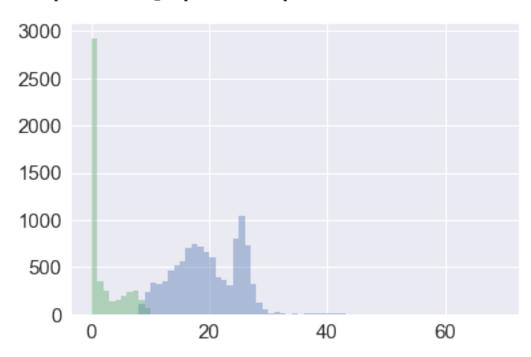


```
In [24]: kobe[(kobe.pred==0)].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4)
     kobe[(kobe.pred==1)].shot_distance.hist(bins=np.arange(0,70,1), alpha=.4)
```

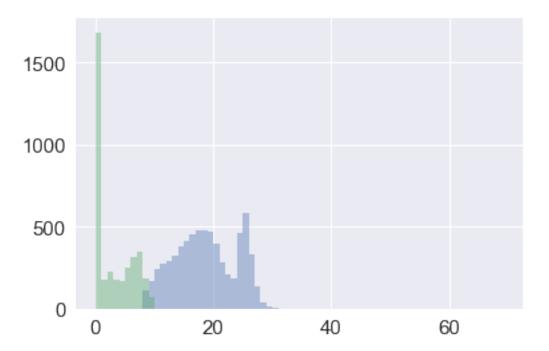
Out[24]: <matplotlib.axes._subplots.AxesSubplot at 0x1a9660389b0>

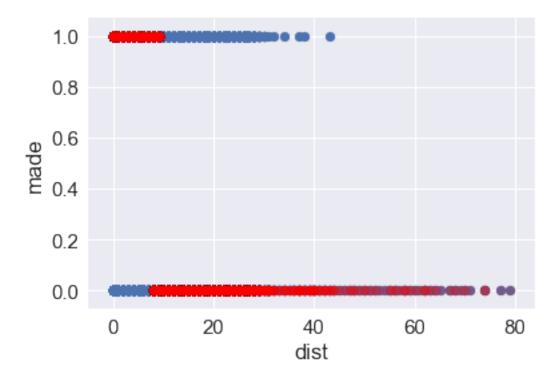


Out[25]: <matplotlib.axes._subplots.AxesSubplot at 0x1a9672205f8>



Out[26]: <matplotlib.axes._subplots.AxesSubplot at 0x1a967418cc0>





1.2 The following is a reminder of how the SciKit-Learn Models can be interfaced

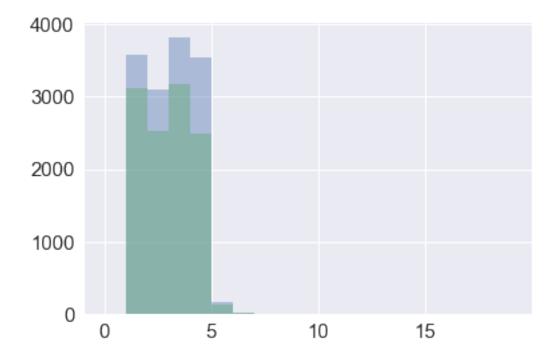
In [28]: from sklearn.linear_model import LogisticRegression as Model

2 Assignment

2.0.1 Warmup. Perform some analysis on Kobe's shot selection. Ask and answer (with charts) questions such as: Does Kobe make more shots in the 4th quarter than on average? Does Kobe make more shots from the left more than the right? What was Kobe's best year for shooting percentage? Etc. The more naunced the more you'll have a feel for the data.

```
In [29]: kobe[kobe.shot_made_flag==0].period.hist(bins=np.arange(0,20,1), alpha=.4)
     kobe[kobe.shot_made_flag==1].period.hist(bins=np.arange(0,20,1), alpha=.4)
```

Out[29]: <matplotlib.axes._subplots.AxesSubplot at 0x1a967702240>



2.0.2 1. Create a new column called abs_x that is equal to the absolute value of loc_x. Plot a histogram of made shots and missed shots using this variable. Explain in detail (with graphics and evidence) why this could be a better feature/column to use in a Logsitic Regression model instead of loc_x.

```
Out [46]:
                        action_type combined_shot_type
                                                          game_event_id
                                                                           game_id \
                          Jump Shot
                                              Jump Shot
                                                                          20000012
         1
                                                                      12
         2
                                                                          20000012
                          Jump Shot
                                              Jump Shot
                                                                      35
         3
                          Jump Shot
                                              Jump Shot
                                                                          20000012
         4
                 Driving Dunk Shot
                                                    Dunk
                                                                     155
                                                                          20000012
         5
                          Jump Shot
                                              Jump Shot
                                                                     244
                                                                          20000012
```

6	Layup	Cho+	Lazun	251	20000012
8			Layup	265	
	_	Shot	Jump Shot		20000012
9	Running Jump		Jump Shot	294	20000012
10	-	Shot	Jump Shot	309	20000012
11	-	Shot	Jump Shot	4	20000019
12	Running Jump		Jump Shot	27	20000019
13	-	Shot	Jump Shot	66	20000019
14	-	Shot	Jump Shot	80	20000019
15	_	Shot	Jump Shot	86	20000019
17	_	Shot	Jump Shot	138	20000019
18	Jump	Shot	Jump Shot	244	20000019
20	Jump	Shot	Jump Shot	255	20000019
21	Jump	Shot	Jump Shot	265	20000019
22	Running Jump	Shot	Jump Shot	274	20000019
23	Running Jump	Shot	Jump Shot	299	20000019
24	Running Jump	Shot	Jump Shot	307	20000019
25	Layup	Shot	Layup	332	20000019
26	Jump	Shot	Jump Shot	345	20000019
27	Jump	Shot	Jump Shot	369	20000019
28	Jump	Shot	Jump Shot	400	20000019
29	Jump	Shot	Jump Shot	429	20000019
30	Running Jump	Shot	Jump Shot	488	20000019
31	Jump	Shot	Jump Shot	499	20000019
38	-	Shot	Jump Shot	184	20000047
39	-	Shot	Jump Shot	202	20000047
	•		•		
30661	Slam Dunk	Shot	Dunk	245	49900087
30662		Shot	Jump Shot	259	49900087
30663	_	Shot	Jump Shot	270	49900087
30665	Layup		Layup	280	49900087
30666	• -	Shot	Jump Shot	295	49900087
30667	-	Shot	Jump Shot	368	49900087
30669	-	Shot	Jump Shot	425	49900087
30670	Running Jump		Jump Shot	15	49900088
30671	Driving Layup		Layup	25	49900088
30672		Shot			49900088
30673	Jump		lumn Shot	.)(1	
30073	Tump		Jump Shot	29 36	
3067/	_	Shot	Jump Shot	36	49900088
30674	Jump	Shot Shot	Jump Shot Jump Shot	36 81	49900088 49900088
30675	Jump Jump	Shot Shot	Jump Shot Jump Shot Jump Shot	36 81 84	49900088 49900088 49900088
30675 30676	Jump Jump Running Jump	Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot	36 81 84 98	49900088 49900088 49900088 49900088
30675 30676 30677	Jump Jump Running Jump Jump	Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot	36 81 84 98 101	49900088 49900088 49900088 49900088
30675 30676 30677 30678	Jump Jump Running Jump Jump Driving Layup	Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup	36 81 84 98 101 181	49900088 49900088 49900088 49900088 49900088
30675 30676 30677 30678 30679	Jump Jump Running Jump Jump Driving Layup Layup	Shot Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup Layup	36 81 84 98 101 181 212	49900088 49900088 49900088 49900088 49900088 49900088
30675 30676 30677 30678 30679 30681	Jump Jump Running Jump Jump Driving Layup Layup Jump	Shot Shot Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup Layup Jump Shot	36 81 84 98 101 181 212 218	49900088 49900088 49900088 49900088 49900088 49900088 49900088
30675 30676 30677 30678 30679 30681 30683	Jump Jump Running Jump Jump Driving Layup Layup Jump Jump Jump	Shot Shot Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup Layup Jump Shot Jump Shot	36 81 84 98 101 181 212 218 228	49900088 49900088 49900088 49900088 49900088 49900088 49900088
30675 30676 30677 30678 30679 30681 30683 30684	Jump Jump Running Jump Jump Driving Layup Layup Jump Jump Jump Jump	Shot Shot Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup Layup Jump Shot Jump Shot Jump Shot Jump Shot	36 81 84 98 101 181 212 218 228 231	49900088 49900088 49900088 49900088 49900088 49900088 49900088 49900088
30675 30676 30677 30678 30679 30681 30683	Jump Jump Running Jump Driving Layup Layup Jump Jump Jump Jump Jump Jump	Shot Shot Shot Shot Shot Shot Shot Shot	Jump Shot Jump Shot Jump Shot Jump Shot Jump Shot Layup Layup Jump Shot Jump Shot	36 81 84 98 101 181 212 218 228	49900088 49900088 49900088 49900088 49900088 49900088 49900088

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Jump Shot
30688
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                                                                       49900088
                  Jump Shot
30689
                  Jump Shot
                                         Jump Shot
                                                                 326
                                                                       49900088
                  Jump Shot
                                         Jump Shot
                                                                 331
                                                                       49900088
30690
30691
        Driving Layup Shot
                                             Layup
                                                                 382
                                                                       49900088
30692
                  Jump Shot
                                         Jump Shot
                                                                 397
                                                                       49900088
         Running Jump Shot
30694
                                         Jump Shot
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                                                                       49900088
30695
                  Jump Shot
                                         Jump Shot
                                                                 448
                                                                       49900088
                                         Jump Shot
30696
                  Jump Shot
                                                                 471
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                                        lon
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1
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                             110 -118.2858
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        33.9813
                              63 -118.3158
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                             196 -118.3278
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                             186 -118.4528
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38
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30665
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                     -14
                              18 -118.2838
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30666
        33.8733
                     -81
                             171 -118.3508
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30667
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                             250 -118.2298
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30669
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30670
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30671
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30672
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30673
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30674
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30675
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                           216 -118.4038
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30676
       34.0443
                   -141
                              0 - 118.4108
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30677
       33.9013
                   -113
                           143 -118.3828
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30678
                     14
                            16 -118.2558
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30679
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30681
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30684
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30685
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                     81
                           250 -118.1888
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30687
       33.9443
                     40
                           100 -118.2298
30688
       33.9833
                   -126
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                            61 -118.3958
30689
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                           679 -118.2818
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30690
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30691
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30692
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30694
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                           166 -118.4038
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30695
       33.7773
                     31
                           267 -118.2388
                                                                       4
                                                              0
30696
       33.9723
                      1
                            72 -118.2688
                                                                          . . .
               shot_zone_area
                                        shot_zone_basic shot_zone_range
                                              Mid-Range
1
                 Left Side(L)
                                                                  8-16 ft.
2
        Left Side Center(LC)
                                              Mid-Range
                                                                 16-24 ft.
3
       Right Side Center(RC)
                                              Mid-Range
                                                                 16-24 ft.
4
                     Center(C)
                                        Restricted Area
                                                          Less Than 8 ft.
5
                 Left Side(L)
                                              Mid-Range
                                                                  8-16 ft.
6
                                        Restricted Area
                                                          Less Than 8 ft.
                     Center(C)
8
                 Left Side(L)
                                 In The Paint (Non-RA)
                                                                  8-16 ft.
9
                     Center(C)
                                 In The Paint (Non-RA)
                                                                  8-16 ft.
        Left Side Center(LC)
                                     Above the Break 3
                                                                   24+ ft.
10
                                                                 16-24 ft.
11
       Right Side Center(RC)
                                              Mid-Range
12
                 Left Side(L)
                                 In The Paint (Non-RA)
                                                                  8-16 ft.
13
                 Left Side(L)
                                              Mid-Range
                                                                  8-16 ft.
14
                     Center(C)
                                 In The Paint (Non-RA)
                                                          Less Than 8 ft.
                                                                 16-24 ft.
15
                     Center(C)
                                              Mid-Range
17
        Left Side Center(LC)
                                     Above the Break 3
                                                                   24+ ft.
        Left Side Center(LC)
                                                                 16-24 ft.
18
                                              Mid-Range
20
                     Center(C)
                                              Mid-Range
                                                                  8-16 ft.
21
       Right Side Center(RC)
                                                                 16-24 ft.
                                              Mid-Range
22
                     Center(C)
                                 In The Paint (Non-RA)
                                                                  8-16 ft.
23
        Left Side Center(LC)
                                              Mid-Range
                                                                 16-24 ft.
24
                     Center(C)
                                 In The Paint (Non-RA)
                                                          Less Than 8 ft.
25
                     Center(C)
                                        Restricted Area
                                                          Less Than 8 ft.
26
                     Center(C)
                                                                 16-24 ft.
                                              Mid-Range
```

```
27
        Left Side Center(LC)
                                    Above the Break 3
                                                                 24+ ft.
                                                               16-24 ft.
28
       Right Side Center(RC)
                                             Mid-Range
29
                    Center(C)
                                In The Paint (Non-RA)
                                                                8-16 ft.
30
                Right Side(R)
                                             Mid-Range
                                                                8-16 ft.
                Right Side(R)
31
                                             Mid-Range
                                                                8-16 ft.
38
       Right Side Center(RC)
                                             Mid-Range
                                                               16-24 ft.
39
                    Center(C)
                                    Above the Break 3
                                                                 24+ ft.
. . .
                    Center(C)
                                      Restricted Area
30661
                                                        Less Than 8 ft.
                                                        Less Than 8 ft.
30662
                    Center(C)
                                In The Paint (Non-RA)
                                             Mid-Range
30663
                Right Side(R)
                                                                8-16 ft.
30665
                    Center(C)
                                      Restricted Area
                                                         Less Than 8 ft.
30666
        Left Side Center(LC)
                                                               16-24 ft.
                                             Mid-Range
                                                                 24+ ft.
30667
                    Center(C)
                                    Above the Break 3
30669
                Right Side(R)
                                             Mid-Range
                                                               16-24 ft.
                    Center(C)
30670
                                In The Paint (Non-RA)
                                                         Less Than 8 ft.
30671
                    Center(C)
                                      Restricted Area
                                                         Less Than 8 ft.
30672
                Right Side(R)
                                             Mid-Range
                                                                8-16 ft.
                Right Side(R)
                                             Mid-Range
                                                                8-16 ft.
30673
30674
       Right Side Center(RC)
                                    Above the Break 3
                                                                 24+ ft.
30675
        Left Side Center(LC)
                                    Above the Break 3
                                                                 24+ ft.
                 Left Side(L)
                                                                8-16 ft.
30676
                                             Mid-Range
30677
        Left Side Center(LC)
                                             Mid-Range
                                                               16-24 ft.
                    Center(C)
                                      Restricted Area
                                                        Less Than 8 ft.
30678
30679
                    Center(C)
                                      Restricted Area
                                                        Less Than 8 ft.
                                    Above the Break 3
                                                                 24+ ft.
30681
                    Center(C)
                    Center(C)
                                                               16-24 ft.
30683
                                             Mid-Range
30684
                 Left Side(L)
                                             Mid-Range
                                                                8-16 ft.
30685
                    Center(C)
                                    Above the Break 3
                                                                 24+ ft.
30687
                    Center(C)
                                In The Paint (Non-RA)
                                                                8-16 ft.
30688
                 Left Side(L)
                                                                8-16 ft.
                                             Mid-Range
30689
               Back Court(BC)
                                             Backcourt
                                                         Back Court Shot
30690
                 Left Side(L)
                                             Mid-Range
                                                                8-16 ft.
30691
                                      Restricted Area
                                                        Less Than 8 ft.
                    Center(C)
                                In The Paint (Non-RA)
                                                         Less Than 8 ft.
30692
                    Center(C)
        Left Side Center(LC)
30694
                                             Mid-Range
                                                               16-24 ft.
                                    Above the Break 3
30695
                    Center(C)
                                                                 24+ ft.
30696
                    Center(C)
                                In The Paint (Non-RA)
                                                        Less Than 8 ft.
          team_id
                              team name
                                           game_date
                                                           matchup opponent
1
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
2
                    Los Angeles Lakers
                                                        LAL @ POR
                                                                         POR
       1610612747
                                          2000-10-31
3
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
                                                         LAL @ POR
4
                    Los Angeles Lakers
       1610612747
                                          2000-10-31
                                                                         POR.
5
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
6
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
8
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
9
       1610612747
                    Los Angeles Lakers
                                          2000-10-31
                                                         LAL @ POR
                                                                         POR
```

```
10
                    Los Angeles Lakers
                                                        LAL @ POR
                                                                         POR
       1610612747
                                         2000-10-31
11
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
12
                    Los Angeles Lakers
                                                      LAL vs. UTA
                                                                         UTA
       1610612747
                                         2000-11-01
                    Los Angeles Lakers
                                                      LAL vs. UTA
13
       1610612747
                                         2000-11-01
                                                                         UTA
                    Los Angeles Lakers
14
       1610612747
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
                    Los Angeles Lakers
                                                      LAL vs. UTA
15
       1610612747
                                         2000-11-01
                                                                         UTA
17
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
                                                      LAL vs. UTA
18
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                                         UTA
20
                    Los Angeles Lakers
       1610612747
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
21
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
22
                    Los Angeles Lakers
                                                      LAL vs. UTA
                                                                         UTA
       1610612747
                                         2000-11-01
                    Los Angeles Lakers
23
       1610612747
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
24
                    Los Angeles Lakers
                                                      LAL vs. UTA
                                                                         UTA
       1610612747
                                         2000-11-01
                    Los Angeles Lakers
25
       1610612747
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
26
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
27
                    Los Angeles Lakers
                                                      LAL vs. UTA
       1610612747
                                         2000-11-01
                                                                         UTA
28
       1610612747
                    Los Angeles Lakers
                                         2000-11-01
                                                      LAL vs. UTA
                                                                         UTA
29
                    Los Angeles Lakers
                                                      LAL vs. UTA
       1610612747
                                         2000-11-01
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                    Los Angeles Lakers
                                                      LAL vs. UTA
30
       1610612747
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31
                    Los Angeles Lakers
                                                      LAL vs. UTA
                                                                         UTA
       1610612747
                                         2000-11-01
                    Los Angeles Lakers
38
       1610612747
                                         2000-11-04
                                                        LAL @ VAN
                                                                         VAN
                    Los Angeles Lakers
39
       1610612747
                                         2000-11-04
                                                        LAL @ VAN
                                                                         VAN
                                                                         . . .
       1610612747
                                                        LAL @ IND
30661
                    Los Angeles Lakers
                                         2000-06-16
                                                                         IND
30662
       1610612747
                    Los Angeles Lakers
                                                        LAL @ IND
                                         2000-06-16
                                                                         IND
                    Los Angeles Lakers
                                                        LAL @ IND
30663
       1610612747
                                         2000-06-16
                                                                         IND
                    Los Angeles Lakers
30665
       1610612747
                                         2000-06-16
                                                        LAL @
                                                                         IND
                                                               IND
30666
       1610612747
                    Los Angeles Lakers
                                         2000-06-16
                                                        LAL @ IND
                                                                         IND
                    Los Angeles Lakers
30667
       1610612747
                                         2000-06-16
                                                        LAL @ IND
                                                                         IND
30669
       1610612747
                    Los Angeles Lakers
                                         2000-06-16
                                                        LAL @ IND
                                                                         IND
                    Los Angeles Lakers
30670
       1610612747
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30671
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30672
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
                    Los Angeles Lakers
                                                      LAL vs.
30673
       1610612747
                                         2000-06-19
                                                               IND
                                                                         IND
                    Los Angeles Lakers
30674
       1610612747
                                                      LAL vs. IND
                                         2000-06-19
                                                                         IND
30675
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                                                                         IND
                    Los Angeles Lakers
30676
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                                         2000-06-19
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                                                                         IND
30677
       1610612747
                    Los Angeles Lakers
                                                      LAL vs. IND
                                                                         IND
                                         2000-06-19
                    Los Angeles Lakers
30678
       1610612747
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30679
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
                    Los Angeles Lakers
30681
       1610612747
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
                    Los Angeles Lakers
30683
       1610612747
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
                    Los Angeles Lakers
                                                      LAL vs. IND
30684
       1610612747
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                                                                         IND
                    Los Angeles Lakers
30685
       1610612747
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30687
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30688
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30689
       1610612747
                    Los Angeles Lakers
                                         2000-06-19
                                                      LAL vs. IND
                                                                         IND
30690
                    Los Angeles Lakers
                                                      LAL vs. IND
       1610612747
                                         2000-06-19
                                                                         IND
```

```
1610612747 Los Angeles Lakers 2000-06-19 LAL vs. IND
30691
                                                                 IND
30692
      1610612747 Los Angeles Lakers 2000-06-19 LAL vs. IND
                                                                 IND
      1610612747 Los Angeles Lakers 2000-06-19 LAL vs. IND
30694
                                                                 IND
30695
      1610612747 Los Angeles Lakers
                                     2000-06-19 LAL vs. IND
                                                                 IND
      1610612747 Los Angeles Lakers 2000-06-19 LAL vs. IND
30696
                                                                 IND
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6 8	9	1.0
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12	13	0.0
13	14	0.0
14	15	1.0
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18	19	0.0
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22	23	0.0
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25	26	1.0
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27	28	0.0
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30662	30663	1.0
30663	30664	0.0
30665	30666	1.0
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30667	30668	0.0
30669	30670	0.0
30670	30671	1.0
30671	30672	1.0
30672	30673	0.0

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30673
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         30675
30674
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30675
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30676
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30684
         30685
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30685
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30687
30688
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30692
         30693
                  1.0
30694
         30695
                  0.0
30695
         30696
                  0.0
30696
         30697
                  1.0
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[25697 rows x 26 columns]

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                                                                        12
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         2
                           Jump Shot
                                                Jump Shot
                                                                        35
                                                                            20000012
         3
                           Jump Shot
                                                Jump Shot
                                                                        43
                                                                            20000012
         4
                  Driving Dunk Shot
                                                     Dunk
                                                                       155
                                                                            20000012
         5
                           Jump Shot
                                                Jump Shot
                                                                       244
                                                                            20000012
         6
                          Layup Shot
                                                    Layup
                                                                       251
                                                                            20000012
         8
                           Jump Shot
                                                Jump Shot
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                  Running Jump Shot
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                                                                       309
                           Jump Shot
                                                Jump Shot
                                                                            20000012
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                                                Jump Shot
                                                                         4
                                                                            20000019
         11
         12
                  Running Jump Shot
                                                Jump Shot
                                                                        27
                                                                            20000019
                           Jump Shot
         13
                                                Jump Shot
                                                                        66
                                                                            20000019
         14
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                                                Jump Shot
                                                                        80
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                                                Jump Shot
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                                                                            20000019
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                                                                            20000019
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                                                Jump Shot
                                                                       255
                                                                            20000019
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                                                Jump Shot
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         23
                  Running Jump Shot
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                                                                       299
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         24
                  Running Jump Shot
                                                Jump Shot
                                                                       307
                                                                            20000019
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25
                Layup Shot
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                                                               332
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26
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                                       Jump Shot
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                                                               369
                                                                    20000019
                  Jump Shot
                                       Jump Shot
28
                                                               400
                  Jump Shot
                                       Jump Shot
                                                                    20000019
29
                  Jump Shot
                                       Jump Shot
                                                               429
                                                                    20000019
30
         Running Jump Shot
                                       Jump Shot
                                                               488
                                                                    20000019
31
                  Jump Shot
                                       Jump Shot
                                                               499
                                                                    20000019
38
                  Jump Shot
                                       Jump Shot
                                                               184
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                                                               259
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                                       Jump Shot
                                                                    49900087
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30663
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                                       Jump Shot
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30665
                 Layup Shot
                                           Layup
                                                               280
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30666
                  Jump Shot
                                       Jump Shot
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30667
                  Jump Shot
                                       Jump Shot
                                                                    49900087
30669
                  Jump Shot
                                       Jump Shot
                                                               425
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30670
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                                                                15
         Running Jump Shot
                                                                    49900088
       Driving Layup Shot
                                                                25
30671
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30672
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30675
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30676
        Running Jump Shot
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                                                                    49900088
30677
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                                       Jump Shot
                                                               101
                                                                    49900088
       Driving Layup Shot
                                                               181
                                                                    49900088
30678
                                           Layup
30679
                 Layup Shot
                                           Layup
                                                               212
                                                                    49900088
                                       Jump Shot
30681
                  Jump Shot
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30683
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                                       Jump Shot
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30684
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                                       Jump Shot
                                                               231
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30685
                                                               249
                  Jump Shot
                                       Jump Shot
                                                                    49900088
30687
                  Jump Shot
                                       Jump Shot
                                                               284
                                                                    49900088
30688
                  Jump Shot
                                       Jump Shot
                                                               308
                                                                    49900088
                                                               326
30689
                  Jump Shot
                                       Jump Shot
                                                                    49900088
30690
                  Jump Shot
                                       Jump Shot
                                                               331
                                                                    49900088
30691
       Driving Layup Shot
                                           Layup
                                                               382
                                                                    49900088
30692
                  Jump Shot
                                       Jump Shot
                                                               397
                                                                    49900088
30694
         Running Jump Shot
                                       Jump Shot
                                                               426
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                                                               448
30695
                  Jump Shot
                                       Jump Shot
                                                                    49900088
30696
                  Jump Shot
                                       Jump Shot
                                                               471
                                                                    49900088
                 loc_x
                                                                                   \
            lat
                         loc_y
                                       lon
                                             minutes_remaining
                                                                  period
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2
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                            175 -118.1318
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6
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13	34.0403	-94	4	-118.3638	2	1	
14	33.9973	-23	47	-118.2928	1	1	
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22	33.9343	-16	110	-118.2858	7	3	
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			0		 9 8		
30661	34.0443	0	0 53	-118.2698		3	
30661 30662	34.0443 33.9913	0 -8	0 53 25	-118.2698 -118.2778	8	3 3	
30661 30662 30663	34.0443 33.9913 34.0193	0 -8 106	0 53 25 18	-118.2698 -118.2778 -118.1638	8 6	3 3 3	
30661 30662 30663 30665	34.0443 33.9913 34.0193 34.0263	0 -8 106 -14	0 53 25 18 171	-118.2698 -118.2778 -118.1638 -118.2838	8 6 5	3 3 3 3	
30661 30662 30663 30665 30666	34.0443 33.9913 34.0193 34.0263 33.8733	0 -8 106 -14 -81	0 53 25 18 171 250	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508	8 6 5 4	3 3 3 3 3	
30661 30662 30663 30665 30666 30667	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943	0 -8 106 -14 -81 40	0 53 25 18 171 250 53	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298	8 6 5 4 9	3 3 3 3 4	
30661 30662 30663 30665 30666 30667 30669	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913	0 -8 106 -14 -81 40 171	0 53 25 18 171 250 53 16	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988	8 6 5 4 9 3	3 3 3 3 4 4	
30661 30662 30663 30665 30666 30667 30669 30670	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913 34.0283	0 -8 106 -14 -81 40 171 -74	0 53 25 18 171 250 53 16	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438	8 6 5 4 9 3 9 8	3 3 3 3 4 4 1	
30661 30662 30663 30665 30666 30667 30669 30670 30671	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913 34.0283 34.0443	0 -8 106 -14 -81 40 171 -74 0	0 53 25 18 171 250 53 16 0 55	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698	8 6 5 4 9 3	3 3 3 3 4 4 1	
30661 30662 30663 30665 30666 30667 30669 30670 30671 30672	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913 34.0283 34.0443 33.9893 34.0443	0 -8 106 -14 -81 40 171 -74 0 89	0 53 25 18 171 250 53 16 0 55	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808 -118.1528	8 6 5 4 9 3 9 8 8 7	3 3 3 3 4 4 1 1	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283	0 -8 106 -14 -81 40 171 -74 0 89 117	0 53 25 18 171 250 53 16 0 55 0	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808	8 6 5 4 9 3 9 8 8 7 2	3 3 3 3 4 4 1 1 1	
30661 30662 30663 30665 30666 30667 30669 30670 30671 30672 30673	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 33.8283	0 -8 106 -14 -81 40 171 -74 0 89 117 117	0 53 25 18 171 250 53 16 0 55 0 216 216	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808 -118.1528 -118.1528 -118.4038	8 6 5 4 9 3 9 8 8 7 2 2	3 3 3 3 4 4 1 1 1 1	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 33.8283 34.0443	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141	0 53 25 18 171 250 53 16 0 55 0 216 216	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808 -118.1528 -118.1528 -118.4038 -118.4108	8 6 5 4 9 3 9 8 8 7 2 2 0	3 3 3 3 4 4 1 1 1 1 1	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 33.8283 34.0443 33.9013	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113	0 53 25 18 171 250 53 16 0 55 0 216 216 0 143	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.1528 -118.4038 -118.4108 -118.3828	8 6 5 4 9 3 9 8 8 7 2 2 0 0	3 3 3 3 4 4 1 1 1 1 1	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 33.8283 34.0443	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141	0 53 25 18 171 250 53 16 0 55 0 216 216 0 143 16	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808 -118.1528 -118.1528 -118.4038 -118.4108	8 6 5 4 9 3 9 8 8 7 2 2 0	3 3 3 3 4 4 1 1 1 1 1 1 2	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676 30677 30678 30679	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 33.8283 34.0443 33.9013 34.0283 34.0443	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113 14	0 53 25 18 171 250 53 16 0 55 0 216 216 0 143 16 0	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1808 -118.1528 -118.1528 -118.4038 -118.4108 -118.3828 -118.2698	8 6 5 4 9 3 9 8 8 7 2 2 0 0 3	3 3 3 3 4 4 1 1 1 1 1 1 2 2	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676 30677 30678 30679 30681	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 34.0443 33.9013 34.0283 34.0443 33.9013 34.0283 34.0443 33.7833	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113 14 0 -18	0 53 25 18 171 250 53 16 0 55 0 216 216 216 0 143 16 0	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.4038 -118.4108 -118.3828 -118.2558 -118.2698 -118.2878	8 6 5 4 9 3 9 8 8 7 2 2 0 0 0 3	3 3 3 3 4 4 1 1 1 1 1 1 2 2	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676 30677 30678 30679 30681 30683	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 34.0443 33.9013 34.0283 34.0443 33.9013 34.0283 34.0443 33.7833 33.7833 33.8283	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113 14 0 -18	0 53 25 18 171 250 53 16 0 55 0 216 216 216 0 143 16 0 261 216	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.1528 -118.4038 -118.4038 -118.3828 -118.2558 -118.2698 -118.2698 -118.2698	8 6 5 4 9 3 9 8 8 7 2 2 0 0 0 3 0	3 3 3 3 4 4 1 1 1 1 1 1 2 2 3	
30661 30662 30663 30665 30666 30667 30669 30670 30671 30672 30673 30674 30675 30676 30677 30678 30678 30681 30683 30684	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913 34.0283 34.0443 33.8283 33.8283 34.0443 33.9013 34.0283 34.0443 33.7833 34.0443 33.7833 33.7833 33.8283 33.9553	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113 14 0 -18 1	0 53 25 18 171 250 53 16 0 216 216 0 143 16 0 261 216 89	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.4038 -118.4038 -118.4108 -118.3828 -118.2558 -118.2698 -118.2698 -118.2698 -118.2688 -118.3658	8 6 5 4 9 3 9 8 8 7 2 2 0 0 0 3 0 0 10 10	3 3 3 3 4 4 1 1 1 1 1 1 2 2 2 3 3	
30661 30662 30663 30665 30666 30667 30670 30671 30672 30673 30674 30675 30676 30677 30678 30679 30681 30683	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 34.0283 34.0443 33.9893 34.0443 33.8283 34.0443 33.9013 34.0283 34.0443 33.7833 34.0443 33.7833 33.7833 33.7833 33.7833 33.7943	0 -8 106 -14 -81 40 171 -74 0 89 117 117 -134 -141 -113 14 0 -18	0 53 25 18 171 250 53 16 0 55 0 216 216 216 0 243 16 0 241 216 89 250	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.1528 -118.4038 -118.4038 -118.3828 -118.2558 -118.2698 -118.2698 -118.2698	8 6 5 4 9 3 9 8 8 7 2 2 0 0 0 3 0 0 10 10 7	3 3 3 3 4 4 1 1 1 1 1 1 2 2 3	
30661 30662 30663 30665 30666 30667 30669 30670 30671 30672 30673 30674 30675 30676 30677 30678 30679 30681 30683 30684 30685	34.0443 33.9913 34.0193 34.0263 33.8733 33.7943 33.9913 34.0283 34.0443 33.8283 33.8283 34.0443 33.9013 34.0283 34.0443 33.7833 34.0443 33.7833 33.7833 33.8283 33.9553	0 -8 106 -14 -81 40 171 -74 0 89 117 -134 -141 -113 14 0 -18 1 -96 81	0 53 25 18 171 250 53 16 0 55 0 216 216 216 216 261 216 89 250 100	-118.2698 -118.2778 -118.1638 -118.2838 -118.3508 -118.2298 -118.0988 -118.3438 -118.2698 -118.1528 -118.1528 -118.4038 -118.4038 -118.3828 -118.2558 -118.2698 -118.2698 -118.2878 -118.2688 -118.2688 -118.3658 -118.1888	8 6 5 4 9 3 9 8 8 7 2 2 0 0 0 3 0 0 10 10	3 3 3 3 4 4 1 1 1 1 1 2 2 2 3 3 3 3	

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30690
       33.9443
                  -113
                           100 -118.3828
                                                           11
                                                                     4
       34.0443
                     0
                             0 -118.2698
                                                            7
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30691
                                                            6
30692
       33.9963
                     1
                            48 -118.2688
                                                                     4
                                                            3
30694
       33.8783
                  -134
                           166 -118.4038
                                                                     4
                                                            2
30695
       33.7773
                    31
                           267 -118.2388
                                                                     4
30696
       33.9723
                     1
                            72 -118.2688
                                                            0
                                                                     4
                                                                        . . .
              shot_zone_basic
                                shot_zone_range
                                                      team_id
                                                                         team name
1
                    Mid-Range
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
2
                                       16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
                    Mid-Range
3
                                                               Los Angeles Lakers
                    Mid-Range
                                       16-24 ft.
                                                  1610612747
4
                                                               Los Angeles Lakers
              Restricted Area
                                Less Than 8 ft.
                                                   1610612747
5
                    Mid-Range
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
6
              Restricted Area
                                Less Than 8 ft.
                                                  1610612747
                                                               Los Angeles Lakers
8
       In The Paint (Non-RA)
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
9
       In The Paint (Non-RA)
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
10
            Above the Break 3
                                         24+ ft.
                                                  1610612747
                                                               Los Angeles Lakers
                                      16-24 ft.
                                                               Los Angeles Lakers
11
                    Mid-Range
                                                  1610612747
12
       In The Paint (Non-RA)
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
                                        8-16 ft.
13
                    Mid-Range
                                                  1610612747
                                                               Los Angeles Lakers
14
       In The Paint (Non-RA)
                                Less Than 8 ft.
                                                  1610612747
                                                               Los Angeles Lakers
15
                    Mid-Range
                                      16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
17
           Above the Break 3
                                         24+ ft.
                                                  1610612747
                                                               Los Angeles Lakers
18
                                      16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
                    Mid-Range
20
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
                    Mid-Range
21
                    Mid-Range
                                       16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
22
       In The Paint (Non-RA)
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
23
                    Mid-Range
                                       16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
24
       In The Paint (Non-RA)
                                Less Than 8 ft.
                                                  1610612747
                                                               Los Angeles Lakers
25
              Restricted Area
                                Less Than 8 ft.
                                                               Los Angeles Lakers
                                                  1610612747
26
                    Mid-Range
                                      16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
            Above the Break 3
27
                                         24+ ft.
                                                  1610612747
                                                               Los Angeles Lakers
28
                                       16-24 ft.
                                                               Los Angeles Lakers
                    Mid-Range
                                                  1610612747
                                                               Los Angeles Lakers
29
       In The Paint (Non-RA)
                                        8-16 ft.
                                                  1610612747
30
                    Mid-Range
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
31
                    Mid-Range
                                        8-16 ft.
                                                  1610612747
                                                               Los Angeles Lakers
38
                    Mid-Range
                                       16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
           Above the Break 3
39
                                         24+ ft.
                                                  1610612747
                                                               Los Angeles Lakers
. . .
                                                  1610612747
30661
              Restricted Area
                                Less Than 8 ft.
                                                               Los Angeles Lakers
       In The Paint (Non-RA)
30662
                                Less Than 8 ft.
                                                  1610612747
                                                               Los Angeles Lakers
30663
                                                               Los Angeles Lakers
                    Mid-Range
                                        8-16 ft.
                                                  1610612747
30665
              Restricted Area
                                Less Than 8 ft.
                                                  1610612747
                                                               Los Angeles Lakers
30666
                    Mid-Range
                                      16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
30667
           Above the Break 3
                                         24+ ft.
                                                  1610612747
                                                               Los Angeles Lakers
30669
                    Mid-Range
                                      16-24 ft.
                                                  1610612747
                                                               Los Angeles Lakers
       In The Paint (Non-RA)
                                Less Than 8 ft.
                                                               Los Angeles Lakers
30670
                                                  1610612747
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30689

33.3653

-12

679 -118.2818

0

3

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30671
              Restricted Area
                               Less Than 8 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30672
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30673
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
                                                               Los Angeles Lakers
           Above the Break 3
                                                               Los Angeles Lakers
30674
                                         24+ ft.
                                                   1610612747
                                                               Los Angeles Lakers
30675
           Above the Break 3
                                         24+ ft.
                                                   1610612747
                                                               Los Angeles Lakers
30676
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
30677
                    Mid-Range
                                      16-24 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30678
              Restricted Area
                                Less Than 8 ft.
                                                   1610612747
                                                               Los Angeles Lakers
                                Less Than 8 ft.
30679
              Restricted Area
                                                   1610612747
                                                               Los Angeles Lakers
30681
           Above the Break 3
                                         24+ ft.
                                                   1610612747
                                                               Los Angeles Lakers
                                       16-24 ft.
30683
                                                   1610612747
                                                               Los Angeles Lakers
                    Mid-Range
                                                               Los Angeles Lakers
30684
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
30685
            Above the Break 3
                                         24+ ft.
                                                   1610612747
                                                               Los Angeles Lakers
30687
       In The Paint (Non-RA)
                                        8-16 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30688
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30689
                                                               Los Angeles Lakers
                    Backcourt
                                Back Court Shot
                                                   1610612747
30690
                    Mid-Range
                                        8-16 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30691
                                Less Than 8 ft.
                                                               Los Angeles Lakers
              Restricted Area
                                                   1610612747
       In The Paint (Non-RA)
                                Less Than 8 ft.
                                                   1610612747
                                                               Los Angeles Lakers
30692
30694
                    Mid-Range
                                       16-24 ft.
                                                   1610612747
                                                               Los Angeles Lakers
           Above the Break 3
30695
                                         24+ ft.
                                                   1610612747
                                                               Los Angeles Lakers
       In The Paint (Non-RA)
                                                               Los Angeles Lakers
30696
                                Less Than 8 ft.
                                                   1610612747
                                                          abs_x
        game_date
                        matchup opponent shot_id pred
1
       2000-10-31
                      LAL @ POR
                                      POR
                                                  2
                                                    0.0
                                                            157
2
                                      POR
                                                 3
                                                    0.0
       2000-10-31
                      LAL @ POR
                                                            101
3
       2000-10-31
                                      POR
                                                 4
                                                    0.0
                                                            138
                      LAL @ POR
4
                                                 5
       2000-10-31
                      LAL @ POR
                                      POR
                                                     1.0
                                                              0
5
                      LAL @ POR
                                                 6
                                                     0.0
       2000-10-31
                                      POR
                                                            145
6
       2000-10-31
                      LAL @ POR
                                      POR
                                                 7
                                                     1.0
                                                              0
8
       2000-10-31
                      LAL @ POR
                                      POR
                                                     0.0
                                                             65
9
       2000-10-31
                      LAL @ POR
                                      POR
                                                10
                                                     0.0
                                                             33
10
       2000-10-31
                      LAL @ POR
                                      POR
                                                11
                                                     0.0
                                                             94
11
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                12
                                                    0.0
                                                            121
12
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                13
                                                     0.0
                                                             67
13
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                14
                                                     0.0
                                                             94
14
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                15
                                                     1.0
                                                             23
15
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                     0.0
                                                             62
                                                16
17
                    LAL vs. UTA
                                      UTA
       2000-11-01
                                                18
                                                     0.0
                                                            117
                    I.AI. vs. UTA
18
       2000-11-01
                                      UTA
                                                19
                                                     0.0
                                                            132
20
                    LAL vs. UTA
                                      UTA
                                                     0.0
                                                              3
       2000-11-01
                                                21
21
                    LAL vs. UTA
                                      UTA
                                                22
                                                     0.0
                                                            134
       2000-11-01
22
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                23
                                                     0.0
                                                             16
23
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                24
                                                     0.0
                                                            109
24
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                25
                                                     1.0
                                                             46
25
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                26
                                                     1.0
                                                              0
26
       2000-11-01
                    LAL vs. UTA
                                      UTA
                                                27
                                                     0.0
                                                             58
27
       2000-11-01
                   LAL vs. UTA
                                      UTA
                                                28
                                                     0.0
                                                            183
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UTA
         29
                 2000-11-01
                              LAL vs. UTA
                                                           30
                                                               1.0
                                                                         3
         30
                 2000-11-01
                              LAL vs. UTA
                                                 UTA
                                                               0.0
                                                                       121
                                                           31
                             LAL vs. UTA
                                                 UTA
                                                           32
                                                               0.0
                                                                       127
         31
                 2000-11-01
         38
                 2000-11-04
                                LAL @ VAN
                                                 VAN
                                                           39
                                                               0.0
                                                                        91
                                LAL @ VAN
                                                                        27
         39
                 2000-11-04
                                                 VAN
                                                           40
                                                               0.0
          . . .
                                                 . . .
                                       . . .
                                                          . . .
                                                               . . .
                                                                       . . .
         30661
                 2000-06-16
                                LAL @ IND
                                                 IND
                                                       30662
                                                               1.0
                                                                         0
                                LAL @ IND
         30662
                 2000-06-16
                                                 IND
                                                       30663
                                                               1.0
                                                                         8
         30663
                 2000-06-16
                                LAL @ IND
                                                 IND
                                                       30664
                                                               0.0
                                                                       106
                                LAL @ IND
         30665
                 2000-06-16
                                                 IND
                                                       30666
                                                               1.0
                                                                        14
                                LAL @ IND
         30666
                 2000-06-16
                                                 IND
                                                       30667
                                                               0.0
                                                                       81
         30667
                                LAL @ IND
                                                 IND
                                                       30668
                                                                        40
                 2000-06-16
                                                               0.0
                                LAL @ IND
         30669
                 2000-06-16
                                                 IND
                                                       30670
                                                               0.0
                                                                       171
         30670
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30671
                                                               1.0
                                                                       74
         30671
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30672
                                                                         0
                                                               1.0
         30672
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30673
                                                               0.0
                                                                       89
         30673
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30674
                                                              0.0
                                                                       117
                 2000-06-19
                              LAL vs. IND
                                                       30675
                                                              0.0
                                                                       117
         30674
                                                 IND
         30675
                 2000-06-19
                              LAL vs.
                                       IND
                                                 IND
                                                       30676
                                                               0.0
                                                                       134
         30676
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30677
                                                               0.0
                                                                       141
         30677
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30678
                                                               0.0
                                                                       113
         30678
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30679
                                                               1.0
                                                                        14
         30679
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30680
                                                                         0
                                                               1.0
         30681
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30682
                                                              0.0
                                                                        18
         30683
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30684
                                                               0.0
                                                                         1
                 2000-06-19
                              LAL vs.
                                                       30685
         30684
                                       IND
                                                 IND
                                                               0.0
                                                                        96
         30685
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30686
                                                               0.0
                                                                        81
                              LAL vs. IND
         30687
                 2000-06-19
                                                 IND
                                                       30688
                                                               0.0
                                                                        40
         30688
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30689
                                                               0.0
                                                                       126
         30689
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30690
                                                               0.0
                                                                        12
         30690
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30691
                                                               0.0
                                                                       113
         30691
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30692
                                                               1.0
                                                                         0
         30692
                 2000-06-19
                              LAL vs.
                                       IND
                                                 IND
                                                       30693
                                                                         1
                                                               1.0
         30694
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30695
                                                               0.0
                                                                       134
         30695
                 2000-06-19
                              LAL vs.
                                       IND
                                                 IND
                                                       30696
                                                               0.0
                                                                        31
         30696
                 2000-06-19
                              LAL vs. IND
                                                 IND
                                                       30697
                                                               1.0
          [25697 rows x 27 columns]
In [53]: plt.scatter(kobe.loc_x, kobe.shot_made_flag)
         plt.scatter(kobe.loc x, kobe.pred, color='red', alpha=.2)
         plt.xlabel('loc')
         plt.ylabel('made')
Out [53]: Text(0,0.5, 'made')
```

28

2000-11-01 LAL vs. UTA

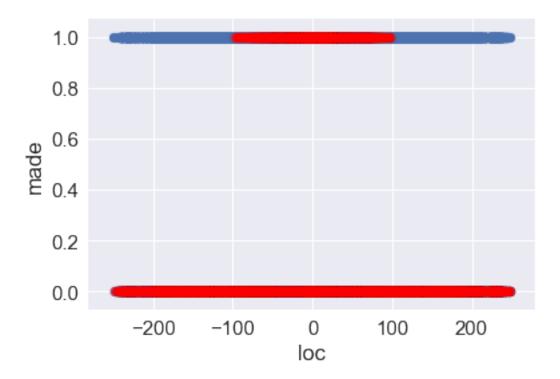
UTA

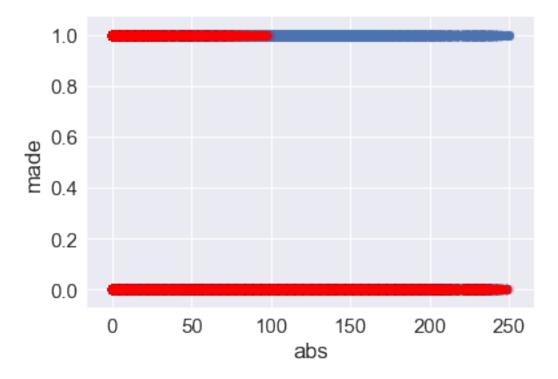
0.0

29

85

1





In []: The absolute value shows a more accurate depiction of shots that are made ${\tt and}$ missed.

2.0.3 2. Convert several (including '') string columns/features into numerical and attempt to use them in fitting a Logistic Regression model. Show histograms (similar to ones above) of made/missed of these new numerical features. Use these histograms to explain and justify why these features could improve the model

In [54]: df.dtypes

Out[54]:	action_type	object
	<pre>combined_shot_type</pre>	object
	game_event_id	int64
	game_id	int64
	lat	float64
	loc_x	int64
	loc_y	int64
	lon	float64
	minutes_remaining	int64
	period	int64
	playoffs	int64
	season	object
	seconds_remaining	int64
	shot_distance	int64
	shot_made_flag	float64

```
shot_type
                                object
         shot_zone_area
                                object
         shot_zone_basic
                                object
         shot_zone_range
                                object
         team id
                                int64
         team_name
                                object
         game_date
                                object
         matchup
                                object
         opponent
                                object
         shot_id
                                 int64
         pred
                               float64
                                 int64
         abs_x
         dtype: object
In [61]: df["shot_zone_area"] = pd.to_numeric(df["shot_zone_area"])
         df["shot_zone_basic"] = pd.to_numeric(df["shot_zone_basic"])
         df["shot_zone_range"] = pd.to_numeric(df["shot_zone_range"])
         df[["shot zone area", "shot zone basic", "shot zone range"]] = df[["shot zone area",
        ValueError
                                                  Traceback (most recent call last)
        pandas/_libs/src\inference.pyx in pandas._libs.lib.maybe_convert_numeric()
        ValueError: Unable to parse string "Left Side(L)"
   During handling of the above exception, another exception occurred:
        ValueError
                                                  Traceback (most recent call last)
        <ipython-input-61-553dc397a3c6> in <module>()
   ----> 1 df["shot_zone_area"] = pd.to_numeric(df["shot_zone_area"])
          2 df["shot_zone_basic"] = pd.to_numeric(df["shot_zone_basic"])
          3 df["shot_zone_range"] = pd.to_numeric(df["shot_zone_range"])
          5 df[["shot_zone_area", "shot_zone_basic", "shot_zone_range"]] = df[["shot_zone_area
        ~\Anaconda3\lib\site-packages\pandas\core\tools\numeric.py in to_numeric(arg, errors,
        131
                        coerce_numeric = False if errors in ('ignore', 'raise') else True
                        values = lib.maybe_convert_numeric(values, set(),
        132
    --> 133
                                                           coerce_numeric=coerce_numeric)
```

```
134
        135
                except Exception:
        pandas/ libs/src\inference.pyx in pandas. libs.lib.maybe convert numeric()
        ValueError: Unable to parse string "Left Side(L)" at position 0
In [71]: from sklearn.linear_model import LogisticRegression as Model
         # from sklearn.tree import DecisionTreeClassifier as Model
         # from sklearn.ensemble import RandomForestClassifier as Model
         model = Model()
         from sklearn.metrics import (accuracy_score,
                                       classification_report,
                                       confusion_matrix, auc, roc_curve
         from sklearn.metrics import *
         from sklearn import cross_validation
         X_train, X_test, y_train, y_test = cross_validation.train_test_split(
             X, y, test_size=0.4, random_state=0)
         cross_validation.cross_val_score(model, X, y, cv=10)
         model.fit(X,y)
         kobe['pred']=model.predict(X)
2.0.4 3. Show a 3 dimensional surface plot [https://matplotlib.org/mpl_toolkits/mplot3d/tutorial.html#surface
```

2.0.4 3. Show a 3 dimensional surface plot [https://matplotlib.org/mpl_toolkits/mplot3d/tutorial.html#surface plots] of probabilities from a trained Logistic Regression model using only abs_x and loc_y. The probabilities arise from a distributed grid of x values and y values as input to the predict_proba() function.

```
In [73]: fig_x=kobe['abs_x']
    fig_y=kobe['loc_y']
    x_train = np.column_stack ((model.predict(X), fig_x))
    y_train = np.column_stack ((model.predict(X), fig_y))

import matplotlib.pyplot as plt
    from mpl_toolkits.mplot3d import Axes3D
    fig = plt.figure()
    ax = fig.add_subplot(111, projection='3d')
```

fig_y= y_train
Z=model.predict_proba(x_train)

