Statistical Analysis of Edmonds Karp, Ford Flukerson and Dinic Running Times

All these numbers were obtained running on an Intel i3-5005U CPU @ 2.0 GHz running on the same 100 test cases for each algorithm

In [1]:
```
# read data
ford_flukerson = [] # data for ford flukerson
with open("FordFlukerson.txt") as text:
    ford_flukerson = [line.split(',') for line in text]
edmonds_karp = []
with open("EdmonsKarp.txt") as text:
    edmonds_karp = [line.split(',') for line in text]
Dinic = []
with open("Dinc.txt") as text:
    Dinic = [line.split(',') for line in text]
# make data integers
for i in range(len(ford_flukerson)):
    for j in range(len(ford_flukerson[i])):
        ford_flukerson[i][j] = ford_flukerson[i][j].rstrip('\n')
        ford_flukerson[i][j] = int(ford_flukerson[i][j])
        edmonds_karp[i][j] = edmonds_karp[i][j].rstrip('\n')
        edmonds_karp[i][j] = int(edmonds_karp[i][j])
        Dinic[i][j] = Dinic[i][j].rstrip('\n')
        Dinic[i][j] = int(Dinic[i][j])
```

Performance comparison

In [2]:
```
total_ford = 0
for line in ford_flukerson:
    total_ford += line[3]
total_edmonds = 0
for line in edmonds_karp:
    total_edmonds += line[3]
total_dinic = 0
for line in Dinic:
    total_dinic += line[3]
print(
    "Total time for ford flukerson is " + str(total_ford) + " milliseconds, which is "
    + str(total_ford/(1000*60*60)) + " hours.")
print(
    "Total time for edmonds karp is " + str(total_edmonds) + " milliseconds, which is "
    + str(total_edmonds/(1000)) + " seconds.")
print(
    "Total time for dinic is " + str(total_edmonds) + " milliseconds, which is "
    + str(total_dinic/(1000)) + " seconds.")
```

```
Total time for ford flukerson is 74524494 milliseconds, which is 20.701248333333332 hour
s.
Total time for edmonds karp is 56315 milliseconds, which is 56.315 seconds.
Total time for dinic is 56315 milliseconds, which is 1.971 seconds.
```

In [3]:
```
total_ford/total_edmonds
```

Out[3]:
```
1323.3506880937584
```

In [4]:
```
total_edmonds/total_dinic
```

Out[4]:
```
28.571790969051243
```

From the above we deduce that ford flukerson is more than 1300 times slower than edmonds karp and that dinic is 21 times faster than edmonds karp.

Performance difference on each test case

In [5]:
```
ctr_edmonds = 0
ctr_ford = 0
ctr_same = 0
for i in range(len(ford_flukerson)):
    print("================================================================")
    print("Test#" + str(i + 1))
    print("Number of nodes: " + str(ford_flukerson[i][0]))
    print("Number of edges: " + str(ford_flukerson[i][1]))
    print("Max Flow: " + str(ford_flukerson[i][2]))
    print("Time took by ford flukerson: " + str(ford_flukerson[i][3]))
    print("Time took by edmonds karp: " + str(edmonds_karp[i][3]))
    print("Time took by Dinic: " + str(Dinic[i][3]))
    print("================================================================")
```

```
================================================================
Test#1
Number of nodes: 292
Number of edges: 42296
Max Flow: 7551533
Time took by ford flukerson: 2595346
Time took by edmonds karp: 983
Time took by Dinic: 23
================================================================
================================================================
Test#2
Number of nodes: 374
Number of edges: 18946
Max Flow: 1710813
Time took by ford flukerson: 383112
Time took by edmonds karp: 213
Time took by Dinic: 31
================================================================
================================================================
Test#3
Number of nodes: 32
Number of edges: 35775
Max Flow: 53269950
Time took by ford flukerson: 18821
Time took by edmonds karp: 2600
Time took by Dinic: 17
================================================================
================================================================
Test#4
Number of nodes: 319
Number of edges: 14722
Max Flow: 2496153
Time took by ford flukerson: 350001
Time took by edmonds karp: 96
Time took by Dinic: 11
================================================================
================================================================
Test#5
Number of nodes: 351
```

```
Number of edges: 8508
Max Flow: 1343485
Time took by ford flukerson: 155305
Time took by edmonds karp: 43
Time took by Dinic: 8
================================================================
================================================================
Test#6
Number of nodes: 257
Number of edges: 32405
Max Flow: 6216967
Time took by ford flukerson: 1492679
Time took by edmonds karp: 468
Time took by Dinic: 38
================================================================
================================================================
Test#7
Number of nodes: 368
Number of edges: 29879
Max Flow: 4183913
Time took by ford flukerson: 1081498
Time took by edmonds karp: 496
Time took by Dinic: 17
================================================================
================================================================
Test#8
Number of nodes: 377
Number of edges: 42155
Max Flow: 5169099
Time took by ford flukerson: 2118126
Time took by edmonds karp: 623
Time took by Dinic: 32
================================================================
================================================================
Test#9
Number of nodes: 171
Number of edges: 12438
Max Flow: 4087840
Time took by ford flukerson: 123517
Time took by edmonds karp: 50
Time took by Dinic: 12
================================================================
================================================================
Test#10
Number of nodes: 106
Number of edges: 7791
Max Flow: 3621538
Time took by ford flukerson: 11048
Time took by edmonds karp: 30
Time took by Dinic: 36
================================================================
================================================================
Test#11
Number of nodes: 100
Number of edges: 30080
Max Flow: 14860593
Time took by ford flukerson: 186985
Time took by edmonds karp: 1473
Time took by Dinic: 25
================================================================
================================================================
Test#12
Number of nodes: 72
Number of edges: 5676
Max Flow: 3853918
```

```
Time took by ford flukerson: 2128
Time took by edmonds karp: 51
Time took by Dinic: 3
================================================================
================================================================
Test#13
Number of nodes: 52
Number of edges: 11429
Max Flow: 10036046
Time took by ford flukerson: 3133
Time took by edmonds karp: 133
Time took by Dinic: 8
================================================================
================================================================
Test#14
Number of nodes: 243
Number of edges: 46011
Max Flow: 9468701
Time took by ford flukerson: 3681020
Time took by edmonds karp: 733
Time took by Dinic: 54
================================================================
================================================================
Test#15
Number of nodes: 472
Number of edges: 7545
Max Flow: 461142
Time took by ford flukerson: 79830
Time took by edmonds karp: 20
Time took by Dinic: 8
================================================================
================================================================
Test#16
Number of nodes: 411
Number of edges: 43024
Max Flow: 4810117
Time took by ford flukerson: 2962709
Time took by edmonds karp: 220
Time took by Dinic: 27
================================================================
================================================================
Test#17
Number of nodes: 294
Number of edges: 7852
Max Flow: 1254953
Time took by ford flukerson: 99732
Time took by edmonds karp: 29
Time took by Dinic: 7
================================================================
================================================================
Test#18
Number of nodes: 339
Number of edges: 12610
Max Flow: 1278247
Time took by ford flukerson: 150920
Time took by edmonds karp: 24
Time took by Dinic: 6
================================================================
================================================================
Test#19
Number of nodes: 250
Number of edges: 47844
Max Flow: 8289874
Time took by ford flukerson: 2858696
Time took by edmonds karp: 996
```

```
Time took by Dinic: 31
================================================================
================================================================
Test#20
Number of nodes: 415
Number of edges: 10063
Max Flow: 1377622
Time took by ford flukerson: 225128
Time took by edmonds karp: 56
Time took by Dinic: 7
================================================================
================================================================
Test#21
Number of nodes: 420
Number of edges: 1117
Max Flow: 3994
Time took by ford flukerson: 0
Time took by edmonds karp: 0
Time took by Dinic: 0
================================================================
================================================================
Test#22
Number of nodes: 110
Number of edges: 36677
Max Flow: 15375424
Time took by ford flukerson: 291145
Time took by edmonds karp: 1091
Time took by Dinic: 26
================================================================
================================================================
Test#23
Number of nodes: 258
Number of edges: 36062
Max Flow: 6466940
Time took by ford flukerson: 1542134
Time took by edmonds karp: 469
Time took by Dinic: 24
================================================================
================================================================
Test#24
Number of nodes: 141
Number of edges: 44417
Max Flow: 14682472
Time took by ford flukerson: 1342594
Time took by edmonds karp: 973
Time took by Dinic: 30
================================================================
================================================================
Test#25
Number of nodes: 346
Number of edges: 12602
Max Flow: 1793164
Time took by ford flukerson: 276340
Time took by edmonds karp: 48
Time took by Dinic: 9
================================================================
================================================================
Test#26
Number of nodes: 445
Number of edges: 8226
Max Flow: 833501
Time took by ford flukerson: 114100
Time took by edmonds karp: 13
Time took by Dinic: 6
================================================================
```

```
==========================================================================
Test#27
Number of nodes: 84
Number of edges: 19531
Max Flow: 11318345
Time took by ford flukerson: 32084
Time took by edmonds karp: 299
Time took by Dinic: 12
==========================================================================
==========================================================================
Test#28
Number of nodes: 101
Number of edges: 47244
Max Flow: 22942730
Time took by ford flukerson: 768200
Time took by edmonds karp: 1809
Time took by Dinic: 36
==========================================================================
==========================================================================
Test#29
Number of nodes: 160
Number of edges: 29090
Max Flow: 9153164
Time took by ford flukerson: 444814
Time took by edmonds karp: 385
Time took by Dinic: 24
==========================================================================
==========================================================================
Test#30
Number of nodes: 92
Number of edges: 6839
Max Flow: 3443917
Time took by ford flukerson: 5730
Time took by edmonds karp: 48
Time took by Dinic: 4
==========================================================================
==========================================================================
Test#31
Number of nodes: 169
Number of edges: 25553
Max Flow: 7200214
Time took by ford flukerson: 458376
Time took by edmonds karp: 196
Time took by Dinic: 9
==========================================================================
==========================================================================
Test#32
Number of nodes: 219
Number of edges: 17907
Max Flow: 3561733
Time took by ford flukerson: 307818
Time took by edmonds karp: 56
Time took by Dinic: 11
==========================================================================
==========================================================================
Test#33
Number of nodes: 396
Number of edges: 12897
Max Flow: 1167579
Time took by ford flukerson: 150252
Time took by edmonds karp: 66
Time took by Dinic: 10
==========================================================================
==========================================================================
Test#34
```

```
Number of nodes: 98
Number of edges: 46311
Max Flow: 22415557
Time took by ford flukerson: 465946
Time took by edmonds karp: 3325
Time took by Dinic: 40
================================================================
================================================================
Test#35
Number of nodes: 137
Number of edges: 36107
Max Flow: 11900558
Time took by ford flukerson: 475420
Time took by edmonds karp: 410
Time took by Dinic: 29
================================================================
================================================================
Test#36
Number of nodes: 234
Number of edges: 45357
Max Flow: 9469420
Time took by ford flukerson: 2432396
Time took by edmonds karp: 846
Time took by Dinic: 35
================================================================
================================================================
Test#37
Number of nodes: 218
Number of edges: 38183
Max Flow: 8787699
Time took by ford flukerson: 1759380
Time took by edmonds karp: 798
Time took by Dinic: 19
================================================================
================================================================
Test#38
Number of nodes: 173
Number of edges: 39120
Max Flow: 10076362
Time took by ford flukerson: 983030
Time took by edmonds karp: 956
Time took by Dinic: 18
================================================================
================================================================
Test#39
Number of nodes: 206
Number of edges: 489
Max Flow: 70450
Time took by ford flukerson: 43
Time took by edmonds karp: 0
Time took by Dinic: 0
================================================================
================================================================
Test#40
Number of nodes: 257
Number of edges: 34255
Max Flow: 6239594
Time took by ford flukerson: 1384291
Time took by edmonds karp: 564
Time took by Dinic: 19
================================================================
================================================================
Test#41
Number of nodes: 471
Number of edges: 9586
```

```
Max Flow: 880325
Time took by ford flukerson: 146568
Time took by edmonds karp: 62
Time took by Dinic: 21
================================================================
================================================================
Test#42
Number of nodes: 161
Number of edges: 40025
Max Flow: 11593045
Time took by ford flukerson: 1004592
Time took by edmonds karp: 817
Time took by Dinic: 29
================================================================
================================================================
Test#43
Number of nodes: 143
Number of edges: 6487
Max Flow: 2045388
Time took by ford flukerson: 15870
Time took by edmonds karp: 43
Time took by Dinic: 4
================================================================
================================================================
Test#44
Number of nodes: 181
Number of edges: 32926
Max Flow: 8696594
Time took by ford flukerson: 979586
Time took by edmonds karp: 645
Time took by Dinic: 29
================================================================
================================================================
Test#45
Number of nodes: 12
Number of edges: 9287
Max Flow: 35255963
Time took by ford flukerson: 548
Time took by edmonds karp: 215
Time took by Dinic: 5
================================================================
================================================================
Test#46
Number of nodes: 326
Number of edges: 42415
Max Flow: 5806051
Time took by ford flukerson: 1799978
Time took by edmonds karp: 273
Time took by Dinic: 21
================================================================
================================================================
Test#47
Number of nodes: 34
Number of edges: 17443
Max Flow: 21817709
Time took by ford flukerson: 5403
Time took by edmonds karp: 446
Time took by Dinic: 12
================================================================
================================================================
Test#48
Number of nodes: 355
Number of edges: 23773
Max Flow: 2661820
Time took by ford flukerson: 427738
```

```
Time took by edmonds karp: 84
Time took by Dinic: 14
================================================================
================================================================
Test#49
Number of nodes: 321
Number of edges: 29221
Max Flow: 3975644
Time took by ford flukerson: 944826
Time took by edmonds karp: 277
Time took by Dinic: 27
================================================================
================================================================
Test#50
Number of nodes: 159
Number of edges: 43340
Max Flow: 14165346
Time took by ford flukerson: 1537592
Time took by edmonds karp: 1327
Time took by Dinic: 25
================================================================
================================================================
Test#51
Number of nodes: 226
Number of edges: 34477
Max Flow: 7362445
Time took by ford flukerson: 1369338
Time took by edmonds karp: 390
Time took by Dinic: 22
================================================================
================================================================
Test#52
Number of nodes: 464
Number of edges: 39721
Max Flow: 4124478
Time took by ford flukerson: 1874327
Time took by edmonds karp: 404
Time took by Dinic: 36
================================================================
================================================================
Test#53
Number of nodes: 350
Number of edges: 30586
Max Flow: 3838285
Time took by ford flukerson: 1066497
Time took by edmonds karp: 328
Time took by Dinic: 17
================================================================
================================================================
Test#54
Number of nodes: 62
Number of edges: 14438
Max Flow: 12284011
Time took by ford flukerson: 10013
Time took by edmonds karp: 180
Time took by Dinic: 10
================================================================
================================================================
Test#55
Number of nodes: 260
Number of edges: 33251
Max Flow: 6312124
Time took by ford flukerson: 1132808
Time took by edmonds karp: 299
Time took by Dinic: 27
```

```
====================================================================
====================================================================
Test#56
Number of nodes: 31
Number of edges: 18473
Max Flow: 28356847
Time took by ford flukerson: 5760
Time took by edmonds karp: 457
Time took by Dinic: 12
====================================================================
====================================================================
Test#57
Number of nodes: 72
Number of edges: 43328
Max Flow: 30238887
Time took by ford flukerson: 151733
Time took by edmonds karp: 1568
Time took by Dinic: 27
====================================================================
====================================================================
Test#58
Number of nodes: 402
Number of edges: 20477
Max Flow: 2807420
Time took by ford flukerson: 651805
Time took by edmonds karp: 136
Time took by Dinic: 19
====================================================================
====================================================================
Test#59
Number of nodes: 463
Number of edges: 23736
Max Flow: 2073432
Time took by ford flukerson: 572731
Time took by edmonds karp: 357
Time took by Dinic: 24
====================================================================
====================================================================
Test#60
Number of nodes: 378
Number of edges: 41991
Max Flow: 4534610
Time took by ford flukerson: 1466819
Time took by edmonds karp: 218
Time took by Dinic: 35
====================================================================
====================================================================
Test#61
Number of nodes: 304
Number of edges: 49741
Max Flow: 7287019
Time took by ford flukerson: 3282942
Time took by edmonds karp: 814
Time took by Dinic: 30
====================================================================
====================================================================
Test#62
Number of nodes: 140
Number of edges: 9925
Max Flow: 2761396
Time took by ford flukerson: 32369
Time took by edmonds karp: 25
Time took by Dinic: 4
====================================================================
====================================================================
```

```
Test#63
Number of nodes: 312
Number of edges: 30871
Max Flow: 5477114
Time took by ford flukerson: 1276601
Time took by edmonds karp: 178
Time took by Dinic: 19
================================================================
================================================================
Test#64
Number of nodes: 330
Number of edges: 35839
Max Flow: 5036102
Time took by ford flukerson: 1718302
Time took by edmonds karp: 300
Time took by Dinic: 40
================================================================
================================================================
Test#65
Number of nodes: 440
Number of edges: 30334
Max Flow: 3421107
Time took by ford flukerson: 1045253
Time took by edmonds karp: 304
Time took by Dinic: 24
================================================================
================================================================
Test#66
Number of nodes: 90
Number of edges: 16717
Max Flow: 8875038
Time took by ford flukerson: 28177
Time took by edmonds karp: 316
Time took by Dinic: 7
================================================================
================================================================
Test#67
Number of nodes: 221
Number of edges: 34811
Max Flow: 8418148
Time took by ford flukerson: 1517187
Time took by edmonds karp: 390
Time took by Dinic: 16
================================================================
================================================================
Test#68
Number of nodes: 345
Number of edges: 2675
Max Flow: 225792
Time took by ford flukerson: 17435
Time took by edmonds karp: 3
Time took by Dinic: 2
================================================================
================================================================
Test#69
Number of nodes: 93
Number of edges: 18000
Max Flow: 9892693
Time took by ford flukerson: 45933
Time took by edmonds karp: 219
Time took by Dinic: 11
================================================================
================================================================
Test#70
Number of nodes: 470
```

```
Number of edges: 8713
Max Flow: 736191
Time took by ford flukerson: 119336
Time took by edmonds karp: 9
Time took by Dinic: 5
================================================================
================================================================
Test#71
Number of nodes: 148
Number of edges: 32111
Max Flow: 9716799
Time took by ford flukerson: 553088
Time took by edmonds karp: 307
Time took by Dinic: 23
================================================================
================================================================
Test#72
Number of nodes: 466
Number of edges: 1760
Max Flow: 384752
Time took by ford flukerson: 29649
Time took by edmonds karp: 2
Time took by Dinic: 1
================================================================
================================================================
Test#73
Number of nodes: 23
Number of edges: 34793
Max Flow: 71859298
Time took by ford flukerson: 12442
Time took by edmonds karp: 2108
Time took by Dinic: 27
================================================================
================================================================
Test#74
Number of nodes: 485
Number of edges: 17392
Max Flow: 1206775
Time took by ford flukerson: 301455
Time took by edmonds karp: 73
Time took by Dinic: 10
================================================================
================================================================
Test#75
Number of nodes: 133
Number of edges: 45465
Max Flow: 17191918
Time took by ford flukerson: 1004602
Time took by edmonds karp: 3004
Time took by Dinic: 38
================================================================
================================================================
Test#76
Number of nodes: 350
Number of edges: 1820
Max Flow: 337436
Time took by ford flukerson: 13742
Time took by edmonds karp: 3
Time took by Dinic: 1
================================================================
================================================================
Test#77
Number of nodes: 414
Number of edges: 7476
Max Flow: 897963
```

```
Time took by ford flukerson: 115653
Time took by edmonds karp: 21
Time took by Dinic: 4
================================================================
================================================================
Test#78
Number of nodes: 47
Number of edges: 23039
Max Flow: 22932228
Time took by ford flukerson: 16584
Time took by edmonds karp: 877
Time took by Dinic: 14
================================================================
================================================================
Test#79
Number of nodes: 43
Number of edges: 43235
Max Flow: 46906083
Time took by ford flukerson: 43872
Time took by edmonds karp: 3235
Time took by Dinic: 33
================================================================
================================================================
Test#80
Number of nodes: 175
Number of edges: 2090
Max Flow: 562423
Time took by ford flukerson: 5600
Time took by edmonds karp: 3
Time took by Dinic: 2
================================================================
================================================================
Test#81
Number of nodes: 308
Number of edges: 26710
Max Flow: 4069987
Time took by ford flukerson: 913478
Time took by edmonds karp: 249
Time took by Dinic: 24
================================================================
================================================================
Test#82
Number of nodes: 455
Number of edges: 2412
Max Flow: 305958
Time took by ford flukerson: 24229
Time took by edmonds karp: 3
Time took by Dinic: 1
================================================================
================================================================
Test#83
Number of nodes: 104
Number of edges: 9972
Max Flow: 3824197
Time took by ford flukerson: 11027
Time took by edmonds karp: 139
Time took by Dinic: 6
================================================================
================================================================
Test#84
Number of nodes: 86
Number of edges: 26824
Max Flow: 15617901
Time took by ford flukerson: 87856
Time took by edmonds karp: 802
```

```
Time took by Dinic: 18
================================================================
================================================================
Test#85
Number of nodes: 485
Number of edges: 19804
Max Flow: 1663186
Time took by ford flukerson: 473005
Time took by edmonds karp: 109
Time took by Dinic: 16
================================================================
================================================================
Test#86
Number of nodes: 422
Number of edges: 9659
Max Flow: 607093
Time took by ford flukerson: 97395
Time took by edmonds karp: 30
Time took by Dinic: 7
================================================================
================================================================
Test#87
Number of nodes: 481
Number of edges: 48894
Max Flow: 4909696
Time took by ford flukerson: 3037768
Time took by edmonds karp: 429
Time took by Dinic: 32
================================================================
================================================================
Test#88
Number of nodes: 31
Number of edges: 49926
Max Flow: 77292152
Time took by ford flukerson: 42678
Time took by edmonds karp: 3607
Time took by Dinic: 34
================================================================
================================================================
Test#89
Number of nodes: 327
Number of edges: 17140
Max Flow: 2486568
Time took by ford flukerson: 362296
Time took by edmonds karp: 95
Time took by Dinic: 14
================================================================
================================================================
Test#90
Number of nodes: 149
Number of edges: 44473
Max Flow: 13383762
Time took by ford flukerson: 1124583
Time took by edmonds karp: 1340
Time took by Dinic: 38
================================================================
================================================================
Test#91
Number of nodes: 246
Number of edges: 43861
Max Flow: 8397805
Time took by ford flukerson: 2305761
Time took by edmonds karp: 509
Time took by Dinic: 40
================================================================
```

```
==========================================================================
Test#92
Number of nodes: 176
Number of edges: 41512
Max Flow: 10485570
Time took by ford flukerson: 1122195
Time took by edmonds karp: 711
Time took by Dinic: 42
==========================================================================
==========================================================================
Test#93
Number of nodes: 426
Number of edges: 12165
Max Flow: 1125359
Time took by ford flukerson: 215421
Time took by edmonds karp: 74
Time took by Dinic: 9
==========================================================================
==========================================================================
Test#94
Number of nodes: 52
Number of edges: 47148
Max Flow: 42140834
Time took by ford flukerson: 84923
Time took by edmonds karp: 1926
Time took by Dinic: 32
==========================================================================
==========================================================================
Test#95
Number of nodes: 93
Number of edges: 29234
Max Flow: 13871779
Time took by ford flukerson: 101323
Time took by edmonds karp: 731
Time took by Dinic: 20
==========================================================================
==========================================================================
Test#96
Number of nodes: 254
Number of edges: 34385
Max Flow: 7077528
Time took by ford flukerson: 1586589
Time took by edmonds karp: 285
Time took by Dinic: 21
==========================================================================
==========================================================================
Test#97
Number of nodes: 166
Number of edges: 41016
Max Flow: 12648466
Time took by ford flukerson: 1822960
Time took by edmonds karp: 667
Time took by Dinic: 29
==========================================================================
==========================================================================
Test#98
Number of nodes: 59
Number of edges: 45772
Max Flow: 37011565
Time took by ford flukerson: 130019
Time took by edmonds karp: 1760
Time took by Dinic: 32
==========================================================================
==========================================================================
Test#99
```

```
Number of nodes: 343
Number of edges: 16972
Max Flow: 2182652
Time took by ford flukerson: 482920
Time took by edmonds karp: 51
Time took by Dinic: 10
================================================================
================================================================
Test#100
Number of nodes: 414
Number of edges: 44505
Max Flow: 4537663
Time took by ford flukerson: 2339487
Time took by edmonds karp: 392
Time took by Dinic: 57
================================================================
```

The fastest time that ford flukerson performed was on test 21 where all of them finished the algorithm nearly instantaneously. If we take a closer look at that test case below

Test 21

Number of nodes: 420

Number of edges: 1117

Max Flow: 3994

Time took by ford flukerson: 0

Time took by edmonds karp: 0

Time took by Dinic: 0

we see that despite having a large number of nodes which is near the max number of nodes (500) It has a small max flow (less than 10^5)

Spearman Rank Correlation Coefficient between Big O Notation and real running time

First we need to get the data ready to calculate the correlation

In [6]:
```
from scipy.stats import pearsonr
```

In [7]:
```
time = []
bigo = []
# Ford Flukerson runs in O(E * MAX_FLOW)
for line in ford_flukerson:
    bigo.append(line[1] * line[2])
    time.append(line[3])
_, corr = pearsonr(time, bigo)
print("%.10f" % corr)
```

```
0.5621336621
```

In [8]:
```
time = []
bigo = []
# Edmonds Karp runs in O(V * E**2)
```

```
for line in edmonds_karp:
    bigo.append(line[0] * (line[1]**2))
    time.append(line[3]/1000)
_, corr = pearsonr(time, bigo)
print("%.10f" % corr)
```

```
0.3736263093
```

In [9]:

```
time = []
bigo = []
# Dinic runs in O(V**2 * E)
for line in Dinic:
    bigo.append((line[0]**2) * line[1])
    time.append(line[3]/1000)
_, corr = pearsonr(time, bigo)
print("%.10f" % corr)
```

```
0.0000483895
```

From the above we see that both of them exibit a positive correlation which enforces the mathematical analysis of the running times.