In [1]: !pip install plotly==4.7.1
!wget https://github.com/plotly/orca/releases/download/v1.2.1/orca-1.2.1-x86_64.AppImage -0 /usr/local/bin/orca
!chmod +x /usr/local/bin/orca
!apt-get install xvfb libgtk2.0-0 libgconf-2-4

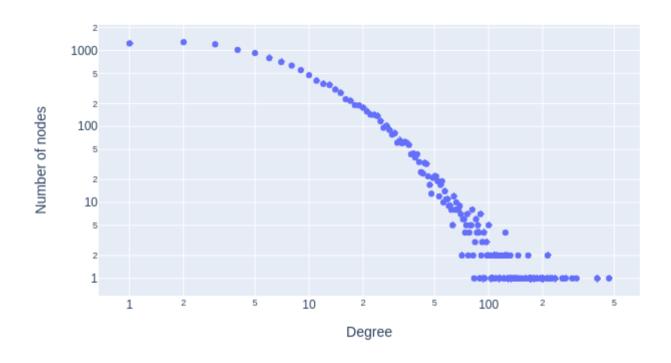
```
Collecting plotly==4.7.1
 Downloading https://files.pythonhosted.org/packages/d7/78/eb6cbe96c8379c54819592bb228c58ed7386fcc60a55eca7db99432fd
f14/plotly-4.7.1-py2.pv3-none-anv.whl (11.5MB)
                                     | 11.5MB 315kB/s
Requirement already satisfied: retrying>=1.3.3 in /usr/local/lib/python3.7/dist-packages (from plotly==4.7.1) (1.3.3)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from plotly==4.7.1) (1.15.0)
Installing collected packages: plotly
 Found existing installation: plotly 4.4.1
   Uninstalling plotly-4.4.1:
     Successfully uninstalled plotly-4.4.1
Successfully installed plotly-4.7.1
--2021-04-12 16:04:33-- https://github.com/plotly/orca/releases/download/v1.2.1/orca-1.2.1-x86 64.AppImage
Resolving github.com (github.com)... 192.30.255.113
Connecting to github.com (github.com)|192.30.255.113|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://github-releases.githubusercontent.com/99037241/9dc3a580-286a-11e9-8a21-4312b7c8a512?X-Amz-Algorithm
=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWNJYAX4CSVEH53A%2F20210412%2Fus-east-1%2Fs3%2Faws4 request&X-Amz-Date=2021041
2T160433Z&X-Amz-Expires=300&X-Amz-Signature=8b8a12109df1b8beb538c88dcee5c6f6565bec74c8d901ab073697469fc7a22d&X-Amz-Si
gnedHeaders=host&actor id=0&key id=0&repo id=99037241&response-content-disposition=attachment%3B%20filename%3Dorca-1.
2.1-x86 64.AppImage&response-content-type=application%2Foctet-stream [following]
--2021-04-12 16:04:33-- https://github-releases.githubusercontent.com/99037241/9dc3a580-286a-11e9-8a21-4312b7c8a512?
X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWNJYAX4CSVEH53A%2F20210412%2Fus-east-1%2Fs3%2Faws4 request&X-A
mz-Date=20210412T160433Z&X-Amz-Expires=300&X-Amz-Signature=8b8a12109df1b8beb538c88dcee5c6f6565bec74c8d901ab073697469f
c7a22d&X-Amz-SignedHeaders=host&actor id=0&key id=0&repo id=99037241&response-content-disposition=attachment%3B%20fil
ename%3Dorca-1.2.1-x86 64.AppImage&response-content-type=application%2Foctet-stream
Resolving github-releases.githubusercontent.com (github-releases.githubusercontent.com)... 185.199.109.154, 185.199.1
08.154, 185.199.110.154, ...
Connecting to github-releases.githubusercontent.com (github-releases.githubusercontent.com) | 185.199.109.154 | :443... c
onnected.
HTTP request sent, awaiting response... 200 OK
Length: 51607939 (49M) [application/octet-stream]
Saving to: '/usr/local/bin/orca'
in 1.7s
2021-04-12 16:04:35 (29.3 MB/s) - '/usr/local/bin/orca' saved [51607939/51607939]
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
```

```
gconf-service gconf-service-backend gconf2-common libdbus-glib-1-2
  libgail-common libgail18 libgtk2.0-bin libgtk2.0-common
Suggested packages:
  gvfs
The following NEW packages will be installed:
  gconf-service gconf-service-backend gconf2-common libdbus-glib-1-2
  libgail-common libgail18 libgconf-2-4 libgtk2.0-0 libgtk2.0-bin
  libgtk2.0-common xvfb
0 upgraded, 11 newly installed, 0 to remove and 31 not upgraded.
Need to get 3,715 kB of archives.
After this operation, 17.2 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu bionic/main amd64 libdbus-glib-1-2 amd64 0.110-2 [58.3 kB]
Get:2 http://archive.ubuntu.com/ubuntu bionic/universe amd64 gconf2-common all 3.2.6-4ubuntu1 [700 kB]
Get:3 http://archive.ubuntu.com/ubuntu bionic/universe amd64 libgconf-2-4 amd64 3.2.6-4ubuntu1 [84.8 kB]
Get:4 http://archive.ubuntu.com/ubuntu bionic/universe amd64 gconf-service-backend amd64 3.2.6-4ubuntu1 [58.1 kB]
Get:5 http://archive.ubuntu.com/ubuntu bionic/universe amd64 gconf-service amd64 3.2.6-4ubuntu1 [2,036 B]
Get:6 http://archive.ubuntu.com/ubuntu bionic/main amd64 libgtk2.0-common all 2.24.32-1ubuntu1 [125 kB]
Get:7 http://archive.ubuntu.com/ubuntu bionic/main amd64 libgtk2.0-0 amd64 2.24.32-1ubuntu1 [1,769 kB]
Get:8 http://archive.ubuntu.com/ubuntu bionic/main amd64 libgail18 amd64 2.24.32-1ubuntu1 [14.2 kB]
Get:9 http://archive.ubuntu.com/ubuntu bionic/main amd64 libgail-common amd64 2.24.32-1ubuntu1 [112 kB]
Get:10 http://archive.ubuntu.com/ubuntu bionic/main amd64 libgtk2.0-bin amd64 2.24.32-1ubuntu1 [7,536 B]
Get:11 http://archive.ubuntu.com/ubuntu bionic-updates/universe amd64 xvfb amd64 2:1.19.6-1ubuntu4.8 [784 kB]
Fetched 3,715 kB in 2s (2,141 kB/s)
Selecting previously unselected package libdbus-glib-1-2:amd64.
(Reading database ... 160983 files and directories currently installed.)
Preparing to unpack .../00-libdbus-glib-1-2 0.110-2 amd64.deb ...
Unpacking libdbus-glib-1-2:amd64 (0.110-2) ...
Selecting previously unselected package gconf2-common.
Preparing to unpack .../01-gconf2-common 3.2.6-4ubuntu1 all.deb ...
Unpacking gconf2-common (3.2.6-4ubuntu1) ...
Selecting previously unselected package libgconf-2-4:amd64.
Preparing to unpack .../02-libgconf-2-4 3.2.6-4ubuntu1 amd64.deb ...
Unpacking libgconf-2-4:amd64 (3.2.6-4ubuntu1) ...
Selecting previously unselected package gconf-service-backend.
Preparing to unpack .../03-gconf-service-backend 3.2.6-4ubuntu1 amd64.deb ...
Unpacking gconf-service-backend (3.2.6-4ubuntu1) ...
Selecting previously unselected package gconf-service.
Preparing to unpack .../04-gconf-service 3.2.6-4ubuntu1 amd64.deb ...
Unpacking gconf-service (3.2.6-4ubuntu1) ...
Selecting previously unselected package libgtk2.0-common.
Preparing to unpack .../05-libgtk2.0-common 2.24.32-1ubuntu1 all.deb ...
Unpacking libgtk2.0-common (2.24.32-1ubuntu1) ...
```

```
Selecting previously unselected package libgtk2.0-0:amd64.
Preparing to unpack .../06-libgtk2.0-0 2.24.32-1ubuntu1 amd64.deb ...
Unpacking libgtk2.0-0:amd64 (2.24.32-1ubuntu1) ...
Selecting previously unselected package libgail18:amd64.
Preparing to unpack .../07-libgail18 2.24.32-1ubuntu1 amd64.deb ...
Unpacking libgail18:amd64 (2.24.32-1ubuntu1) ...
Selecting previously unselected package libgail-common:amd64.
Preparing to unpack .../08-libgail-common 2.24.32-1ubuntu1 amd64.deb ...
Unpacking libgail-common:amd64 (2.24.32-1ubuntu1) ...
Selecting previously unselected package libgtk2.0-bin.
Preparing to unpack .../09-libgtk2.0-bin 2.24.32-1ubuntu1 amd64.deb ...
Unpacking libgtk2.0-bin (2.24.32-1ubuntu1) ...
Selecting previously unselected package xvfb.
Preparing to unpack .../10-xvfb 2%3a1.19.6-1ubuntu4.8 amd64.deb ...
Unpacking xvfb (2:1.19.6-1ubuntu4.8) ...
Setting up gconf2-common (3.2.6-4ubuntu1) ...
Creating config file /etc/gconf/2/path with new version
Setting up libgtk2.0-common (2.24.32-1ubuntu1) ...
Setting up libdbus-glib-1-2:amd64 (0.110-2) ...
Setting up xvfb (2:1.19.6-1ubuntu4.8) ...
Setting up libgconf-2-4:amd64 (3.2.6-4ubuntu1) ...
Setting up libgtk2.0-0:amd64 (2.24.32-1ubuntu1) ...
Setting up libgail18:amd64 (2.24.32-1ubuntu1) ...
Setting up libgail-common:amd64 (2.24.32-1ubuntu1) ...
Setting up libgtk2.0-bin (2.24.32-1ubuntu1) ...
Setting up gconf-service-backend (3.2.6-4ubuntu1) ...
Setting up gconf-service (3.2.6-4ubuntu1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.2) ...
/sbin/ldconfig.real: /usr/local/lib/python3.7/dist-packages/ideep4py/lib/libmkldnn.so.0 is not a symbolic link
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

```
In [2]: import pandas as pd
        import networkx as nx
        from collections import Counter
        import plotly.graph objects as go
        import numpy as np
        import pandas as pd
        from tgdm.autonotebook import tgdm
        /usr/local/lib/python3.7/dist-packages/ipykernel launcher.py:7: TqdmExperimentalWarning: Using `tqdm.autonotebook.tqd
        m' in notebook mode. Use 'tadm.tadm' instead to force console mode (e.g. in jupyter console)
          import sys
In [3]: def create graph(df):
          G=nx.Graph()
          edge list = [tuple(edge) for edge in df.values]
          for edge in edge list:
            G.add edge(edge[1],edge[0])
          return G
        def compute degree distribution(G, subtitle):
In [4]:
          node list=list(G.nodes)
          degree dict={}
          for node in node list:
            degree dict[node]=G.degree(node)
          degree dict final=dict(sorted(dict(Counter(degree_dict.values())).items()))
          figure = go.Figure()
          figure.add trace(go.Scatter(x=list(degree dict final),y=list(degree dict final.values()),mode='markers'))
          figure.update xaxes(type="log",title text="Degree")
          figure.update yaxes(type="log",title text="Number of nodes")
          figure.update layout(title="Degree distribution on log-log scale of the {}".format(subtitle))
          figure.show(renderer="png")
In [5]: path = "/content/drive/My Drive/"
        project name="2 TwitterFollowGraph"
        df facebook=pd.read csv(path+project name+"/Datasets/Facebook/athletes edges.csv")
        G=create graph(df facebook)
```

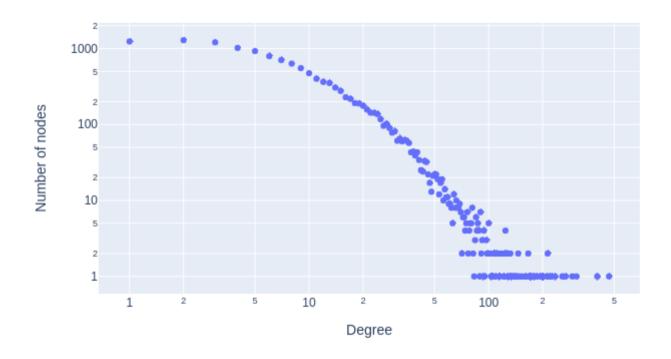
Degree distribution on log-log scale of the Facebook atheletes social pages network



```
In [8]: connected_components_length_list=[len(1) for 1 in list(nx.connected_components(G))]
    connected_components_length_list.sort(reverse=True)
    print("Size of top 10 connected components in the network:{}".format(connected_components_length_list[:10]))
```

Size of top 10 connected components in the network:[13866]

Degree distribution on log-log scale of the largest connected component



```
In [ ]: print("Average clustering coefficient of largest connected component is {}".format(nx.average_clustering(largest_connected_component)))
    print("Degree Assortavity Coeffecient of largest connected component is {}".format(nx.degree_assortativity_coefficient (largest_connected_component)))
```

Average clustering coefficient of largest connected component is 0.27618837043394373 Degree Assortavity Coeffecient of largest connected component is -0.026900174171377172

In []: print("Average path length of largest connected component is {}".format(nx.average_shortest_path_length(largest_connected_component)))
 print("Diameter of largest connected component is {}".format(nx.diameter(largest_connected_component)))

Average path length of largest connected component is 4.274808736799688 Diameter of largest connected component is 11