skills_jobs_transitions

December 18, 2022

[1]:
```
from google.colab import drive
```

[2]:
```
drive.mount('/content/drive/')
```

```
Mounted at /content/drive/
```

[3]:
```
!ln -s /content/gdrive/MyDrive/ /mydrive
!ls /mydrive
```

```
/mydrive
```

[4]:
```
!ls
```

```
drive  sample_data
```

[5]:
```
%cd ..
```

```
/
```

[6]:
```
%cd /content/drive/MyDrive/Colab Notebooks/Network Final Project
```

```
/content/drive/MyDrive/Colab Notebooks/Network Final Project
```

[7]:
```
import numpy as np
import pandas as pd
from collections import defaultdict
import json
import os
import glob
import networkx as nx
from networkx.algorithms import community
import networkx.algorithms.community as nx_comm
import matplotlib.pyplot as plt
import matplotlib.cm as cm
```

[8]:
```
jobs_excel=pd.read_excel('fossil_fuel.xlsx')
```

[9]:
```
jobs_titles=[]
for jobs in jobs_excel['Fossil Fuel Related Jobs']:
  jobs_titles.append(jobs)
for jobs in jobs_excel['Green Jobs']:
  jobs_titles.append(jobs)
```

[10]:
```
# jobs_titles
```

[11]:
```
jobs_list = [x for x in jobs_titles if str(x) != 'nan']
```

[12]:
```
jobs_list[14]
```

[12]:
```
'Sailors and Marine Oilers'
```

[13]:
```
csv=pd.read_csv('skills_jobs_csv/Auditory_Attention.csv')
```

[14]:
```
%cd skills_jobs_csv
```

```
/content/drive/MyDrive/Colab Notebooks/Network Final Project/skills_jobs_csv
```

[15]:
```
path = os.getcwd()
csv_files = glob.glob(os.path.join(path, "*.csv"))
```

[16]:
```
len(csv_files)
```

[16]:
```
52
```

[17]:
```
pd.set_option('display.max_rows', 1000)
```

[18]:
```
df = pd.read_csv("Arm-Hand_Steadiness.csv")
# print(df['Occupation'][0])
# print(jobs_list[0])
# print(type(df['Level'][0]))
# print(type("Not relevant"))
a=[]
for job in jobs_list:
  b=df.loc[df['Occupation'] == job]

  a.append(b.iloc[0]['Importance'])
print(a)
```

```
[69, 53, 75, 0, 69, 50, 50, 53, 50, 72, 0, 66, 72, 56, 66, 60, 35, 53, 44, 60,
44, 44, 25, 50, 47, 50, 0, 56, 31, 25, 50, 53, 35, 10, 25, 66, 0, 38, 53]
```

[19]:
```
for f in csv_files:
  print((f.split("/")[-1]).split(".")[0])
```

Perceptual_Speed
Flexibility_of_Closure
Memorization
Speed_of_Closure
Problem_Sensitivity
Originality
Information_Ordering
Inductive_Reasoning
Fluency_of_Ideas
Deductive_Reasoning
Category_Flexibility
Selective_Attention
Time_Sharing
Mathematical_Reasoning
Number_Facility
Spatial_Orientation
Visualization
Oral_Comprehension
Oral_Expression
Written_Comprehension
Written_Expression
Stamina
Dynamic_Flexibility
Extent_Flexibility
Gross_Body_Coordination
Gross_Body_Equilibrium
Dynamic_Strength
Explosive_Strength
Static_Strength
Trunk_Strength
Control_Precision
Multilimb_Coordination
Rate_Control
Response_Orientation
Arm-Hand_Steadiness
Finger_Dexterity
Manual_Dexterity
Reaction_Time
Speed_of_Limb_Movement
Wrist-Finger_Speed
Auditory_Attention
Hearing_Sensitivity
Sound_Localization
Speech_Clarity
Speech_Recognition
Depth_Perception
Far_Vision
Glare_Sensitivity

```
Near_Vision
Night_Vision
Peripheral_Vision
Visual_Color_Discrimination
```

[20]:
```
def create_onet_j_s(csv_files):

    if not os.path.isfile('onet_j_s.json'): # create onet file if doesn't exist
      onet_j_s = {}
      for f in csv_files:
        df = pd.read_csv(f)
        importance_score=[]
        for job in jobs_list:
          row=df.loc[df['Occupation'] == job]
          if row.iloc[0]['Level']=="Not relevant":
            importance_score.append(float(0))
          else:
            importance_score.append(float(row.iloc[0]['Importance']/100))
        # print(importance_score)

        onet_j_s[(f.split("/")[-1]).split(".")[0]]=importance_score
        my_json = json.dumps(onet_j_s)
        f = open("onet_j_s.json","w")
        f.write(my_json)
        f.close()
    else:
        print("opening json file")
        with open('onet_j_s.json') as json_file:
          onet_j_s = json.load(json_file)
    print('onet_j_s.json loaded')
    return onet_j_s
```

[21]:
```
onet_j_s=create_onet_j_s(csv_files)
```

```
opening json file
onet_j_s.json loaded
```

[22]:
```
len(jobs_list)
```

[22]: 39

[23]:
```
sum_j_over_s={}
for key,value in onet_j_s.items():
  sum_j_over_s[key]=sum(value)
```

[24]:
```
sum_s_over_j=np.zeros(len(jobs_list))
for key,value in onet_j_s.items():
```

```
  sum_s_over_j+=value
len(sum_s_over_j)
```

[24]: 39

[25]:
```
sum_s_over_j
```

[25]:
```
array([24.16, 22.21, 25.87, 16.8 , 26.86, 25.16, 20.4 , 23.77, 22.86,
       22.69, 16.84, 24.58, 24.51, 22.09, 26.36, 23.76, 19.92, 22.65,
       20.7 , 24.87, 20.77, 20.32, 18.25, 24.49, 20.39, 21.97, 15.37,
       23.4 , 18.59, 16.61, 22.92, 21.97, 21.72, 15.94, 15.63, 24.51,
       14.73, 21.62, 24.74])
```

[26]:
```
sum(sum_s_over_j)
```

[26]: 841.0000000000001

[27]:
```
sum_j_over_s
```

[27]:
```
{'Perceptual_Speed': 21.519999999999996,
 'Flexibility_of_Closure': 20.580000000000002,
 'Memorization': 14.500000000000002,
 'Speed_of_Closure': 16.500000000000004,
 'Problem_Sensitivity': 27.3,
 'Originality': 17.300000000000004,
 'Information_Ordering': 23.580000000000002,
 'Inductive_Reasoning': 24.040000000000006,
 'Fluency_of_Ideas': 18.44000000000001,
 'Deductive_Reasoning': 24.92,
 'Category_Flexibility': 21.089999999999996,
 'Selective_Attention': 21.48,
 'Time_Sharing': 17.520000000000003,
 'Mathematical_Reasoning': 18.17,
 'Number_Facility': 17.37,
 'Spatial_Orientation': 8.27,
 'Visualization': 19.689999999999994,
 'Oral_Comprehension': 25.630000000000003,
 'Oral_Expression': 24.98,
 'Written_Comprehension': 24.210000000000008,
 'Written_Expression': 22.36,
 'Stamina': 10.56,
 'Dynamic_Flexibility': 1.04,
 'Extent_Flexibility': 12.32,
 'Gross_Body_Coordination': 9.970000000000004,
 'Gross_Body_Equilibrium': 11.170000000000002,
 'Dynamic_Strength': 9.810000000000002,
 'Explosive_Strength': 3.9600000000000004,
```

```
 'Static_Strength': 11.710000000000004,
 'Trunk_Strength': 14.380000000000003,
 'Control_Precision': 17.909999999999997,
 'Multilimb_Coordination': 16.069999999999997,
 'Rate_Control': 12.519999999999998,
 'Response_Orientation': 11.880000000000004,
 'Arm-Hand_Steadiness': 17.449999999999996,
 'Finger_Dexterity': 17.290000000000006,
 'Manual_Dexterity': 15.97,
 'Reaction_Time': 14.649999999999999,
 'Speed_of_Limb_Movement': 6.539999999999999,
 'Wrist-Finger_Speed': 9.73,
 'Auditory_Attention': 17.050000000000004,
 'Hearing_Sensitivity': 16.7,
 'Sound_Localization': 7.25,
 'Speech_Clarity': 22.880000000000003,
 'Speech_Recognition': 22.680000000000003,
 'Depth_Perception': 14.970000000000002,
 'Far_Vision': 20.52999999999999,
 'Glare_Sensitivity': 8.42,
 'Near_Vision': 25.320000000000004,
 'Night_Vision': 6.149999999999999,
 'Peripheral_Vision': 6.7700000000000005,
 'Visual_Color_Discrimination': 17.900000000000002}
```

[28]:
```
a=0
for key,value in onet_j_s.items():
  a+=value[2]
a
```

[28]:
```
25.869999999999997
```

[29]:
```
rca_j_s={}
for key,value in onet_j_s.items():
  list_each_keys=[]
  for i in range(len(value)):
    list_each_keys.append((value[i]/sum_s_over_j[i])/(sum_j_over_s[key]/
 ↪sum(sum_s_over_j)))
  rca_j_s[key]=list_each_keys
```

[30]:
```
e_j_s={}
for key,value in rca_j_s.items():
  list_each_keys=[]
  for i in value:
    if(i>1):
      list_each_keys.append(int(1))
    else:
```

```
        list_each_keys.append(int(0))
    e_j_s[key]=list_each_keys
```

[31]:
```
len(e_j_s['Perceptual_Speed'])
```

[31]: 39

[32]:
```
len(jobs_list)
```

[32]: 39

[33]:
```
rca_j_s
```

[33]:
```
{'Perceptual_Speed': [0.857299693493193,
  0.8797822073515901,
  0.9063763196882328,
  1.1630930253142153,
  0.814771346400308,
  1.1183444542289938,
  1.0153117938625267,
  1.1344193815264942,
  1.1795778083501645,
  1.033404821081295,
  1.0907105140001236,
  0.9539444829265492,
  0.8450575518072441,
  0.9376351559436648,
  1.0229570826587544,
  1.0855534902932678,
  0.9809218285782537,
  0.9662144973206303,
  1.0005971301833596,
  0.9428208842112815,
  1.0536715630386269,
  0.903915603137898,
  1.134923868207975,
  1.1968127496087473,
  1.3799679484257723,
  1.1739986768032795,
  1.1950270042786002,
  0.7849386775966707,
  0.7988365652077406,
  0.8940621160272066,
  0.8013771839337736,
  0.8893929369721807,
  0.9536077621913233,
  0.9316418912930927,
```

```
 1.1001386619478797,
 0.8450575518072438,
 1.2469494267319814,
 1.1930042057987071,
 0.8845900713141581],
'Flexibility_of_Closure': [0.8457143500730472,
 0.9199666230420901,
 0.8372016319919101,
 1.2162177796288585,
 0.9128425330349138,
 1.0232471366925147,
 0.7011137788448712,
 0.9111655961140394,
 1.0010653430225982,
 0.954535311574734,
 1.2133289012924477,
 0.881139390546408,
 0.8836559045136971,
 0.813968476868857,
 0.8681469552919805,
 0.9631462012414396,
 1.0872693885356781,
 0.8479695883399085,
 1.1055243353379998,
 0.8708647454616286,
 1.1017984468703228,
 1.1261985109004233,
 1.343504133551659,
 1.201418559607241,
 1.2024987953564388,
 1.1160195920490577,
 1.3293727194381797,
 0.9779638351066928,
 0.9672169797758494,
 1.0825143680935005,
 0.9984447531193981,
 0.7626133879001886,
 0.9971641905907324,
 1.358745685045841,
 1.2288234917401748,
 0.883655904513697,
 1.3039043568159492,
 1.0584807466002133,
 0.8258875787293781],
'Memorization': [0.7442052980132449,
 0.6528590724898694,
 0.784692694240433,
```

```
 1.4154761904761903,
 0.7557706626954578,
 1.0143084260731314,
 0.796078431372549,
 0.6832141354648718,
 0.8880139982502184,
 0.7924195680916705,
 1.3087885985748215,
 0.7314890154597232,
 0.6625866993064057,
 0.6564056133997287,
 0.6820940819423369,
 1.0008417508417509,
 1.106425702811245,
 0.9730684326710816,
 1.2328502415458935,
 0.8862082830719739,
 1.1449205584978335,
 1.170275590551181,
 1.3983561643835614,
 1.0420579828501428,
 1.2515939185875429,
 1.0823850705507514,
 1.8867924528301885,
 0.9418803418803422,
 1.2791823561054327,
 1.3269114990969297,
 0.8856893542757417,
 0.8183887118798358,
 1.255064456721915,
 1.4918444165621074,
 1.4101087651951376,
 1.0412076703386373,
 1.102511880515954,
 1.0999074930619799,
 0.8908649959579625],
'Speed_of_Closure': [0.8016756973710614,
 0.6425715961960897,
 0.9260053179651169,
 1.3349206349206348,
 0.9488029964575012,
 1.0736859854506908,
 0.6995840760546642,
 0.8791575834066367,
 1.0479334022641105,
 1.0557848204388531,
 1.3317498020585903,
```

```
 0.8501861577532853,
 0.852614269994931,
 0.6460622522188845,
 0.79277601508254,
 0.9438832772166106,
 1.0490750882317144,
 0.990139808682855,
 1.2311521007173176,
 0.8402724470275732,
 1.1533826468828876,
 1.1036745406824147,
 1.3964300539643002,
 0.9157479243228527,
 1.1748777624206754,
 1.0207859201942047,
 1.2601486563750712,
 1.023750323750324,
 1.124129949304774,
 1.166073741630635,
 0.9784758580570099,
 0.8815878401677214,
 1.0325352977286675,
 1.311014790312155,
 1.23918649062603,
 0.9150006799945599,
 1.2110925960213128,
 1.1080368906455866,
 0.8446877832488175],
'Problem_Sensitivity': [0.9563077650825994,
 0.9154375565901905,
 0.8930960805719215,
 1.375261643118786,
 0.7569571158551054,
 0.8815667639197047,
 1.0872656755009693,
 0.8942382817014706,
 0.8489804159095495,
 0.9368022898212409,
 1.4268747879199184,
 0.7519738195084004,
 0.8672396554893496,
 0.7809543708140362,
 0.8063749603962047,
 0.8946146446146446,
 1.1598592170881326,
 0.9384566868010574,
 1.116154377023942,
```

```
 0.7432053270412736,
 1.023401249689165,
 1.137027342736004,
 1.485433288173014,
 0.9056847603193048,
 1.17844881944931,
 1.0936992002080763,
 1.4430852166701222,
 0.7898938668169441,
 1.0936992002080759,
 1.1127944902779339,
 0.8870797614253112,
 0.9675031386456051,
 1.0637382874951933,
 1.3914817929874386,
 1.182566633622296,
 0.942651799444945,
 1.3803033354968184,
 1.0259121082432834,
 0.9338882621016813],
'Originality': [0.7646039888221106,
 0.6128573027303745,
 0.7704373356332574,
 1.7361684558216346,
 0.5610551822982796,
 0.8501429004659193,
 0.6672333673353734,
 0.572636125100615,
 0.7442891892848651,
 0.8141398135717143,
 1.6165749042329711,
 0.5537656913605215,
 0.55534723352271,
 0.5501665545835875,
 0.6454647521643406,
 0.9002354956112182,
 1.1469867910950156,
 0.944352996720642,
 1.1037669989667973,
 0.7427757285863363,
 1.2404785693015437,
 1.5071856083018522,
 1.4916778842346976,
 0.6153508451013388,
 1.1920725052232901,
 1.1063431215977648,
 1.7711855164140036,
```

```
 0.9764092683167829,
 1.5689956997204657,
 1.5511583313903108,
 1.0604868403797072,
 0.9735819470060324,
 1.1190772735498564,
 1.433373706311964,
 1.6484158595261078,
 0.8726885098214011,
 2.0791589654238725,
 1.1917085977980144,
 0.8645753991803773],
'Information_Ordering': [0.9743145779620174,
 0.7065718206082048,
 0.6893277636305755,
 1.4648461165636737,
 0.7037559121306912,
 0.9355898332099497,
 0.9790616840459679,
 0.8402548739813945,
 0.8268978040170762,
 0.8802493765772477,
 1.5884420348981279,
 0.8125654334636999,
 0.7275768765860054,
 0.8072842573618376,
 0.7171048482484965,
 0.8406085166051241,
 1.1279852233360925,
 0.9447898937813501,
 1.137171024326683,
 0.8604540045897698,
 0.9101051420236095,
 1.2637494740638338,
 1.4657185680923,
 1.09225658912554,
 1.3118864084200335,
 1.1201372215871521,
 1.2994702898202828,
 0.8535409553221263,
 1.1511291605243452,
 1.1380423720548083,
 0.9336601699017271,
 0.9740323665975228,
 1.1822923256435127,
 1.4096277069545142,
 1.2093975559712329,
```

```
 0.8148861017763258,
 1.5254219720879136,
 1.0392907330645222,
 0.951472926578914],
'Inductive_Reasoning': [0.8687920794261218,
 0.7875587812897757,
 0.7572741475198854,
 1.5617571903969574,
 0.7293627027676631,
 0.8342613926444792,
 0.9088814394310135,
 0.7358721300986926,
 0.7651653776223061,
 0.8171521094928461,
 1.5580475533651352,
 0.7116224789440977,
 0.7564741478740384,
 0.7443268311679118,
 0.7033832080573854,
 0.7803527510266279,
 1.2644588336707894,
 0.818595203725946,
 1.2168125587788463,
 0.8439894104919621,
 1.061122651462776,
 1.1879192487586303,
 1.3801654776286094,
 1.0713565046414404,
 1.23531240641109,
 1.194243095069135,
 1.638778137067152,
 0.7475077150617918,
 1.1855576907413585,
 1.1162661868990174,
 0.9615845318883884,
 0.7961620633794225,
 1.1113498680835803,
 1.6460176159767173,
 1.5443710258973367,
 0.7992934392631347,
 1.6387317810438136,
 1.1164902467518676,
 0.975687919756482],
'Fluency_of_Ideas': [0.7173345448276849,
 0.5749691614552862,
 0.7228072617383595,
 1.8731600557793606,
```

```
 0.5942882109047796,
 0.8519660722353072,
 0.6259835821530345,
 0.6715431781616483,
 0.8778322449390134,
 0.8844092163642949,
 1.5166348071166158,
 0.5751947247378516,
 0.6512681087271474,
 0.5780925792631014,
 0.6055607490478899,
 0.8445810235398086,
 1.1447634355208247,
 0.8859710869450707,
 1.1677250673289523,
 0.8068856099439421,
 1.1637895471212962,
 1.346674466667805,
 1.5743915847027004,
 0.8752742497933987,
 1.1183760488266223,
 0.9756698396650134,
 1.661687062579298,
 0.9160455716854848,
 1.619196755188745,
 1.455262425870519,
 1.1143163242514753,
 0.9756698396650126,
 1.175880762055424,
 1.5164309218136331,
 1.5465072868655996,
 0.8187370509712709,
 1.8577342269307398,
 1.2656995912437465,
 0.8111255100770349],
'Deductive_Reasoning': [0.8381124233308175,
 0.7597477167819509,
 0.6913968533865774,
 1.5066068562256365,
 0.7538643390793951,
 0.8048011187469215,
 0.8767861077015076,
 0.752479452970583,
 0.7824337968989831,
 0.7882960157386848,
 1.5030282176122736,
 0.6864929532028937,
```

```
 0.7297607750759184,
 0.7180424165841334,
 0.6785446357022291,
 0.980055369100313,
 1.2706322883830667,
 0.8343874792271251,
 1.2227533905599364,
 0.8141856110845415,
 1.1211418184797033,
 1.2456198417613529,
 1.3869038457309966,
 1.033523690673364,
 1.1916898174206505,
 1.1520707867360356,
 1.5809079620824376,
 0.721110973919963,
 1.2526151463057251,
 1.3409798773293082,
 0.9276280957703396,
 0.8602128540962394,
 1.072104768408077,
 1.587891793261649,
 1.5546100689191982,
 0.908758701037936,
 1.5808632430294256,
 1.1238924781316868,
 0.9412334506800092],
'Category_Flexibility': [0.8747790139390001,
 0.8438567243278258,
 0.7707135451118527,
 1.709002235318025,
 0.742306753985243,
 0.8875581296299226,
 0.918728325849069,
 0.8388035091309898,
 0.8721942000019083,
 0.8787289295744217,
 1.4207857063213984,
 0.9085013239010928,
 0.8134785561829307,
 0.9025966234515,
 0.7563869276192575,
 0.8391565409109272,
 1.1210322560988384,
 0.827463922619029,
 1.0787904609414907,
 0.8498054272925708,
```

```
 1.0175571004702093,
 1.2363352785027053,
 1.6387692667433116,
 0.9118400384438081,
 1.0365208914549409,
 1.1434835165760118,
 1.4528928133694772,
 0.8520666415403263,
 1.136883323118141,
 1.200382866468611,
 1.0438931629342214,
 0.9075266004571515,
 0.9179723486207929,
 1.400938678888887,
 1.1991079876724893,
 0.8622872695539064,
 1.5160191813638062,
 1.0328844838801512,
 0.9026258100844324],
'Selective_Attention': [0.9723352695253247,
 0.7756500712263255,
 0.9080641713077637,
 1.2351744701605039,
 0.8745949408686465,
 1.0270581129930454,
 0.8444700040165042,
 0.8729882666679204,
 0.9591212644043331,
 0.9145408152797033,
 1.3019900299455498,
 0.8442201423391563,
 1.0063729546029558,
 0.9393812176865765,
 0.8317720828635456,
 0.9227909134799268,
 0.9827484986500938,
 0.9161558983971948,
 1.0024604395505536,
 0.9445766028038535,
 1.1875879209108542,
 1.2138878502617343,
 1.201397923522359,
 1.1510797931432506,
 1.1521147676180405,
 1.2296478438093599,
 1.3500931098696465,
 0.9369876967642338,
```

```
 1.1162415868045434,
 1.1078729131561276,
 0.8541164962089823,
 0.8910491621806947,
 0.9013052529056108,
 1.228127358413417,
 1.0270382006621943,
 0.8466312157770897,
 1.0897900255499047,
 1.0141309946476904,
 0.9970170217186108],
'Time_Sharing': [0.9338192491457253,
 0.8212907510089452,
 0.9277596270781375,
 1.3429210154381386,
 0.8399505978913152,
 0.9539404432635692,
 0.7294464589488763,
 0.7068068610331506,
 0.9869235808994191,
 1.057784995703456,
 1.2542164231716175,
 0.917863021129403,
 0.9792387414325345,
 1.1517071093554598,
 0.9105137159526333,
 1.0101490552403793,
 1.0602913938860463,
 1.0596530486760005,
 0.9507698586019011,
 1.0229678345662279,
 1.2942358468373996,
 1.1102890285118467,
 1.236223181334834,
 0.9212361396227327,
 1.1771035582398928,
 1.0924506851393456,
 1.0930903764969413,
 0.9026070327440193,
 1.1361487125449188,
 0.8958884866078914,
 0.9215097978276634,
 0.9613566029226234,
 1.0387234373554661,
 1.2346885867665842,
 0.8599257370061674,
 0.9204844169465821,
```

```
 1.140583780499524,
 1.1767442204284047,
 0.7373026507642954],
'Mathematical_Reasoning': [0.7279938913936441,
 0.45847450550196667,
 0.8408964087190111,
 1.5428361768482848,
 0.6031191309347352,
 0.9198148908078004,
 0.6352854845845878,
 0.9151867940076068,
 0.7693933690319528,
 0.5711689680707622,
 1.9789347636533814,
 0.7720457679102481,
 0.4154516020888895,
 0.5238239622617538,
 0.6672356758752067,
 0.9155719736347144,
 1.301187137100963,
 0.6334824037390308,
 1.117997229600206,
 0.8188756547807539,
 1.1810830626811617,
 1.4350198692142018,
 1.6738715781696456,
 0.9449792834922117,
 1.1349947352979044,
 1.116572381059979,
 2.3488852659889305,
 0.8109779903946114,
 1.5685639452626452,
 1.3096923596364127,
 0.9491269674328454,
 0.7373591195679099,
 1.0015649214346596,
 1.5389645678725044,
 2.0432955125245997,
 0.5287565844767683,
 1.5711162697029377,
 1.1988736249329877,
 0.9915559907796168],
'Number_Facility': [0.821642894996702,
 0.5449888630456595,
 0.8234788040552616,
 1.527435096087946,
 0.7390503478451348,
```

```
 0.9621782709256036,
 0.664544459119284,
 0.9573370205594829,
 0.80482887249917,
 0.6614901403183202,
 1.610060209742683,
 0.8076034313718601,
 0.4345858151960347,
 0.5479494182093302,
 0.5693934477929699,
 0.9577399401809304,
 1.288198273809111,
 0.6626583348266085,
 1.2396574692887674,
 0.8565901351391075,
 1.0956139132739002,
 1.3343215517749403,
 1.6713748314287742,
 0.9885016454262228,
 1.1160324168072047,
 1.16799770661254,
 2.268061394075667,
 0.9104015667055394,
 1.302227288676073,
 1.2825645190192423,
 0.8660947793682514,
 0.6831684699054473,
 1.047693415225548,
 1.518720533029372,
 1.951541309889644,
 0.5531092193404077,
 1.5448676835505029,
 1.2540894510669192,
 0.919801979737223],
'Spatial_Orientation': [1.3048339566133076,
 1.1446743108951762,
 1.7296042111777385,
 0.0,
 1.552273826126964,
 1.5359017884090789,
 1.3957844322735142,
 1.197896609944455,
 1.3790371125012033,
 1.120459076464604,
 0.0,
 1.2825381770454642,
 1.8255757218754833,
```

```
 2.025570889233504,
 1.9289238577376226,
 1.1984007751843306,
 1.2762658857922622,
 1.1224378121404797,
 0.9334127776901553,
 1.431142059629055,
 0.0,
 0.0,
 0.0,
 1.0381060206199209,
 0.0,
 0.0,
 0.0,
 1.3472131791357917,
 0.0,
 0.795910448608704,
 0.9761095319190246,
 1.43490161091386,
 1.1704979947045056,
 0.0,
 0.0,
 1.0372589328837971,
 0.0,
 1.646276735567744,
 1.1509297663047569],
'Visualization': [0.8839411541139318,
 0.8461637140650826,
 0.8750436559874818,
 1.423734552226173,
 0.8904966670662585,
 0.9506653607869514,
 0.9212400043816412,
 0.898444185250004,
 0.9342090237704546,
 0.828263379875958,
 1.4203527599406,
 0.8688371962324083,
 0.8713185754138149,
 0.9667731228335267,
 0.8587776699695051,
 1.0066809965235568,
 1.0720892712546481,
 0.9994427982514856,
 0.907888699970313,
 0.858706002548958,
 0.9048288921225558,
```

```
 0.9879260426372558,
 1.240404349610748,
 0.819708337541406,
 0.9845344377826895,
 0.9137304135816589,
 1.2227258353536423,
 0.9674093752306052,
 1.1487906553734584,
 1.2085886325339579,
 0.9876692574343873,
 1.283110793540201,
 0.9832420940788484,
 1.2593887820821226,
 1.448328815124514,
 0.9758768044634722,
 1.1018719548797267,
 1.1063247214338443,
 0.9668043846968352],
'Oral_Comprehension': [0.896384617570986,
 0.7387012525246279,
 0.7610307608150902,
 1.4648709659439274,
 0.6841154652569108,
 0.7825065891210801,
 0.7559883102675327,
 0.9525050757101111,
 0.7607588848506694,
 0.766458709020992,
 1.461391462461875,
 0.7075243331035925,
 0.6292191566486198,
 0.7427141158248979,
 0.8589167545382906,
 0.7319422604245079,
 1.2848506785628666,
 0.7243512061179684,
 1.1888807839544915,
 0.8312126687334417,
 1.2322689223385797,
 1.2111137907410423,
 1.402423315998482,
 0.8843059355049008,
 1.2069559699783219,
 1.1201562233890756,
 1.6011601969979168,
 0.925497964124574,
 1.3238209912779977,
```

```
 1.4816274670594811,
 1.0737274095924074,
 0.7915770645282795,
 1.1330493659234795,
 1.5439041548217047,
 1.2596203315602295,
 0.9237472725266969,
 1.6038994527320884,
 1.1838217167887284,
 0.8753699418154816],
'Oral_Expression': [0.9197092773556594,
 0.7124474906354621,
 0.7287778425291453,
 1.5029881047695302,
 0.7520536160872108,
 0.8028680496066166,
 0.8251699398734674,
 0.9347991645314571,
 0.736372124821467,
 0.7864025905607697,
 1.4394413392947136,
 0.7259346940530456,
 0.7280079469532381,
 0.7620401436586123,
 0.6769148247277642,
 0.7509879957838327,
 1.3182835424966481,
 0.7431994160449773,
 1.2198164328564298,
 0.8528415011864737,
 1.2157053519560956,
 1.1432177237853274,
 1.4389155159744236,
 0.9485579480325785,
 1.238361949981761,
 1.1493036031009611,
 1.6428236929165976,
 0.8632547063291663,
 1.2496064630079533,
 1.4593733987792283,
 1.0576000067069364,
 0.7662024020673067,
 1.2090335251626714,
 1.5207146896940384,
 1.2923966812605558,
 0.769215943950591,
 1.645634226321995,
```

```
 1.2146257246315098,
 0.8164979841593564],
'Written_Comprehension': [0.7620441719939489,
 0.4379360321039025,
 0.6713898664357276,
 1.550790700418953,
 0.5690466546287862,
 0.7731764128002916,
 0.8003296320593497,
 0.774547210575255,
 0.8509675654442407,
 0.8114141558119793,
 1.5471071120569122,
 0.7490230754830678,
 0.4960505545199752,
 0.6919236370905028,
 0.6589095540475065,
 0.7310124513759374,
 1.1509482788651504,
 0.8588573309516708,
 1.2586127423690048,
 0.8799661585971956,
 1.2543709083793166,
 1.282149791684961,
 1.4846802804230106,
 0.9787268707911526,
 1.2777481003942328,
 1.1384229593243915,
 1.8306796661289186,
 0.8907105561380656,
 1.457526364589561,
 1.3803064247437569,
 1.136705225437976,
 0.7431372095589771,
 1.199506619108582,
 1.6344594584089334,
 1.5335266196849222,
 0.7936808872319602,
 1.7687225911091928,
 1.2532569434653078,
 0.8424667345849118],
'Written_Expression': [0.8717968463078581,
 0.3725617962867055,
 0.7269386702329593,
 1.6790985177613087,
 0.6161278849983417,
 0.8969429284066763,
```

```
 0.7559235679960714,
 0.8861006229195565,
 0.9213740947855578,
 0.8288190127336561,
 1.5411013474179798,
 0.6732788849086841,
 0.47571032669663527,
 0.47674540078763844,
 0.6706202274275819,
 0.8389839058443712,
 1.2461743216156216,
 0.8302827107693888,
 1.2537268932617767,
 0.8469083959307538,
 1.2495015257832829,
 1.3327018156719679,
 1.5456906903227385,
 0.7679013229451471,
 1.2174493617745554,
 1.1812538320673098,
 1.8353191345731936,
 0.8036710854242164,
 1.396027256079547,
 1.4265766575946772,
 1.13229261302438,
 0.6505455886747498,
 1.2987502347325035,
 1.6989021891125706,
 1.443831355003966,
 0.7672747204784438,
 1.9150614459192117,
 1.14818651649321,
 0.7601416086874151],
'Stamina': [1.1537273605257876,
 1.7928894983149823,
 1.354529055534081,
 0.0,
 1.8679558992757057,
 1.2028321770968826,
 1.7177287581699345,
 1.37368372407287,
 1.0799845568546353,
 0.8774807350721852,
 0.0,
 1.5228181941465098,
 1.4296885624915003,
 1.586313565716011,
```

```
 1.5106250287395964,
 1.173150380063259,
 0.0,
 1.089997658706268,
 0.9618375786854045,
 1.120790230410254,
 0.9585959498694213,
 0.8622457349081365,
 0.0,
 0.8129864384968508,
 0.0,
 1.0149860001931013,
 0.0,
 1.2933016058016062,
 0.9424870001793078,
 0.9109951106489338,
 1.2161454201702893,
 1.7037265003241326,
 0.9166684106255928,
 0.0,
 0.0,
 1.624646093740341,
 0.0,
 0.0,
 1.2232521251316721],
'Dynamic_Flexibility': [0.0,
 4.7332282755515545,
 0.0,
 0.0,
 0.0,
 0.0,
 6.342383107088991,
 0.0,
 0.0,
 0.0,
 0.0,
 4.276851098454028,
 4.289065687474502,
 0.0,
 0.0,
 3.4034252784252796,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
```

```
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 3.455785667324131,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 6.268634466308886,
 0.0,
 0.0,
 3.2686089173558854],
'Extent_Flexibility': [1.1584364517932397,
 1.7211739183823835,
 1.3193464826630659,
 0.0,
 1.6773481544516544,
 1.112393667540726,
 1.271565444359562,
 1.4359063317834881,
 0.9257010487325447,
 1.0529768820866223,
 0.0,
 1.3052727378398656,
 1.4761070223126531,
 1.5451106159571537,
 1.3725107403976906,
 1.522701309633128,
 0.0,
 1.0548364439092917,
 0.8244322103017754,
 1.372396200502352,
 0.7230552307586493,
 0.6382858037631661,
 0.0,
 1.2264481129323923,
 0.0,
 0.8699880001655155,
 0.0,
 1.7503330003330013,
 0.8078460001536925,
 0.7808529519848004,
```

```
 1.131759819587045,
 1.4603370002778282,
 0.9742875678649159,
 0.0,
 0.0,
 1.476107022312653,
 0.0,
 0.7893499885868067,
 1.3796076599229385],
'Gross_Body_Coordination': [1.4314881731286568,
 1.7850489785430126,
 1.434686742872607,
 0.0,
 1.7586639292411854,
 1.2740128174667078,
 1.2818357031879948,
 1.4549749374332501,
 1.033195825446593,
 0.9294078798758548,
 0.0,
 1.4070282450280045,
 1.4110466855482806,
 1.336512934003459,
 1.5040188851836234,
 1.2425745249215658,
 0.0,
 1.042775124490469,
 1.0187567533518425,
 1.3906214018008982,
 0.7716457026351079,
 0.7887343131757476,
 0.0,
 0.8610969699625619,
 0.0,
 0.9598663993802071,
 0.0,
 1.5861258990647156,
 0.7260080402584836,
 0.9649055535057911,
 1.3985236687374512,
 1.4589969270579137,
 0.9709145853767559,
 0.0,
 0.0,
 1.6175413224577848,
 0.0,
 0.0,
```

```
 1.2956411676419712],
'Gross_Body_Equilibrium': [1.371192942306438,
 1.5932800641068792,
 1.45517893163912,
 0.0,
 1.6818531181610137,
 1.2269194256134057,
 1.4024786279776011,
 1.3936904285285463,
 1.1527486996086094,
 0.9291083392878916,
 0.0,
 0.9495604945538038,
 0.7679616271216655,
 0.954344419123688,
 1.513816680546065,
 1.2992126577623446,
 0.8315266437280006,
 0.9307491487170975,
 0.8001937557034671,
 1.3320475064786301,
 0.7974969062620016,
 0.7040000986895439,
 0.0,
 1.168254961647328,
 0.0,
 0.9595570422595479,
 0.0,
 1.5122542830689656,
 1.0125196062803665,
 0.9972312307683187,
 1.5439245298348077,
 1.5078753521221453,
 0.8666086317104976,
 0.0,
 0.0,
 1.6280786494979305,
 0.0,
 0.6616689179172772,
 1.4303456032261022],
'Dynamic_Strength': [1.348384200471204,
 1.5825676599193772,
 1.4580863227767473,
 0.0,
 1.4043444962857203,
 0.954057133226048,
 1.4708380803901577,
```

```
 1.6951013299814692,
 1.1625521835254788,
 0.9445664181816792,
 0.0,
 1.6392416034849275,
 1.5389919694098104,
 1.474737993815496,
 1.5285492645546104,
 1.010272620874048,
 0.0,
 0.9462345266464591,
 0.5383937321179707,
 1.413302280933227,
 0.660405185280071,
 0.8015984813824877,
 0.0,
 0.8751413649874356,
 0.0,
 0.9755217127238192,
 0.0,
 1.6119954346254044,
 0.8761958656101207,
 0.9806430548881487,
 0.9350877848404147,
 1.482793003340204,
 0.9867500933951333,
 0.0,
 0.0,
 1.8537857813345442,
 0.0,
 0.6344410591242866,
 1.4207286874215586],
'Explosive_Strength': [0.0,
 1.5299323718954516,
 0.0,
 0.0,
 0.0,
 0.0,
 1.9779906912259855,
 0.8934528286652814,
 0.0,
 1.778360956412962,
 0.0,
 2.4192289041760158,
 1.906251416655334,
 1.5382434576640105,
 1.772466700387793,
```

```
 1.6982748359010986,
 0.0,
 1.2189221129618482,
 1.0259600839310983,
 3.7573158200419945,
 1.3292530504855975,
 0.0,
 0.0,
 1.3874968550346254,
 0.0,
 0.0,
 0.0,
 3.1765302598635943,
 2.5132986671448205,
 0.0,
 0.0,
 0.0,
 2.4444490950015805,
 0.0,
 0.0,
 1.3863646666584244,
 0.0,
 0.0,
 2.6611098862513565],
'Static_Strength': [1.397140328354663,
 1.810833704053882,
 1.471358632484501,
 0.0,
 1.764724958398324,
 1.1703407330573647,
 1.8658846971751974,
 1.5107058930463337,
 0.9739228796229672,
 0.9812197896950656,
 0.0,
 1.5485780236930036,
 1.4650950256104187,
 1.4305270071700318,
 1.4440078840050847,
 1.2393002038604086,
 0.0,
 1.395158569023664,
 0.9714641682859108,
 1.1839876495264694,
 0.8644554424099988,
 0.6715355339335785,
 0.0,
```

```
 0.7331457549553153,
 0.0,
 0.9153076141792611,
 0.0,
 1.4425175356003708,
 0.8499284988807418,
 0.9512444788797709,
 1.1907157111282998,
 1.6344778824629647,
 0.8266454667981432,
 0.0,
 0.0,
 1.4650950256104183,
 0.0,
 0.0,
 1.1031206183937194],
'Trunk_Strength': [1.0651060615829562,
 1.4746079745807343,
 1.1303441353552828,
 0.34811908073382336,
 1.3717395199131746,
 0.9530382464604827,
 1.4334315089039784,
 1.2302062592192329,
 0.9721750706057427,
 1.2114359900723974,
 0.5556675112900933,
 1.2610464991269175,
 1.2646480191162643,
 1.4031925282272362,
 1.109332427224627,
 1.2307240227963454,
 0.8220643352268601,
 0.9811886143067233,
 0.8758474263100249,
 1.1757942413205127,
 0.9855272964443338,
 0.7195374700206979,
 0.4165983957932439,
 0.7403038678896495,
 0.6310191870486569,
 0.7453582866508448,
 0.38050751830372365,
 1.2496582385316741,
 0.8808779751328161,
 0.8802529434569888,
 0.9696301096879271,
```

```
 1.3309969404479358,
 0.8347164698258526,
 0.9172522829874892,
 0.0,
 1.2646480191162643,
 0.6352641473268957,
 0.8385773230627903,
 1.3238093417719523],
'Control_Precision': [1.4576885531409811,
 1.2685368912700983,
 1.361335734205107,
 0.5310613916141556,
 1.2587135229385948,
 1.0451480152928572,
 1.2890158855278575,
 1.1852841546112278,
 1.2324673821132492,
 1.3037864509856472,
 0.4461473373730623,
 1.2608472250048728,
 1.4368729271271365,
 1.4667421914158092,
 1.2825889691248356,
 1.1067308108067466,
 0.966484587148146,
 1.4304783668156826,
 0.7032208816492554,
 1.189501993279627,
 0.7912832229407888,
 0.8088067195118199,
 0.4116778718554722,
 0.9586975757148796,
 1.082383198210003,
 0.9404225395423998,
 0.0,
 0.9431535645941012,
 0.7830377756933614,
 0.5371361456422525,
 1.0243675230915101,
 1.13278169535789,
 0.6701966965994286,
 0.0,
 0.6609431603885643,
 1.072865118921595,
 0.0,
 0.8253313024160792,
 1.195752407957329],
```

```
'Multilimb_Coordination': [1.494625129297733,
 1.5551614993722593,
 1.3958308126723324,
 0.40496192254126306,
 1.4612865066784793,
 0.9776138377112057,
 1.436607001232354,
 1.1668816408230822,
 1.1446531224667236,
 1.5222625342026395,
 0.3107692444131746,
 1.5329596967700811,
 1.4732820531959707,
 1.4214633071755172,
 1.3103238581584935,
 1.1673727526247755,
 0.99833059681164,
 1.293897696474173,
 0.7078933049550729,
 1.1783989877418581,
 0.7055075306966785,
 0.6438673813875321,
 0.0,
 0.8761433936816344,
 1.052317396334636,
 0.6669727543272652,
 0.0,
 0.9840494843606238,
 0.7037861855726009,
 0.6931594802540213,
 0.9361584516257954,
 1.1910227755844012,
 0.7469335927875398,
 0.0,
 0.6361722805018514,
 1.195707173608324,
 0.0,
 0.6777701855952829,
 1.1845910600299117],
'Rate_Control': [1.6681918202399342,
 1.5122135065659918,
 1.2982706602563079,
 0.0,
 1.3254444415368771,
 1.3349070739598834,
 1.0207589425546577,
 1.412968530956276,
```

```
 1.3810623911627657,
 1.4802230930291178,
 0.0,
 1.8036560543001015,
 1.8088072547815794,
 1.702879738276613,
 1.2741374044321199,
 1.3287494218005405,
 0.8430286641774768,
 1.5718074039594048,
 0.908613850689139,
 1.4315013148243068,
 1.1319394986317513,
 0.6280895449171092,
 0.36806862444745947,
 0.8502851134387511,
 0.8235964193435674,
 0.7643664538195424,
 0.0,
 0.803773790994239,
 0.0,
 0.0,
 0.8206067499679399,
 0.7643664538195418,
 0.7731644102401167,
 0.0,
 0.8165565932639578,
 0.8495912863368021,
 0.0,
 0.8699494315108782,
 1.0317525911653722],
'Response_Orientation': [1.2013415055633594,
 1.4024380075708305,
 1.2861184971737734,
 0.0,
 1.4759157722672238,
 1.3224119841766893,
 1.735079553707004,
 1.2210521991758843,
 1.5483649560639932,
 1.3727698610907073,
 0.0,
 1.526418237158676,
 1.530777652768677,
 1.410056502858676,
 1.2622111351246403,
 1.2215661100341233,
```

```
 0.8884443497897311,
 1.3751941787261872,
 0.7523707282161385,
 1.2524386066806645,
 0.44308435016186576,
 0.7664406532516768,
 0.0,
 1.185153563675409,
 1.4234630100250498,
 0.9022097779494233,
 0.0,
 0.9378327433882991,
 0.0,
 0.0,
 0.9574732196896245,
 0.9988751113011461,
 0.8148163650005267,
 0.0,
 0.8605461740458541,
 1.3574820694363734,
 0.0,
 0.9168153941511945,
 1.0873352223392638],
'Arm-Hand_Steadiness': [1.3764255488718953,
 1.1500795351483435,
 1.3972219484019177,
 0.0,
 1.2380655718817941,
 0.9577671384514465,
 1.181246137423451,
 1.0746010296863573,
 1.0541304113490113,
 1.529320693387012,
 0.0,
 1.2940844584433968,
 1.4157603644614978,
 1.2217796173766875,
 1.2066993925849279,
 1.2170414749211316,
 0.8467969298397028,
 1.1277380342447993,
 1.0244314328031783,
 1.1627223741104171,
 1.0209788473291188,
 1.0435891072355215,
 0.6602033206421479,
 0.9839698327251286,
```

```
 1.1109159358132465,
 1.0968330088046614,
 0.0,
 1.1533808439252575,
 0.8036794591786879,
 0.7253889585622639,
 1.051370907654381,
 1.1626429893329404,
 0.776620388692766,
 0.0,
 0.7708707998540757,
 1.297780334089706,
 0.0,
 0.847087886892377,
 1.0324683296541917],
'Finger_Dexterity': [1.268366088425342,
 1.095021000705969,
 0.9401011374441275,
 0.8106805475226525,
 1.014105226982916,
 1.0246280370119374,
 1.0491160026763737,
 1.0231559287202179,
 1.06388523296936,
 1.5434728802546758,
 0.7221026254655455,
 0.9894392361952634,
 0.9922650520473106,
 1.034911337262961,
 0.9226258128103026,
 1.023586549902339,
 1.1476501726977308,
 1.0093241253924414,
 0.9634174622732969,
 1.0952499556397715,
 0.7259825798710321,
 1.1250586338650983,
 0.5863552453314527,
 0.9334908713817394,
 1.1211962452250515,
 1.040564016392299,
 0.5063456900596919,
 1.1016940774025796,
 0.9157768422794889,
 1.024942293677044,
 1.0611001930924773,
 1.239820955701462,
```

```
 0.6942291981547576,
 0.4882392256096275,
 1.1825666336222955,
 1.369325771825288,
 0.6274106070440081,
 0.7874325392218181,
 1.1010051090040873],
'Manual_Dexterity': [1.503984084396654,
 1.5648995175273765,
 1.2213662116274744,
 0.0,
 1.3528017676479214,
 1.1093186449553165,
 1.3681596621115573,
 1.1741883511601083,
 1.0136021663541273,
 1.6710485973452318,
 0.0,
 1.4140121352434107,
 1.2891368378132504,
 1.3350065324497928,
 1.2585956407262102,
 1.1081910737514997,
 0.8195273265887596,
 1.1624997753790565,
 0.7886465867462844,
 1.2704762321995475,
 0.8874065449511286,
 0.9070587568225856,
 0.4616875820245151,
 1.010648538897325,
 0.9039447738418314,
 1.0546629732751647,
 0.0,
 1.1252401671938308,
 0.8781594591526676,
 0.3170453932851973,
 1.0798770819195243,
 1.2703894905359927,
 0.7516106973134479,
 0.0,
 0.0,
 1.4180505215945751,
 0.0,
 0.7550871575230388,
 1.277152138027597],
'Reaction_Time': [1.2593235088036527,
```

```
 1.2923490172154415,
 1.397984936496608,
 0.0,
 1.4746924388626148,
 1.3689859303189957,
 1.575854915344978,
 1.2075335158752611,
 1.5067229224333307,
 1.4168109419584645,
 0.0,
 1.5414180068148307,
 1.6160848187617236,
 1.5592433683488438,
 1.1542206362934846,
 1.2080417370519763,
 0.8069136614718261,
 1.4193130363371986,
 0.7765082191554963,
 1.3849491759881758,
 0.9673639947351211,
 0.5367700411168742,
 0.4089204731403993,
 1.2423542659328808,
 1.3232411658662901,
 0.8100093052735585,
 0.0,
 0.9322365158542638,
 0.0,
 0.0,
 0.7012966900749903,
 0.9145266349862748,
 0.7400423635597962,
 0.0,
 0.5876508595747657,
 1.1710759556244372,
 0.0,
 1.0089886434315343,
 1.0905775008897998],
'Speed_of_Limb_Movement': [1.3306423030965837,
 2.373851489879067,
 2.336251948994562,
 0.0,
 2.537395169425337,
 1.7888571247988405,
 1.386790190082149,
 1.8934642515750462,
 1.5750707002603268,
```

```
 1.0768057167271148,
 0.0,
 1.83106774857359,
 1.6264346949444597,
 1.8046135976952788,
 1.8537725123321878,
 1.3530436886706005,
 1.0328776881225208,
 1.7599962195624148,
 0.0,
 0.0,
 0.0,
 0.0,
 0.0,
 1.1551866017834154,
 0.0,
 1.1120947525051543,
 0.0,
 1.2089965759690537,
 0.0,
 0.0,
 1.2343158759893478,
 2.0485955967200193,
 0.0,
 0.0,
 0.0,
 1.154243977057358,
 0.0,
 0.0,
 0.0],
'Wrist-Finger_Speed': [0.7870619303989164,
 1.3620800792954109,
 1.570307065408472,
 0.0,
 1.4158910080742981,
 1.4084984567422143,
 1.186345041613768,
 1.4908633223236905,
 1.323350768204334,
 0.9523326374473048,
 0.0,
 1.4417339776905662,
 1.0932048206512606,
 0.8608155834512372,
 1.3443786483927969,
 1.0185790761330333,
 0.0,
```

```
 1.335620245525434,
 0.0,
 1.2163972079272645,
 1.5813582025225135,
 0.8081892191533614,
 0.0,
 0.8823367718938073,
 1.0597561325983005,
 0.9835424462302845,
 0.0,
 1.4036243532646417,
 1.0228841440794956,
 0.0,
 0.8296429423402192,
 1.101567539777918,
 0.9948631465782385,
 1.355610259954789,
 0.8847980568109266,
 1.0932048206512601,
 0.5867868986742525,
 1.5191863953003057,
 1.2227889475000433],
'Auditory_Attention': [1.0820580295585633,
 1.11043478605315,
 1.067734340550032,
 0.734010613042871,
 1.1569275247126949,
 1.29391250833376,
 0.7495543672014259,
 1.0375581236112943,
 1.5535594707553047,
 1.0869438782829646,
 0.9080112286763115,
 1.1237708458107942,
 1.0062324193488565,
 1.1164670257238785,
 1.2350090557540752,
 0.9757151179438568,
 0.9409485449127888,
 1.0888634259708814,
 1.0484650148044252,
 1.0511669478944465,
 1.0449314302576607,
 0.9224259357609623,
 1.0270517816253562,
 1.3293115030493021,
 1.209551574214834,
```

```
 1.055211251813657,
 0.0,
 0.8010126074642205,
 0.8225341092473957,
 0.6533180555825289,
 0.7532255505570823,
 0.8531495227429561,
 0.7040013393604551,
 1.0830570651673979,
 0.6942810558685736,
 1.006232419348856,
 0.8371607806598936,
 1.0722937651408901,
 0.93706512539798],
'Hearing_Sensitivity': [0.9171392314708332,
 1.0656849291062183,
 1.226376007166186,
 1.0491516966067866,
 1.1811745087635601,
 1.2609835971935301,
 0.6171480568275215,
 1.0593033537468608,
 1.1675598933366862,
 1.0431406908527594,
 0.8373277198571979,
 1.2907382955813356,
 1.2944246146629637,
 1.0714740731303356,
 1.0698481640664048,
 0.9325792858726993,
 1.0365113147199576,
 1.1116839169343433,
 0.7541728137927044,
 1.0124503706699988,
 0.994092700492131,
 1.0161075486821634,
 1.1313591994094003,
 1.233792113608634,
 1.234901457506762,
 1.0085609391140347,
 0.7208225059315333,
 0.8823634781718618,
 0.8397728480639581,
 0.6670103501606061,
 0.9008422944686545,
 0.8022643833861632,
 0.6491988398892823,
```

```
 0.8846046927475038,
 0.8054907459553065,
 0.9656818553834804,
 0.8547060664821073,
 0.9550094999639946,
 0.895637988372487],
'Sound_Localization': [0.9122516556291391,
 1.6190904997748763,
 1.9729416312330892,
 0.0,
 1.511541325390916,
 1.2909379968203496,
 1.0803921568627453,
 1.220025241901557,
 1.268591426071741,
 1.2780960775672106,
 0.0,
 1.3213995117982102,
 1.9404324765401884,
 1.3128112267994576,
 2.2003034901365712,
 1.3670033670033674,
 0.9317269076305222,
 1.4339955849889627,
 0.7285024154589371,
 1.7724165661439482,
 0.0,
 0.0,
 0.0,
 1.3262556145365456,
 0.0,
 0.0,
 0.0,
 1.0905982905982912,
 0.0,
 0.0,
 1.1134380453752184,
 1.4783796085571232,
 1.3351749539594842,
 0.0,
 0.0,
 1.1831905344757243,
 0.0,
 1.180388529139686,
 1.6410670978172994],
'Speech_Clarity': [0.8063413201037373,
 0.7281889654694698,
```

```
 0.7956674172368028,
 1.3783872377622377,
 0.8210795161651453,
 0.7742927779692482,
 0.9009066913478677,
 0.7731803324988011,
 0.8521962508182979,
 0.8099822169897093,
 1.571557895785924,
 0.7477012409884664,
 0.704846459130425,
 0.8319826393615442,
 0.7390442448295256,
 0.7735057450966543,
 1.162495260763333,
 0.8114126491609934,
 1.171962095875139,
 0.8867790834015197,
 1.2741952318264307,
 1.0853442817025494,
 1.3292939936775552,
 0.9905927065992397,
 1.13569914636614,
 1.054023923277451,
 1.7218630426177595,
 0.8796545335006878,
 1.1072574547561098,
 1.5269310761484152,
 0.962224947827042,
 0.7863353078419073,
 1.2692331839431283,
 1.6602907757236482,
 1.3169492056248298,
 0.7498366586493881,
 1.6469528434905218,
 1.1220913683910914,
 0.8914387956425139],
'Speech_Recognition': [0.8134519137554457,
 0.8347845283159706,
 0.8026838847609369,
 1.3905423280423281,
 0.7730987378542603,
 0.7811207566109525,
 0.9088511947989071,
 0.7799985012157218,
 0.8597112089383887,
 0.7680974222769434,
```

```
 1.519357413062876,
 0.7542947263587351,
 0.7110620363714341,
 0.8393193469396883,
 0.745561389845659,
 0.8271463904179954,
 1.2844366885531542,
 0.769453885715843,
 1.1822968586253608,
 0.9393289550104987,
 1.1783122279029838,
 1.094915218930967,
 1.341016162933971,
 0.9993280920189862,
 1.0184125600179224,
 0.8945379260961119,
 1.592293101727064,
 0.9983380816714154,
 1.1170216298421425,
 1.4734223343494868,
 0.9707101766438591,
 0.8945379260961112,
 1.2804257164293993,
 1.6749317878552503,
 1.2573895224780276,
 0.7564489748632276,
 1.5104329428837238,
 1.1319863540030057,
 0.9442647983472556],
'Depth_Perception': [1.0928866563148367,
 1.2647236541219913,
 1.1509425241411828,
 0.835997391608614,
 1.3176763057014995,
 1.1164353083485459,
 0.7710846529660628,
 1.1817211761905524,
 1.1550368161227669,
 1.0151344263376172,
 0.7339302516354956,
 1.005645682468816,
 1.4440140991898118,
 1.3478896830933638,
 1.4705435149509944,
 1.1112854215726626,
 0.9870812575619777,
 1.0913364624760926,
```

```
 0.6784906366678605,
 0.926151995721774,
 0.757348431415873,
 0.8570618928145003,
 0.76957568104245,
 1.0093413995542464,
 0.854119551838678,
 0.792694477104718,
 0.0,
 0.984333339042758,
 0.7555006013461384,
 1.0484947418417006,
 1.1520131595360588,
 1.125114741697018,
 0.7242231547195064,
 0.88110139140682,
 1.1142352950729781,
 1.0772803597130338,
 0.6102270166039252,
 0.805527181405673,
 0.9991419108764548],
'Far_Vision': [0.7460411673435421,
 1.0328720250594727,
 0.8867447884256239,
 1.1460290399647444,
 0.9150657247860953,
 0.9768944899743446,
 0.9437886211474366,
 0.913384703751921,
 1.075182212062752,
 0.9568600444329292,
 1.2892609506047004,
 0.8832853705526101,
 1.002801524592188,
 0.927216891796987,
 1.1655285170596794,
 0.8620463442674846,
 1.089917389969034,
 0.9585498634959452,
 1.0488480390426644,
 0.823571416960009,
 1.0453131636101667,
 1.0684623232373602,
 1.1896522963388032,
 1.1541635431979456,
 1.0647942328682276,
 0.9322813445514538,
```

```
 1.1726971114521785,
 0.9278271114608192,
 0.9695725983335115,
 1.233125896435607,
 1.0723675989421693,
 0.8204075832052787,
 0.9430120230108392,
 1.2078599668386263,
 1.074563105222793,
 0.8858080133897659,
 1.307079964114576,
 0.8905313539041496,
 0.927246874558241],
'Glare_Sensitivity': [1.1575639835774174,
 1.259196120811815,
 1.351311646851102,
 0.0,
 1.7477356858736157,
 1.2306511485636813,
 1.0771505751944483,
 1.0504967937988463,
 1.3544699430385927,
 1.1004984040810304,
 0.0,
 1.0158791207729283,
 1.6707999352632261,
 1.4016832457158102,
 1.8945606061152183,
 1.0509389220790648,
 0.8022589169027655,
 1.1024418891213499,
 0.9167842840258413,
 1.2450013227930126,
 0.7694269438951897,
 0.0,
 0.0,
 1.0196124454307298,
 0.9307226424391819,
 1.1365638957031672,
 0.0,
 1.1951600787705308,
 1.1820264515312935,
 0.0,
 1.2201896092159865,
 1.4093392306719263,
 1.149645892661076,
 0.0,
```

```
 0.0,
 1.1410341021309836,
 0.0,
 1.1549634037279641,
 1.413032833631285],
'Near_Vision': [0.9898465208248328,
 0.9421591828112097,
 0.8473831058317473,
 1.3048691040397202,
 0.6924912865140056,
 0.8712957451457588,
 1.0257527181488708,
 1.0060871663074449,
 0.915369879712903,
 0.9661437174027018,
 1.3609410003264624,
 0.8918552053648209,
 0.8944023234543984,
 0.842024262370584,
 0.7056265537088846,
 1.0065106036670017,
 1.0004472867774414,
 1.0558362888798216,
 1.0590242003800625,
 0.8013232791558756,
 1.0074798002039946,
 1.0297911146770162,
 1.2557943257806918,
 1.0171963021951118,
 1.1728637539542894,
 1.0885157916762846,
 1.4911025663954216,
 0.8942459594118365,
 0.9469537632133329,
 1.2598046628679693,
 0.9129736234832884,
 0.9524513177167483,
 1.055167884231014,
 1.4377820856648444,
 1.190039408558298,
 0.9350569745205071,
 1.1951032218693731,
 0.9678702798444484,
 0.9263640438762175],
'Night_Vision': [1.5848274376783507,
 1.5392612278216438,
 1.4800707728762645,
```

```
 0.0,
 1.27278450744299,
 1.1957294453707652,
 1.0725330782719595,
 1.265652202167794,
 1.4954939575642476,
 1.5066986280263865,
 0.0,
 1.390845885676107,
 2.287501699986401,
 1.919052508768638,
 2.1269600404653524,
 1.438846459171663,
 0.8924315146765928,
 1.5093594644555721,
 0.0,
 1.2096724103549839,
 0.0,
 0.0,
 0.0,
 1.3959572017116662,
 0.0,
 0.0,
 0.0,
 1.2856646515183108,
 0.0,
 0.0,
 1.3125895656862332,
 1.3693469661141762,
 1.5739867343424816,
 0.0,
 0.0,
 0.8926835902385954,
 0.0,
 1.3915149327256464,
 1.2160288134813442],
'Peripheral_Vision': [1.1311835425083392,
 1.3982949115366479,
 1.34452514818154,
 0.0,
 1.6187111682546733,
 1.3824668355904774,
 1.522359313001419,
 1.3065262930260393,
 1.5215601742544367,
 1.3687144109840879,
 0.0,
```

```
 1.263471520961308,
 1.5711791587794333,
 1.968247260268019,
 2.0735504087254535,
 1.3070761778295015,
 1.1848724291553214,
 1.371131566676775,
 0.6001184538208492,
 1.3985872771795904,
 0.0,
 0.0,
 0.0,
 1.2681147401073478,
 0.0,
 0.0,
 0.0,
 1.1679228370513457,
 0.0,
 0.0,
 1.1923819540576561,
 1.5831982514090313,
 1.4298402387306144,
 0.0,
 0.0,
 1.2670799667576071,
 0.0,
 1.0917048468443113,
 1.4059363614978342],
'Visual_Color_Discrimination': [0.913995153353805,
 0.9307800854715904,
 0.9625480215862295,
 1.1466147911678637,
 0.9270706373207653,
 0.9897105452478436,
 0.5757750027385256,
 0.9882886037750039,
 0.9659721305786494,
 0.9732094713542502,
 1.2275905996629464,
 0.9557209158556487,
 0.9584504329551959,
 0.999643409009866,
 1.0694212493959867,
 1.0480268231664882,
 1.1085403064773056,
 1.0993870780766337,
 0.9986775699673438,
```

```
 1.1334919233646241,
 1.1310361151531942,
 1.0867186469009809,
 1.2099793372618042,
 1.0167871506098713,
 1.1521147676180405,
 1.0692589946168345,
 0.7642036470960261,
 1.1243852361170803,
 0.9603889878922107,
 0.87686962488102,
 1.147932570904872,
 1.0692589946168336,
 0.7570964124407129,
 0.9137267546595821,
 0.8416703302987739,
 0.9009434069778838,
 0.8930962160604097,
 1.1517630582070197,
 0.8925676194433275]}
```

[34]:
```
# e_j_s
```

[35]:
```
len(e_j_s)
```

[35]:
```
52
```

[36]:
```
keys=list(e_j_s.keys())
```

[37]:
```
keys[0]
```

[37]:
```
'Perceptual_Speed'
```

[38]:
```
jobs_list
```

[38]:
```
['Rotary Drill Operators, Oil and Gas',
 'Roustabouts, Oil and Gas',
 'Service Unit Operators, Oil and Gas',
 'Petroleum Engineers',
 'Derrick Operators, Oil and Gas',
 'Petroleum Pump System Operators, Refinery Operators, and Gaugers',
 'Wellhead Pumpers',
 'Pump Operators, Except Wellhead Pumpers',
 'Gas Plant Operators',
 'Gas Compressor and Gas Pumping Station Operators',
 'Energy Engineers, Except Wind and Solar',
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders',
```

```
 'Continuous Mining Machine Operators',
 'Loading and Moving Machine Operators, Underground Mining',
 'Sailors and Marine Oilers',
 'Geothermal Technicians',
 'Geothermal Production Managers',
 'Biomass Plant Technicians',
 'Biomass Power Plant Managers',
 'Biofuels Processing Technicians',
 'Biofuels Production Managers',
 'Biofuels/Biodiesel Technology and Product Development Managers',
 'Nuclear Engineers',
 'Nuclear Technicians',
 'Nuclear Power Reactor Operators',
 'Nuclear Monitoring Technicians',
 'Environmental Economists',
 'Solar Thermal Installers and Technicians',
 'Solar Energy Systems Engineers',
 'Solar Sales Representatives and Assessors',
 'Solar Energy Installation Managers',
 'Solar Photovoltaic Installers',
 'Wind Energy Operations Managers',
 'Wind Energy Development Managers',
 'Wind Energy Engineers',
 'Wind Turbine Service Technicians',
 'Sustainability Specialists',
 'Hydroelectric Production Managers',
 'Hydroelectric Plant Technicians']
```

[39]:
```
start=0
eta_i_j={}
for i in range(0,len(jobs_list)):
  eta_each_job=np.zeros(len(jobs_list))
  for j in range(i+1,len(jobs_list)):
    numerator=0
    denominator1=0
    denominator2=0
    for skill in keys:
      numerator+=e_j_s[skill][i]*e_j_s[skill][j]
      denominator1+=e_j_s[skill][i]
      denominator2+=e_j_s[skill][j]
    denonminator=max(denominator1,denominator2)
    eta_each_job[j]=numerator/denonminator
  eta_i_j[jobs_list[i]]=eta_each_job
```

[40]:
```
eta_i_j
```

```
[40]: {'Rotary Drill Operators, Oil and Gas': array([0.        , 0.78571429, 0.875
      , 0.        , 0.88      ,
              0.69230769, 0.74074074, 0.81481481, 0.73076923, 0.73913043,
              0.        , 0.8       , 0.74074074, 0.84      , 0.75      ,
              0.67741935, 0.14285714, 0.73076923, 0.11538462, 0.76923077,
              0.10714286, 0.07692308, 0.03703704, 0.48      , 0.21212121,
              0.24137931, 0.        , 0.68181818, 0.08333333, 0.08333333,
              0.58333333, 0.81818182, 0.16666667, 0.04      , 0.08      ,
              0.8       , 0.        , 0.19354839, 0.82608696]),
       'Roustabouts, Oil and Gas': array([0.        , 0.        , 0.85714286,
      0.07142857, 0.89285714,
              0.75      , 0.85714286, 0.89285714, 0.82142857, 0.71428571,
              0.03571429, 0.89285714, 0.92857143, 0.85714286, 0.92857143,
              0.80645161, 0.21428571, 0.82142857, 0.17857143, 0.85714286,
              0.21428571, 0.14285714, 0.10714286, 0.57142857, 0.3030303 ,
              0.27586207, 0.03571429, 0.67857143, 0.14285714, 0.10714286,
              0.57142857, 0.71428571, 0.21428571, 0.10714286, 0.10714286,
              0.85714286, 0.03571429, 0.25806452, 0.82142857]),
       'Service Unit Operators, Oil and Gas': array([0.        , 0.        , 0.
      , 0.03846154, 0.96      ,
              0.76923077, 0.77777778, 0.88888889, 0.80769231, 0.75      ,
              0.        , 0.92      , 0.85185185, 0.88      , 0.85714286,
              0.70967742, 0.14285714, 0.80769231, 0.11538462, 0.84615385,
              0.14285714, 0.07692308, 0.07407407, 0.56      , 0.24242424,
              0.24137931, 0.        , 0.66666667, 0.125     , 0.04166667,
              0.58333333, 0.79166667, 0.20833333, 0.08      , 0.04      ,
              0.84      , 0.        , 0.25806452, 0.83333333]),
       'Petroleum Engineers': array([0.        , 0.        , 0.        , 0.        ,
      0.03846154,
              0.23076923, 0.11111111, 0.11111111, 0.19230769, 0.15384615,
              0.96153846, 0.03846154, 0.11111111, 0.07692308, 0.14285714,
              0.19354839, 0.85714286, 0.15384615, 0.84615385, 0.11538462,
              0.82142857, 0.92307692, 0.96296296, 0.42307692, 0.75757576,
              0.75862069, 0.92307692, 0.07692308, 0.76923077, 0.84615385,
              0.34615385, 0.07692308, 0.69230769, 0.88461538, 0.88461538,
              0.03846154, 0.92307692, 0.74193548, 0.        ]),
       'Derrick Operators, Oil and Gas': array([0.        , 0.        , 0.        , 0.
      , 0.        ,
              0.80769231, 0.81481481, 0.92592593, 0.84615385, 0.76      ,
              0.        , 0.92      , 0.85185185, 0.92      , 0.85714286,
              0.74193548, 0.17857143, 0.84615385, 0.11538462, 0.88461538,
              0.14285714, 0.11538462, 0.07407407, 0.56      , 0.27272727,
              0.27586207, 0.        , 0.68      , 0.12      , 0.08      ,
              0.6       , 0.8       , 0.2       , 0.08      , 0.08      ,
              0.88      , 0.        , 0.25806452, 0.84      ]),
       'Petroleum Pump System Operators, Refinery Operators, and Gaugers': array([0.
      , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.7037037 , 0.81481481, 0.84615385, 0.69230769,
        0.19230769, 0.73076923, 0.74074074, 0.73076923, 0.75      ,
        0.67741935, 0.28571429, 0.76923077, 0.26923077, 0.73076923,
        0.28571429, 0.23076923, 0.25925926, 0.69230769, 0.36363636,
        0.4137931 , 0.19230769, 0.57692308, 0.23076923, 0.23076923,
        0.53846154, 0.61538462, 0.26923077, 0.23076923, 0.26923077,
        0.73076923, 0.19230769, 0.41935484, 0.65384615]),
 'Wellhead Pumpers': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.88888889, 0.74074074, 0.66666667,
        0.11111111, 0.81481481, 0.81481481, 0.77777778, 0.82142857,
        0.83870968, 0.21428571, 0.77777778, 0.22222222, 0.81481481,
        0.25      , 0.14814815, 0.11111111, 0.51851852, 0.3030303 ,
        0.31034483, 0.11111111, 0.7037037 , 0.18518519, 0.11111111,
        0.51851852, 0.7037037 , 0.2962963 , 0.11111111, 0.14814815,
        0.81481481, 0.11111111, 0.29032258, 0.85185185]),
 'Pump Operators, Except Wellhead Pumpers': array([0.        , 0.        , 0.
, 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.85185185, 0.74074074,
        0.07407407, 0.85185185, 0.85185185, 0.85185185, 0.89285714,
        0.80645161, 0.21428571, 0.85185185, 0.18518519, 0.85185185,
        0.21428571, 0.14814815, 0.14814815, 0.59259259, 0.33333333,
        0.34482759, 0.07407407, 0.62962963, 0.11111111, 0.11111111,
        0.55555556, 0.74074074, 0.22222222, 0.11111111, 0.14814815,
        0.81481481, 0.07407407, 0.29032258, 0.77777778]),
 'Gas Plant Operators': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.73076923,
        0.15384615, 0.76923077, 0.77777778, 0.76923077, 0.82142857,
        0.67741935, 0.28571429, 0.76923077, 0.26923077, 0.76923077,
        0.28571429, 0.23076923, 0.22222222, 0.61538462, 0.39393939,
        0.37931034, 0.15384615, 0.57692308, 0.15384615, 0.19230769,
        0.53846154, 0.65384615, 0.23076923, 0.19230769, 0.23076923,
        0.73076923, 0.15384615, 0.35483871, 0.69230769]),
 'Gas Compressor and Gas Pumping Station Operators': array([0.        , 0.
, 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.12      , 0.76      , 0.7037037 , 0.84      , 0.71428571,
        0.64516129, 0.25      , 0.76923077, 0.19230769, 0.73076923,
        0.25      , 0.19230769, 0.18518519, 0.6       , 0.33333333,
        0.34482759, 0.125     , 0.56521739, 0.16666667, 0.125     ,
        0.45833333, 0.60869565, 0.33333333, 0.12      , 0.16      ,
        0.68      , 0.125     , 0.32258065, 0.69565217]),
 'Energy Engineers, Except Wind and Solar': array([0.        , 0.        , 0.
, 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.07407407, 0.04      , 0.10714286,
```

```
        0.19354839, 0.82142857, 0.11538462, 0.84615385, 0.07692308,
        0.82142857, 0.88461538, 0.92592593, 0.4       , 0.72727273,
        0.72413793, 0.96      , 0.08      , 0.8       , 0.88      ,
        0.36      , 0.08      , 0.72      , 0.92      , 0.92      ,
        0.04      , 0.96      , 0.74193548, 0.        ]),
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders':
array([0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.92592593, 0.92      , 0.85714286,
        0.74193548, 0.14285714, 0.84615385, 0.15384615, 0.84615385,
        0.17857143, 0.07692308, 0.07407407, 0.56      , 0.24242424,
        0.24137931, 0.        , 0.68      , 0.12      , 0.04      ,
        0.52      , 0.72      , 0.24      , 0.08      , 0.04      ,
        0.88      , 0.        , 0.25806452, 0.84      ]),
 'Continuous Mining Machine Operators': array([0.        , 0.        , 0.
, 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.85185185, 0.89285714,
        0.74193548, 0.17857143, 0.81481481, 0.22222222, 0.81481481,
        0.25      , 0.14814815, 0.14814815, 0.59259259, 0.3030303 ,
        0.27586207, 0.07407407, 0.62962963, 0.14814815, 0.11111111,
        0.51851852, 0.66666667, 0.22222222, 0.14814815, 0.11111111,
        0.81481481, 0.07407407, 0.29032258, 0.77777778]),
 'Loading and Moving Machine Operators, Underground Mining': array([0.        ,
0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.82142857,
        0.74193548, 0.21428571, 0.88461538, 0.15384615, 0.88461538,
        0.17857143, 0.15384615, 0.11111111, 0.56      , 0.27272727,
        0.31034483, 0.04      , 0.64      , 0.12      , 0.08      ,
        0.56      , 0.72      , 0.28      , 0.08      , 0.08      ,
        0.84      , 0.04      , 0.25806452, 0.8       ]),
 'Sailors and Marine Oilers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.80645161, 0.21428571, 0.82142857, 0.21428571, 0.85714286,
        0.28571429, 0.14285714, 0.17857143, 0.64285714, 0.33333333,
        0.31034483, 0.07142857, 0.64285714, 0.14285714, 0.07142857,
        0.57142857, 0.71428571, 0.21428571, 0.10714286, 0.10714286,
        0.78571429, 0.07142857, 0.32258065, 0.75      ]),
 'Geothermal Technicians': array([0.        , 0.        , 0.        , 0.
, 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.29032258, 0.77419355, 0.19354839, 0.77419355,
        0.29032258, 0.19354839, 0.19354839, 0.5483871 , 0.36363636,
```

```
       0.35483871, 0.16129032, 0.64516129, 0.22580645, 0.16129032,
       0.51612903, 0.70967742, 0.29032258, 0.16129032, 0.19354839,
       0.77419355, 0.16129032, 0.38709677, 0.74193548]),
 'Geothermal Production Managers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.28571429, 0.71428571, 0.21428571,
       0.75      , 0.85714286, 0.85714286, 0.42857143, 0.72727273,
       0.75862069, 0.78571429, 0.21428571, 0.67857143, 0.78571429,
       0.42857143, 0.21428571, 0.71428571, 0.78571429, 0.78571429,
       0.17857143, 0.78571429, 0.74193548, 0.10714286]),
 'Biomass Plant Technicians': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.19230769, 0.88461538,
       0.28571429, 0.23076923, 0.18518519, 0.61538462, 0.36363636,
       0.37931034, 0.07692308, 0.61538462, 0.15384615, 0.11538462,
       0.57692308, 0.69230769, 0.30769231, 0.15384615, 0.11538462,
       0.76923077, 0.07692308, 0.32258065, 0.73076923]),
 'Biomass Power Plant Managers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.15384615,
       0.85714286, 0.84615385, 0.85185185, 0.42307692, 0.72727273,
       0.72413793, 0.84615385, 0.15384615, 0.73076923, 0.80769231,
       0.38461538, 0.07692308, 0.69230769, 0.84615385, 0.84615385,
       0.19230769, 0.84615385, 0.67741935, 0.11538462]),
 'Biofuels Processing Technicians': array([0.        , 0.        , 0.        ,
0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.25      , 0.19230769, 0.14814815, 0.53846154, 0.33333333,
       0.31034483, 0.03846154, 0.69230769, 0.19230769, 0.03846154,
       0.53846154, 0.73076923, 0.26923077, 0.11538462, 0.03846154,
       0.80769231, 0.03846154, 0.32258065, 0.84615385]),
 'Biofuels Production Managers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.82142857, 0.85714286, 0.39285714, 0.78787879,
       0.75862069, 0.78571429, 0.17857143, 0.71428571, 0.71428571,
       0.35714286, 0.10714286, 0.64285714, 0.82142857, 0.75      ,
```

```
       0.17857143, 0.78571429, 0.74193548, 0.14285714]),
 'Biofuels/Biodiesel Technology and Product Development Managers': array([0.
, 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.88888889, 0.38461538, 0.78787879,
       0.79310345, 0.84615385, 0.15384615, 0.73076923, 0.84615385,
       0.42307692, 0.11538462, 0.69230769, 0.84615385, 0.84615385,
       0.11538462, 0.84615385, 0.67741935, 0.07692308]),
 'Nuclear Engineers': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.44444444, 0.78787879,
       0.79310345, 0.88888889, 0.07407407, 0.74074074, 0.81481481,
       0.33333333, 0.07407407, 0.66666667, 0.88888889, 0.85185185,
       0.07407407, 0.88888889, 0.77419355, 0.        ]),
 'Nuclear Technicians': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.42424242,
       0.48275862, 0.36      , 0.44      , 0.32      , 0.36      ,
       0.44      , 0.44      , 0.44      , 0.36      , 0.4       ,
       0.56      , 0.36      , 0.48387097, 0.44      ]),
 'Nuclear Power Reactor Operators': array([0.        , 0.        , 0.        ,
0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.75757576, 0.6969697 , 0.15151515, 0.60606061, 0.66666667,
       0.36363636, 0.18181818, 0.54545455, 0.72727273, 0.6969697 ,
       0.27272727, 0.6969697 , 0.75757576, 0.21212121]),
 'Nuclear Monitoring Technicians': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.68965517, 0.27586207, 0.62068966, 0.65517241,
       0.44827586, 0.24137931, 0.5862069 , 0.68965517, 0.68965517,
       0.27586207, 0.68965517, 0.70967742, 0.17241379]),
 'Environmental Economists': array([0.        , 0.        , 0.        , 0.
```

```
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.04166667, 0.83333333, 0.91666667,
       0.33333333, 0.04166667, 0.75      , 0.92      , 0.92      ,
       0.04      , 1.        , 0.70967742, 0.        ]),
 'Solar Thermal Installers and Technicians': array([0.        , 0.        , 0.
, 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.20833333, 0.08333333,
       0.58333333, 0.81818182, 0.29166667, 0.08      , 0.08      ,
       0.72      , 0.04166667, 0.25806452, 0.7826087 ]),
 'Solar Energy Systems Engineers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.79166667,
       0.375     , 0.16666667, 0.79166667, 0.84      , 0.76      ,
       0.2       , 0.83333333, 0.70967742, 0.16666667]),
 'Solar Sales Representatives and Assessors': array([0.        , 0.        , 0.
, 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.41666667, 0.125     , 0.70833333, 0.88      , 0.96      ,
       0.12      , 0.91666667, 0.64516129, 0.04166667]),
 'Solar Energy Installation Managers': array([0.        , 0.        , 0.
, 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.66666667, 0.41666667, 0.32      , 0.4       ,
       0.56      , 0.33333333, 0.38709677, 0.54166667]),
 'Solar Photovoltaic Installers': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.20833333, 0.08      , 0.12      ,
        0.76      , 0.04166667, 0.25806452, 0.7826087 ]),
 'Wind Energy Operations Managers': array([0.        , 0.        , 0.        ,
0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.72      , 0.68      ,
        0.24      , 0.75      , 0.70967742, 0.25      ]),
 'Wind Energy Development Managers': array([0.        , 0.        , 0.        ,
0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.88      ,
        0.12      , 0.92      , 0.74193548, 0.04      ]),
 'Wind Energy Engineers': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.12      , 0.92      , 0.67741935, 0.04      ]),
 'Wind Turbine Service Technicians': array([0.        , 0.        , 0.        ,
0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.04      , 0.25806452, 0.84      ]),
 'Sustainability Specialists': array([0.        , 0.        , 0.        , 0.
, 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.70967742, 0.        ]),
 'Hydroelectric Production Managers': array([0.        , 0.        , 0.
0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.22580645]),
 'Hydroelectric Plant Technicians': array([0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0.])}
```

[41]:
```
len(eta_i_j)
```

[41]:
```
39
```

[42]:
```
len(eta_i_j['Wind Energy Operations Managers'])
```

[42]:
```
39
```

[43]:
```
start=0
theta_i_j={}
for i in range(0,len(e_j_s)):
  theta_each_key=np.zeros(len(e_j_s))
  for j in range(i+1,len(e_j_s)):
    theta_each_key[j]=sum(np.array(e_j_s[keys[i]])*np.array(e_j_s[keys[j]]))/
 ↪max(sum(np.array(e_j_s[keys[i]])),sum(np.array(e_j_s[keys[j]])))
  theta_i_j[keys[i]]=theta_each_key
```

[44]:
```
# i=0
# for key, value in theta_i_j.items():
#   print(i)
#   print(len(value))
#   i+=1
```

[45]:
```
theta_i_j
```

[45]:
```
{'Perceptual_Speed': array([0.        , 0.73684211, 0.66666667, 0.66666667,
0.63157895,
        0.57894737, 0.57894737, 0.63157895, 0.52631579, 0.63157895,
        0.57894737, 0.68421053, 0.57894737, 0.57894737, 0.57894737,
```

```
        0.375     , 0.42105263, 0.57894737, 0.57894737, 0.57894737,
        0.57894737, 0.33333333, 0.10526316, 0.33333333, 0.33333333,
        0.36842105, 0.26315789, 0.36842105, 0.26315789, 0.26315789,
        0.38095238, 0.36842105, 0.42105263, 0.45      , 0.4       ,
        0.39130435, 0.39130435, 0.47619048, 0.40909091, 0.40909091,
        0.52173913, 0.5       , 0.39130435, 0.57894737, 0.52631579,
        0.4       , 0.63157895, 0.38461538, 0.7       , 0.39130435,
        0.36      , 0.52631579]),
 'Flexibility_of_Closure': array([0.        , 0.        , 0.80952381,
0.80952381, 0.83333333,
        0.83333333, 0.83333333, 0.88888889, 0.77777778, 0.88888889,
        0.83333333, 0.88888889, 0.63157895, 0.83333333, 0.83333333,
        0.20833333, 0.55555556, 0.83333333, 0.83333333, 0.83333333,
        0.83333333, 0.14285714, 0.        , 0.0952381 , 0.14285714,
        0.16666667, 0.05555556, 0.16666667, 0.05263158, 0.        ,
        0.14285714, 0.10526316, 0.16666667, 0.2       , 0.24      ,
        0.34782609, 0.17391304, 0.23809524, 0.22727273, 0.27272727,
        0.43478261, 0.45      , 0.17391304, 0.83333333, 0.77777778,
        0.25      , 0.78947368, 0.19230769, 0.75      , 0.17391304,
        0.2       , 0.55555556]),
 'Memorization': array([0.        , 0.        , 0.        , 0.85714286,
0.80952381,
        0.80952381, 0.80952381, 0.85714286, 0.76190476, 0.85714286,
        0.76190476, 0.80952381, 0.71428571, 0.80952381, 0.80952381,
        0.29166667, 0.57142857, 0.80952381, 0.80952381, 0.80952381,
        0.80952381, 0.19047619, 0.0952381 , 0.19047619, 0.19047619,
        0.23809524, 0.0952381 , 0.33333333, 0.14285714, 0.0952381 ,
        0.19047619, 0.14285714, 0.14285714, 0.23809524, 0.28      ,
        0.39130435, 0.2173913 , 0.28571429, 0.27272727, 0.36363636,
        0.43478261, 0.38095238, 0.26086957, 0.80952381, 0.76190476,
        0.28571429, 0.66666667, 0.30769231, 0.80952381, 0.2173913 ,
        0.28      , 0.52380952]),
 'Speed_of_Closure': array([0.        , 0.        , 0.        , 0.        ,
0.80952381,
        0.80952381, 0.76190476, 0.80952381, 0.76190476, 0.80952381,
        0.76190476, 0.76190476, 0.71428571, 0.80952381, 0.80952381,
        0.29166667, 0.52380952, 0.80952381, 0.80952381, 0.80952381,
        0.80952381, 0.19047619, 0.04761905, 0.14285714, 0.19047619,
        0.19047619, 0.0952381 , 0.28571429, 0.0952381 , 0.0952381 ,
        0.19047619, 0.14285714, 0.19047619, 0.19047619, 0.32      ,
        0.43478261, 0.2173913 , 0.23809524, 0.27272727, 0.36363636,
        0.43478261, 0.42857143, 0.26086957, 0.80952381, 0.76190476,
        0.23809524, 0.66666667, 0.30769231, 0.71428571, 0.26086957,
        0.28      , 0.47619048]),
 'Problem_Sensitivity': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.94444444, 0.88888889, 0.94444444, 0.88888889, 0.94444444,
```

```
        0.88888889, 0.83333333, 0.73684211, 0.94444444, 0.94444444,
        0.16666667, 0.61111111, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.0952381 , 0.05555556, 0.04761905, 0.0952381 ,
        0.11111111, 0.05555556, 0.27777778, 0.05263158, 0.05555556,
        0.0952381 , 0.10526316, 0.11111111, 0.1       , 0.24      ,
        0.30434783, 0.08695652, 0.14285714, 0.13636364, 0.27272727,
        0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
        0.1       , 0.68421053, 0.19230769, 0.8       , 0.13043478,
        0.16      , 0.5       ]),
 'Originality': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.88888889, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.83333333, 0.73684211, 0.94444444, 0.94444444,
        0.125     , 0.61111111, 1.        , 1.        , 1.        ,
        1.        , 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
        0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.75      , 0.13043478,
        0.16      , 0.55555556]),
 'Information_Ordering': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.94444444, 0.88235294, 0.94444444,
        0.88235294, 0.83333333, 0.68421053, 0.94117647, 0.94117647,
        0.16666667, 0.64705882, 0.88888889, 0.88888889, 0.88888889,
        0.88888889, 0.04761905, 0.        , 0.04761905, 0.04761905,
        0.11111111, 0.        , 0.22222222, 0.        , 0.        ,
        0.04761905, 0.05263158, 0.        , 0.1       , 0.16      ,
        0.26086957, 0.08695652, 0.14285714, 0.13636364, 0.18181818,
        0.30434783, 0.35      , 0.13043478, 0.94117647, 0.88235294,
        0.15      , 0.68421053, 0.19230769, 0.75      , 0.13043478,
        0.16      , 0.52941176]),
 'Inductive_Reasoning': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.88888889, 1.        ,
        0.88888889, 0.88888889, 0.73684211, 0.94444444, 0.94444444,
        0.16666667, 0.61111111, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.04761905, 0.        , 0.04761905, 0.04761905,
        0.11111111, 0.        , 0.27777778, 0.        , 0.        ,
        0.04761905, 0.05263158, 0.05555556, 0.1       , 0.2       ,
        0.26086957, 0.08695652, 0.14285714, 0.13636364, 0.22727273,
        0.34782609, 0.35      , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.8       , 0.13043478,
        0.16      , 0.55555556]),
 'Fluency_of_Ideas': array([0.        , 0.        , 0.        , 0.        , 0.
,
```

```
        0.        , 0.        , 0.        , 0.        , 0.88888889,
        0.94117647, 0.77777778, 0.68421053, 0.94117647, 0.94117647,
        0.125     , 0.64705882, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.04761905, 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.2       ,
        0.26086957, 0.04347826, 0.0952381 , 0.09090909, 0.22727273,
        0.26086957, 0.25      , 0.13043478, 0.94117647, 0.94117647,
        0.15      , 0.73684211, 0.15384615, 0.7       , 0.13043478,
        0.16      , 0.52941176]),
 'Deductive_Reasoning': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.88888889, 0.88888889, 0.73684211, 0.94444444, 0.94444444,
        0.16666667, 0.61111111, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.04761905, 0.        , 0.04761905, 0.04761905,
        0.11111111, 0.        , 0.27777778, 0.        , 0.        ,
        0.04761905, 0.05263158, 0.05555556, 0.1       , 0.2       ,
        0.26086957, 0.08695652, 0.14285714, 0.13636364, 0.22727273,
        0.34782609, 0.35      , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.8       , 0.13043478,
        0.16      , 0.55555556]),
 'Category_Flexibility': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.83333333, 0.68421053, 0.94117647, 0.94117647,
        0.08333333, 0.64705882, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.16666667, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
        0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.30434783, 0.3       , 0.08695652, 0.94117647, 0.88235294,
        0.15      , 0.73684211, 0.15384615, 0.7       , 0.08695652,
        0.12      , 0.58823529]),
 'Selective_Attention': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.63157895, 0.83333333, 0.83333333,
        0.16666667, 0.55555556, 0.83333333, 0.83333333, 0.83333333,
        0.83333333, 0.14285714, 0.05555556, 0.14285714, 0.14285714,
        0.16666667, 0.05555556, 0.27777778, 0.10526316, 0.05555556,
        0.14285714, 0.10526316, 0.16666667, 0.2       , 0.24      ,
        0.26086957, 0.17391304, 0.23809524, 0.18181818, 0.31818182,
        0.43478261, 0.4       , 0.17391304, 0.83333333, 0.77777778,
        0.25      , 0.73684211, 0.23076923, 0.7       , 0.17391304,
        0.16      , 0.5       ]),
 'Time_Sharing': array([0.        , 0.        , 0.        , 0.        , 0.
```

```
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.73684211, 0.73684211,
        0.33333333, 0.52631579, 0.73684211, 0.73684211, 0.73684211,
        0.73684211, 0.23809524, 0.05263158, 0.23809524, 0.19047619,
        0.15789474, 0.15789474, 0.42105263, 0.21052632, 0.21052632,
        0.28571429, 0.31578947, 0.31578947, 0.3       , 0.36      ,
        0.39130435, 0.26086957, 0.33333333, 0.27272727, 0.36363636,
        0.43478261, 0.5       , 0.30434783, 0.73684211, 0.68421053,
        0.2       , 0.52631579, 0.34615385, 0.7       , 0.30434783,
        0.32      , 0.63157895]),
 'Mathematical_Reasoning': array([0.        , 0.        , 0.        , 0.
, 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 1.        ,
        0.125     , 0.64705882, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.04761905, 0.        , 0.        , 0.04761905,
        0.05555556, 0.        , 0.22222222, 0.        , 0.        ,
        0.04761905, 0.05263158, 0.05555556, 0.05      , 0.2       ,
        0.26086957, 0.04347826, 0.0952381 , 0.09090909, 0.22727273,
        0.30434783, 0.3       , 0.08695652, 1.        , 0.94117647,
        0.1       , 0.68421053, 0.15384615, 0.75      , 0.08695652,
        0.12      , 0.52941176]),
 'Number_Facility': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.125     , 0.64705882, 0.94444444, 0.94444444, 0.94444444,
        0.94444444, 0.04761905, 0.        , 0.        , 0.04761905,
        0.05555556, 0.        , 0.22222222, 0.        , 0.        ,
        0.04761905, 0.05263158, 0.05555556, 0.05      , 0.2       ,
        0.26086957, 0.04347826, 0.0952381 , 0.09090909, 0.22727273,
        0.30434783, 0.3       , 0.08695652, 1.        , 0.94117647,
        0.1       , 0.68421053, 0.15384615, 0.75      , 0.08695652,
        0.12      , 0.52941176]),
 'Spatial_Orientation': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.16666667, 0.125     , 0.125     , 0.125     ,
        0.125     , 0.79166667, 0.33333333, 0.83333333, 0.79166667,
        0.66666667, 0.70833333, 0.625     , 0.75      , 0.70833333,
        0.79166667, 0.75      , 0.70833333, 0.79166667, 0.76      ,
        0.70833333, 0.875     , 0.83333333, 0.83333333, 0.75      ,
        0.70833333, 0.625     , 0.91666667, 0.125     , 0.125     ,
        0.70833333, 0.25      , 0.88461538, 0.29166667, 0.91666667,
        0.96      , 0.375     ]),
```

```
 'Visualization': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.61111111, 0.61111111, 0.61111111,
        0.61111111, 0.0952381 , 0.07692308, 0.0952381 , 0.0952381 ,
        0.16666667, 0.11764706, 0.11111111, 0.10526316, 0.11764706,
        0.0952381 , 0.10526316, 0.05555556, 0.05      , 0.08      ,
        0.2173913 , 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.13043478, 0.15      , 0.13043478, 0.64705882, 0.6875    ,
        0.2       , 0.47368421, 0.15384615, 0.5       , 0.13043478,
        0.16      , 0.41176471]),
 'Oral_Comprehension': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 1.        , 1.        ,
        1.        , 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
        0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.75      , 0.13043478,
        0.16      , 0.55555556]),
 'Oral_Expression': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 1.        ,
        1.        , 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
        0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.75      , 0.13043478,
        0.16      , 0.55555556]),
 'Written_Comprehension': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        1.        , 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
        0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
        0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
        0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
        0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
        0.15      , 0.73684211, 0.19230769, 0.75      , 0.13043478,
```

```
       0.16      , 0.55555556]),
 'Written_Expression': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.0952381 , 0.        , 0.04761905, 0.0952381 ,
       0.11111111, 0.        , 0.22222222, 0.05263158, 0.        ,
       0.0952381 , 0.05263158, 0.05555556, 0.05      , 0.24      ,
       0.30434783, 0.08695652, 0.0952381 , 0.13636364, 0.22727273,
       0.30434783, 0.3       , 0.13043478, 0.94444444, 0.88888889,
       0.15      , 0.73684211, 0.19230769, 0.75      , 0.13043478,
       0.16      , 0.55555556]),
 'Stamina': array([0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.38095238, 0.9047619 , 0.95238095,
       0.76190476, 0.80952381, 0.57142857, 0.9047619 , 0.76190476,
       0.9047619 , 0.80952381, 0.76190476, 0.80952381, 0.8       ,
       0.73913043, 0.91304348, 0.80952381, 0.86363636, 0.77272727,
       0.65217391, 0.61904762, 0.82608696, 0.04761905, 0.        ,
       0.76190476, 0.23809524, 0.80769231, 0.23809524, 0.82608696,
       0.8       , 0.38095238]),
 'Dynamic_Flexibility': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.38095238, 0.38095238,
       0.33333333, 0.47058824, 0.44444444, 0.42105263, 0.47058824,
       0.33333333, 0.36842105, 0.33333333, 0.35      , 0.32      ,
       0.26086957, 0.34782609, 0.33333333, 0.31818182, 0.36363636,
       0.17391304, 0.15      , 0.34782609, 0.        , 0.        ,
       0.25      , 0.10526316, 0.30769231, 0.1       , 0.30434783,
       0.32      , 0.11764706]),
 'Extent_Flexibility': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.9047619 ,
       0.76190476, 0.76190476, 0.66666667, 0.9047619 , 0.80952381,
       0.9047619 , 0.80952381, 0.76190476, 0.85714286, 0.76      ,
       0.69565217, 0.91304348, 0.85714286, 0.86363636, 0.72727273,
       0.65217391, 0.61904762, 0.86956522, 0.        , 0.        ,
       0.80952381, 0.23809524, 0.80769231, 0.23809524, 0.86956522,
```

```
       0.84      , 0.38095238]),
 'Gross_Body_Coordination': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.76190476, 0.80952381, 0.61904762, 0.9047619 , 0.76190476,
       0.9047619 , 0.80952381, 0.76190476, 0.80952381, 0.8       ,
       0.69565217, 0.86956522, 0.80952381, 0.81818182, 0.77272727,
       0.65217391, 0.57142857, 0.82608696, 0.04761905, 0.04761905,
       0.76190476, 0.28571429, 0.76923077, 0.23809524, 0.82608696,
       0.8       , 0.33333333]),
 'Gross_Body_Equilibrium': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.77777778, 0.55555556, 0.78947368, 0.72222222,
       0.71428571, 0.68421053, 0.66666667, 0.7       , 0.6       ,
       0.60869565, 0.73913043, 0.66666667, 0.68181818, 0.68181818,
       0.47826087, 0.45      , 0.69565217, 0.05555556, 0.05555556,
       0.65      , 0.26315789, 0.69230769, 0.2       , 0.69565217,
       0.68      , 0.38888889]),
 'Dynamic_Strength': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.61111111, 0.84210526, 0.94117647,
       0.76190476, 0.84210526, 0.77777778, 0.75      , 0.68      ,
       0.56521739, 0.73913043, 0.71428571, 0.68181818, 0.68181818,
       0.52173913, 0.5       , 0.69565217, 0.        , 0.        ,
       0.65      , 0.21052632, 0.65384615, 0.15      , 0.69565217,
       0.68      , 0.29411765]),
 'Explosive_Strength': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.63157895, 0.66666667,
       0.57142857, 0.63157895, 0.66666667, 0.65      , 0.6       ,
       0.43478261, 0.60869565, 0.61904762, 0.54545455, 0.59090909,
       0.52173913, 0.45      , 0.65217391, 0.22222222, 0.22222222,
```

```
       0.5       , 0.31578947, 0.61538462, 0.35      , 0.60869565,
       0.6       , 0.38888889]),
 'Static_Strength': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.84210526,
       0.85714286, 0.84210526, 0.78947368, 0.8       , 0.72      ,
       0.65217391, 0.82608696, 0.76190476, 0.77272727, 0.72727273,
       0.56521739, 0.55      , 0.7826087 , 0.        , 0.        ,
       0.75      , 0.21052632, 0.73076923, 0.2       , 0.7826087 ,
       0.76      , 0.36842105]),
 'Trunk_Strength': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.76190476, 0.84210526, 0.77777778, 0.75      , 0.68      ,
       0.56521739, 0.73913043, 0.71428571, 0.68181818, 0.63636364,
       0.52173913, 0.5       , 0.69565217, 0.        , 0.        ,
       0.65      , 0.15789474, 0.65384615, 0.15      , 0.69565217,
       0.68      , 0.29411765]),
 'Control_Precision': array([0.        , 0.        , 0.        , 0.        , 0.
,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.9047619 , 0.80952381, 0.9047619 , 0.8       ,
       0.73913043, 0.86956522, 0.9047619 , 0.81818182, 0.77272727,
       0.69565217, 0.66666667, 0.82608696, 0.04761905, 0.04761905,
       0.80952381, 0.28571429, 0.76923077, 0.23809524, 0.82608696,
       0.8       , 0.33333333]),
 'Multilimb_Coordination': array([0.        , 0.        , 0.        , 0.
, 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.        , 0.        , 0.        ,
       0.        , 0.        , 0.84210526, 0.9       , 0.76      ,
       0.65217391, 0.7826087 , 0.85714286, 0.72727273, 0.72727273,
```

```
        0.65217391, 0.65      , 0.73913043, 0.05263158, 0.05263158,
        0.75      , 0.26315789, 0.69230769, 0.25      , 0.73913043,
        0.72      , 0.31578947]),
 'Rate_Control': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.85      , 0.68      ,
        0.56521739, 0.73913043, 0.80952381, 0.68181818, 0.68181818,
        0.65217391, 0.65      , 0.69565217, 0.05555556, 0.05555556,
        0.7       , 0.26315789, 0.65384615, 0.25      , 0.73913043,
        0.68      , 0.27777778]),
 'Response_Orientation': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.72      ,
        0.65217391, 0.82608696, 0.95238095, 0.77272727, 0.72727273,
        0.73913043, 0.75      , 0.7826087 , 0.05      , 0.05      ,
        0.8       , 0.3       , 0.73076923, 0.3       , 0.7826087 ,
        0.76      , 0.3       ]),
 'Arm-Hand_Steadiness': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.76      , 0.84      , 0.72      , 0.76      , 0.72      ,
        0.72      , 0.6       , 0.76      , 0.2       , 0.16      ,
        0.64      , 0.36      , 0.80769231, 0.36      , 0.76      ,
        0.8       , 0.44      ]),
 'Finger_Dexterity': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.7826087 , 0.65217391, 0.73913043, 0.60869565,
        0.56521739, 0.56521739, 0.69565217, 0.26086957, 0.2173913 ,
        0.65217391, 0.34782609, 0.69230769, 0.43478261, 0.69565217,
        0.72      , 0.43478261]),
 'Manual_Dexterity': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.82608696, 0.91304348, 0.73913043,
        0.73913043, 0.65217391, 0.91304348, 0.04347826, 0.        ,
        0.7826087 , 0.26086957, 0.88461538, 0.26086957, 0.91304348,
        0.88      , 0.39130435]),
 'Reaction_Time': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.77272727, 0.77272727,
        0.7826087 , 0.71428571, 0.82608696, 0.0952381 , 0.0952381 ,
        0.76190476, 0.28571429, 0.76923077, 0.28571429, 0.82608696,
        0.8       , 0.33333333]),
 'Speed_of_Limb_Movement': array([0.        , 0.        , 0.        , 0.
, 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.68181818,
        0.69565217, 0.68181818, 0.82608696, 0.09090909, 0.04545455,
        0.81818182, 0.31818182, 0.80769231, 0.31818182, 0.82608696,
        0.84      , 0.40909091]),
 'Wrist-Finger_Speed': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.69565217, 0.54545455, 0.7826087 , 0.22727273, 0.22727273,
        0.59090909, 0.31818182, 0.73076923, 0.31818182, 0.73913043,
        0.72      , 0.40909091]),
 'Auditory_Attention': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.73913043, 0.69565217, 0.30434783, 0.26086957,
        0.65217391, 0.43478261, 0.69230769, 0.39130435, 0.69565217,
        0.68      , 0.39130435]),
 'Hearing_Sensitivity': array([0.        , 0.        , 0.        , 0.        ,
0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.60869565, 0.3       , 0.25      ,
        0.65      , 0.5       , 0.57692308, 0.45      , 0.60869565,
        0.6       , 0.5       ]),
 'Sound_Localization': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.08695652, 0.08695652,
        0.73913043, 0.26086957, 0.88461538, 0.26086957, 0.95652174,
        0.92      , 0.39130435]),
 'Speech_Clarity': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.94117647,
        0.1       , 0.68421053, 0.15384615, 0.75      , 0.08695652,
        0.12      , 0.52941176]),
 'Speech_Recognition': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.1       , 0.68421053, 0.11538462, 0.7       , 0.08695652,
        0.12      , 0.47058824]),
 'Depth_Perception': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.4       , 0.69230769, 0.3       , 0.73913043,
        0.72      , 0.3       ]),
 'Far_Vision': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.23076923, 0.7       , 0.26086957,
        0.28      , 0.52631579]),
 'Glare_Sensitivity': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
```

```
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.26923077, 0.88461538,
        0.92307692, 0.38461538]),
 'Near_Vision': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.26086957,
        0.28      , 0.55      ]),
 'Night_Vision': array([0.        , 0.        , 0.        , 0.        , 0.
,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.        , 0.        , 0.        , 0.        , 0.        ,
        0.92      , 0.39130435]),
 'Peripheral_Vision': array([0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,
        0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. ,
        0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. ,
        0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0. , 0.4]),
 'Visual_Color_Discrimination': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0.])}
```

[46]:
```
G_jobs=nx.Graph()
G_jobs.add_nodes_from(jobs_list)
```

[47]:
```
edges_jobs=[]
for job,value in eta_i_j.items():
```

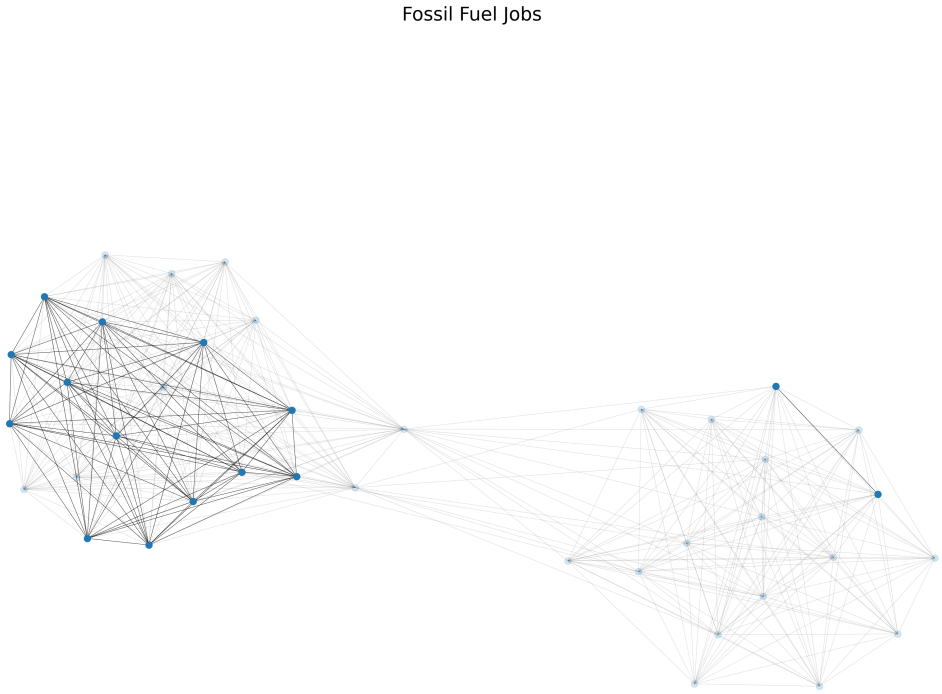
```
  for i in range(len(value)):
    if(value[i]>=0.4):
      edges_jobs.append((job,jobs_list[i]))
```

[48]:
```
G_jobs.add_edges_from(edges_jobs)
```

[49]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500,  with_labels=False, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[50]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500,  with_labels=False, font_size=30,␣
 ↪alpha=0.2)
nx.draw(G_jobs.subgraph(jobs_list[:15]), pos=pos, node_size=500, ␣
 ↪with_labels=False)
plt.axis('equal')
fontsize = 60
plt.title("Fossil Fuel Jobs", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('fossil_fuel_jobs.svg')
```



[51]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500,  with_labels=False, font_size=30,␣
 ↪alpha=0.2)
nx.draw(G_jobs.subgraph(jobs_list[15:]), pos=pos, node_size=500, ␣
 ↪with_labels=False)
plt.axis('equal')
fontsize = 60
plt.title("Green Jobs", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('green_jobs.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:

[ ]:

[ ]:
```
G=nx.Graph()
G.add_nodes_from(keys)
```

[ ]:
```
edges=[]
for key,value in theta_i_j.items():
  for i in range(len(value)):
    if(value[i]>=0.5):
      edges.append((key,keys[i]))
```

[ ]:
```
# edges
```

[ ]:
```
G.add_edges_from(edges)
```

[ ]:
```
G.nodes()
```

[ ]:
```
NodeView(('Perceptual_Speed', 'Flexibility_of_Closure', 'Memorization',
'Speed_of_Closure', 'Problem_Sensitivity', 'Originality',
'Information_Ordering', 'Inductive_Reasoning', 'Fluency_of_Ideas',
'Deductive_Reasoning', 'Category_Flexibility', 'Selective_Attention',
'Time_Sharing', 'Mathematical_Reasoning', 'Number_Facility',
'Spatial_Orientation', 'Visualization', 'Oral_Comprehension', 'Oral_Expression',
'Written_Comprehension', 'Written_Expression', 'Stamina', 'Dynamic_Flexibility',
'Extent_Flexibility', 'Gross_Body_Coordination', 'Gross_Body_Equilibrium',
'Dynamic_Strength', 'Explosive_Strength', 'Static_Strength', 'Trunk_Strength',
'Control_Precision', 'Multilimb_Coordination', 'Rate_Control',
'Response_Orientation', 'Arm-Hand_Steadiness', 'Finger_Dexterity',
'Manual_Dexterity', 'Reaction_Time', 'Speed_of_Limb_Movement', 'Wrist-
Finger_Speed', 'Auditory_Attention', 'Hearing_Sensitivity',
'Sound_Localization', 'Speech_Clarity', 'Speech_Recognition',
'Depth_Perception', 'Far_Vision', 'Glare_Sensitivity', 'Near_Vision',
'Night_Vision', 'Peripheral_Vision', 'Visual_Color_Discrimination'))
```

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
nx.draw(G, pos=pos, node_size=500,  with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("Skills Used by Fossil Fuel and Green Jobs", fontdict={'fontsize':␣
 ↪fontsize})
plt.show()
fig.savefig('fossil_fuel_to_green_jobs_skills.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
import community
```

[ ]:
```
from community import community_louvain
partition = community_louvain.best_partition(G)
```

[ ]:
```
partition.keys()
```

[ ]:
```
dict_keys(['Perceptual_Speed', 'Flexibility_of_Closure', 'Memorization',
'Speed_of_Closure', 'Problem_Sensitivity', 'Originality',
'Information_Ordering', 'Inductive_Reasoning', 'Fluency_of_Ideas',
'Deductive_Reasoning', 'Category_Flexibility', 'Selective_Attention',
'Time_Sharing', 'Mathematical_Reasoning', 'Number_Facility',
'Spatial_Orientation', 'Visualization', 'Oral_Comprehension', 'Oral_Expression',
'Written_Comprehension', 'Written_Expression', 'Stamina', 'Dynamic_Flexibility',
'Extent_Flexibility', 'Gross_Body_Coordination', 'Gross_Body_Equilibrium',
'Dynamic_Strength', 'Explosive_Strength', 'Static_Strength', 'Trunk_Strength',
'Control_Precision', 'Multilimb_Coordination', 'Rate_Control',
'Response_Orientation', 'Arm-Hand_Steadiness', 'Finger_Dexterity',
'Manual_Dexterity', 'Reaction_Time', 'Speed_of_Limb_Movement', 'Wrist-
Finger_Speed', 'Auditory_Attention', 'Hearing_Sensitivity',
'Sound_Localization', 'Speech_Clarity', 'Speech_Recognition',
'Depth_Perception', 'Far_Vision', 'Glare_Sensitivity', 'Near_Vision',
'Night_Vision', 'Peripheral_Vision', 'Visual_Color_Discrimination'])
```

[ ]:
```
partition
```

[ ]:
```
{'Perceptual_Speed': 0,
 'Flexibility_of_Closure': 0,
 'Memorization': 0,
 'Speed_of_Closure': 0,
 'Problem_Sensitivity': 0,
 'Originality': 0,
 'Information_Ordering': 0,
 'Inductive_Reasoning': 0,
 'Fluency_of_Ideas': 0,
 'Deductive_Reasoning': 0,
 'Category_Flexibility': 0,
 'Selective_Attention': 0,
 'Time_Sharing': 0,
 'Mathematical_Reasoning': 0,
 'Number_Facility': 0,
 'Spatial_Orientation': 1,
 'Visualization': 0,
 'Oral_Comprehension': 0,
 'Oral_Expression': 0,
 'Written_Comprehension': 0,
 'Written_Expression': 0,
 'Stamina': 1,
 'Dynamic_Flexibility': 2,
```

```
 'Extent_Flexibility': 1,
 'Gross_Body_Coordination': 1,
 'Gross_Body_Equilibrium': 1,
 'Dynamic_Strength': 1,
 'Explosive_Strength': 1,
 'Static_Strength': 1,
 'Trunk_Strength': 1,
 'Control_Precision': 1,
 'Multilimb_Coordination': 1,
 'Rate_Control': 1,
 'Response_Orientation': 1,
 'Arm-Hand_Steadiness': 1,
 'Finger_Dexterity': 1,
 'Manual_Dexterity': 1,
 'Reaction_Time': 1,
 'Speed_of_Limb_Movement': 1,
 'Wrist-Finger_Speed': 1,
 'Auditory_Attention': 1,
 'Hearing_Sensitivity': 1,
 'Sound_Localization': 1,
 'Speech_Clarity': 0,
 'Speech_Recognition': 0,
 'Depth_Perception': 1,
 'Far_Vision': 0,
 'Glare_Sensitivity': 1,
 'Near_Vision': 0,
 'Night_Vision': 1,
 'Peripheral_Vision': 1,
 'Visual_Color_Discrimination': 0}
```

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
nx.draw(G, pos=pos, node_size=600, node_color=list(partition.values()),␣
 ↪with_labels=False)
plt.axis('equal')
plt.show()
fig.savefig('Louvain_skills.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
nx.draw(G, pos=pos, node_size=600, node_color=list(partition.values()),␣
 ↪with_labels=True, font_size=35, alpha=0.8)
plt.axis('equal')
plt.show()
```

```
fig.savefig('Louvain_skills_with_label.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
keys=list(e_j_s.keys())
```

[ ]:
```
e_j_s['Perceptual_Speed'][3]
```

[ ]:
```
1
```

[ ]:
```
occupation_use_skills={}
for job_num in range(len(jobs_list)):
  skills_list=[]
  for key in keys:
    if e_j_s[key][job_num]==1:
      skills_list.append(key)
  occupation_use_skills[jobs_list[job_num]]=skills_list
```

[ ]:
```
len(occupation_use_skills.keys())
```

[ ]:
```
39
```

[ ]:
```
occupation_use_skills['Hydroelectric Production Managers']
```

[ ]:
```
['Perceptual_Speed',
 'Flexibility_of_Closure',
 'Memorization',
 'Speed_of_Closure',
 'Problem_Sensitivity',
 'Originality',
 'Information_Ordering',
 'Inductive_Reasoning',
 'Fluency_of_Ideas',
 'Deductive_Reasoning',
 'Category_Flexibility',
 'Selective_Attention',
 'Time_Sharing',
 'Mathematical_Reasoning',
 'Number_Facility',
 'Spatial_Orientation',
 'Visualization',
 'Oral_Comprehension',
 'Oral_Expression',
 'Written_Comprehension',
 'Written_Expression',
 'Reaction_Time',
```

```
 'Wrist-Finger_Speed',
 'Auditory_Attention',
 'Sound_Localization',
 'Speech_Clarity',
 'Speech_Recognition',
 'Glare_Sensitivity',
 'Night_Vision',
 'Peripheral_Vision',
 'Visual_Color_Discrimination']
```

[ ]:
```
jobs_list
```

[ ]:
```
['Rotary Drill Operators, Oil and Gas',
 'Roustabouts, Oil and Gas',
 'Service Unit Operators, Oil and Gas',
 'Petroleum Engineers',
 'Derrick Operators, Oil and Gas',
 'Petroleum Pump System Operators, Refinery Operators, and Gaugers',
 'Wellhead Pumpers',
 'Pump Operators, Except Wellhead Pumpers',
 'Gas Plant Operators',
 'Gas Compressor and Gas Pumping Station Operators',
 'Energy Engineers, Except Wind and Solar',
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders',
 'Continuous Mining Machine Operators',
 'Loading and Moving Machine Operators, Underground Mining',
 'Sailors and Marine Oilers',
 'Geothermal Technicians',
 'Geothermal Production Managers',
 'Biomass Plant Technicians',
 'Biomass Power Plant Managers',
 'Biofuels Processing Technicians',
 'Biofuels Production Managers',
 'Biofuels/Biodiesel Technology and Product Development Managers',
 'Nuclear Engineers',
 'Nuclear Technicians',
 'Nuclear Power Reactor Operators',
 'Nuclear Monitoring Technicians',
 'Environmental Economists',
 'Solar Thermal Installers and Technicians',
 'Solar Energy Systems Engineers',
 'Solar Sales Representatives and Assessors',
 'Solar Energy Installation Managers',
 'Solar Photovoltaic Installers',
 'Wind Energy Operations Managers',
 'Wind Energy Development Managers',
 'Wind Energy Engineers',
```

```
 'Wind Turbine Service Technicians',
 'Sustainability Specialists',
 'Hydroelectric Production Managers',
 'Hydroelectric Plant Technicians']
```

[ ]:
```
for i in range(0,15):
  fig = plt.figure(figsize=(50, 40))
  pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
  nx.draw(G, pos=pos, node_size=500,  with_labels=False, font_size=30, alpha=0.
 ↪2)
  nx.draw(G.subgraph(occupation_use_skills[jobs_list[i]]), pos=pos,␣
 ↪node_size=500,  with_labels=False)
  plt.axis('equal')
  fontsize = 60
  plt.title(jobs_list[i], fontdict={'fontsize': fontsize})
  plt.show()
  # fig.savefig('fossil_fuel_to_green_jobs_skills.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
for i in range(15,39):
  fig = plt.figure(figsize=(50, 40))
  pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
  nx.draw(G, pos=pos, node_size=500,  with_labels=False, font_size=30, alpha=0.
 ↪2)
  nx.draw(G.subgraph(occupation_use_skills[jobs_list[i]]), pos=pos,␣
 ↪node_size=500,  with_labels=False)
  plt.axis('equal')
  fontsize = 60
  plt.title(jobs_list[i], fontdict={'fontsize': fontsize})
  plt.show()
  # fig.savefig('fossil_fuel_to_green_jobs_skills.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
for i in range(34,39):
  fig = plt.figure(figsize=(50, 40))
  pos = nx.spring_layout(G, seed=54111, k=0.6, iterations=25)
  nx.draw(G, pos=pos, node_size=500,  with_labels=False, font_size=30, alpha=0.
 ↪2)
  nx.draw(G.subgraph(occupation_use_skills[jobs_list[i]]), pos=pos,␣
 ↪node_size=500,  with_labels=False)
  plt.axis('equal')
  fontsize = 60
  plt.title(jobs_list[i], fontdict={'fontsize': fontsize})
```

```
  plt.show()
  # fig.savefig('fossil_fuel_to_green_jobs_skills.svg')
```

```
Output hidden; open in https://colab.research.google.com to view.
```

[ ]:

[ ]:

[ ]:

[ ]:

[ ]:

[ ]:
```
!pip install stellargraph
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-
wheels/public/simple/
Collecting stellargraph
  Downloading stellargraph-1.2.1-py3-none-any.whl (435 kB)
     |                  | 435 kB 4.2 MB/s
Requirement already satisfied: networkx>=2.2 in
/usr/local/lib/python3.8/dist-packages (from stellargraph) (2.8.8)
Requirement already satisfied: pandas>=0.24 in /usr/local/lib/python3.8/dist-
packages (from stellargraph) (1.3.5)
Requirement already satisfied: scikit-learn>=0.20 in
/usr/local/lib/python3.8/dist-packages (from stellargraph) (1.0.2)
Requirement already satisfied: numpy>=1.14 in /usr/local/lib/python3.8/dist-
packages (from stellargraph) (1.21.6)
Requirement already satisfied: scipy>=1.1.0 in /usr/local/lib/python3.8/dist-
packages (from stellargraph) (1.7.3)
Requirement already satisfied: tensorflow>=2.1.0 in
/usr/local/lib/python3.8/dist-packages (from stellargraph) (2.9.2)
Requirement already satisfied: matplotlib>=2.2 in /usr/local/lib/python3.8/dist-
packages (from stellargraph) (3.2.2)
Requirement already satisfied: gensim>=3.4.0 in /usr/local/lib/python3.8/dist-
packages (from stellargraph) (3.6.0)
Requirement already satisfied: smart-open>=1.2.1 in
/usr/local/lib/python3.8/dist-packages (from gensim>=3.4.0->stellargraph)
(5.2.1)
Requirement already satisfied: six>=1.5.0 in /usr/local/lib/python3.8/dist-
packages (from gensim>=3.4.0->stellargraph) (1.15.0)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.8/dist-packages (from matplotlib>=2.2->stellargraph)
(1.4.4)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.8/dist-
```

```
packages (from matplotlib>=2.2->stellargraph) (0.11.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in
/usr/local/lib/python3.8/dist-packages (from matplotlib>=2.2->stellargraph)
(3.0.9)
Requirement already satisfied: python-dateutil>=2.1 in
/usr/local/lib/python3.8/dist-packages (from matplotlib>=2.2->stellargraph)
(2.8.2)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.8/dist-
packages (from pandas>=0.24->stellargraph) (2022.6)
Requirement already satisfied: threadpoolctl>=2.0.0 in
/usr/local/lib/python3.8/dist-packages (from scikit-learn>=0.20->stellargraph)
(3.1.0)
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.8/dist-
packages (from scikit-learn>=0.20->stellargraph) (1.2.0)
Requirement already satisfied: gast<=0.4.0,>=0.2.1 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(0.4.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.8/dist-
packages (from tensorflow>=2.1.0->stellargraph) (21.3)
Requirement already satisfied: setuptools in /usr/local/lib/python3.8/dist-
packages (from tensorflow>=2.1.0->stellargraph) (57.4.0)
Requirement already satisfied: tensorboard<2.10,>=2.9 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(2.9.1)
Requirement already satisfied: libclang>=13.0.0 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(14.0.6)
Requirement already satisfied: tensorflow-estimator<2.10.0,>=2.9.0rc0 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(2.9.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.8/dist-
packages (from tensorflow>=2.1.0->stellargraph) (3.1.0)
Requirement already satisfied: google-pasta>=0.1.1 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(0.2.0)
Requirement already satisfied: opt-einsum>=2.3.2 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(3.3.0)
Requirement already satisfied: keras-preprocessing>=1.1.1 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(1.1.2)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(0.28.0)
Requirement already satisfied: wrapt>=1.11.0 in /usr/local/lib/python3.8/dist-
packages (from tensorflow>=2.1.0->stellargraph) (1.14.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
```

```
(1.51.1)
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.8/dist-
packages (from tensorflow>=2.1.0->stellargraph) (1.3.0)
Requirement already satisfied: typing-extensions>=3.6.6 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(4.4.0)
Requirement already satisfied: termcolor>=1.1.0 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(2.1.1)
Requirement already satisfied: keras<2.10.0,>=2.9.0rc0 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(2.9.0)
Requirement already satisfied: flatbuffers<2,>=1.12 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(1.12)
Requirement already satisfied: protobuf<3.20,>=3.9.2 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(3.19.6)
Requirement already satisfied: astunparse>=1.6.0 in
/usr/local/lib/python3.8/dist-packages (from tensorflow>=2.1.0->stellargraph)
(1.6.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in
/usr/local/lib/python3.8/dist-packages (from
astunparse>=1.6.0->tensorflow>=2.1.0->stellargraph) (0.38.4)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in
/usr/local/lib/python3.8/dist-packages (from
tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (0.4.6)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in
/usr/local/lib/python3.8/dist-packages (from
tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (1.8.1)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.8/dist-
packages (from tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (3.4.1)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.8/dist-
packages (from tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (1.0.1)
Requirement already satisfied: google-auth<3,>=1.6.3 in
/usr/local/lib/python3.8/dist-packages (from
tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (2.15.0)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in
/usr/local/lib/python3.8/dist-packages (from
tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (0.6.1)
Requirement already satisfied: requests<3,>=2.21.0 in
/usr/local/lib/python3.8/dist-packages (from
tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (2.23.0)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in
/usr/local/lib/python3.8/dist-packages (from google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (5.2.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in
/usr/local/lib/python3.8/dist-packages (from google-
```

```
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (0.2.8)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.8/dist-
packages (from google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in
/usr/local/lib/python3.8/dist-packages (from google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(1.3.1)
Requirement already satisfied: importlib-metadata>=4.4 in
/usr/local/lib/python3.8/dist-packages (from
markdown>=2.6.8->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(4.13.0)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.8/dist-
packages (from importlib-metadata>=4.4->markdown>=2.6.8->tensorboard<2.10,>=2.9-
>tensorflow>=2.1.0->stellargraph) (3.11.0)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in
/usr/local/lib/python3.8/dist-packages (from pyasn1-modules>=0.2.1->google-
auth<3,>=1.6.3->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph) (0.4.8)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.8/dist-
packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(2.10)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.8/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(2022.9.24)
Requirement already satisfied: chardet<4,>=3.0.2 in
/usr/local/lib/python3.8/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
/usr/local/lib/python3.8/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(1.24.3)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.8/dist-
packages (from requests-oauthlib>=0.7.0->google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.10,>=2.9->tensorflow>=2.1.0->stellargraph)
(3.2.2)
Installing collected packages: stellargraph
Successfully installed stellargraph-1.2.1
```

[ ]:
```
from sklearn.manifold import TSNE
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegressionCV
from sklearn.metrics import accuracy_score
from sklearn.metrics.pairwise import pairwise_distances
from sklearn import preprocessing
```

```
import numpy as np

from stellargraph.data import BiasedRandomWalk
from stellargraph import StellarGraph

from gensim.models import Word2Vec

import warnings
import collections
from stellargraph import datasets
from IPython.display import display, HTML
import matplotlib.pyplot as plt
import multiprocessing

%matplotlib inline
```

[ ]:
```
len(G_jobs.edges())
```

[ ]: 385

[ ]:
```
eta_i_j['Rotary Drill Operators, Oil and Gas']
```

[ ]:
```
array([0.        , 0.78571429, 0.875     , 0.        , 0.88      ,
       0.69230769, 0.74074074, 0.81481481, 0.73076923, 0.73913043,
       0.        , 0.8       , 0.74074074, 0.84      , 0.75      ,
       0.67741935, 0.14285714, 0.73076923, 0.11538462, 0.76923077,
       0.10714286, 0.07692308, 0.03703704, 0.48      , 0.21212121,
       0.24137931, 0.        , 0.68181818, 0.08333333, 0.08333333,
       0.58333333, 0.81818182, 0.16666667, 0.04      , 0.08      ,
       0.8       , 0.        , 0.19354839, 0.82608696])
```

[ ]:
```
jobs_list[0]
```

[ ]: 'Rotary Drill Operators, Oil and Gas'

[ ]:
```
len(jobs_list)
```

[ ]: 39

[ ]:
```
source=[]
target=[]
value=[]
for i in range(len(jobs_list)):
  for j in range(i+1, len(jobs_list)):
    if eta_i_j[jobs_list[i]][j]>0:
      source.append(jobs_list[i])
```

```
        target.append(jobs_list[j])
        value.append(eta_i_j[jobs_list[i]][j])
```

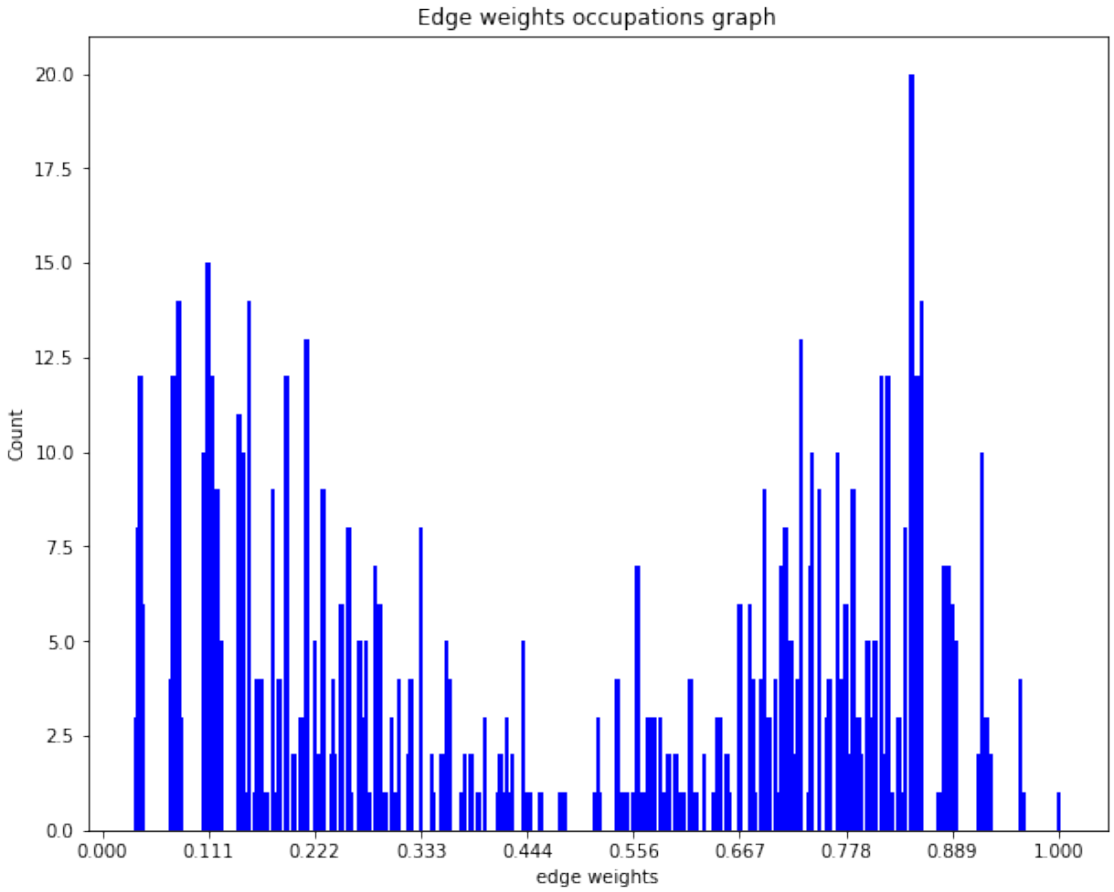
[ ]:
```
data = {'source': source,
        'target': target,
        'weight': value}
df_jobs = pd.DataFrame(data)
```

[ ]:
```
df_jobs
```

[ ]:
```
stellar_G = StellarGraph(edges=df_jobs)
print(stellar_G.info())
```

```
StellarGraph: Undirected multigraph
 Nodes: 39, Edges: 723

 Node types:
  default: [39]
    Features: none
    Edge types: default-default->default

 Edge types:
    default-default->default: [723]
        Weights: range=[0.0357143, 1], mean=0.480812, std=0.303205
        Features: none
```

[ ]:
```
_, weights = stellar_G.edges(include_edge_weight=True)

wt, cnt = np.unique(weights, return_counts=True)

plt.figure(figsize=(10, 8))
plt.bar(wt, cnt, width=0.005, color="b")
plt.title("Edge weights occupations graph")
plt.ylabel("Count")
plt.xlabel("edge weights")
plt.xticks(np.linspace(0, 1, 10))

plt.show()
```



[ ]:
```
walk_length = 500
```

[ ]:
```
rw = BiasedRandomWalk(stellar_G)
```

[ ]:
```
weighted_walks = rw.run(
    nodes=stellar_G.nodes(),
    length=walk_length,
    n=100,
    p=1,
    q=0.5,
    weighted=True,
    seed=42,
)
print("Number of random walks: {}".format(len(weighted_walks)))
```

```
Number of random walks: 3900
```

[ ]:
```
weighted_walks1 = rw.run(
    nodes=stellar_G.nodes(),
```

```
    length=walk_length,
    n=100,
    p=0.3,
    q=4,
    weighted=True,
    seed=42,
)
print("Number of random walks: {}".format(len(weighted_walks)))
```

```
Number of random walks: 3900
```

[ ]:
```
weighted_model = Word2Vec(
    weighted_walks, size=1024, window=5, min_count=0, sg=1, workers = 1, iter=1
)
```

[ ]:
```
weighted_model1 = Word2Vec(
    weighted_walks1, size=1024, window=5, min_count=0, sg=1, workers = 1, iter=1
)
```

[ ]:
```
jobs_list
```

[ ]:
```
emb = weighted_model.wv['Rotary Drill Operators, Oil and Gas']
print(emb.shape)
print(emb)
```

```
(1024,)
[ 0.00944027 -0.00147957 -0.05383601 … -0.01187107 -0.0079139
  0.04390134]
```

[ ]:
```
a=weighted_model.wv['Rotary Drill Operators, Oil and Gas']
a
```

[ ]:
```
array([ 0.00944027, -0.00147957, -0.05383601, …, -0.01187107,
       -0.0079139 ,  0.04390134], dtype=float32)
```

[ ]:
```
weighted_node_embeddings = []
```

[ ]:
```
for i in jobs_list:
  a=weighted_model.wv[i]
  list_a=[]
  for i in a:
    list_a.append(i)
  weighted_node_embeddings.append(list_a)
  # weighted_node_embeddings.append(list(weighted_model.wv[i]))
```

[ ]:
```

```

[ ]:

[ ]:

[ ]:
```
weighted_node_embeddings1 = []
```

[ ]:
```
for i in jobs_list:
  a=weighted_model1.wv[i]
  list_a=[]
  for i in a:
    list_a.append(i)
  weighted_node_embeddings1.append(list_a)
  # weighted_node_embeddings.append(list(weighted_model.wv[i]))
```

[ ]:
```
weighted_node_embeddings[0]
```

[ ]:

[ ]:

[ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
%matplotlib inline
```

[ ]:
```
Kmean = KMeans(n_clusters=2)
Kmean.fit(weighted_node_embeddings)
```

[ ]:
```
KMeans(n_clusters=2)
```

[ ]:
```
labels_jobs_2=Kmean.labels_
len(labels_jobs_2)
```

[ ]:
```
39
```

[ ]:
```
Kmean = KMeans(n_clusters=3)
Kmean.fit(weighted_node_embeddings)
labels_jobs_3=Kmean.labels_
len(labels_jobs_3)
partition_jobs_3={}
for i in range(len(jobs_list)):
  partition_jobs_3[jobs_list[i]]=labels_jobs_3[i]
```

[ ]:
```
Kmean = KMeans(n_clusters=4)
Kmean.fit(weighted_node_embeddings)
labels_jobs_4=Kmean.labels_
```

```
len(labels_jobs_4)
partition_jobs_4={}
for i in range(len(jobs_list)):
  partition_jobs_4[jobs_list[i]]=labels_jobs_4[i]
```

[ ]:
```
partition_jobs={}
for i in range(len(jobs_list)):
  partition_jobs[jobs_list[i]]=labels_jobs_2[i]
```

[ ]:
```

```

[ ]:
```

```

[ ]:
```
Kmean = KMeans(n_clusters=2)
Kmean.fit(weighted_node_embeddings1)
labels_jobs_2_pq=Kmean.labels_
len(labels_jobs_2_pq)
partition_jobs_2_pq={}
for i in range(len(jobs_list)):
  partition_jobs_2_pq[jobs_list[i]]=labels_jobs_2_pq[i]
```

[ ]:
```
Kmean = KMeans(n_clusters=3)
Kmean.fit(weighted_node_embeddings1)
labels_jobs_3_pq=Kmean.labels_
len(labels_jobs_3_pq)
partition_jobs_3_pq={}
for i in range(len(jobs_list)):
  partition_jobs_3_pq[jobs_list[i]]=labels_jobs_3_pq[i]
```

[ ]:
```
Kmean = KMeans(n_clusters=4)
Kmean.fit(weighted_node_embeddings1)
labels_jobs_4_pq=Kmean.labels_
len(labels_jobs_4_pq)
partition_jobs_4_pq={}
for i in range(len(jobs_list)):
  partition_jobs_4_pq[jobs_list[i]]=labels_jobs_4_pq[i]
```

[ ]:
```
partition_jobs_4_pq
```

[ ]:
```

```

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
```

```
plt.title("fossil fuel jobs and green jobs", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs_3.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs 3", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs3.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs_4.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs 4", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs4.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:

[ ]:

[ ]:

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs_2_pq.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs 4", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs4.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs_3_pq.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs 4", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs4.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:
```
partition_jobs_4_pq
```

[ ]:
```
{'Rotary Drill Operators, Oil and Gas': 3,
 'Roustabouts, Oil and Gas': 3,
 'Service Unit Operators, Oil and Gas': 3,
 'Petroleum Engineers': 2,
 'Derrick Operators, Oil and Gas': 3,
 'Petroleum Pump System Operators, Refinery Operators, and Gaugers': 3,
 'Wellhead Pumpers': 3,
 'Pump Operators, Except Wellhead Pumpers': 3,
 'Gas Plant Operators': 3,
 'Gas Compressor and Gas Pumping Station Operators': 3,
 'Energy Engineers, Except Wind and Solar': 2,
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders': 3,
 'Continuous Mining Machine Operators': 3,
 'Loading and Moving Machine Operators, Underground Mining': 3,
 'Sailors and Marine Oilers': 3,
 'Geothermal Technicians': 3,
 'Geothermal Production Managers': 2,
 'Biomass Plant Technicians': 3,
 'Biomass Power Plant Managers': 2,
 'Biofuels Processing Technicians': 3,
 'Biofuels Production Managers': 2,
 'Biofuels/Biodiesel Technology and Product Development Managers': 2,
 'Nuclear Engineers': 2,
 'Nuclear Technicians': 3,
 'Nuclear Power Reactor Operators': 2,
 'Nuclear Monitoring Technicians': 2,
 'Environmental Economists': 2,
 'Solar Thermal Installers and Technicians': 3,
 'Solar Energy Systems Engineers': 2,
 'Solar Sales Representatives and Assessors': 2,
```

```
 'Solar Energy Installation Managers': 3,
 'Solar Photovoltaic Installers': 3,
 'Wind Energy Operations Managers': 2,
 'Wind Energy Development Managers': 2,
 'Wind Energy Engineers': 2,
 'Wind Turbine Service Technicians': 3,
 'Sustainability Specialists': 2,
 'Hydroelectric Production Managers': 2,
 'Hydroelectric Plant Technicians': 3}
```

[ ]:
```
fig = plt.figure(figsize=(50, 40))
pos = nx.spring_layout(G_jobs, seed=5411, k=0.6, iterations=25)
nx.draw(G_jobs, pos=pos, node_size=500, node_color=list(partition_jobs_4_pq.
 ↪values()), with_labels=True, font_size=30)
plt.axis('equal')
fontsize = 60
plt.title("fossil fuel jobs and green jobs 4", fontdict={'fontsize': fontsize})
plt.show()
fig.savefig('jobs4.svg')
```

Output hidden; open in https://colab.research.google.com to view.

[ ]:

[ ]:

[ ]:
```
!ls
```

```
ffai_us_job_transitions_per_year_counts.gzip  jobs.svg
fossil_fuel.xlsx                              skills_jobs_csv
```

[ ]:
```
# %cd Network Final Project
```

[ ]:
```
transition_df = pd.read_csv("ffai_us_job_transitions_per_year_counts.gzip",␣
 ↪compression="gzip")
transition_df
```

[ ]:

	S_Soc	D_Soc	Date	Counts
0	15-1252	15-1252	2017	7800
1	15-1252	15-1252	2016	7513
2	15-1252	15-1252	2015	7290
3	15-1252	15-1252	2018	6976
4	15-1252	15-1252	2014	6276
…	…	…	…	…
1149364	25-1081	39-6012	2010	1
1149365	25-1081	39-6012	2011	1

```
1149366  25-1081  39-6012  2014       1
1149367  25-1081  39-6012  2015       1
1149368  55-3019  55-3019  2019       1

[1149369 rows x 4 columns]
```

[ ]:
```
transition_df.loc[[900]]
```

[ ]:
```
       S_Soc    D_Soc  Date  Counts
900  11-2022  11-2021  2018     456
```

[ ]:
```
jobs_list
```

[ ]:
```
['Rotary Drill Operators, Oil and Gas',
 'Roustabouts, Oil and Gas',
 'Service Unit Operators, Oil and Gas',
 'Petroleum Engineers',
 'Derrick Operators, Oil and Gas',
 'Petroleum Pump System Operators, Refinery Operators, and Gaugers',
 'Wellhead Pumpers',
 'Pump Operators, Except Wellhead Pumpers',
 'Gas Plant Operators',
 'Gas Compressor and Gas Pumping Station Operators',
 'Energy Engineers, Except Wind and Solar',
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders',
 'Continuous Mining Machine Operators',
 'Loading and Moving Machine Operators, Underground Mining',
 'Sailors and Marine Oilers',
 'Geothermal Technicians',
 'Geothermal Production Managers',
 'Biomass Plant Technicians',
 'Biomass Power Plant Managers',
 'Biofuels Processing Technicians',
 'Biofuels Production Managers',
 'Biofuels/Biodiesel Technology and Product Development Managers',
 'Nuclear Engineers',
 'Nuclear Technicians',
 'Nuclear Power Reactor Operators',
 'Nuclear Monitoring Technicians',
 'Environmental Economists',
 'Solar Thermal Installers and Technicians',
 'Solar Energy Systems Engineers',
 'Solar Sales Representatives and Assessors',
 'Solar Energy Installation Managers',
 'Solar Photovoltaic Installers',
 'Wind Energy Operations Managers',
 'Wind Energy Development Managers',
```

```
 'Wind Energy Engineers',
 'Wind Turbine Service Technicians',
 'Sustainability Specialists',
 'Hydroelectric Production Managers',
 'Hydroelectric Plant Technicians']
```

[ ]:
```
jobs_list_code=['47-5012','47-5071','47-5013','17-2171','47-5011','51-8093','53-7073','53-7072
      ␣
↪'53-7071','17-2199','51-9021','47-5041','47-5044','53-5011','49-9099','11-3051','51-8013',
      ␣
↪'11-3051','51-8099','11-3051','11-9041','17-2161','19-4051','51-8011','19-4051','19-3011',
      ␣
↪'47-2152','17-2199','41-4011','47-1011','47-2231','11-9199','11-9199','17-2199','49-9081',
       '13-1199','11-3051','51-8013']
```

[ ]:
```
len(jobs_list_code)
```

[ ]:
```
39
```

[ ]:
```
subset=(transition_df.loc[transition_df['S_Soc'].isin(jobs_list_code) &␣
↪transition_df['D_Soc'].isin(jobs_list_code)]).copy()
```

[ ]:
```
subset
```

[ ]:

	S_Soc	D_Soc	Date	Counts
204	11-9041	11-9041	2017	1278
224	11-9041	11-9041	2016	1231
226	11-9041	11-9041	2015	1217
268	11-9041	11-9041	2014	1122
272	11-9041	11-9041	2018	1109
…	…	…	…	…
1097329	19-4051	51-8011	2011	1
1097330	19-4051	51-8011	2014	1
1097331	19-4051	51-8011	2017	1
1097333	19-4051	51-8013	1976	1
1097334	19-4051	51-8092	2013	1

[3032 rows x 4 columns]

[ ]:
```
subset=subset.loc[(subset['Date'] > 2009) & (subset['Date'] < 2019)]
```

[ ]:
```
subset
```

[ ]:

	S_Soc	D_Soc	Date	Counts
204	11-9041	11-9041	2017	1278
224	11-9041	11-9041	2016	1231
226	11-9041	11-9041	2015	1217

```
268       11-9041  11-9041  2014    1122
272       11-9041  11-9041  2018    1109
…           …        …      …       …
1093288   19-4051  17-2199  2013       1
1097329   19-4051  51-8011  2011       1
1097330   19-4051  51-8011  2014       1
1097331   19-4051  51-8011  2017       1
1097334   19-4051  51-8092  2013       1

[1295 rows x 4 columns]
```

[ ]:
```
subset=subset.reset_index()
```

[ ]:
```
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset
```

[ ]:
```
         S_Soc    D_Soc  Date  Counts
42    17-2199  11-9041  2013     109
44    17-2199  11-9041  2015     103
46    17-2199  11-9041  2016      81
47    17-2199  11-9041  2012      80
49    17-2199  11-9041  2010      79
53    17-2199  11-9041  2017      76
55    17-2199  11-9041  2014      71
57    11-9041  17-2199  2015      65
58    17-2199  11-9041  2011      61
64    11-9041  17-2199  2017      56
65    11-9041  11-9199  2017      55
67    11-9041  11-3051  2012      55
70    11-9041  17-2199  2013      51
71    11-9041  11-3051  2014      51
73    11-9041  11-3051  2015      50
74    17-2199  11-9041  2018      49
76    11-9041  17-2199  2016      48
77    11-3051  11-9041  2013      48
79    11-9041  11-3051  2010      46
80    11-3051  11-9041  2015      46
81    11-9041  17-2199  2018      45
82    11-9041  17-2199  2014      45
83    11-9041  11-3051  2013      44
85    11-9041  11-3051  2011      43
86    11-9041  11-3051  2017      42
87    11-9041  11-9199  2014      42
91    11-3051  11-9041  2014      40
93    11-9041  17-2199  2012      39
94    11-9199  11-9041  2016      38
```

95	11-9041	11-9199	2015	38
96	11-3051	11-9041	2016	38
97	11-3051	11-9041	2012	38
98	11-3051	11-9041	2011	38
99	11-9041	11-9199	2012	37
100	11-9041	17-2199	2011	37
101	11-9199	11-9041	2013	37
102	11-9199	11-9041	2015	36
105	11-9199	11-9041	2017	35
106	11-9041	11-3051	2018	35
107	11-9041	11-3051	2016	35
108	11-9041	11-9199	2016	35
109	11-3051	11-9041	2018	35
110	11-9041	11-9199	2013	33
111	11-9041	11-9199	2018	33
112	11-3051	11-9041	2017	33
113	11-9199	11-9041	2014	31
118	11-3051	11-9041	2010	31
119	11-9199	11-9041	2012	30
125	11-9041	17-2199	2010	27
129	11-9199	11-9041	2018	26
133	11-9199	11-9041	2011	24
142	11-9199	11-9041	2010	22
146	11-9041	11-9199	2010	22
153	11-9041	11-9199	2011	20
166	47-5012	17-2171	2015	16
167	47-5012	17-2171	2014	16
176	17-2171	47-5012	2014	14
179	11-9041	41-4011	2018	12
180	41-4011	11-9041	2016	12
181	41-4011	11-9041	2015	12
184	11-3051	11-9199	2013	12
186	17-2161	11-9041	2013	11
190	11-3051	11-9199	2017	11
191	11-3051	11-9199	2016	11
192	41-4011	11-9041	2014	11
193	17-2161	51-8011	2015	11
194	17-2171	11-9041	2015	10
196	17-2161	11-9041	2014	10
197	47-5012	17-2171	2012	10
198	11-3051	11-9199	2012	10
199	11-9041	41-4011	2017	10
202	11-9199	11-3051	2015	10
203	11-9199	11-3051	2012	10
204	11-9199	11-3051	2010	10
205	17-2171	11-9041	2016	10
207	17-2161	51-8011	2014	10

214	17-2199	17-2171	2013	9
215	17-2161	51-8011	2013	9
217	17-2199	11-3051	2015	9
218	11-9199	11-3051	2016	9
219	11-9199	11-3051	2017	9
220	51-8011	17-2161	2015	9
221	17-2199	11-9199	2010	9
222	47-5012	17-2171	2011	9
223	41-4011	11-9041	2017	8
224	17-2161	51-8011	2012	8
225	11-9041	17-2171	2013	8
226	47-5012	47-1011	2014	8
227	17-2161	11-9041	2011	8
228	11-9199	11-3051	2018	8
229	11-9041	41-4011	2015	8
231	17-2171	47-5012	2011	8
235	17-2171	11-9041	2018	8
236	17-2171	11-9041	2012	8
237	47-1011	47-2152	2014	8
238	51-8011	17-2161	2010	8
239	51-8011	17-2161	2013	8
240	11-3051	11-9199	2015	8
241	11-3051	11-9199	2014	8
246	17-2171	17-2199	2014	7
247	17-2199	47-5012	2014	7
248	17-2171	17-2199	2017	7
249	47-5012	17-2171	2016	7
250	17-2171	47-5012	2017	7
251	17-2171	47-5012	2015	7
252	17-2171	47-5012	2012	7
253	17-2171	47-5012	2013	7
256	47-1011	11-9199	2016	7
257	47-1011	11-3051	2015	7
259	11-9041	41-4011	2013	7
260	41-4011	11-3051	2015	7
261	17-2161	51-8011	2011	7
262	17-2161	51-8011	2010	7
263	17-2171	11-9041	2010	7
264	17-2171	11-9041	2013	7
265	51-8011	17-2161	2017	7
266	47-1011	47-5012	2014	7
267	17-2199	11-9199	2015	7
268	11-3051	11-9199	2011	6
269	11-3051	11-9199	2010	6
270	17-2199	11-3051	2016	6
271	11-3051	11-9199	2018	6
272	47-1011	47-5012	2016	6

275	11-9199	11-3051	2013	6
276	17-2199	17-2171	2012	6
277	17-2161	11-9041	2015	6
278	17-2171	17-2199	2011	6
279	17-2161	51-8011	2016	6
280	41-4011	11-9041	2018	6
281	41-4011	11-9041	2013	6
282	41-4011	11-9041	2012	6
283	11-9041	41-4011	2012	6
284	11-9041	17-2161	2014	6
285	47-2152	47-1011	2014	6
288	17-2171	47-5012	2018	6
289	17-2171	47-5012	2016	6
290	51-8013	11-3051	2012	5
291	51-8011	11-9041	2010	5
292	17-2199	47-5012	2011	5
294	51-8011	17-2161	2012	5
295	51-8011	17-2161	2011	5
299	41-4011	11-9041	2011	5
300	11-9041	17-2161	2011	5
301	11-9041	17-2161	2012	5
302	11-9041	17-2161	2013	5
303	17-2161	51-8011	2017	5
304	17-2171	11-9041	2017	5
305	17-2171	11-9041	2014	5
306	17-2171	11-9041	2011	5
307	17-2161	11-9041	2010	5
308	19-3011	11-9199	2017	5
309	17-2199	17-2171	2011	5
310	17-2161	17-2199	2015	5
312	17-2199	11-3051	2012	5
313	17-2199	11-3051	2011	5
314	11-3051	41-4011	2014	5
315	47-1011	17-2199	2016	5
316	47-1011	47-2152	2013	5
317	47-1011	47-2152	2015	5
318	47-1011	47-2152	2016	5
319	47-1011	11-9199	2012	5
320	17-2199	11-9199	2016	5
321	17-2199	11-9199	2014	5
322	17-2199	11-9199	2017	5
323	47-1011	11-9199	2010	5
324	47-1011	11-9041	2014	5
325	47-1011	11-3051	2013	5
326	17-2171	17-2199	2016	5
327	17-2171	17-2199	2015	5
328	17-2171	17-2199	2013	5

329	17-2171	17-2199	2010	5
331	17-2171	51-8093	2017	5
332	17-2171	47-5012	2010	5
333	47-5012	11-9041	2017	5
334	47-5012	47-1011	2017	5
335	47-5012	17-2171	2017	5
336	17-2171	51-8092	2013	4
337	17-2171	51-8093	2011	4
338	51-8011	17-2161	2014	4
339	51-8011	17-2199	2012	4
340	51-8011	11-9041	2013	4
341	51-8011	11-9041	2015	4
342	17-2199	11-3051	2010	4
343	17-2161	19-4051	2014	4
344	17-2161	11-9041	2012	4
345	17-2161	11-9041	2016	4
346	17-2161	11-9041	2017	4
347	17-2199	17-2171	2017	4
348	17-2199	17-2161	2011	4
349	17-2161	17-2199	2010	4
350	17-2171	11-3051	2015	4
351	11-9199	17-2199	2014	4
352	11-9199	17-2199	2016	4
353	11-9199	19-3011	2015	4
354	11-9199	17-2161	2016	4
355	11-9041	41-4011	2010	4
356	11-9041	41-4011	2014	4
357	11-9041	47-5012	2012	4
359	41-4011	11-9041	2010	4
364	41-4011	11-3051	2017	4
365	11-9041	17-2171	2014	4
366	47-5012	17-2171	2018	4
367	47-5012	17-2171	2013	4
368	47-5013	11-9041	2014	4
371	47-5013	47-5012	2015	4
372	47-2152	47-1011	2015	4
373	47-2152	47-1011	2013	4
374	47-2152	47-1011	2011	4
375	47-1011	47-2152	2017	4
376	47-1011	47-5012	2013	4
377	11-3051	41-4011	2015	4
380	11-3051	17-2199	2013	4
381	47-1011	11-3051	2014	4
382	47-1011	11-3051	2016	4
383	51-8093	11-3051	2017	4
384	51-8093	11-9199	2012	4
385	51-8093	17-2171	2014	4

386	47-1011	11-9041	2012	4
387	47-1011	11-9041	2017	4
388	51-8092	17-2171	2011	4
389	47-1011	11-9199	2015	4
390	47-1011	11-9199	2013	4
391	53-7072	11-3051	2013	4
395	47-1011	11-9199	2014	3
396	47-1011	11-9199	2011	3
397	47-1011	17-2199	2014	3
398	47-1011	11-9041	2016	3
399	17-2171	51-8093	2013	3
400	17-2171	53-7071	2015	3
401	47-2231	11-9041	2017	3
402	17-2171	17-2199	2012	3
403	17-2199	11-3051	2013	3
404	47-2152	47-1011	2012	3
405	17-2171	11-9199	2012	3
406	47-1011	11-3051	2011	3
407	47-1011	11-3051	2017	3
408	17-2199	11-9199	2011	3
409	47-1011	47-5012	2018	3
410	47-1011	47-2152	2012	3
411	17-2199	11-3051	2017	3
412	17-2199	11-3051	2018	3
413	17-2199	49-9081	2015	3
414	17-2199	47-5012	2013	3
415	17-2199	47-5012	2018	3
416	17-2199	51-8092	2016	3
417	17-2199	51-8092	2015	3
418	17-2199	51-8092	2014	3
419	17-2199	41-4011	2013	3
420	17-2199	41-4011	2015	3
421	17-2199	17-2171	2015	3
422	17-2199	17-2171	2018	3
423	17-2161	17-2199	2013	3
424	47-5012	11-9041	2012	3
425	47-5012	47-1011	2013	3
426	47-5012	41-4011	2014	3
427	47-5012	17-2171	2010	3
428	47-5012	17-2199	2014	3
429	17-2161	11-9199	2014	3
430	17-2161	11-9041	2018	3
431	17-2199	17-2161	2013	3
432	17-2199	17-2161	2014	3
433	17-2161	17-2199	2017	3
434	17-2161	19-4051	2015	3
435	17-2199	19-4051	2013	3

436	47-5013	11-9041	2013	3
438	11-9041	17-2161	2010	3
439	11-9041	17-2171	2010	3
440	11-9041	17-2171	2012	3
441	11-9041	17-2171	2015	3
442	11-9041	17-2171	2018	3
443	11-9041	47-1011	2018	3
444	11-9041	47-5012	2013	3
445	11-9041	47-5012	2014	3
446	11-9041	47-5013	2011	3
447	11-9041	47-2231	2018	3
448	11-9041	47-2152	2016	3
449	11-9041	51-8093	2014	3
450	11-9041	41-4011	2016	3
451	41-4011	11-3051	2013	3
452	41-4011	11-9199	2010	3
453	41-4011	11-9199	2015	3
454	41-4011	11-9199	2016	3
456	41-4011	17-2199	2018	3
458	53-7071	51-8092	2014	3
459	11-9199	41-4011	2011	3
460	11-9199	41-4011	2014	3
461	11-9199	17-2199	2015	3
462	19-4051	17-2199	2014	3
463	11-3051	17-2161	2010	3
464	11-3051	17-2199	2011	3
465	11-3051	17-2199	2015	3
466	11-3051	51-8093	2011	3
467	11-3051	47-1011	2013	3
468	11-3051	47-1011	2016	3
470	51-8092	51-8093	2016	3
471	51-8092	17-2171	2015	3
472	51-8092	17-2199	2015	3
473	51-8093	11-9041	2012	3
474	51-8093	11-9041	2015	3
475	51-8093	17-2171	2015	3
476	51-8093	17-2171	2011	3
477	51-8092	11-9199	2016	3
478	49-9081	11-9041	2013	3
480	19-3011	11-9199	2018	3
481	19-3011	11-9199	2015	3
482	19-3011	11-9199	2014	3
483	19-3011	11-9199	2010	3
484	51-8011	11-9041	2014	3
485	51-8011	17-2161	2018	3
487	19-3011	11-9041	2017	2
488	19-3011	11-9199	2011	2

489	17-2199	51-8093	2010	2
490	17-2199	51-8092	2012	2
491	17-2199	47-2152	2017	2
492	17-2199	47-5012	2012	2
493	17-2199	47-5012	2010	2
494	17-2199	47-5013	2013	2
495	17-2199	47-5013	2010	2
496	17-2199	47-1011	2017	2
497	17-2199	47-1011	2015	2
498	17-2199	47-1011	2014	2
499	17-2199	17-2161	2015	2
501	53-5011	41-4011	2011	2
502	53-5011	17-2171	2017	2
503	53-5011	17-2199	2015	2
504	41-4011	17-2199	2016	2
505	41-4011	51-8093	2010	2
506	11-9041	19-3011	2015	2
507	11-9041	17-2171	2017	2
508	11-9041	17-2171	2016	2
509	11-9041	17-2161	2015	2
510	11-9041	17-2161	2016	2
511	11-9041	17-2161	2017	2
512	11-9041	17-2171	2011	2
513	11-9041	51-8011	2012	2
514	11-9041	49-9081	2010	2
515	11-9041	49-9081	2012	2
516	11-9041	47-2152	2014	2
517	11-9041	47-2231	2015	2
518	11-9041	47-1011	2017	2
519	11-9041	47-1011	2012	2
520	11-9041	47-1011	2010	2
521	11-9041	47-5012	2010	2
522	11-9041	47-5012	2011	2
523	11-9041	47-5012	2016	2
524	11-9041	51-8011	2014	2
525	11-9041	51-8011	2015	2
526	11-9041	51-8011	2017	2
527	11-9041	51-8093	2012	2
528	11-9041	51-8093	2015	2
529	11-9041	51-8093	2016	2
530	11-9041	51-8013	2010	2
531	11-9041	51-8013	2015	2
532	11-9041	51-8092	2014	2
533	11-9041	51-8092	2010	2
534	11-9041	51-8092	2011	2
535	11-9041	51-8092	2012	2
536	11-9041	51-8092	2013	2

537	41-4011	11-3051	2018	2
538	41-4011	11-3051	2014	2
539	41-4011	11-3051	2010	2
540	41-4011	11-3051	2012	2
541	41-4011	11-9199	2012	2
542	41-4011	11-9199	2013	2
543	41-4011	11-9199	2017	2
544	11-9199	19-3011	2013	2
545	11-9199	19-3011	2014	2
546	11-9199	19-3011	2011	2
547	11-9199	17-2199	2017	2
548	11-9199	17-2199	2010	2
549	11-9199	17-2199	2012	2
550	11-9199	17-2199	2018	2
551	11-9199	11-3051	2014	2
552	11-9199	11-3051	2011	2
553	11-9199	41-4011	2017	2
554	11-9199	41-4011	2016	2
555	11-9199	41-4011	2013	2
556	11-9199	41-4011	2012	2
557	11-9199	51-8093	2015	2
558	11-9199	51-8011	2010	2
559	11-9199	47-1011	2015	2
560	11-9199	47-1011	2013	2
561	11-9199	47-1011	2014	2
562	11-9199	47-1011	2017	2
563	11-9199	47-5012	2014	2
564	11-3051	47-1011	2010	2
565	11-3051	47-1011	2014	2
566	11-3051	41-4011	2013	2
567	11-3051	41-4011	2016	2
568	11-3051	41-4011	2018	2
569	11-3051	17-2161	2016	2
570	11-3051	17-2199	2012	2
571	11-3051	17-2199	2016	2
572	11-3051	17-2199	2017	2
573	11-3051	51-8013	2015	2
574	11-3051	51-8013	2016	2
575	11-3051	51-8013	2017	2
576	11-3051	51-8093	2013	2
577	11-3051	51-8011	2010	2
578	11-3051	51-8011	2013	2
579	11-3051	47-5012	2012	2
580	11-3051	47-5013	2012	2
581	53-7072	17-2199	2015	2
585	53-7071	11-9041	2016	2
586	53-7072	11-3051	2012	2

587	53-7072	11-9041	2018	2
588	53-7072	11-9041	2017	2
589	53-7071	51-8092	2016	2
590	53-7071	51-8092	2015	2
596	47-5071	17-2171	2014	2
597	47-5071	47-5012	2016	2
601	47-5013	11-9041	2016	2
602	47-5012	47-5013	2016	2
603	47-5012	47-5013	2015	2
604	47-5012	47-5013	2014	2
605	47-5012	47-5013	2013	2
606	47-5012	47-5013	2012	2
608	47-5013	47-1011	2016	2
609	47-5012	11-9199	2014	2
610	47-5012	11-9041	2015	2
611	47-5012	11-3051	2014	2
612	47-5012	47-1011	2011	2
613	47-5012	47-1011	2018	2
614	47-5012	47-1011	2015	2
615	47-5012	47-1011	2012	2
616	47-5012	17-2199	2017	2
617	47-5012	17-2199	2016	2
618	47-5012	17-2199	2013	2
619	17-2171	47-5013	2014	2
620	17-2171	47-5013	2016	2
621	17-2171	47-1011	2014	2
622	17-2171	47-1011	2011	2
623	17-2171	51-8092	2011	2
624	17-2171	51-8093	2014	2
625	17-2171	51-8093	2015	2
626	17-2199	11-9199	2013	2
627	17-2199	11-9199	2018	2
628	17-2199	11-3051	2014	2
629	17-2161	17-2199	2012	2
630	17-2161	17-2199	2014	2
631	17-2161	19-4051	2013	2
632	17-2161	19-4051	2010	2
633	17-2161	17-2199	2016	2
634	17-2171	11-9199	2013	2
635	17-2171	11-3051	2014	2
636	17-2161	51-8013	2012	2
637	17-2161	51-8013	2016	2
638	47-2231	11-9041	2014	2
639	47-2231	11-9041	2012	2
641	47-2152	47-1011	2018	2
642	47-2152	47-1011	2017	2
643	47-2152	47-1011	2016	2

644	47-2152	47-1011	2010	2
645	47-2152	11-9041	2010	2
646	47-2152	17-2199	2017	2
647	47-2152	17-2199	2013	2
648	47-1011	11-9041	2018	2
649	47-1011	11-9041	2013	2
650	47-1011	11-9041	2011	2
651	47-1011	11-3051	2018	2
652	47-1011	11-3051	2012	2
653	47-1011	17-2199	2017	2
654	47-1011	51-8093	2015	2
655	47-1011	47-5012	2017	2
656	47-1011	47-5012	2010	2
657	51-8092	11-9041	2017	2
658	51-8092	11-9041	2015	2
659	51-8092	11-9041	2012	2
660	51-8092	11-9041	2011	2
661	51-8092	11-9199	2012	2
662	51-8092	11-3051	2013	2
663	51-8013	51-8093	2014	2
664	51-8013	51-8092	2013	2
667	51-8093	11-9199	2018	2
668	51-8093	11-9199	2013	2
669	51-8093	17-2171	2012	2
670	51-8092	51-8093	2015	2
671	51-8093	11-3051	2015	2
672	51-8093	11-3051	2012	2
673	51-8093	51-8092	2017	2
674	51-8093	51-8092	2015	2
675	51-8093	51-8092	2011	2
676	51-8093	51-8092	2010	2
677	51-8011	51-8013	2011	2
678	51-8011	11-3051	2015	2
679	51-8011	11-3051	2014	2
680	51-8011	17-2161	2016	2
681	51-8011	19-4051	2017	2
682	51-8013	11-3051	2014	2
683	51-8013	11-9041	2017	2
684	51-8013	11-9041	2014	2
685	51-8013	11-9041	2012	2
686	51-8013	11-9041	2010	2
687	49-9081	11-3051	2015	2
688	49-9081	11-9041	2018	2
689	49-9081	11-9041	2016	2
690	49-9081	11-9041	2011	2
691	49-9081	11-9041	2010	2
693	49-9081	51-8013	2011	2

694	49-9081	51-8013	2013	2
695	49-9081	47-2231	2016	2
696	49-9081	17-2199	2015	2
697	51-8013	53-7071	2018	1
698	51-8013	47-1011	2011	1
699	51-8013	47-2231	2018	1
702	51-8013	51-8092	2014	1
703	51-8013	51-8093	2011	1
704	51-8013	51-8011	2011	1
705	51-8013	51-8011	2014	1
706	51-8013	51-8011	2017	1
707	51-8092	11-3051	2010	1
708	51-8092	11-3051	2012	1
709	51-8092	11-3051	2014	1
710	51-8092	11-3051	2017	1
711	51-8092	11-3051	2018	1
712	51-8011	19-4051	2010	1
713	51-8011	19-4051	2013	1
714	51-8011	19-4051	2018	1
715	51-8011	17-2199	2015	1
716	51-8011	49-9081	2014	1
717	51-8011	51-8092	2013	1
718	51-8011	51-8092	2010	1
719	51-8011	51-8013	2012	1
720	51-8011	51-8013	2016	1
721	51-8011	51-8013	2018	1
722	51-8011	47-1011	2014	1
723	51-8011	47-1011	2013	1
724	51-8011	11-9041	2012	1
725	51-8011	11-9041	2017	1
726	51-8011	11-9041	2018	1
727	51-8011	11-9199	2011	1
728	51-8011	11-9199	2014	1
729	51-8011	11-9199	2015	1
730	51-8011	11-9041	2011	1
731	51-8011	11-3051	2016	1
732	51-8011	11-3051	2013	1
733	51-8011	11-3051	2011	1
734	51-8013	11-9199	2012	1
735	51-8013	11-9199	2014	1
736	51-8013	11-9199	2016	1
737	51-8013	11-9041	2016	1
738	51-8013	11-9041	2015	1
739	51-8013	11-9041	2013	1
740	51-8013	11-3051	2018	1
741	51-8013	11-3051	2010	1
742	51-8013	11-3051	2015	1

743	51-8013	11-3051	2017	1
744	51-8013	19-4051	2010	1
745	51-9021	47-1011	2016	1
746	51-8092	53-7071	2015	1
747	51-8092	53-7071	2018	1
748	51-8092	49-9081	2011	1
749	51-8092	49-9081	2017	1
750	51-8092	51-8093	2011	1
751	51-8092	51-8093	2018	1
752	51-8092	51-8013	2013	1
753	51-8093	11-3051	2011	1
754	51-8093	11-3051	2013	1
755	51-8093	11-9041	2011	1
756	51-8093	11-9041	2013	1
757	51-8093	11-9041	2014	1
758	51-8093	11-9041	2017	1
759	51-8093	11-9199	2011	1
760	51-8093	11-9199	2017	1
761	51-8092	11-9041	2010	1
762	51-8092	11-9041	2013	1
763	51-8092	11-9041	2014	1
764	51-8092	11-9041	2016	1
765	51-8092	11-9041	2018	1
766	51-8092	11-9199	2010	1
767	51-8092	11-9199	2011	1
768	51-8092	11-9199	2014	1
769	51-8092	41-4011	2013	1
770	51-8092	47-2152	2017	1
771	51-8092	47-5012	2015	1
772	51-8092	47-5012	2017	1
773	51-8092	47-5013	2013	1
774	51-8092	17-2161	2013	1
775	51-8092	17-2171	2010	1
776	51-8092	17-2171	2012	1
777	51-8092	17-2171	2014	1
778	51-8092	17-2199	2010	1
779	51-8092	17-2199	2012	1
780	51-8092	17-2199	2014	1
781	51-8092	17-2199	2016	1
782	51-8092	17-2199	2017	1
783	51-8092	17-2199	2018	1
784	51-8092	19-3011	2017	1
785	51-8093	53-7071	2010	1
786	51-8093	53-7071	2011	1
787	51-8093	53-7071	2013	1
788	51-8093	53-7072	2014	1
789	51-8093	53-7073	2010	1

791	51-8099	11-3051	2013	1
792	51-8099	11-3051	2016	1
793	51-8099	11-3051	2017	1
794	51-8093	41-4011	2012	1
795	51-8093	41-4011	2013	1
796	51-8093	17-2199	2017	1
797	51-8093	17-2171	2017	1
798	51-8093	17-2171	2016	1
799	51-8093	17-2171	2013	1
800	51-8093	17-2171	2010	1
801	51-8093	19-3011	2012	1
802	51-8093	19-3011	2015	1
803	51-8093	19-3011	2018	1
804	51-8093	51-8092	2013	1
805	51-8093	51-8092	2014	1
806	51-8093	51-8092	2018	1
807	51-8093	47-5012	2011	1
808	51-8093	47-5012	2015	1
809	51-8093	47-5041	2010	1
810	51-8093	47-5044	2012	1
811	51-8093	47-1011	2010	1
812	51-8093	47-1011	2012	1
813	51-8093	47-1011	2014	1
814	51-8093	47-1011	2015	1
815	51-8093	47-2152	2015	1
816	49-9081	11-9041	2012	1
817	49-9081	11-9041	2014	1
818	49-9081	11-9041	2015	1
819	49-9081	11-9041	2017	1
820	49-9081	11-9199	2013	1
821	49-9081	11-3051	2017	1
822	49-9081	11-3051	2018	1
823	49-9081	41-4011	2013	1
824	49-9081	51-8013	2016	1
825	49-9081	17-2161	2013	1
826	49-9081	17-2199	2010	1
827	49-9081	17-2199	2013	1
829	49-9081	53-7072	2015	1
830	53-5011	51-8011	2011	1
831	53-5011	17-2199	2018	1
832	53-5011	17-2161	2013	1
833	53-5011	17-2161	2015	1
834	53-5011	17-2199	2010	1
835	53-5011	17-2199	2011	1
836	53-5011	17-2199	2012	1
837	53-5011	11-9199	2010	1
838	53-5011	11-9041	2010	1

839	53-5011	19-4051	2016	1
840	53-5011	11-3051	2014	1
841	53-7072	51-8013	2010	1
842	53-7072	51-8013	2017	1
843	53-7072	51-8092	2012	1
844	53-7072	51-8093	2012	1
845	53-7072	51-8093	2017	1
846	53-7073	11-3051	2015	1
848	53-7072	41-4011	2010	1
849	53-7072	41-4011	2014	1
850	53-7072	41-4011	2015	1
851	53-7072	47-1011	2011	1
852	53-7072	47-1011	2012	1
853	53-7072	47-5012	2011	1
854	53-7072	47-5071	2012	1
855	53-7072	47-5071	2017	1
856	53-7073	53-7072	2014	1
858	53-7071	11-3051	2011	1
859	53-7071	11-9041	2010	1
860	53-7071	11-9041	2012	1
861	53-7071	11-9041	2014	1
862	53-7071	11-9041	2015	1
863	53-7071	17-2171	2010	1
864	53-7072	11-3051	2014	1
865	53-7072	11-3051	2015	1
866	53-7072	11-3051	2016	1
867	53-7072	11-3051	2017	1
868	53-7071	17-2171	2013	1
869	53-7072	11-9041	2011	1
870	53-7072	11-9041	2015	1
871	53-7072	11-9041	2016	1
872	53-7072	17-2199	2016	1
873	53-7072	17-2199	2017	1
874	53-7072	11-9199	2018	1
875	53-7071	47-5012	2011	1
876	53-7071	17-2199	2015	1
881	53-7071	51-8092	2010	1
882	53-7071	51-8092	2011	1
883	53-7071	51-8092	2012	1
884	53-7071	51-8092	2013	1
885	53-7071	51-8093	2012	1
886	53-7071	51-8093	2013	1
887	41-4011	53-7072	2016	1
888	41-4011	51-8092	2012	1
889	41-4011	51-8093	2011	1
890	41-4011	51-8093	2013	1
891	41-4011	51-8093	2018	1

892	41-4011	51-8013	2015	1
893	41-4011	51-8013	2016	1
894	41-4011	47-1011	2010	1
895	41-4011	47-1011	2017	1
896	41-4011	47-5071	2014	1
897	41-4011	47-2152	2010	1
898	41-4011	47-2231	2014	1
899	41-4011	47-2231	2015	1
900	41-4011	47-2231	2017	1
901	41-4011	11-9199	2014	1
902	41-4011	13-1199	2014	1
903	41-4011	17-2171	2018	1
904	41-4011	17-2199	2015	1
905	47-2152	41-4011	2012	1
906	47-2152	41-4011	2013	1
907	47-2152	17-2171	2014	1
908	47-2152	17-2199	2015	1
909	47-2152	17-2199	2018	1
910	47-2152	51-8092	2016	1
911	47-2152	51-8093	2015	1
912	47-2152	51-8093	2016	1
913	47-2152	51-8093	2018	1
914	47-2152	51-8011	2015	1
915	47-2152	53-7072	2010	1
916	47-2152	47-5071	2015	1
917	47-2152	11-9041	2011	1
918	47-2152	11-9041	2012	1
919	47-2152	11-3051	2014	1
920	47-2152	11-3051	2015	1
921	47-2152	11-3051	2016	1
922	47-2152	11-9041	2014	1
923	47-2152	11-9041	2018	1
924	47-2152	11-9199	2012	1
925	47-2152	11-9199	2013	1
926	47-2152	11-9199	2016	1
927	47-1011	11-9199	2017	1
928	47-1011	17-2171	2011	1
929	47-1011	17-2171	2016	1
930	47-1011	17-2199	2011	1
931	47-1011	17-2199	2013	1
932	47-1011	17-2199	2015	1
933	47-1011	11-9041	2010	1
934	47-1011	11-9041	2015	1
935	47-1011	51-8092	2010	1
936	47-1011	51-8092	2015	1
937	47-1011	51-8092	2016	1
938	47-1011	51-8093	2014	1

939	47-1011	51-8093	2016	1
940	47-1011	51-8093	2018	1
941	47-1011	47-2152	2011	1
942	47-1011	47-2152	2018	1
943	47-1011	47-2231	2017	1
944	47-1011	47-5041	2013	1
945	47-1011	47-5012	2012	1
946	47-1011	47-5012	2015	1
947	47-1011	47-5013	2015	1
948	47-1011	47-5013	2016	1
949	47-1011	51-8099	2013	1
950	47-1011	53-7071	2014	1
951	47-1011	53-5011	2017	1
952	47-1011	53-5011	2012	1
953	47-1011	47-2152	2010	1
954	47-1011	41-4011	2017	1
955	47-1011	41-4011	2013	1
956	47-1011	41-4011	2012	1
957	47-2231	11-9041	2016	1
958	47-2231	17-2199	2012	1
959	47-2231	17-2199	2018	1
960	47-2231	17-2199	2015	1
961	47-2231	11-9041	2018	1
962	47-2231	11-9041	2015	1
963	47-2231	11-9041	2013	1
964	47-2231	11-9041	2010	1
965	47-2231	41-4011	2012	1
966	47-2231	49-9081	2015	1
967	47-2231	47-1011	2015	1
968	47-2231	47-2152	2018	1
971	47-5044	51-8093	2012	1
972	47-5044	51-8093	2016	1
975	47-5044	47-1011	2012	1
976	47-5044	53-7071	2016	1
977	47-5044	53-7072	2013	1
978	47-5044	41-4011	2016	1
980	47-5071	47-2152	2011	1
981	47-5071	47-1011	2013	1
983	47-5071	51-8093	2015	1
984	47-5071	53-7072	2012	1
985	47-5071	53-7072	2014	1
986	47-5071	17-2171	2012	1
987	47-5071	17-2171	2013	1
988	47-5071	17-2171	2015	1
989	47-5071	17-2199	2011	1
990	47-5071	17-2199	2014	1
993	47-5013	47-5012	2012	1

994	47-5013	47-5012	2017	1
995	47-5013	47-5012	2018	1
997	47-5013	41-4011	2010	1
998	47-5013	47-5012	2011	1
999	47-5013	47-1011	2012	1
1000	47-5013	47-1011	2015	1
1001	47-5013	51-8092	2013	1
1002	47-5013	51-8093	2011	1
1003	47-5013	53-7072	2010	1
1004	47-5013	41-4011	2016	1
1005	47-5013	11-3051	2010	1
1006	47-5013	11-3051	2015	1
1007	47-5013	11-9041	2011	1
1008	47-5013	17-2171	2012	1
1009	47-5013	17-2171	2014	1
1010	47-5013	17-2171	2015	1
1011	47-5013	17-2171	2017	1
1012	47-5013	17-2199	2010	1
1013	47-5013	17-2199	2011	1
1014	47-5013	17-2199	2014	1
1015	47-5013	17-2199	2015	1
1016	47-5013	17-2199	2017	1
1017	47-5012	17-2199	2012	1
1018	47-5012	17-2199	2015	1
1019	47-5012	11-9199	2017	1
1020	47-5012	11-9041	2013	1
1021	47-5012	11-9041	2018	1
1022	47-5012	11-9199	2010	1
1023	47-5012	11-9199	2013	1
1024	47-5012	11-3051	2011	1
1025	47-5012	11-3051	2015	1
1026	47-5012	11-3051	2016	1
1027	47-5012	11-3051	2018	1
1028	47-5012	47-5071	2016	1
1029	47-5012	47-5013	2010	1
1030	47-5012	47-5013	2018	1
1031	47-5012	51-8092	2017	1
1032	47-5012	51-8093	2012	1
1033	47-5012	51-8093	2014	1
1034	47-5012	53-7071	2017	1
1035	47-5012	47-1011	2010	1
1036	47-5012	41-4011	2011	1
1037	47-5012	41-4011	2018	1
1038	17-2199	17-2161	2010	1
1039	17-2199	17-2161	2012	1
1040	17-2199	17-2161	2018	1
1041	17-2199	17-2171	2010	1

1042	17-2199	17-2171	2014	1
1043	17-2199	17-2171	2016	1
1044	17-2199	19-4051	2015	1
1045	17-2199	19-3011	2010	1
1046	17-2199	19-3011	2014	1
1047	17-2199	19-3011	2016	1
1048	17-2199	11-9199	2012	1
1049	17-2199	41-4011	2010	1
1050	17-2199	41-4011	2011	1
1051	17-2199	47-1011	2011	1
1052	17-2199	47-1011	2013	1
1053	17-2199	47-1011	2016	1
1054	17-2199	47-5011	2010	1
1055	17-2199	47-5011	2011	1
1056	17-2199	47-5012	2015	1
1057	17-2199	47-5013	2011	1
1058	17-2199	47-5013	2014	1
1059	17-2199	47-5013	2015	1
1060	17-2199	47-2152	2012	1
1061	17-2199	47-2152	2015	1
1062	17-2199	47-2231	2016	1
1063	17-2161	47-2152	2013	1
1064	17-2161	49-9081	2016	1
1065	17-2161	49-9081	2012	1
1066	17-2171	11-3051	2010	1
1067	17-2161	51-8092	2017	1
1068	17-2161	51-8092	2012	1
1069	17-2161	51-8011	2018	1
1070	17-2161	51-8013	2011	1
1071	17-2161	51-8013	2014	1
1072	17-2161	53-5011	2013	1
1073	17-2161	17-2199	2018	1
1074	17-2161	19-4051	2011	1
1075	17-2161	19-4051	2016	1
1076	17-2171	51-8092	2012	1
1077	17-2171	51-8092	2014	1
1078	17-2171	49-9081	2012	1
1079	17-2171	51-8092	2016	1
1080	17-2171	47-5013	2010	1
1081	17-2171	47-5013	2011	1
1082	17-2171	47-5013	2013	1
1083	17-2171	47-5013	2017	1
1084	17-2171	47-5071	2013	1
1085	17-2171	51-8092	2015	1
1086	17-2171	51-8092	2017	1
1087	17-2171	53-7072	2014	1
1088	17-2171	53-7072	2015	1

1089	17-2171	53-7072	2017	1
1090	17-2171	51-8093	2012	1
1091	17-2171	51-8093	2016	1
1092	17-2171	51-8093	2018	1
1093	17-2171	41-4011	2015	1
1094	17-2171	41-4011	2016	1
1095	17-2171	41-4011	2017	1
1096	17-2171	47-1011	2012	1
1097	17-2171	47-1011	2018	1
1098	17-2171	47-2231	2014	1
1099	17-2171	11-9199	2011	1
1100	17-2171	11-9199	2015	1
1101	17-2171	11-9199	2017	1
1102	17-2171	19-4051	2012	1
1103	17-2171	19-3011	2010	1
1104	17-2171	19-3011	2014	1
1105	17-2171	17-2199	2018	1
1106	17-2199	47-5071	2014	1
1107	17-2199	49-9081	2010	1
1108	17-2199	49-9081	2011	1
1109	17-2199	49-9081	2013	1
1110	17-2199	49-9081	2014	1
1111	17-2199	49-9081	2016	1
1112	17-2199	51-8011	2011	1
1113	17-2199	51-8011	2016	1
1114	17-2199	51-8011	2017	1
1115	17-2199	51-8013	2012	1
1116	17-2199	51-8013	2016	1
1117	17-2199	51-8011	2015	1
1118	17-2199	53-5011	2016	1
1119	17-2199	53-5011	2017	1
1120	17-2199	51-8092	2013	1
1121	17-2199	51-8092	2018	1
1122	17-2199	51-8093	2013	1
1123	17-2199	51-8093	2014	1
1124	17-2199	51-8099	2011	1
1125	17-2161	11-3051	2013	1
1126	17-2161	11-3051	2015	1
1127	17-2161	11-3051	2017	1
1128	17-2161	11-9199	2010	1
1129	17-2161	11-9199	2013	1
1130	17-2161	11-9199	2016	1
1131	17-2161	11-9199	2017	1
1132	17-2161	11-9199	2018	1
1133	11-3051	47-1011	2011	1
1134	11-3051	47-1011	2015	1
1135	11-3051	47-1011	2017	1

1136	11-3051	49-9081	2012	1
1137	11-3051	49-9081	2013	1
1138	11-3051	49-9081	2015	1
1139	11-3051	49-9081	2018	1
1140	11-3051	47-5013	2013	1
1141	11-3051	47-5041	2010	1
1142	11-3051	47-5044	2014	1
1143	11-3051	47-5071	2014	1
1144	11-3051	47-5013	2014	1
1145	11-3051	47-5012	2018	1
1146	11-3051	47-2231	2010	1
1147	11-3051	47-2231	2016	1
1148	11-3051	47-2231	2017	1
1149	11-3051	41-4011	2011	1
1150	11-3051	41-4011	2012	1
1151	11-3051	41-4011	2017	1
1152	11-3051	51-8011	2012	1
1153	11-3051	51-8011	2018	1
1154	11-3051	51-8092	2012	1
1155	11-3051	51-8092	2013	1
1156	11-3051	51-8092	2014	1
1157	11-3051	51-8092	2016	1
1158	11-3051	51-8092	2018	1
1159	11-3051	51-8093	2010	1
1160	11-3051	51-8093	2015	1
1161	11-3051	51-8093	2018	1
1162	11-3051	51-8099	2014	1
1163	11-3051	51-8099	2015	1
1164	11-3051	51-8099	2017	1
1165	11-3051	51-8013	2010	1
1166	11-3051	51-8013	2013	1
1167	11-3051	51-8013	2014	1
1168	11-3051	51-8013	2018	1
1169	11-3051	53-7071	2010	1
1170	11-3051	53-7071	2012	1
1171	11-3051	53-7071	2015	1
1172	11-3051	17-2161	2011	1
1173	11-3051	17-2161	2012	1
1174	11-3051	17-2161	2014	1
1175	11-3051	17-2161	2015	1
1176	11-3051	17-2171	2013	1
1177	11-3051	17-2199	2014	1
1178	11-3051	17-2199	2018	1
1179	11-9041	51-8011	2011	1
1180	11-9041	51-8011	2013	1
1181	11-9041	51-8011	2016	1
1182	11-9041	51-8013	2011	1

1183	11-9041	51-8013	2013	1
1184	11-9041	51-8013	2014	1
1185	11-9041	51-8092	2018	1
1186	11-9041	51-8093	2013	1
1187	11-9041	51-8093	2018	1
1188	11-9041	51-8013	2018	1
1189	11-9041	53-7071	2011	1
1190	11-9041	53-7071	2017	1
1191	11-9041	53-7072	2011	1
1192	11-9041	53-7072	2012	1
1193	11-9041	53-7072	2013	1
1194	11-9041	53-5011	2013	1
1195	11-9041	53-7072	2016	1
1196	11-9041	53-7072	2017	1
1197	11-9041	47-2152	2012	1
1198	11-9041	47-2231	2011	1
1199	11-9041	47-2231	2012	1
1200	11-9041	47-1011	2013	1
1201	11-9041	47-1011	2014	1
1202	11-9041	47-1011	2016	1
1203	11-9041	47-2231	2013	1
1204	11-9041	47-5012	2015	1
1205	11-9041	47-5012	2017	1
1206	11-9041	47-5012	2018	1
1207	11-9041	47-5013	2013	1
1208	11-9041	47-5013	2016	1
1209	11-9041	49-9081	2013	1
1210	11-9041	49-9081	2014	1
1211	11-9041	49-9081	2015	1
1212	11-9041	49-9081	2018	1
1213	11-9041	19-3011	2013	1
1214	11-9041	19-3011	2017	1
1215	11-9041	19-3011	2018	1
1216	11-9041	19-4051	2012	1
1217	11-9041	19-4051	2013	1
1218	11-9041	17-2161	2018	1
1219	11-9041	41-4011	2011	1
1220	11-9199	51-8013	2011	1
1221	11-9199	51-8013	2017	1
1222	11-9199	51-8013	2018	1
1223	11-9199	51-8092	2012	1
1224	11-9199	51-8092	2017	1
1225	11-9199	51-8093	2012	1
1226	11-9199	51-8093	2016	1
1227	11-9199	51-8093	2017	1
1228	11-9199	51-8011	2014	1
1229	11-9199	51-8011	2017	1

1230	11-9199	53-5011	2013	1
1231	11-9199	53-5011	2014	1
1232	11-9199	53-5011	2016	1
1233	11-9199	53-5011	2017	1
1234	11-9199	41-4011	2010	1
1235	11-9199	41-4011	2018	1
1236	11-9199	47-1011	2010	1
1237	11-9199	47-1011	2012	1
1238	11-9199	47-1011	2016	1
1239	11-9199	47-2152	2014	1
1240	11-9199	47-2152	2015	1
1241	11-9199	47-2152	2017	1
1242	11-9199	47-5044	2011	1
1243	11-9199	47-5044	2014	1
1244	11-9199	47-5013	2010	1
1245	11-9199	47-2231	2015	1
1246	11-9199	47-2231	2016	1
1247	11-9199	47-5012	2018	1
1248	11-9199	47-5012	2013	1
1249	11-9199	19-4051	2017	1
1250	11-9199	19-4051	2010	1
1251	11-9199	19-3011	2010	1
1252	11-9199	19-3011	2012	1
1253	11-9199	19-3011	2016	1
1254	11-9199	19-3011	2017	1
1255	11-9199	17-2199	2013	1
1256	11-9199	17-2199	2011	1
1257	11-9199	17-2161	2011	1
1258	11-9199	17-2161	2012	1
1259	11-9199	17-2161	2014	1
1260	11-9199	17-2161	2015	1
1261	11-9199	17-2171	2011	1
1262	19-3011	11-9199	2013	1
1263	19-3011	11-3051	2016	1
1264	19-3011	11-9041	2010	1
1265	19-3011	11-9041	2013	1
1266	19-3011	11-9041	2014	1
1267	19-3011	11-9041	2015	1
1268	19-3011	11-9041	2018	1
1269	19-3011	53-7072	2017	1
1270	19-3011	47-1011	2010	1
1271	19-3011	47-5012	2010	1
1272	19-3011	51-8093	2017	1
1273	19-3011	53-5011	2015	1
1274	19-3011	17-2171	2017	1
1275	19-4051	11-9041	2016	1
1276	19-4051	11-9041	2017	1

```
1277  19-4051  11-9199  2010       1
1278  19-4051  11-9199  2011       1
1279  19-4051  11-9199  2012       1
1280  19-4051  11-9041  2015       1
1281  19-4051  11-9041  2011       1
1282  19-4051  19-3011  2014       1
1283  19-4051  17-2199  2016       1
1284  19-4051  17-2199  2015       1
1285  19-4051  17-2161  2010       1
1286  19-4051  17-2161  2012       1
1287  19-4051  17-2161  2014       1
1288  19-4051  17-2161  2016       1
1289  19-4051  17-2161  2017       1
1290  19-4051  17-2199  2013       1
1291  19-4051  51-8011  2011       1
1292  19-4051  51-8011  2014       1
1293  19-4051  51-8011  2017       1
1294  19-4051  51-8092  2013       1
```

[ ]:
```
for i,row in subset.iterrows():
  if subset['S_Soc'][i]==subset['D_Soc'][i]:
    subset.drop(i)
```

[ ]:
```
subset=subset[subset['S_Soc'] != subset['D_Soc']]
```

[ ]:
```
subset=subset.reset_index()
```

[ ]:
```
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset.drop('Date', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '11-9041']
subset=subset[subset['D_Soc'] != '11-9041']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '11-9199']
subset=subset[subset['D_Soc'] != '11-9199']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '41-4011']
subset=subset[subset['D_Soc'] != '41-4011']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '47-1011']
subset=subset[subset['D_Soc'] != '47-1011']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '17-2199']
subset=subset[subset['D_Soc'] != '17-2199']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '19-3011']
subset=subset[subset['D_Soc'] != '19-3011']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset[subset['S_Soc'] != '47-2152']
subset=subset[subset['D_Soc'] != '47-2152']
subset=subset.reset_index()
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset=subset.reset_index()
```

[ ]:
```
subset=subset.drop('index', axis=1)
```

[ ]:
```
subset
```

[ ]:

	S_Soc	D_Soc	Counts
0	47-5012	17-2171	16
1	47-5012	17-2171	16
2	17-2171	47-5012	14
3	17-2161	51-8011	11
4	47-5012	17-2171	10
5	17-2161	51-8011	10
6	17-2161	51-8011	9
7	51-8011	17-2161	9
8	47-5012	17-2171	9
9	17-2161	51-8011	8
10	17-2171	47-5012	8
11	51-8011	17-2161	8
12	51-8011	17-2161	8
13	47-5012	17-2171	7
14	17-2171	47-5012	7
15	17-2171	47-5012	7
16	17-2171	47-5012	7
17	17-2171	47-5012	7
18	17-2161	51-8011	7
19	17-2161	51-8011	7

20	51-8011	17-2161	7
21	17-2161	51-8011	6
22	17-2171	47-5012	6
23	17-2171	47-5012	6
24	51-8013	11-3051	5
25	51-8011	17-2161	5
26	51-8011	17-2161	5
27	17-2161	51-8011	5
28	17-2171	51-8093	5
29	17-2171	47-5012	5
30	47-5012	17-2171	5
31	17-2171	51-8092	4
32	17-2171	51-8093	4
33	51-8011	17-2161	4
34	17-2161	19-4051	4
35	17-2171	11-3051	4
36	47-5012	17-2171	4
37	47-5012	17-2171	4
38	47-5013	47-5012	4
39	51-8093	11-3051	4
40	51-8093	17-2171	4
41	51-8092	17-2171	4
42	53-7072	11-3051	4
43	17-2171	51-8093	3
44	17-2171	53-7071	3
45	47-5012	17-2171	3
46	17-2161	19-4051	3
47	53-7071	51-8092	3
48	11-3051	17-2161	3
49	11-3051	51-8093	3
50	51-8092	51-8093	3
51	51-8092	17-2171	3
52	51-8093	17-2171	3
53	51-8093	17-2171	3
54	51-8011	17-2161	3
55	53-5011	17-2171	2
56	11-3051	17-2161	2
57	11-3051	51-8013	2
58	11-3051	51-8013	2
59	11-3051	51-8013	2
60	11-3051	51-8093	2
61	11-3051	51-8011	2
62	11-3051	51-8011	2
63	11-3051	47-5012	2
64	11-3051	47-5013	2
65	53-7072	11-3051	2
66	53-7071	51-8092	2

67	53-7071	51-8092	2
68	47-5071	17-2171	2
69	47-5071	47-5012	2
70	47-5012	47-5013	2
71	47-5012	47-5013	2
72	47-5012	47-5013	2
73	47-5012	47-5013	2
74	47-5012	47-5013	2
75	47-5012	11-3051	2
76	17-2171	47-5013	2
77	17-2171	47-5013	2
78	17-2171	51-8092	2
79	17-2171	51-8093	2
80	17-2171	51-8093	2
81	17-2161	19-4051	2
82	17-2161	19-4051	2
83	17-2171	11-3051	2
84	17-2161	51-8013	2
85	17-2161	51-8013	2
86	51-8092	11-3051	2
87	51-8013	51-8093	2
88	51-8013	51-8092	2
89	51-8093	17-2171	2
90	51-8092	51-8093	2
91	51-8093	11-3051	2
92	51-8093	11-3051	2
93	51-8093	51-8092	2
94	51-8093	51-8092	2
95	51-8093	51-8092	2
96	51-8093	51-8092	2
97	51-8011	51-8013	2
98	51-8011	11-3051	2
99	51-8011	11-3051	2
100	51-8011	17-2161	2
101	51-8011	19-4051	2
102	51-8013	11-3051	2
103	49-9081	11-3051	2
104	49-9081	51-8013	2
105	49-9081	51-8013	2
106	49-9081	47-2231	2
107	51-8013	53-7071	1
108	51-8013	47-2231	1
109	51-8013	51-8092	1
110	51-8013	51-8093	1
111	51-8013	51-8011	1
112	51-8013	51-8011	1
113	51-8013	51-8011	1

114	51-8092	11-3051	1
115	51-8092	11-3051	1
116	51-8092	11-3051	1
117	51-8092	11-3051	1
118	51-8092	11-3051	1
119	51-8011	19-4051	1
120	51-8011	19-4051	1
121	51-8011	19-4051	1
122	51-8011	49-9081	1
123	51-8011	51-8092	1
124	51-8011	51-8092	1
125	51-8011	51-8013	1
126	51-8011	51-8013	1
127	51-8011	51-8013	1
128	51-8011	11-3051	1
129	51-8011	11-3051	1
130	51-8011	11-3051	1
131	51-8013	11-3051	1
132	51-8013	11-3051	1
133	51-8013	11-3051	1
134	51-8013	11-3051	1
135	51-8013	19-4051	1
136	51-8092	53-7071	1
137	51-8092	53-7071	1
138	51-8092	49-9081	1
139	51-8092	49-9081	1
140	51-8092	51-8093	1
141	51-8092	51-8093	1
142	51-8092	51-8013	1
143	51-8093	11-3051	1
144	51-8093	11-3051	1
145	51-8092	47-5012	1
146	51-8092	47-5012	1
147	51-8092	47-5013	1
148	51-8092	17-2161	1
149	51-8092	17-2171	1
150	51-8092	17-2171	1
151	51-8092	17-2171	1
152	51-8093	53-7071	1
153	51-8093	53-7071	1
154	51-8093	53-7071	1
155	51-8093	53-7072	1
156	51-8093	53-7073	1
157	51-8099	11-3051	1
158	51-8099	11-3051	1
159	51-8099	11-3051	1
160	51-8093	17-2171	1

161	51-8093	17-2171	1
162	51-8093	17-2171	1
163	51-8093	17-2171	1
164	51-8093	51-8092	1
165	51-8093	51-8092	1
166	51-8093	51-8092	1
167	51-8093	47-5012	1
168	51-8093	47-5012	1
169	51-8093	47-5041	1
170	51-8093	47-5044	1
171	49-9081	11-3051	1
172	49-9081	11-3051	1
173	49-9081	51-8013	1
174	49-9081	17-2161	1
175	49-9081	53-7072	1
176	53-5011	51-8011	1
177	53-5011	17-2161	1
178	53-5011	17-2161	1
179	53-5011	19-4051	1
180	53-5011	11-3051	1
181	53-7072	51-8013	1
182	53-7072	51-8013	1
183	53-7072	51-8092	1
184	53-7072	51-8093	1
185	53-7072	51-8093	1
186	53-7073	11-3051	1
187	53-7072	47-5012	1
188	53-7072	47-5071	1
189	53-7072	47-5071	1
190	53-7073	53-7072	1
191	53-7071	11-3051	1
192	53-7071	17-2171	1
193	53-7072	11-3051	1
194	53-7072	11-3051	1
195	53-7072	11-3051	1
196	53-7072	11-3051	1
197	53-7071	17-2171	1
198	53-7071	47-5012	1
199	53-7071	51-8092	1
200	53-7071	51-8092	1
201	53-7071	51-8092	1
202	53-7071	51-8092	1
203	53-7071	51-8093	1
204	53-7071	51-8093	1
205	47-2231	49-9081	1
206	47-5044	51-8093	1
207	47-5044	51-8093	1

208	47-5044	53-7071	1
209	47-5044	53-7072	1
210	47-5071	51-8093	1
211	47-5071	53-7072	1
212	47-5071	53-7072	1
213	47-5071	17-2171	1
214	47-5071	17-2171	1
215	47-5071	17-2171	1
216	47-5013	47-5012	1
217	47-5013	47-5012	1
218	47-5013	47-5012	1
219	47-5013	47-5012	1
220	47-5013	51-8092	1
221	47-5013	51-8093	1
222	47-5013	53-7072	1
223	47-5013	11-3051	1
224	47-5013	11-3051	1
225	47-5013	17-2171	1
226	47-5013	17-2171	1
227	47-5013	17-2171	1
228	47-5013	17-2171	1
229	47-5012	11-3051	1
230	47-5012	11-3051	1
231	47-5012	11-3051	1
232	47-5012	11-3051	1
233	47-5012	47-5071	1
234	47-5012	47-5013	1
235	47-5012	47-5013	1
236	47-5012	51-8092	1
237	47-5012	51-8093	1
238	47-5012	51-8093	1
239	47-5012	53-7071	1
240	17-2161	49-9081	1
241	17-2161	49-9081	1
242	17-2171	11-3051	1
243	17-2161	51-8092	1
244	17-2161	51-8092	1
245	17-2161	51-8011	1
246	17-2161	51-8013	1
247	17-2161	51-8013	1
248	17-2161	53-5011	1
249	17-2161	19-4051	1
250	17-2161	19-4051	1
251	17-2171	51-8092	1
252	17-2171	51-8092	1
253	17-2171	49-9081	1
254	17-2171	51-8092	1

255	17-2171	47-5013	1
256	17-2171	47-5013	1
257	17-2171	47-5013	1
258	17-2171	47-5013	1
259	17-2171	47-5071	1
260	17-2171	51-8092	1
261	17-2171	51-8092	1
262	17-2171	53-7072	1
263	17-2171	53-7072	1
264	17-2171	53-7072	1
265	17-2171	51-8093	1
266	17-2171	51-8093	1
267	17-2171	51-8093	1
268	17-2171	47-2231	1
269	17-2171	19-4051	1
270	17-2161	11-3051	1
271	17-2161	11-3051	1
272	17-2161	11-3051	1
273	11-3051	49-9081	1
274	11-3051	49-9081	1
275	11-3051	49-9081	1
276	11-3051	49-9081	1
277	11-3051	47-5013	1
278	11-3051	47-5041	1
279	11-3051	47-5044	1
280	11-3051	47-5071	1
281	11-3051	47-5013	1
282	11-3051	47-5012	1
283	11-3051	47-2231	1
284	11-3051	47-2231	1
285	11-3051	47-2231	1
286	11-3051	51-8011	1
287	11-3051	51-8011	1
288	11-3051	51-8092	1
289	11-3051	51-8092	1
290	11-3051	51-8092	1
291	11-3051	51-8092	1
292	11-3051	51-8092	1
293	11-3051	51-8093	1
294	11-3051	51-8093	1
295	11-3051	51-8093	1
296	11-3051	51-8099	1
297	11-3051	51-8099	1
298	11-3051	51-8099	1
299	11-3051	51-8013	1
300	11-3051	51-8013	1
301	11-3051	51-8013	1

```
302  11-3051  51-8013       1
303  11-3051  53-7071       1
304  11-3051  53-7071       1
305  11-3051  53-7071       1
306  11-3051  17-2161       1
307  11-3051  17-2161       1
308  11-3051  17-2161       1
309  11-3051  17-2161       1
310  11-3051  17-2171       1
311  19-4051  17-2161       1
312  19-4051  17-2161       1
313  19-4051  17-2161       1
314  19-4051  17-2161       1
315  19-4051  17-2161       1
316  19-4051  51-8011       1
317  19-4051  51-8011       1
318  19-4051  51-8011       1
319  19-4051  51-8092       1
```

[ ]:
```
num=len(subset)
num
```

[ ]:
```
320
```

[ ]:
```
subset.loc[0,'S_Soc']
# subset_new.loc[0,'S_Soc']
```

[ ]:
```
'47-5012'
```

[ ]:
```
subset
```

[ ]:
```
      S_Soc    D_Soc  Counts
0    47-5012  17-2171      16
1    47-5012  17-2171      16
2    17-2171  47-5012      14
3    17-2161  51-8011      11
4    47-5012  17-2171      10
5    17-2161  51-8011      10
6    17-2161  51-8011       9
7    51-8011  17-2161       9
8    47-5012  17-2171       9
9    17-2161  51-8011       8
10   17-2171  47-5012       8
11   51-8011  17-2161       8
12   51-8011  17-2161       8
13   47-5012  17-2171       7
14   17-2171  47-5012       7
```

15	17-2171	47-5012	7
16	17-2171	47-5012	7
17	17-2171	47-5012	7
18	17-2161	51-8011	7
19	17-2161	51-8011	7
20	51-8011	17-2161	7
21	17-2161	51-8011	6
22	17-2171	47-5012	6
23	17-2171	47-5012	6
24	51-8013	11-3051	5
25	51-8011	17-2161	5
26	51-8011	17-2161	5
27	17-2161	51-8011	5
28	17-2171	51-8093	5
29	17-2171	47-5012	5
30	47-5012	17-2171	5
31	17-2171	51-8092	4
32	17-2171	51-8093	4
33	51-8011	17-2161	4
34	17-2161	19-4051	4
35	17-2171	11-3051	4
36	47-5012	17-2171	4
37	47-5012	17-2171	4
38	47-5013	47-5012	4
39	51-8093	11-3051	4
40	51-8093	17-2171	4
41	51-8092	17-2171	4
42	53-7072	11-3051	4
43	17-2171	51-8093	3
44	17-2171	53-7071	3
45	47-5012	17-2171	3
46	17-2161	19-4051	3
47	53-7071	51-8092	3
48	11-3051	17-2161	3
49	11-3051	51-8093	3
50	51-8092	51-8093	3
51	51-8092	17-2171	3
52	51-8093	17-2171	3
53	51-8093	17-2171	3
54	51-8011	17-2161	3
55	53-5011	17-2171	2
56	11-3051	17-2161	2
57	11-3051	51-8013	2
58	11-3051	51-8013	2
59	11-3051	51-8013	2
60	11-3051	51-8093	2
61	11-3051	51-8011	2

62	11-3051	51-8011	2
63	11-3051	47-5012	2
64	11-3051	47-5013	2
65	53-7072	11-3051	2
66	53-7071	51-8092	2
67	53-7071	51-8092	2
68	47-5071	17-2171	2
69	47-5071	47-5012	2
70	47-5012	47-5013	2
71	47-5012	47-5013	2
72	47-5012	47-5013	2
73	47-5012	47-5013	2
74	47-5012	47-5013	2
75	47-5012	11-3051	2
76	17-2171	47-5013	2
77	17-2171	47-5013	2
78	17-2171	51-8092	2
79	17-2171	51-8093	2
80	17-2171	51-8093	2
81	17-2161	19-4051	2
82	17-2161	19-4051	2
83	17-2171	11-3051	2
84	17-2161	51-8013	2
85	17-2161	51-8013	2
86	51-8092	11-3051	2
87	51-8013	51-8093	2
88	51-8013	51-8092	2
89	51-8093	17-2171	2
90	51-8092	51-8093	2
91	51-8093	11-3051	2
92	51-8093	11-3051	2
93	51-8093	51-8092	2
94	51-8093	51-8092	2
95	51-8093	51-8092	2
96	51-8093	51-8092	2
97	51-8011	51-8013	2
98	51-8011	11-3051	2
99	51-8011	11-3051	2
100	51-8011	17-2161	2
101	51-8011	19-4051	2
102	51-8013	11-3051	2
103	49-9081	11-3051	2
104	49-9081	51-8013	2
105	49-9081	51-8013	2
106	49-9081	47-2231	2
107	51-8013	53-7071	1
108	51-8013	47-2231	1

109	51-8013	51-8092	1
110	51-8013	51-8093	1
111	51-8013	51-8011	1
112	51-8013	51-8011	1
113	51-8013	51-8011	1
114	51-8092	11-3051	1
115	51-8092	11-3051	1
116	51-8092	11-3051	1
117	51-8092	11-3051	1
118	51-8092	11-3051	1
119	51-8011	19-4051	1
120	51-8011	19-4051	1
121	51-8011	19-4051	1
122	51-8011	49-9081	1
123	51-8011	51-8092	1
124	51-8011	51-8092	1
125	51-8011	51-8013	1
126	51-8011	51-8013	1
127	51-8011	51-8013	1
128	51-8011	11-3051	1
129	51-8011	11-3051	1
130	51-8011	11-3051	1
131	51-8013	11-3051	1
132	51-8013	11-3051	1
133	51-8013	11-3051	1
134	51-8013	11-3051	1
135	51-8013	19-4051	1
136	51-8092	53-7071	1
137	51-8092	53-7071	1
138	51-8092	49-9081	1
139	51-8092	49-9081	1
140	51-8092	51-8093	1
141	51-8092	51-8093	1
142	51-8092	51-8013	1
143	51-8093	11-3051	1
144	51-8093	11-3051	1
145	51-8092	47-5012	1
146	51-8092	47-5012	1
147	51-8092	47-5013	1
148	51-8092	17-2161	1
149	51-8092	17-2171	1
150	51-8092	17-2171	1
151	51-8092	17-2171	1
152	51-8093	53-7071	1
153	51-8093	53-7071	1
154	51-8093	53-7071	1
155	51-8093	53-7072	1

156	51-8093	53-7073	1
157	51-8099	11-3051	1
158	51-8099	11-3051	1
159	51-8099	11-3051	1
160	51-8093	17-2171	1
161	51-8093	17-2171	1
162	51-8093	17-2171	1
163	51-8093	17-2171	1
164	51-8093	51-8092	1
165	51-8093	51-8092	1
166	51-8093	51-8092	1
167	51-8093	47-5012	1
168	51-8093	47-5012	1
169	51-8093	47-5041	1
170	51-8093	47-5044	1
171	49-9081	11-3051	1
172	49-9081	11-3051	1
173	49-9081	51-8013	1
174	49-9081	17-2161	1
175	49-9081	53-7072	1
176	53-5011	51-8011	1
177	53-5011	17-2161	1
178	53-5011	17-2161	1
179	53-5011	19-4051	1
180	53-5011	11-3051	1
181	53-7072	51-8013	1
182	53-7072	51-8013	1
183	53-7072	51-8092	1
184	53-7072	51-8093	1
185	53-7072	51-8093	1
186	53-7073	11-3051	1
187	53-7072	47-5012	1
188	53-7072	47-5071	1
189	53-7072	47-5071	1
190	53-7073	53-7072	1
191	53-7071	11-3051	1
192	53-7071	17-2171	1
193	53-7072	11-3051	1
194	53-7072	11-3051	1
195	53-7072	11-3051	1
196	53-7072	11-3051	1
197	53-7071	17-2171	1
198	53-7071	47-5012	1
199	53-7071	51-8092	1
200	53-7071	51-8092	1
201	53-7071	51-8092	1
202	53-7071	51-8092	1

203	53-7071	51-8093	1
204	53-7071	51-8093	1
205	47-2231	49-9081	1
206	47-5044	51-8093	1
207	47-5044	51-8093	1
208	47-5044	53-7071	1
209	47-5044	53-7072	1
210	47-5071	51-8093	1
211	47-5071	53-7072	1
212	47-5071	53-7072	1
213	47-5071	17-2171	1
214	47-5071	17-2171	1
215	47-5071	17-2171	1
216	47-5013	47-5012	1
217	47-5013	47-5012	1
218	47-5013	47-5012	1
219	47-5013	47-5012	1
220	47-5013	51-8092	1
221	47-5013	51-8093	1
222	47-5013	53-7072	1
223	47-5013	11-3051	1
224	47-5013	11-3051	1
225	47-5013	17-2171	1
226	47-5013	17-2171	1
227	47-5013	17-2171	1
228	47-5013	17-2171	1
229	47-5012	11-3051	1
230	47-5012	11-3051	1
231	47-5012	11-3051	1
232	47-5012	11-3051	1
233	47-5012	47-5071	1
234	47-5012	47-5013	1
235	47-5012	47-5013	1
236	47-5012	51-8092	1
237	47-5012	51-8093	1
238	47-5012	51-8093	1
239	47-5012	53-7071	1
240	17-2161	49-9081	1
241	17-2161	49-9081	1
242	17-2171	11-3051	1
243	17-2161	51-8092	1
244	17-2161	51-8092	1
245	17-2161	51-8011	1
246	17-2161	51-8013	1
247	17-2161	51-8013	1
248	17-2161	53-5011	1
249	17-2161	19-4051	1

250	17-2161	19-4051	1
251	17-2171	51-8092	1
252	17-2171	51-8092	1
253	17-2171	49-9081	1
254	17-2171	51-8092	1
255	17-2171	47-5013	1
256	17-2171	47-5013	1
257	17-2171	47-5013	1
258	17-2171	47-5013	1
259	17-2171	47-5071	1
260	17-2171	51-8092	1
261	17-2171	51-8092	1
262	17-2171	53-7072	1
263	17-2171	53-7072	1
264	17-2171	53-7072	1
265	17-2171	51-8093	1
266	17-2171	51-8093	1
267	17-2171	51-8093	1
268	17-2171	47-2231	1
269	17-2171	19-4051	1
270	17-2161	11-3051	1
271	17-2161	11-3051	1
272	17-2161	11-3051	1
273	11-3051	49-9081	1
274	11-3051	49-9081	1
275	11-3051	49-9081	1
276	11-3051	49-9081	1
277	11-3051	47-5013	1
278	11-3051	47-5041	1
279	11-3051	47-5044	1
280	11-3051	47-5071	1
281	11-3051	47-5013	1
282	11-3051	47-5012	1
283	11-3051	47-2231	1
284	11-3051	47-2231	1
285	11-3051	47-2231	1
286	11-3051	51-8011	1
287	11-3051	51-8011	1
288	11-3051	51-8092	1
289	11-3051	51-8092	1
290	11-3051	51-8092	1
291	11-3051	51-8092	1
292	11-3051	51-8092	1
293	11-3051	51-8093	1
294	11-3051	51-8093	1
295	11-3051	51-8093	1
296	11-3051	51-8099	1

```
297  11-3051  51-8099       1
298  11-3051  51-8099       1
299  11-3051  51-8013       1
300  11-3051  51-8013       1
301  11-3051  51-8013       1
302  11-3051  51-8013       1
303  11-3051  53-7071       1
304  11-3051  53-7071       1
305  11-3051  53-7071       1
306  11-3051  17-2161       1
307  11-3051  17-2161       1
308  11-3051  17-2161       1
309  11-3051  17-2161       1
310  11-3051  17-2171       1
311  19-4051  17-2161       1
312  19-4051  17-2161       1
313  19-4051  17-2161       1
314  19-4051  17-2161       1
315  19-4051  17-2161       1
316  19-4051  51-8011       1
317  19-4051  51-8011       1
318  19-4051  51-8011       1
319  19-4051  51-8092       1
```

[ ]:
```
list_s=[]
for i in range(len(subset)):
  list_s.append(subset['S_Soc'][i])
for i in range(len(subset)):
  list_s.append(subset['D_Soc'][i])
nodes=np.unique(list_s)
nodes
```

[ ]:
```
array(['11-3051', '17-2161', '17-2171', '19-4051', '47-2231', '47-5012',
       '47-5013', '47-5041', '47-5044', '47-5071', '49-9081', '51-8011',
       '51-8013', '51-8092', '51-8093', '51-8099', '53-5011', '53-7071',
       '53-7072', '53-7073'], dtype='<U7')
```

[ ]:
```
len(nodes)
```

[ ]:
```
20
```

[ ]:
```
resume_dict={}
for i in range(len(nodes)):
  row_i=np.zeros(len(nodes))
  for j in range(i+1,len(nodes)):
    count=0
    for z in range(len(subset)):
```

```
      if subset['S_Soc'][z]==nodes[i] and subset['D_Soc'][z]==nodes[j]:
        count+=subset['Counts'][z]
      if subset['S_Soc'][z]==nodes[j] and subset['D_Soc'][z]==nodes[i]:
        count+=subset['Counts'][z]
    row_i[j]=count
  resume_dict[nodes[i]]=row_i
```

[ ]:
```
resume_dict
```

[ ]:
```
{'11-3051': array([ 0., 12.,  8.,  0.,  3.,  9.,  6.,  1.,  1.,  1.,  8., 13.,
21.,
        12., 18.,  6.,  1.,  4., 10.,  1.]),
 '17-2161': array([  0.,   0.,   0.,  18.,   0.,   0.,   0.,   0.,   0.,   0.,
3.,
        115.,   6.,   3.,   0.,   0.,   3.,   0.,   0.,   0.]),
 '17-2171': array([  0.,   0.,   0.,   1.,   1., 141.,  12.,   0.,   0.,   6.,
1.,
          0.,   0.,  21.,  35.,   0.,   2.,   5.,   3.,   0.]),
 '19-4051': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 8., 1., 1., 0.,
0., 1.,
        0., 0., 0.]),
 '47-2231': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 3., 0., 1., 0., 0.,
0., 0.,
        0., 0., 0.]),
 '47-5012': array([ 0.,  0.,  0.,  0.,  0.,  0., 20.,  0.,  0.,  3.,  0.,  0.,
0.,
         3.,  4.,  0.,  0.,  2.,  1.,  0.]),
 '47-5013': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 2., 1.,
0., 0.,
        0., 1., 0.]),
 '47-5041': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 1.,
0., 0.,
        0., 0., 0.]),
 '47-5044': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 3.,
0., 0.,
        1., 1., 0.]),
 '47-5071': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 1.,
0., 0.,
        0., 4., 0.]),
 '49-9081': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 1., 5., 2., 0.,
0., 0.,
        0., 1., 0.]),
 '51-8011': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 8., 2., 0.,
0., 1.,
        0., 0., 0.]),
 '51-8013': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 4., 3.,
0., 0.,
```

```
        1., 2., 0.]),
 '51-8092': array([ 0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
0.,
         0., 18.,  0.,  0., 13.,  1.,  0.]),
 '51-8093': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        5., 3., 1.]),
 '51-8099': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        0., 0., 0.]),
 '53-5011': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        0., 0., 0.]),
 '53-7071': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        0., 0., 0.]),
 '53-7072': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        0., 0., 1.]),
 '53-7073': array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
0., 0.,
        0., 0., 0.])}
```

[ ]:
```
len(list(resume_dict.keys()))
```

[ ]: 20

[ ]:
```
len(resume_dict['51-8013'])
```

[ ]: 20

[ ]:
```
S_Soc=[]
D_Soc=[]
count=[]
list_keys=list(resume_dict.keys())
for i in range(len(list_keys)):
  for j in range(len(list_keys)):
    if resume_dict[list_keys[i]][j]!=0:
      S_Soc.append(list_keys[i])
      D_Soc.append(list_keys[j])
      count.append(resume_dict[list_keys[i]][j])
```

[ ]:
```
dict1 = {'S_Soc': S_Soc, 'D_Soc': D_Soc, 'count': count}

resume_transition = pd.DataFrame(dict1)
```

[ ]:
```
resume_transition
```

[ ]:

	S_Soc	D_Soc	count
0	11-3051	17-2161	12.0
1	11-3051	17-2171	8.0
2	11-3051	47-2231	3.0
3	11-3051	47-5012	9.0
4	11-3051	47-5013	6.0
5	11-3051	47-5041	1.0
6	11-3051	47-5044	1.0
7	11-3051	47-5071	1.0
8	11-3051	49-9081	8.0
9	11-3051	51-8011	13.0
10	11-3051	51-8013	21.0
11	11-3051	51-8092	12.0
12	11-3051	51-8093	18.0
13	11-3051	51-8099	6.0
14	11-3051	53-5011	1.0
15	11-3051	53-7071	4.0
16	11-3051	53-7072	10.0
17	11-3051	53-7073	1.0
18	17-2161	19-4051	18.0
19	17-2161	49-9081	3.0
20	17-2161	51-8011	115.0
21	17-2161	51-8013	6.0
22	17-2161	51-8092	3.0
23	17-2161	53-5011	3.0
24	17-2171	19-4051	1.0
25	17-2171	47-2231	1.0
26	17-2171	47-5012	141.0
27	17-2171	47-5013	12.0
28	17-2171	47-5071	6.0
29	17-2171	49-9081	1.0
30	17-2171	51-8092	21.0
31	17-2171	51-8093	35.0
32	17-2171	53-5011	2.0
33	17-2171	53-7071	5.0
34	17-2171	53-7072	3.0
35	19-4051	51-8011	8.0
36	19-4051	51-8013	1.0
37	19-4051	51-8092	1.0
38	19-4051	53-5011	1.0
39	47-2231	49-9081	3.0
40	47-2231	51-8013	1.0
41	47-5012	47-5013	20.0
42	47-5012	47-5071	3.0
43	47-5012	51-8092	3.0
44	47-5012	51-8093	4.0
45	47-5012	53-7071	2.0

```
46  47-5012  53-7072    1.0
47  47-5013  51-8092    2.0
48  47-5013  51-8093    1.0
49  47-5013  53-7072    1.0
50  47-5041  51-8093    1.0
51  47-5044  51-8093    3.0
52  47-5044  53-7071    1.0
53  47-5044  53-7072    1.0
54  47-5071  51-8093    1.0
55  47-5071  53-7072    4.0
56  49-9081  51-8011    1.0
57  49-9081  51-8013    5.0
58  49-9081  51-8092    2.0
59  49-9081  53-7072    1.0
60  51-8011  51-8013    8.0
61  51-8011  51-8092    2.0
62  51-8011  53-5011    1.0
63  51-8013  51-8092    4.0
64  51-8013  51-8093    3.0
65  51-8013  53-7071    1.0
66  51-8013  53-7072    2.0
67  51-8092  51-8093   18.0
68  51-8092  53-7071   13.0
69  51-8092  53-7072    1.0
70  51-8093  53-7071    5.0
71  51-8093  53-7072    3.0
72  51-8093  53-7073    1.0
73  53-7072  53-7073    1.0
```

[ ]:
```
resume_transition=resume_transition[resume_transition['S_Soc'] != '11-3051']
resume_transition=resume_transition[resume_transition['D_Soc'] != '11-3051']
resume_transition=resume_transition.reset_index()
resume_transition=resume_transition.drop('index', axis=1)
```

[ ]:
```
resume_transition
```

[ ]:
```
      S_Soc    D_Soc  count
0   17-2161  19-4051   18.0
1   17-2161  49-9081    3.0
2   17-2161  51-8011  115.0
3   17-2161  51-8013    6.0
4   17-2161  51-8092    3.0
5   17-2161  53-5011    3.0
6   17-2171  19-4051    1.0
7   17-2171  47-2231    1.0
8   17-2171  47-5012  141.0
9   17-2171  47-5013   12.0
```

10	17-2171	47-5071	6.0
11	17-2171	49-9081	1.0
12	17-2171	51-8092	21.0
13	17-2171	51-8093	35.0
14	17-2171	53-5011	2.0
15	17-2171	53-7071	5.0
16	17-2171	53-7072	3.0
17	19-4051	51-8011	8.0
18	19-4051	51-8013	1.0
19	19-4051	51-8092	1.0
20	19-4051	53-5011	1.0
21	47-2231	49-9081	3.0
22	47-2231	51-8013	1.0
23	47-5012	47-5013	20.0
24	47-5012	47-5071	3.0
25	47-5012	51-8092	3.0
26	47-5012	51-8093	4.0
27	47-5012	53-7071	2.0
28	47-5012	53-7072	1.0
29	47-5013	51-8092	2.0
30	47-5013	51-8093	1.0
31	47-5013	53-7072	1.0
32	47-5041	51-8093	1.0
33	47-5044	51-8093	3.0
34	47-5044	53-7071	1.0
35	47-5044	53-7072	1.0
36	47-5071	51-8093	1.0
37	47-5071	53-7072	4.0
38	49-9081	51-8011	1.0
39	49-9081	51-8013	5.0
40	49-9081	51-8092	2.0
41	49-9081	53-7072	1.0
42	51-8011	51-8013	8.0
43	51-8011	51-8092	2.0
44	51-8011	53-5011	1.0
45	51-8013	51-8092	4.0
46	51-8013	51-8093	3.0
47	51-8013	53-7071	1.0
48	51-8013	53-7072	2.0
49	51-8092	51-8093	18.0
50	51-8092	53-7071	13.0
51	51-8092	53-7072	1.0
52	51-8093	53-7071	5.0
53	51-8093	53-7072	3.0
54	51-8093	53-7073	1.0
55	53-7072	53-7073	1.0

[ ]:
```
dict_code_name={}
for i in range(len(jobs_list_code)):
  dict_code_name[jobs_list_code[i]]=jobs_list[i]
```

[ ]:
```

```

[ ]:
```
for i in range(len(resume_transition)):
  name1=resume_transition['S_Soc'][i]
  name2=resume_transition['D_Soc'][i]
  resume_transition['S_Soc'][i]=dict_code_name[name1]
  resume_transition['D_Soc'][i]=dict_code_name[name2]
```

```
<ipython-input-1043-4666a30b31c0>:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  resume_transition['S_Soc'][i]=dict_code_name[name1]
<ipython-input-1043-4666a30b31c0>:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  resume_transition['D_Soc'][i]=dict_code_name[name2]
```

[ ]:
```
resume_transition
```

[ ]:
```
                                        S_Soc  \
0                                Nuclear Engineers
1                                Nuclear Engineers
2                                Nuclear Engineers
3                                Nuclear Engineers
4                                Nuclear Engineers
5                                Nuclear Engineers
6                             Petroleum Engineers
7                             Petroleum Engineers
8                             Petroleum Engineers
9                             Petroleum Engineers
10                            Petroleum Engineers
11                            Petroleum Engineers
12                            Petroleum Engineers
13                            Petroleum Engineers
14                            Petroleum Engineers
15                            Petroleum Engineers
16                            Petroleum Engineers
17                  Nuclear Monitoring Technicians
18                  Nuclear Monitoring Technicians
```

```
19                     Nuclear Monitoring Technicians
20                     Nuclear Monitoring Technicians
21                      Solar Photovoltaic Installers
22                      Solar Photovoltaic Installers
23                Rotary Drill Operators, Oil and Gas
24                Rotary Drill Operators, Oil and Gas
25                Rotary Drill Operators, Oil and Gas
26                Rotary Drill Operators, Oil and Gas
27                Rotary Drill Operators, Oil and Gas
28                Rotary Drill Operators, Oil and Gas
29                Service Unit Operators, Oil and Gas
30                Service Unit Operators, Oil and Gas
31                Service Unit Operators, Oil and Gas
32                Continuous Mining Machine Operators
33  Loading and Moving Machine Operators, Undergro…
34  Loading and Moving Machine Operators, Undergro…
35  Loading and Moving Machine Operators, Undergro…
36                           Roustabouts, Oil and Gas
37                           Roustabouts, Oil and Gas
38                   Wind Turbine Service Technicians
39                   Wind Turbine Service Technicians
40                   Wind Turbine Service Technicians
41                   Wind Turbine Service Technicians
42                    Nuclear Power Reactor Operators
43                    Nuclear Power Reactor Operators
44                    Nuclear Power Reactor Operators
45                    Hydroelectric Plant Technicians
46                    Hydroelectric Plant Technicians
47                    Hydroelectric Plant Technicians
48                    Hydroelectric Plant Technicians
49                                Gas Plant Operators
50                                Gas Plant Operators
51                                Gas Plant Operators
52  Petroleum Pump System Operators, Refinery Oper…
53  Petroleum Pump System Operators, Refinery Oper…
54  Petroleum Pump System Operators, Refinery Oper…
55            Pump Operators, Except Wellhead Pumpers
```

	D_Soc	count
0	Nuclear Monitoring Technicians	18.0
1	Wind Turbine Service Technicians	3.0
2	Nuclear Power Reactor Operators	115.0
3	Hydroelectric Plant Technicians	6.0
4	Gas Plant Operators	3.0
5	Sailors and Marine Oilers	3.0
6	Nuclear Monitoring Technicians	1.0
7	Solar Photovoltaic Installers	1.0

```
8                Rotary Drill Operators, Oil and Gas  141.0
9                Service Unit Operators, Oil and Gas   12.0
10                         Roustabouts, Oil and Gas    6.0
11                  Wind Turbine Service Technicians    1.0
12                               Gas Plant Operators   21.0
13  Petroleum Pump System Operators, Refinery Oper…   35.0
14                           Sailors and Marine Oilers    2.0
15   Gas Compressor and Gas Pumping Station Operators    5.0
16            Pump Operators, Except Wellhead Pumpers    3.0
17                    Nuclear Power Reactor Operators    8.0
18                    Hydroelectric Plant Technicians    1.0
19                               Gas Plant Operators    1.0
20                           Sailors and Marine Oilers    1.0
21                  Wind Turbine Service Technicians    3.0
22                    Hydroelectric Plant Technicians    1.0
23               Service Unit Operators, Oil and Gas   20.0
24                         Roustabouts, Oil and Gas    3.0
25                               Gas Plant Operators    3.0
26  Petroleum Pump System Operators, Refinery Oper…    4.0
27   Gas Compressor and Gas Pumping Station Operators    2.0
28            Pump Operators, Except Wellhead Pumpers    1.0
29                               Gas Plant Operators    2.0
30  Petroleum Pump System Operators, Refinery Oper…    1.0
31            Pump Operators, Except Wellhead Pumpers    1.0
32  Petroleum Pump System Operators, Refinery Oper…    1.0
33  Petroleum Pump System Operators, Refinery Oper…    3.0
34   Gas Compressor and Gas Pumping Station Operators    1.0
35            Pump Operators, Except Wellhead Pumpers    1.0
36  Petroleum Pump System Operators, Refinery Oper…    1.0
37            Pump Operators, Except Wellhead Pumpers    4.0
38                    Nuclear Power Reactor Operators    1.0
39                    Hydroelectric Plant Technicians    5.0
40                               Gas Plant Operators    2.0
41            Pump Operators, Except Wellhead Pumpers    1.0
42                    Hydroelectric Plant Technicians    8.0
43                               Gas Plant Operators    2.0
44                           Sailors and Marine Oilers    1.0
45                               Gas Plant Operators    4.0
46  Petroleum Pump System Operators, Refinery Oper…    3.0
47   Gas Compressor and Gas Pumping Station Operators    1.0
48            Pump Operators, Except Wellhead Pumpers    2.0
49  Petroleum Pump System Operators, Refinery Oper…   18.0
50   Gas Compressor and Gas Pumping Station Operators   13.0
51            Pump Operators, Except Wellhead Pumpers    1.0
52   Gas Compressor and Gas Pumping Station Operators    5.0
53            Pump Operators, Except Wellhead Pumpers    3.0
54                                 Wellhead Pumpers    1.0
```

55 Wellhead Pumpers 1.0

[ ]:
```
from numpy import dot
from numpy.linalg import norm
def cos_sim(a,b):
  cos_sim = dot(a, b)/(norm(a)*norm(b))
  return cos_sim
```

[ ]:
```
a=weighted_model.wv['Rotary Drill Operators, Oil and Gas']
```

[ ]:
```
b=weighted_model.wv['Gas Plant Operators']
```

[ ]:
```
score=cos_sim(a,b)
score
```

[ ]:
```
0.8896638
```

[ ]:
```
c=weighted_model.wv['Petroleum Engineers']
```

[ ]:
```
d=weighted_model.wv['Rotary Drill Operators, Oil and Gas']
```

[ ]:
```
score=cos_sim(c,d)
score
```

[ ]:
```
0.33061278
```

[ ]:
```
jobs_list
```

[ ]:
```
['Rotary Drill Operators, Oil and Gas',
 'Roustabouts, Oil and Gas',
 'Service Unit Operators, Oil and Gas',
 'Petroleum Engineers',
 'Derrick Operators, Oil and Gas',
 'Petroleum Pump System Operators, Refinery Operators, and Gaugers',
 'Wellhead Pumpers',
 'Pump Operators, Except Wellhead Pumpers',
 'Gas Plant Operators',
 'Gas Compressor and Gas Pumping Station Operators',
 'Energy Engineers, Except Wind and Solar',
 'Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders',
 'Continuous Mining Machine Operators',
 'Loading and Moving Machine Operators, Underground Mining',
 'Sailors and Marine Oilers',
 'Geothermal Technicians',
 'Geothermal Production Managers',
 'Biomass Plant Technicians',
 'Biomass Power Plant Managers',
```

```
'Biofuels Processing Technicians',
'Biofuels Production Managers',
'Biofuels/Biodiesel Technology and Product Development Managers',
'Nuclear Engineers',
'Nuclear Technicians',
'Nuclear Power Reactor Operators',
'Nuclear Monitoring Technicians',
'Environmental Economists',
'Solar Thermal Installers and Technicians',
'Solar Energy Systems Engineers',
'Solar Sales Representatives and Assessors',
'Solar Energy Installation Managers',
'Solar Photovoltaic Installers',
'Wind Energy Operations Managers',
'Wind Energy Development Managers',
'Wind Energy Engineers',
'Wind Turbine Service Technicians',
'Sustainability Specialists',
'Hydroelectric Production Managers',
'Hydroelectric Plant Technicians']
```

[ ]:
```
similarity_score=[]
for i in range(len(resume_transition)):
  a=weighted_model.wv[resume_transition['S_Soc'][i]]
  b=weighted_model.wv[resume_transition['D_Soc'][i]]
  similarity_score.append(cos_sim(a,b))
```

[ ]:
```
len(similarity_score)
```

[ ]: 56

[ ]:
```
count_transition=[]
for i in range(len(resume_transition)):
  count_transition.append(resume_transition['count'][i])
len(count_transition)
```

[ ]: 56

[ ]:
```
count_transition
```

[ ]:
```
len(similarity_score)
```

[ ]: 56

[ ]:
```
similarity_score_pow=[i**10 for i in similarity_score]
```

[ ]:
```
resume_transition['similarity']=similarity_score
```

[ ]:
```
resume_transition
```

[ ]:

	S_Soc
0	Nuclear Engineers
1	Nuclear Engineers
2	Nuclear Engineers
3	Nuclear Engineers
4	Nuclear Engineers
5	Nuclear Engineers
6	Petroleum Engineers
7	Petroleum Engineers
8	Petroleum Engineers
9	Petroleum Engineers
10	Petroleum Engineers
11	Petroleum Engineers
12	Petroleum Engineers
13	Petroleum Engineers
14	Petroleum Engineers
15	Petroleum Engineers
16	Petroleum Engineers
17	Nuclear Monitoring Technicians
18	Nuclear Monitoring Technicians
19	Nuclear Monitoring Technicians
20	Nuclear Monitoring Technicians
21	Solar Photovoltaic Installers
22	Solar Photovoltaic Installers
23	Rotary Drill Operators, Oil and Gas
24	Rotary Drill Operators, Oil and Gas
25	Rotary Drill Operators, Oil and Gas
26	Rotary Drill Operators, Oil and Gas
27	Rotary Drill Operators, Oil and Gas
28	Rotary Drill Operators, Oil and Gas
29	Service Unit Operators, Oil and Gas
30	Service Unit Operators, Oil and Gas
31	Service Unit Operators, Oil and Gas
32	Continuous Mining Machine Operators
33	Loading and Moving Machine Operators, Undergro…
34	Loading and Moving Machine Operators, Undergro…
35	Loading and Moving Machine Operators, Undergro…
36	Roustabouts, Oil and Gas
37	Roustabouts, Oil and Gas
38	Wind Turbine Service Technicians
39	Wind Turbine Service Technicians
40	Wind Turbine Service Technicians
41	Wind Turbine Service Technicians
42	Nuclear Power Reactor Operators
43	Nuclear Power Reactor Operators

44	Nuclear Power Reactor Operators
45	Hydroelectric Plant Technicians
46	Hydroelectric Plant Technicians
47	Hydroelectric Plant Technicians
48	Hydroelectric Plant Technicians
49	Gas Plant Operators
50	Gas Plant Operators
51	Gas Plant Operators
52	Petroleum Pump System Operators, Refinery Oper…
53	Petroleum Pump System Operators, Refinery Oper…
54	Petroleum Pump System Operators, Refinery Oper…
55	Pump Operators, Except Wellhead Pumpers

	D_Soc	count	similarity
0	Nuclear Monitoring Technicians	18.0	0.842887
1	Wind Turbine Service Technicians	3.0	0.317127
2	Nuclear Power Reactor Operators	115.0	0.900529
3	Hydroelectric Plant Technicians	6.0	0.357048
4	Gas Plant Operators	3.0	0.396068
5	Sailors and Marine Oilers	3.0	0.380712
6	Nuclear Monitoring Technicians	1.0	0.878806
7	Solar Photovoltaic Installers	1.0	0.322519
8	Rotary Drill Operators, Oil and Gas	141.0	0.330613
9	Service Unit Operators, Oil and Gas	12.0	0.294428
10	Roustabouts, Oil and Gas	6.0	0.378762
11	Wind Turbine Service Technicians	1.0	0.273219
12	Gas Plant Operators	21.0	0.486320
13	Petroleum Pump System Operators, Refinery Oper…	35.0	0.434110
14	Sailors and Marine Oilers	2.0	0.374711
15	Gas Compressor and Gas Pumping Station Operators	5.0	0.423293
16	Pump Operators, Except Wellhead Pumpers	3.0	0.289825
17	Nuclear Power Reactor Operators	8.0	0.931373
18	Hydroelectric Plant Technicians	1.0	0.611163
19	Gas Plant Operators	1.0	0.731241
20	Sailors and Marine Oilers	1.0	0.591733
21	Wind Turbine Service Technicians	3.0	0.918509
22	Hydroelectric Plant Technicians	1.0	0.906074
23	Service Unit Operators, Oil and Gas	20.0	0.926701
24	Roustabouts, Oil and Gas	3.0	0.949994
25	Gas Plant Operators	3.0	0.889664
26	Petroleum Pump System Operators, Refinery Oper…	4.0	0.907733
27	Gas Compressor and Gas Pumping Station Operators	2.0	0.932293
28	Pump Operators, Except Wellhead Pumpers	1.0	0.951527
29	Gas Plant Operators	2.0	0.863985
30	Petroleum Pump System Operators, Refinery Oper…	1.0	0.903952
31	Pump Operators, Except Wellhead Pumpers	1.0	0.905102
32	Petroleum Pump System Operators, Refinery Oper…	1.0	0.956451

```
33  Petroleum Pump System Operators, Refinery Oper…    3.0    0.950829
34   Gas Compressor and Gas Pumping Station Operators    1.0    0.939606
35            Pump Operators, Except Wellhead Pumpers    1.0    0.956422
36  Petroleum Pump System Operators, Refinery Oper…    1.0    0.883280
37            Pump Operators, Except Wellhead Pumpers    4.0    0.890497
38                    Nuclear Power Reactor Operators    1.0    0.543426
39                    Hydroelectric Plant Technicians    5.0    0.871979
40                                Gas Plant Operators    2.0    0.871638
41            Pump Operators, Except Wellhead Pumpers    1.0    0.909545
42                    Hydroelectric Plant Technicians    8.0    0.598605
43                                Gas Plant Operators    2.0    0.682281
44                           Sailors and Marine Oilers    1.0    0.613732
45                                Gas Plant Operators    4.0    0.887586
46  Petroleum Pump System Operators, Refinery Oper…    3.0    0.915669
47   Gas Compressor and Gas Pumping Station Operators    1.0    0.905346
48            Pump Operators, Except Wellhead Pumpers    2.0    0.894053
49  Petroleum Pump System Operators, Refinery Oper…   18.0    0.874309
50   Gas Compressor and Gas Pumping Station Operators   13.0    0.957296
51            Pump Operators, Except Wellhead Pumpers    1.0    0.863965
52   Gas Compressor and Gas Pumping Station Operators    5.0    0.930478
53            Pump Operators, Except Wellhead Pumpers    3.0    0.952773
54                                 Wellhead Pumpers    1.0    0.939173
55                                 Wellhead Pumpers    1.0    0.900141
```

[ ]:
```
from scipy.stats.stats import pearsonr
print(pearsonr(similarity_score,count_transition))
```

```
(-0.15792960906773404, 0.24503478242875829)
```

[ ]:
```
from scipy.stats.stats import pearsonr
print(pearsonr(similarity_score_pow,count_transition))
```

```
(-0.12264952732896642, 0.367838023018368)
```

[ ]:

[ ]:
```
pd.set_option('display.max_rows', 1100)
```

[ ]: