Брагин Алексей. КЭ - 402

In [ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from scipy.cluster.hierarchy import dendrogram
from sklearn.cluster import AgglomerativeClustering, KMeans
from mpl_toolkits.mplot3d import Axes3D
```

In [2]:
```
hiring_data = pd.read_csv('hiring-data.txt', sep='\t')
```

In [3]:
```
names = hiring_data['NAME']
hiring_data = hiring_data.drop(['NR', 'NAME'], axis=1)
```

In [6]:
```
hiring_data
```

Out[6]:

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
0	10	10	9	10	10	10	9	10	10	9
1	10	10	4	10	5	5	4	5	4	3
2	5	4	10	5	10	4	10	5	3	10
3	10	10	9	10	10	10	9	10	10	9
4	4	3	5	4	3	10	4	10	10	5
5	10	10	4	10	5	4	3	4	5	5
6	4	4	5	5	4	10	5	10	10	6
7	4	5	3	4	5	10	4	10	10	4
8	4	5	10	4	10	5	10	4	3	10
9	10	10	4	10	5	4	4	5	4	4
10	4	5	10	5	10	4	10	4	5	10
11	10	10	9	10	10	9	9	10	10	10
12	6	5	4	3	5	10	5	10	10	5
13	4	5	10	4	10	5	10	3	4	10
14	10	10	9	10	10	9	10	9	10	10
15	6	5	3	4	4	10	4	10	10	5
16	10	10	5	10	4	5	4	3	4	5
17	4	5	10	4	10	4	10	4	4	10

In [68]:
```
def plot_dendrogram(model, **kwargs):
    # Create linkage matrix and then plot the dendrogram

    # create the counts of samples under each node
```

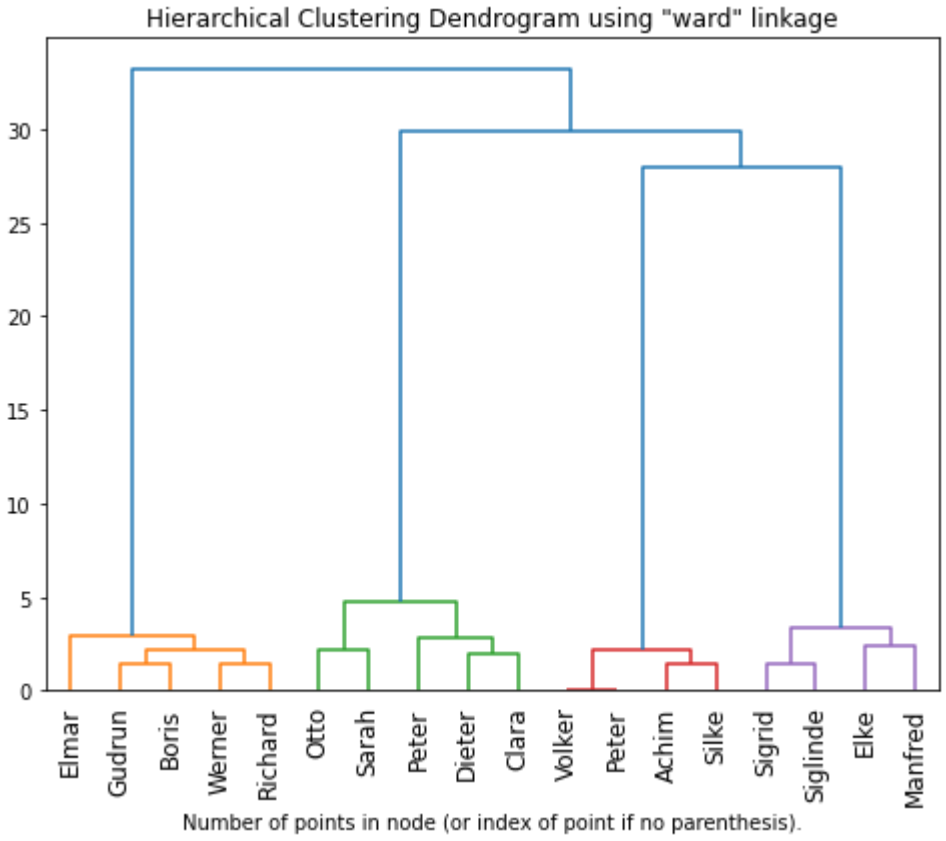
```
    counts = np.zeros(model.children_.shape[0])
    n_samples = len(model.labels_)
    for i, merge in enumerate(model.children_):
        current_count = 0
        for child_idx in merge:
            if child_idx < n_samples:
                current_count += 1  # leaf node
            else:
                current_count += counts[child_idx - n_samples]
        counts[i] = current_count

    linkage_matrix = np.column_stack([model.children_, model.distances_,
                                      counts]).astype(float)

    # Plot the corresponding dendrogram
    dendrogram(linkage_matrix, **kwargs)

def perform_agglomerative_clustering(depth, linkage, data, labels, xticks_rot='v
    model = AgglomerativeClustering(compute_distances=True, linkage=linkage)
    model = model.fit(data)

    plt.figure(figsize=(8, 6))
    plt.title(f'Hierarchical Clustering Dendrogram using "{linkage}" linkage')
    plot_dendrogram(model, truncate_mode='level', p=depth, labels=labels)
    plt.xlabel("Number of points in node (or index of point if no parenthesis)."
    plt.xticks(rotation=xticks_rot)
    plt.show()
```

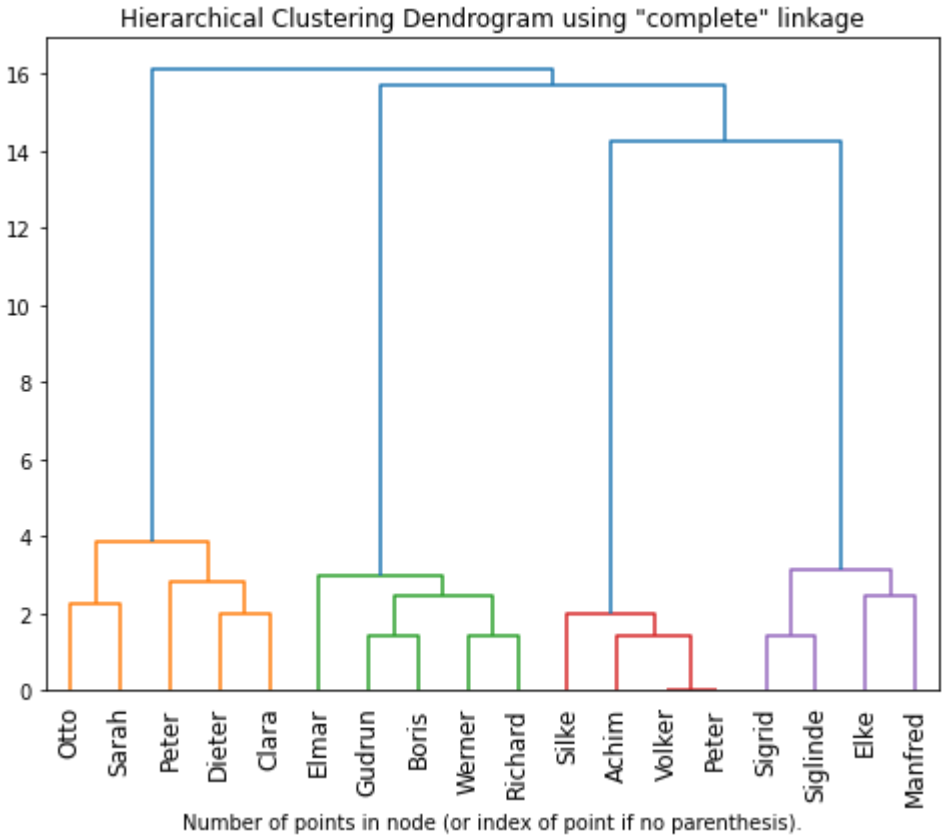
Иерархическая кластеризация данных о кандидатах

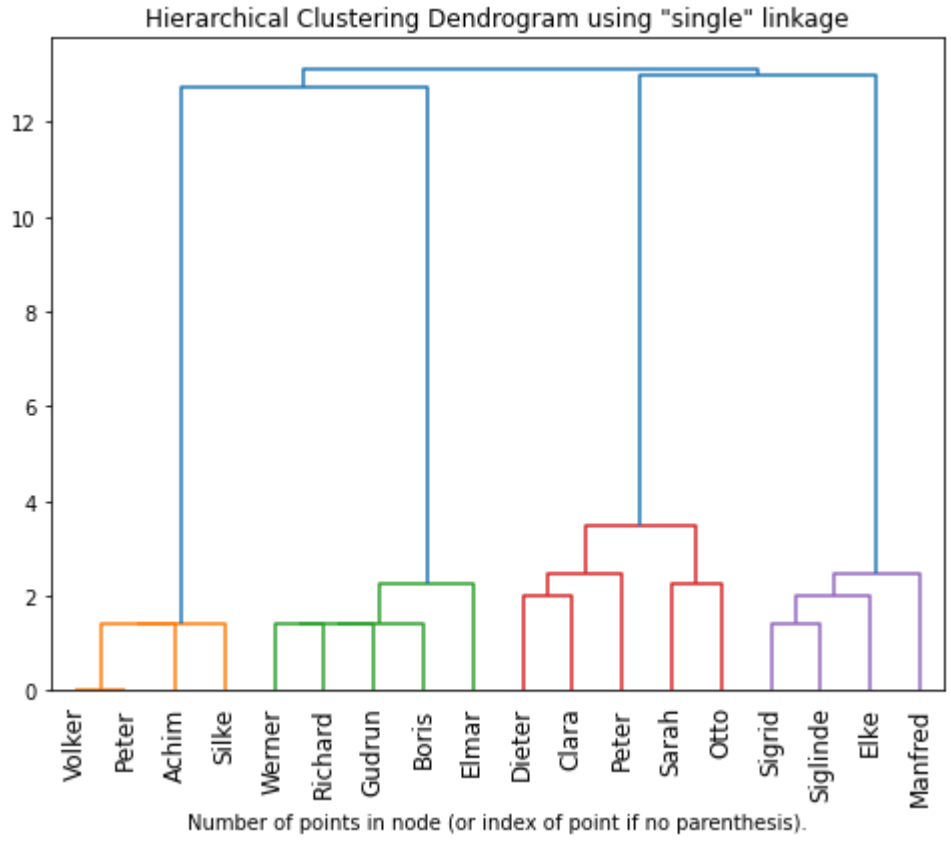
На всех типах схожести все кандидаты разбиваются на 4 кластера

In [69]:

```
linkage = ['ward', 'complete', 'single']
for linkage_type in linkage:
    perform_agglomerative_clustering(6, linkage_type, hiring_data, names.values)
```


Hierarchical Clustering Dendrogram using "ward" linkage
30
25
20
15
10
5
0
Elmar
Gudrun
Boris
Werner
Richard
Otto
Sarah
Peter
Dieter
Clara
Volker
Peter
Achim
Silke
Sigrid
Siglinde
Elke
Manfred
Number of points in node (or index of point if no parenthesis).


Hierarchical Clustering Dendrogram using "complete" linkage
16
14
12
10
8
6
4
2
0
Otto
Sarah
Peter
Dieter
Clara
Elmar
Gudrun
Boris
Werner
Richard
Silke
Achim
Volker
Peter
Sigrid
Siglinde
Elke
Manfred
Number of points in node (or index of point if no parenthesis).



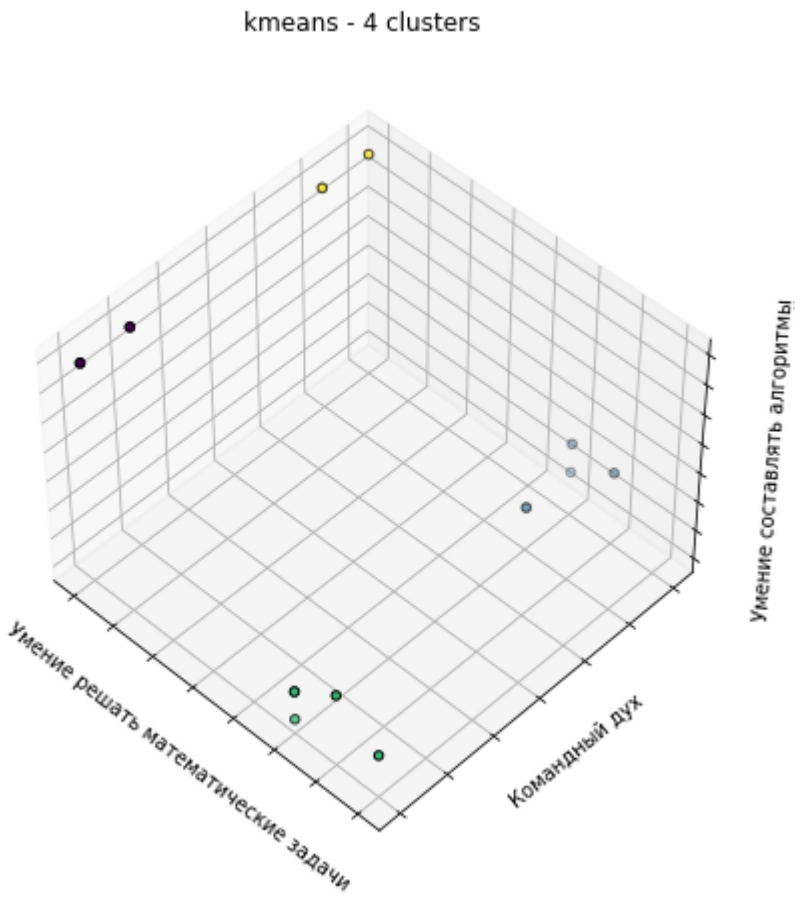
На основе результатов иерахрическая кластеризации строится k-means кластеризация

На графике отчетливо видны 4 кластера кандидатов

In [47]:

```
kmeans = KMeans(n_clusters=4).fit(hiring_data)
labels = kmeans.labels_

fig = plt.figure(1, figsize=(8, 6))
ax = Axes3D(fig, rect=[0, 0, .95, 1], elev=48, azim=134)

ax.scatter(hiring_data['T2'], hiring_data['T6'], hiring_data['T4'],
           c=labels.astype(float), edgecolor='k')
ax.w_xaxis.set_ticklabels([])
ax.w_yaxis.set_ticklabels([])
ax.w_zaxis.set_ticklabels([])
ax.set_xlabel('Умение решать математические задачи')
ax.set_ylabel('Командный дух')
ax.set_zlabel('Умение составлять алгоритмы')
ax.set_title('kmeans - 4 clusters')
ax.dist = 12

fig.show()
```

```
<ipython-input-47-041cdda54ac4>:18: UserWarning: Matplotlib is currently using m
odule://ipykernel.pylab.backend_inline, which is a non-GUI backend, so cannot sh
ow the figure.
  fig.show()
```



In [64]:
```
customers_data = pd.read_csv('customers.csv')
customers_data = customers_data.dropna()
customers_ids = customers_data['CustomerId']
customers_data = customers_data.drop(['Row', 'CustomerId'], axis=1)
```

In [65]:
```
customers_data.head()
```

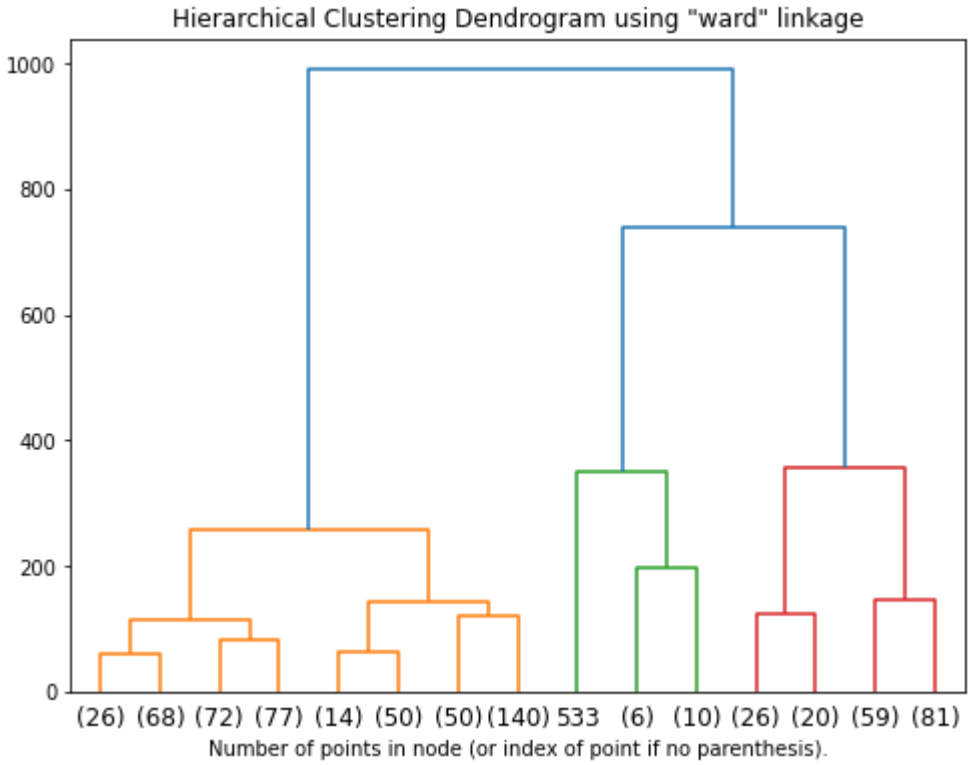
Out[65]:

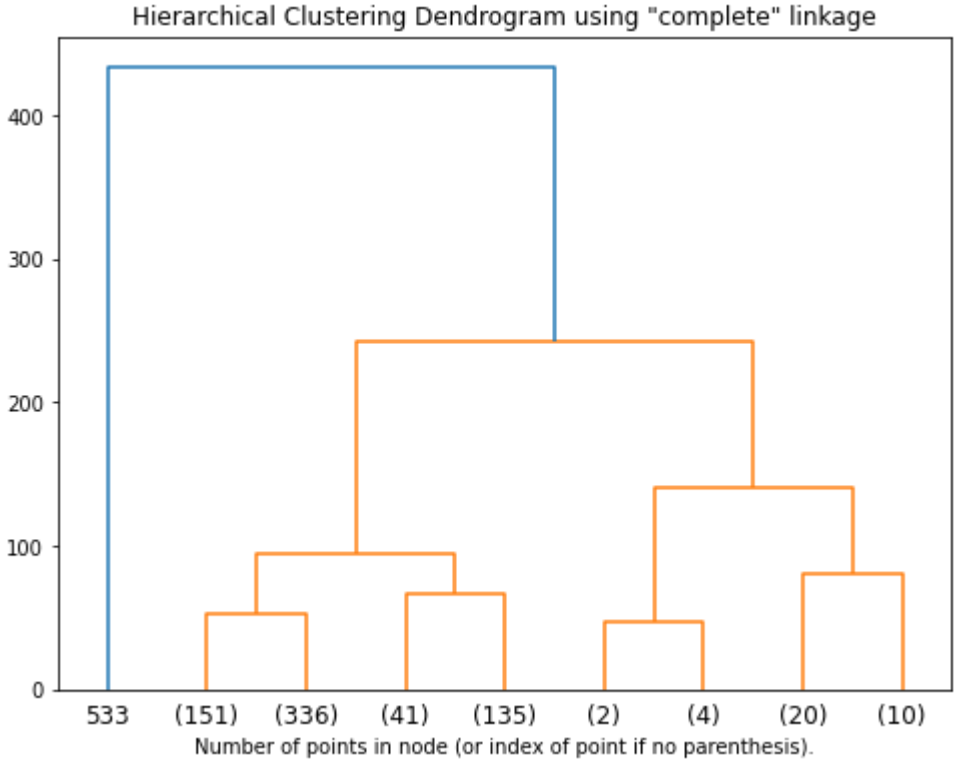
	Age	Education	YearsEmployed	Income	CardDebt	OtherDebt	Defaulted	DebtIncomeRatio
0	41	2	6	19	0.124	1.073	0.0	6.3
1	47	1	26	100	4.582	8.218	0.0	12.8
2	33	2	10	57	6.111	5.802	1.0	20.9
3	29	2	4	19	0.681	0.516	0.0	6.3
4	47	1	31	253	9.308	8.908	0.0	7.2

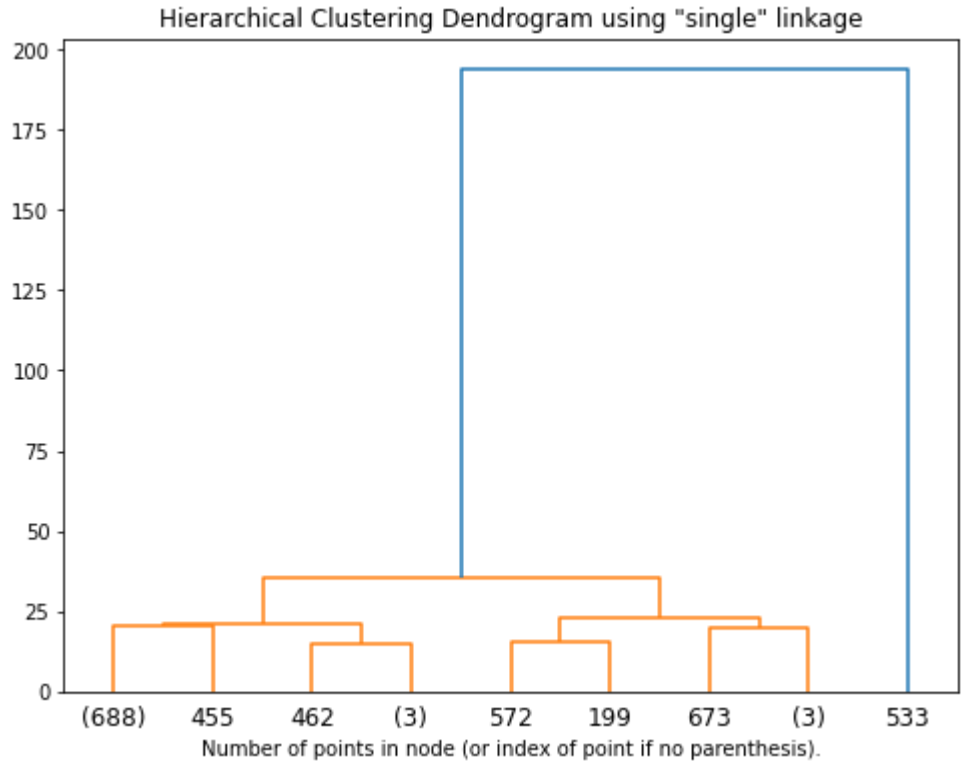
Иерархическая кластеризация данных о покупателях

Наиболее подробное разбиение данных предоставляет тип схожести "ward". Он разбил данные на 3 кластера, в то время, как другие типы разбили данные на 2 кластера

In [73]:
```
for linkage_type in linkage:
    perform_agglomerative_clustering(3, linkage_type, customers_data,
                                     customers_ids.values, xticks_rot='horizonta
```


Hierarchical Clustering Dendrogram using "ward" linkage
1000
800
600
400
200
0
(26) (68) (72) (77) (14) (50) (50) (140) 533 (6) (10) (26) (20) (59) (81)
Number of points in node (or index of point if no parenthesis).


Hierarchical Clustering Dendrogram using "complete" linkage
400
300
200
100
0
533 (151) (336) (41) (135) (2) (4) (20) (10)
Number of points in node (or index of point if no parenthesis).


Hierarchical Clustering Dendrogram using "single" linkage
200
175
150
125
100
75
50
25
0
(688)
455
462
(3)
572
199
673
(3)
533
Number of points in node (or index of point if no parenthesis).

In [ ]:

In [ ]: