Clustering

In [189]:
```
% matplotlib inline

from IPython.core.display import display, HTML
display(HTML("<style>.container { width:90% !important; }</style>"))
import numpy as np
import pandas as pd
pd.set_option('display.max_columns', 100)

df = pd.read_csv('User_Knowledge.csv')

df.loc[df.UNS == 'very_low','grade'] = 0
df.loc[df.UNS == 'Low','grade'] = 1
df.loc[df.UNS == 'Middle','grade'] = 2
df.loc[df.UNS == 'High','grade'] = 3

df.sample(5)
```

Out[189]:

	STG	SCG	STR	LPR	PEG	UNS	grade
57	0.090	0.600	0.66	0.19	0.59	Middle	2.0
109	0.299	0.295	0.80	0.37	0.84	High	3.0
44	0.115	0.350	0.65	0.27	0.04	very_low	0.0
2	0.060	0.060	0.05	0.25	0.33	Low	1.0
31	0.150	0.295	0.75	0.65	0.24	Low	1.0

Attribute Information

- STG (The degree of study time for goal object materails), (input value)
- SCG (The degree of repetition number of user for goal object materails) (input value)
- STR (The degree of study time of user for related objects with goal object) (input value)
- LPR (The exam performance of user for related objects with goal object) (input value)
- PEG (The exam performance of user for goal objects) (input value)
- UNS (The knowledge level of user) (target value)
  - Very Low: 50
  - Low:129
  - Middle: 122
  - High 130

In [190]:
```
y = list(df['UNS'])
#y = df.grade

# feature selection, dropping SCG
X = df.drop(columns=['SCG']).iloc[:,0:4]
# keeping all features
#X = df.iloc[:,0:5]
```

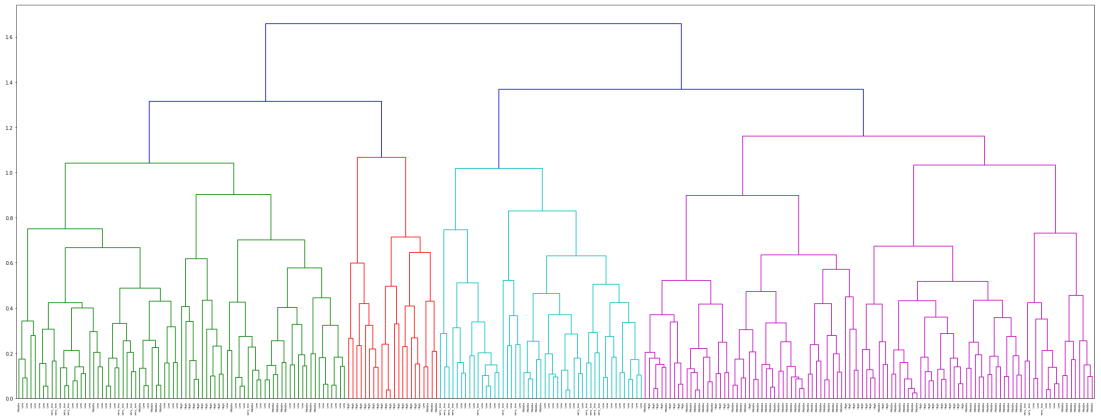
In [191]:
```
df['UNS'].value_counts()
```

Out[191]:
```
Middle      88
Low         83
High        63
very_low    24
Name: UNS, dtype: int64
```

In [192]:
```
import matplotlib.pyplot as plt
from scipy.cluster.hierarchy import linkage, dendrogram
```

Hierarchical clustering (unnormalized)

In [193]:
```
mergings=linkage(X,method='complete')
dendrogram(mergings,labels=y,leaf_rotation=90,leaf_font_size=6)
plt.gcf().set_size_inches(40, 15)
plt.show()
```



normalizing X

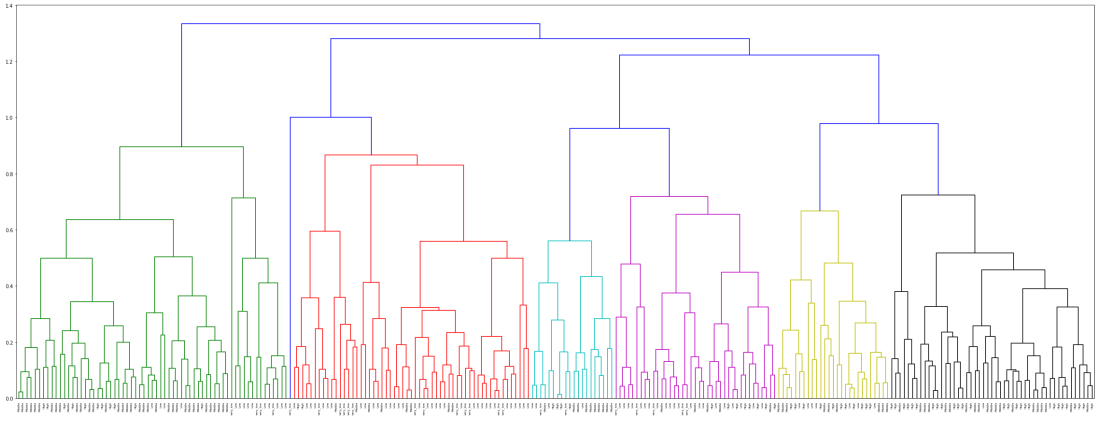
In [194]:
```
plt.clf

from sklearn.preprocessing import normalize
X_norm = normalize(X)
```

In [195]:
```
X_norm
```

Out[195]:
```
array([[ 0.        ,  0.        ,  0.        ,  0.        ],
       [ 0.08508713,  0.10635891,  0.25526138,  0.95723017],
       [ 0.1424138 ,  0.11867817,  0.59339083,  0.78327589],
       ...,
       [ 0.44497603,  0.58506108,  0.23896861,  0.63450286],
       [ 0.43100245,  0.69822397,  0.52582299,  0.22412128],
       [ 0.43352618,  0.49921196,  0.57146632,  0.4860748 ]])
```

In [196]:
```
# Hierarchical clustering (normalized)
mergings=linkage(X_norm,method='complete')
dendrogram(mergings,labels=y,leaf_rotation=90,leaf_font_size=6)
plt.gcf().set_size_inches(40, 15)
plt.show()
```



calculating distance

In [197]:
```
from scipy.cluster.hierarchy import fcluster
labels = fcluster(mergings, 1, criterion='distance')
varieties = list(df['UNS'])
df3 = pd.DataFrame({'labels': labels, 'varieties': varieties})

ct = pd.crosstab(df3.iloc[:,0], df3['varieties'])
df3.count()
```

Out[197]:
```
labels       258
varieties    258
dtype: int64
```

In [198]:
```
df3.sample(5)
```

Out[198]:

	labels	varieties
114	4	Middle
111	1	Low
22	4	Middle
156	1	Middle
208	3	very_low

In [199]:
```
ct
```

Out[199]:

varieties	High	Low	Middle	very_low
labels				
1	11	14	36	4
2	2	35	8	13
3	12	25	15	7
4	38	9	29	0

K means

In [200]:
```
# on goal_results - pairing study time and exam performance for goal objects
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
X_sc = sc.fit_transform(X)

from sklearn.decomposition import PCA
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_sc)

from sklearn.cluster import KMeans
kmeans = KMeans(n_clusters=4)
kmeans.fit(X_pca)
```

Out[200]:
```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
    n_clusters=4, n_init=10, n_jobs=1, precompute_distances='auto',
    random_state=None, tol=0.0001, verbose=0)
```

In [201]:
```
plt.gcf().set_size_inches(10, 10)
plt.scatter(X_pca[:,0],X_pca[:,1],c=kmeans.labels_,cmap='rainbow')
plt.title('K means')
plt.show()
```