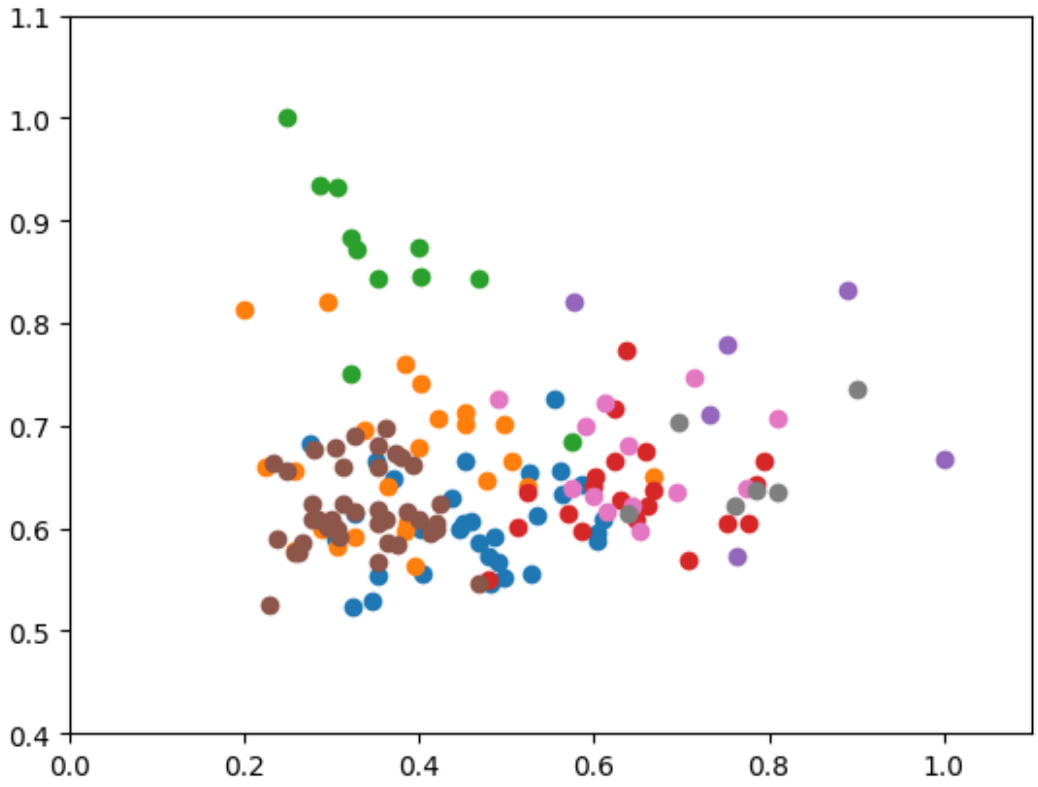
```
import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt


file_path = r'C:\Users\abdur\Desktop\AYBU\1-year 2-semestr\Applied
linear algebra\player_stats.xlsx'
data = pd.read_excel(file_path, sheet_name='normalized', usecols =
"C:K")

players_data = data.values
k = 8
kmeans = KMeans(n_clusters=k, random_state=0).fit(players_data)
labels=kmeans.labels_
group_representative=kmeans.cluster_centers_
J_clust=kmeans.inertia_

grps = [[players_data[i, :] for i in range(len(data)) if labels[i] ==
j] for j in range(k)]

for i in range(k):
    if len(grps[i]) >= 2:
        plt.scatter([c[0] for c in grps[i]], [c[1] for c in grps[i]])

plt.xlim(0, 1.1)
plt.ylim(0.4, 1.1)
plt.show()

print("Group representatives:")
for i in range(k):
    print(f"Group {i+1} centroid:", group_representative[i])

print("\nPlayers in each group:")
for i in range(k):
    group_players = data.iloc[labels == i].index.tolist()
    print(f"Group {i+1} ({len(group_players)} players):",
group_players)

print("\nCost (Jclust):", J_clust)
```




```
Group representatives:
Group 1 centroid: [0.46056312 0.60526202 0.77398981 0.89177715
0.28578256 0.37691002
 0.40860215 0.11669829 0.4156039 ]
Group 2 centroid: [0.38379094 0.66756393 0.70263158 0.82955771
0.5367284  0.21345029
 0.36507937 0.25245098 0.3255814 ]
Group 3 centroid: [0.36442459 0.86027163 0.06143541 0.72070217
0.71717172 0.16586922
 0.3030303  0.43582888 0.32980973]
Group 4 centroid: [0.64190751 0.63512786 0.79157895 0.89449838
0.34222222 0.55438596
 0.46190476 0.13970588 0.54651163]
Group 5 centroid: [0.78564547 0.73059668 0.78280702 0.82002877
0.68888889 0.76900585
 0.58730159 0.18627451 0.81395349]
Group 6 centroid: [0.3319253  0.61987093 0.81155196 0.83271098
0.2702754  0.18263608
 0.41758242 0.12895928 0.25402504]
Group 7 centroid: [0.6469542  0.66652863 0.73554656 0.87453323
0.61139601 0.3414305
 0.43589744 0.40723982 0.59391771]
Group 8 centroid: [0.76541426 0.65814266 0.80877193 0.91190219
0.39506173 0.44736842
 0.83333333 0.17647059 0.56589147]
```

```
Players in each group:
Group 1 (31 players): [15, 36, 41, 42, 49, 50, 51, 56, 57, 65, 66, 68,
70, 72, 73, 76, 79, 82, 83, 86, 88, 93, 94, 100, 105, 106, 127, 130,
137, 141, 147]
Group 2 (24 players): [28, 32, 33, 44, 45, 52, 59, 63, 64, 69, 77, 80,
96, 103, 108, 111, 112, 124, 132, 134, 135, 138, 143, 144]
Group 3 (11 players): [25, 34, 62, 75, 84, 126, 128, 129, 140, 146,
148]
Group 4 (20 players): [0, 3, 5, 6, 11, 16, 17, 20, 23, 24, 30, 31, 37,
39, 40, 47, 55, 58, 61, 71]
Group 5 (6 players): [1, 7, 10, 19, 21, 29]
Group 6 (39 players): [38, 43, 60, 67, 81, 85, 87, 89, 90, 91, 92, 97,
98, 99, 101, 102, 104, 107, 109, 110, 113, 114, 115, 116, 117, 118,
119, 120, 121, 122, 123, 125, 131, 133, 136, 139, 142, 145, 149]
Group 7 (13 players): [2, 4, 8, 9, 14, 22, 46, 48, 53, 54, 74, 78, 95]
Group 8 (6 players): [12, 13, 18, 26, 27, 35]

Cost (Jclust): 11.538807403246553
```

```python
import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt

file_path = r'C:\Users\abdur\Desktop\AYBU\1-year 2-semestr\Applied
linear algebra\player_stats.xlsx'
data = pd.read_excel(file_path, sheet_name='normalized',
usecols="C:K")

players_data = data.values
k = 15
kmeans = KMeans(n_clusters=k, random_state=0).fit(players_data)
labels = kmeans.labels_
group_representative = kmeans.cluster_centers_
J_clust = kmeans.inertia_

grps = [[players_data[i, :] for i in range(len(data)) if labels[i] ==
j] for j in range(k)]

for i in range(k):
    if len(grps[i]) >= 2:
        plt.scatter([c[0] for c in grps[i]], [c[1] for c in grps[i]])

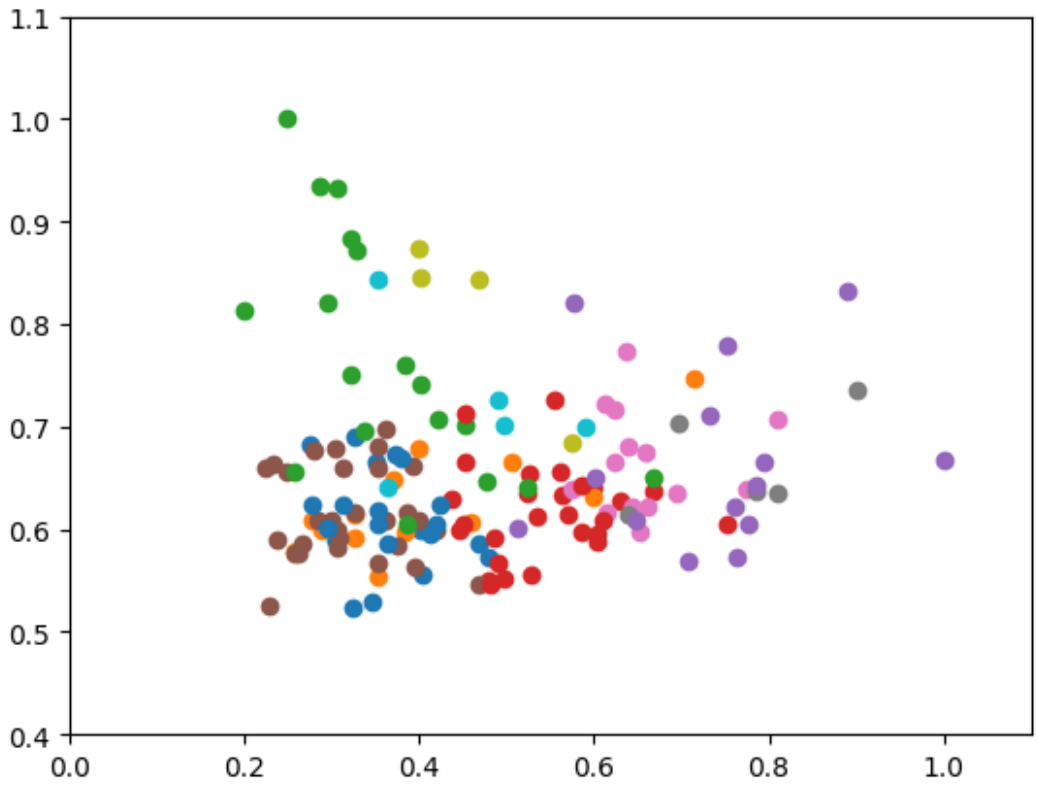
plt.xlim(0, 1.1)
plt.ylim(0.4, 1.1)
plt.show()

print("Group representatives:")
for i in range(k):
```

```
    print(f"Group {i+1} centroid: {group_representative[i]}")

print("\nPlayers in each group:")
for i in range(k):
    group_players = data.iloc[labels == i].index.tolist()
    print(f"Group {i+1} ({len(group_players)} players):
{group_players}")

print("\nCost (Jclust):", J_clust)
```




```
Group representatives:
Group 1 centroid: [0.35910405 0.5916891  0.77657895 0.88781014
0.23055556 0.48684211
 0.4047619  0.0625     0.33430233]
Group 2 centroid: [0.35890699 0.61360578 0.75100478 0.83475532
0.43905724 0.31339713
 0.4025974  0.14438503 0.37843552]
Group 3 centroid: [3.02023121e-01 8.95468820e-01 1.11022302e-16
6.90758720e-01
 6.28395062e-01 1.21345029e-01 2.69841270e-01 4.36274510e-01
 2.59689922e-01]
Group 4 centroid: [0.55510597 0.62889188 0.81978947 0.90658037
0.28839506 0.48538012
 0.46349206 0.14901961 0.4372093 ]
```

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Group 5 centroid: [0.79017341 0.76204576 0.78315789 0.79935275
0.78666667 0.73333333
 0.57142857 0.21176471 0.77674419]
Group 6 centroid: [0.32090891 0.61572377 0.81132486 0.81754268
0.28454662 0.16364186
 0.3546798  0.12373225 0.23175621]
Group 7 centroid: [0.6587531  0.66516055 0.74661654 0.84126984
0.52698413 0.39786967
 0.43537415 0.22058824 0.61461794]
Group 8 centroid: [0.76647399 0.6654105  0.81347368 0.91305286
0.39703704 0.44912281
 0.87619048 0.18235294 0.53488372]
Group 9 centroid: [0.46098266 0.8115747  0.03736842 0.7877562
0.84814815 0.23026316
 0.35714286 0.38235294 0.44767442]
Group 10 centroid: [0.45895954 0.7230148  0.71578947 0.82804746
0.54814815 0.17017544
 0.2952381  0.64117647 0.31627907]
Group 11 centroid: [0.3668297  0.62211409 0.79724696 0.89187619
0.26780627 0.21862348
 0.54945055 0.15837104 0.29695886]
Group 12 centroid: [0.65606936 0.68909825 0.62315789 0.87971953
0.83703704 0.30701754
 0.57142857 0.85294118 0.63953488]
Group 13 centroid: [0.40052987 0.70367878 0.67736842 0.81921971
0.61975309 0.20175439
 0.36904762 0.25735294 0.32751938]
Group 14 centroid: [0.52914258 0.60161507 0.72368421 0.88169723
0.30123457 0.28216374
 0.37698413 0.12254902 0.47674419]
Group 15 centroid: [0.70552344 0.61522357 0.80444444 0.94174757
0.31193416 0.66276803
 0.4973545  0.12418301 0.68475452]

Players in each group:
Group 1 (8 players): [73, 82, 93, 94, 100, 106, 127, 137]
Group 2 (11 players): [32, 41, 50, 64, 77, 80, 83, 96, 108, 121, 147]
Group 3 (6 players): [126, 128, 129, 140, 146, 148]
Group 4 (15 players): [0, 3, 5, 6, 17, 30, 49, 51, 57, 58, 61, 65, 68,
130, 141]
Group 5 (5 players): [1, 10, 19, 21, 29]
Group 6 (29 players): [45, 67, 81, 90, 92, 97, 98, 99, 101, 102, 107,
110, 113, 114, 115, 116, 118, 119, 120, 122, 124, 131, 133, 135, 136,
139, 142, 145, 149]
Group 7 (14 players): [2, 4, 8, 14, 22, 23, 31, 39, 40, 46, 48, 53,
54, 71]
Group 8 (5 players): [12, 13, 26, 27, 35]
Group 9 (4 players): [25, 34, 62, 75]
Group 10 (5 players): [69, 74, 78, 84, 112]
```

```
Group 11 (13 players): [38, 43, 60, 85, 86, 87, 89, 91, 104, 109, 117,
123, 125]
Group 12 (2 players): [9, 95]
Group 13 (12 players): [28, 33, 44, 52, 59, 63, 103, 111, 132, 138,
143, 144]
Group 14 (12 players): [15, 36, 42, 56, 66, 70, 72, 76, 79, 88, 105,
134]
Group 15 (9 players): [7, 11, 16, 18, 20, 24, 37, 47, 55]

Cost (Jclust): 7.777577260155553
```