In [30]:

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

In [31]:

```
ODAQ_results = pd.read_csv('./ODAQ/ODAQ_listening_test/ODAQ_results.cs
ODAQ_results_BSU1 = pd.read_csv('./ODAQ_v1_BSU/Cohort_B1_results.csv')
ODAQ_results_BSU2 = pd.read_csv('./ODAQ_v1_BSU/Cohort_B2_results.csv')
```

In [32]:

```
ODAQ_results
```

Out[32]:

	score	method	condition	process	item	subject
0	47.0	LP	LP3.5	LP35	LP_11_guitar	Subject 1: USLA08
1	5.0	LP	LP3.5	LP35	LP_11_guitar	Subject 2: DEID44
2	10.0	LP	LP3.5	LP35	LP_11_guitar	Subject 3: DEID1115
3	20.0	LP	LP3.5	LP35	LP_11_guitar	Subject 4: DEID337
4	30.0	LP	LP3.5	LP35	LP_11_guitar	Subject 5: USLA06
...	...	...	...	...	...	...
6235	100.0	DE	Ref	reference	DE_SitaSings_remix2_LD6	Subject 22: DEID2
6236	100.0	DE	Ref	reference	DE_SitaSings_remix2_LD6	Subject 23: USLA01
6237	100.0	DE	Ref	reference	DE_SitaSings_remix2_LD6	Subject 24: USLA05
6238	100.0	DE	Ref	reference	DE_SitaSings_remix2_LD6	Subject 25: DEID1
6239	100.0	DE	Ref	reference	DE_SitaSings_remix2_LD6	Subject 26: DEID3

6240 rows × 6 columns

In [33]:

```
methods = ODAQ_results['method'].unique()
conditions = ODAQ_results['condition'].unique()
processes = ODAQ_results['process'].unique()
items = ODAQ_results['item'].unique()

print(methods)
print(conditions)
print(processes)
print(items)
```

```
['LP' 'TM' 'UN' 'SH' 'PE' 'DE']
['LP3.5' 'LP7' 'Q1' 'Q2' 'Q3' 'Q4' 'Q5' 'Ref']
['LP35' 'LP70' 'LP50' 'LP90' 'LP105' 'LP120' 'LP150' 'reference' 'TM3k'
 'TM5k' 'TM7k' 'TM9k' 'TM10.5k' 'UN3k' 'UN5k' 'UN7k' 'UN9k' 'UN10.5k'
 'SH70_MS' 'SH50_MS' 'SH30_MS' 'SH20_MS' 'SH10_MS' 'PE_4096_MS_NMR10'
 'PE_2048_MS_NMR10' 'PE_1024_MS_NMR10' 'PE_2048_MS_NMR16'
 'PE_1024_MS_NMR16' 'OpenUnmix_mid' 'TFC_TDF_U_Net_mid' 'Cocktail_mid'
 'DeepFilterNet2_mid' 'PSM_quantize_mask']
['LP_11_guitar' 'LP_23_jazz' 'LP_AmateurOnPurpose'
 'LP_CreatureFromTheBlackjackTable' 'TM_01b_trumpet' 'TM_02_violin'
 'TM_AmateurOnPurpose' 'TM_CreatureFromTheBlackjackTable'
 'UN_20c_accordion' 'UN_21_violin' 'UN_AmateurOnPurpose'
 'UN_CreatureFromTheBlackjackTable' 'SH_04_choral' 'SH_13_glockenspiel'
 'SH_AmateurOnPurpose' 'SH_CreatureFromTheBlackjackTable'
 'PE_27_castanets' 'PE_39_clapping' 'PE_AmateurOnPurpose'
 'PE_CreatureFromTheBlackjackTable' 'DE_CosmosLandromat_remix1_LD6'
 'DE_CosmosLandromat_remix3_LD3' 'DE_ElephantsDream_LD0'
 'DE_female_speech_music_1_LD0' 'DE_female_speech_music_2_LD9'
 'DE_female_speech_music_3_LD3' 'DE_Meridian_remix1_LD3'
 'DE_Meridian_remix2_LD6' 'DE_SitaSings_remix1_LD0'
 'DE_SitaSings_remix2_LD6']
```

In [34]:

```python
# Get unique subjects from ODAQ_results
unique_subjects = ODAQ_results['subject'].unique()

print(unique_subjects)

# Dynamically create expert variables
for i, subject in enumerate(unique_subjects, start=1):
    globals()[f"expert{i}"] = ODAQ_results[ODAQ_results['subject'] ==
```

```
['Subject 1: USLA08' 'Subject 2: DEID44' 'Subject 3: DEID1115'
 'Subject 4: DEID337' 'Subject 5: USLA06' 'Subject 6: DEID5'
 'Subject 7: DEID9' 'Subject 8: DEID4' 'Subject 9: USLG04'
 'Subject 10: USLA04' 'Subject 11: USLA07' 'Subject 12: DEID256'
 'Subject 13: DEID6' 'Subject 14: USLG05' 'Subject 15: USLA09'
 'Subject 16: USLG02' 'Subject 17: USLG03' 'Subject 18: DEID7'
 'Subject 19: USLA12' 'Subject 20: DEID10' 'Subject 21: DEID8'
 'Subject 22: DEID2' 'Subject 23: USLA01' 'Subject 24: USLA05'
 'Subject 25: DEID1' 'Subject 26: DEID3']
```

In [35]:

```python
# Initialize score lists dynamically for 26 experts
for i in range(1, 27):  # Assuming 26 experts
    globals()[f"expert{i}_scores"] = []

# Append scores systematically
for item in items:
    for i in range(1, 27):
        expert_df = globals()[f"expert{i}"]  # Access expert data fram
        scores = expert_df[expert_df['item'] == item]['score'].values
        globals()[f"expert{i}_scores"].append(scores)
```

In [36]:

```python
# create expert{}_scores_df

# Initialize expert{}_scores_df
for i in range(1, 27):
    globals()[f"expert{i}_scores_df"] = pd.DataFrame()

# Append scores systematically
for i in range(1, 27):
    globals()[f"expert{i}_scores_df"]['item'] = items
    globals()[f"expert{i}_scores_df"]['score'] = globals()[f"expert{i}
    globals()[f"expert{i}_scores_df"]['condition'] = [list(conditions)

# expand the scores column such that each element in the vector is a r
for i in range(1, 27):
    globals()[f"expert{i}_scores_df"] = globals()[f"expert{i}_scores_d
```

In [37]:
```
expert1_scores_df
```

Out[37]:

	item	score	condition
0	LP_11_guitar	47.0	LP3.5
0	LP_11_guitar	66.0	LP7
0	LP_11_guitar	56.0	Q1
0	LP_11_guitar	76.0	Q2
0	LP_11_guitar	90.0	Q3
...	...	...	...
29	DE_SitaSings_remix2_LD6	44.0	Q2
29	DE_SitaSings_remix2_LD6	60.0	Q3
29	DE_SitaSings_remix2_LD6	74.0	Q4
29	DE_SitaSings_remix2_LD6	65.0	Q5
29	DE_SitaSings_remix2_LD6	100.0	Ref

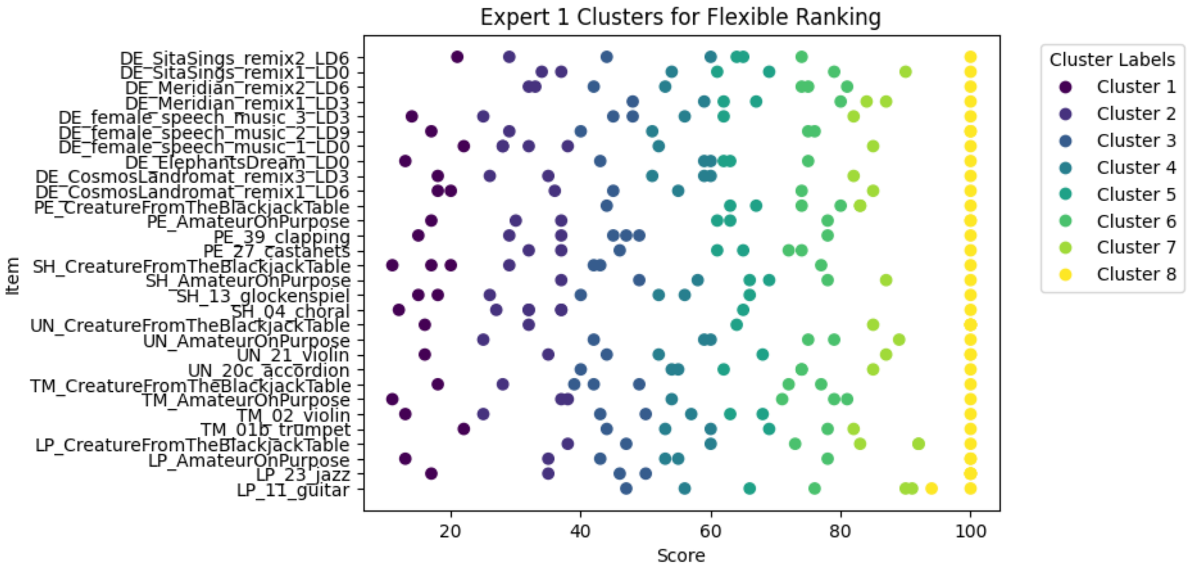
240 rows × 3 columns

In [38]:
```
for i in range(1, 27):
    # Dynamically access each expert's DataFrame
    df = globals()[f"expert{i}_scores_df"]

    # Apply K-means clustering (k=8)
    kmeans = KMeans(n_clusters=8, random_state=0).fit(df['score'].valu

    # Assign initial cluster labels
    df['cluster'] = kmeans.labels_

    # Compute mean score for each cluster
    cluster_means = df.groupby('cluster')['score'].mean()

    # Rank clusters by mean score, assigning new labels from 1 to 8
    cluster_rank = {old_label: new_label for new_label, old_label in e

    # Reassign cluster labels based on ranking
    df['cluster'] = df['cluster'].map(cluster_rank)

    # Store back the updated DataFrame
    globals()[f"expert{i}_scores_df"] = df
```

In [39]:

```
# Visualize the clusters

scatter = plt.scatter(expert1_scores_df['score'],
                      expert1_scores_df['item'],
                      c=expert1_scores_df['cluster'])

# Labels and title
plt.xlabel('Score')
plt.ylabel('Item')
plt.title('Expert 1 Clusters for Flexible Ranking')

# Create legend and move it outside
legend = plt.legend(handles=scatter.legend_elements()[0],
                    labels=[f'Cluster {i+1}' for i in range(8)],
                    title='Cluster Labels',
                    bbox_to_anchor=(1.05, 1), loc='upper left')  # Mov

# Adjust layout to prevent cutting off the legend
plt.tight_layout(rect=[1, 0, 0.8, 1])

plt.show()
```

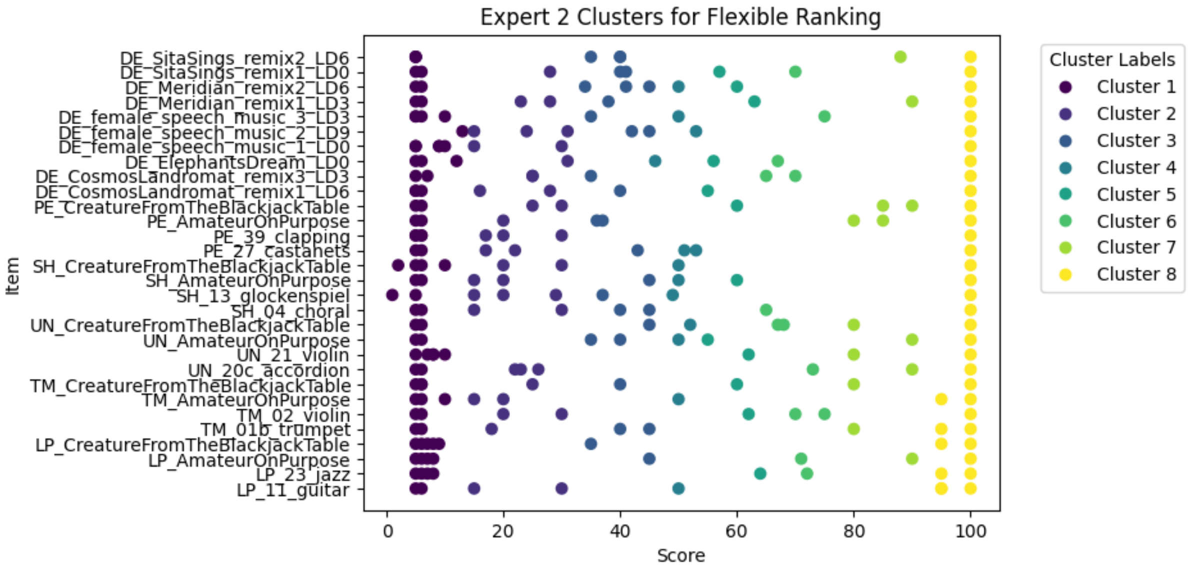
```
/var/folders/d3/99lvl9fd1673ngz9966pvq100000gn/T/ipykernel_23097/280842
3240.py:19: UserWarning:

Tight layout not applied. The left and right margins cannot be made lar
ge enough to accommodate all Axes decorations.
```



In [40]:

```
# Visualize the clusters

scatter = plt.scatter(expert2_scores_df['score'],
                       expert2_scores_df['item'],
                       c=expert2_scores_df['cluster'])

# Labels and title
plt.xlabel('Score')
plt.ylabel('Item')
plt.title('Expert 2 Clusters for Flexible Ranking')

# Create legend and move it outside
legend = plt.legend(handles=scatter.legend_elements()[0],
                    labels=[f'Cluster {i+1}' for i in range(8)],
                    title='Cluster Labels',
                    bbox_to_anchor=(1.05, 1), loc='upper left')  # Mov

# Adjust layout to prevent cutting off the legend
plt.tight_layout(rect=[1, 0, 0.8, 1])

plt.show()
```

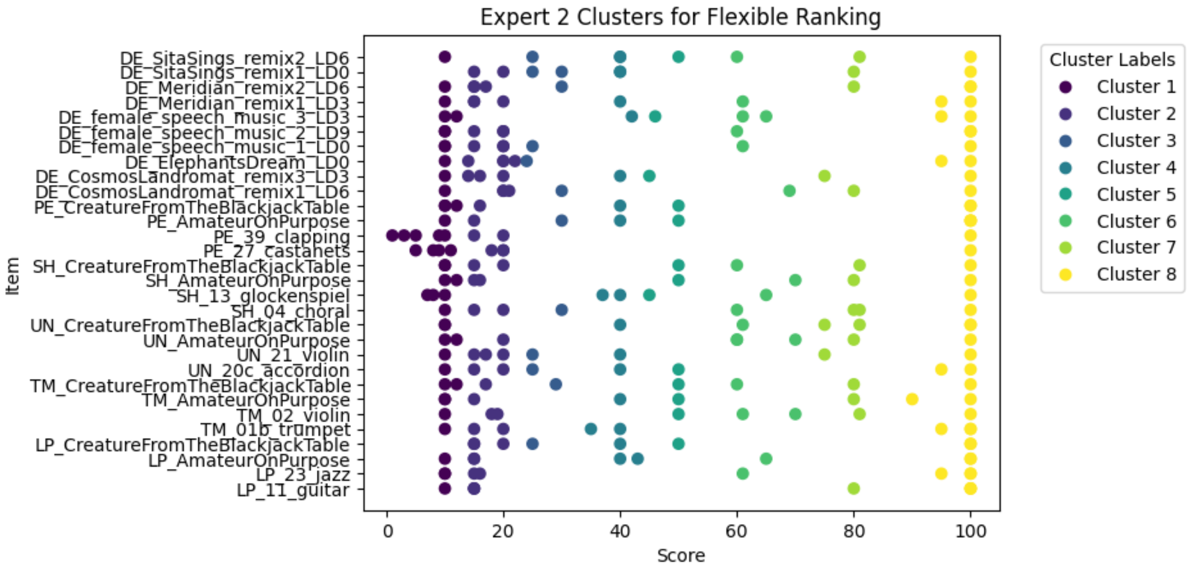
```
/var/folders/d3/99lvl9fd1673ngz9966pvq100000gn/T/ipykernel_23097/200472
4561.py:19: UserWarning:

Tight layout not applied. The left and right margins cannot be made lar
ge enough to accommodate all Axes decorations.
```



In [41]:

```
# Visualize the clusters

scatter = plt.scatter(expert3_scores_df['score'],
                      expert3_scores_df['item'],
                      c=expert3_scores_df['cluster'])

# Labels and title
plt.xlabel('Score')
plt.ylabel('Item')
plt.title('Expert 2 Clusters for Flexible Ranking')

# Create legend and move it outside
legend = plt.legend(handles=scatter.legend_elements()[0],
                    labels=[f'Cluster {i+1}' for i in range(8)],
                    title='Cluster Labels',
                    bbox_to_anchor=(1.05, 1), loc='upper left')  # Mov

# Adjust layout to prevent cutting off the legend
plt.tight_layout(rect=[1, 0, 0.8, 1])

plt.show()
```

```
/var/folders/d3/99lvl9fd1673ngz9966pvq100000gn/T/ipykernel_23097/398142
6970.py:19: UserWarning:

Tight layout not applied. The left and right margins cannot be made lar
ge enough to accommodate all Axes decorations.
```



In [42]:

```python
import plotly.graph_objects as go
import pandas as pd

# Define distinct colors for the 8 clusters
cluster_colors = [
    "#636EFA", "#EF553B", "#00CC96", "#AB63FA", "#FFA15A",
    "#19D3F3", "#FF6692", "#B6E880"
]

# Get the full list of unique items across all experts (ensures all it
all_items = set()
for i in range(1, 27):
    all_items.update(globals()[f"expert{i}_scores_df"]['item'])

all_items = sorted(all_items)  # Sort for consistency
item_mapping = {item: idx for idx, item in enumerate(all_items)}  # Ma

# Create a figure
fig = go.Figure()

# Loop through all experts
for i in range(1, 27):
    df = globals()[f"expert{i}_scores_df"].copy()

    # Convert categorical items to numeric for proper visualization
    df['item_numeric'] = df['item'].map(item_mapping)

    # Create scatter traces for each cluster
    for cluster in range(1, 9):
        cluster_df = df[df['cluster'] == cluster]

        fig.add_trace(go.Scatter(
            x=cluster_df['score'],
            y=cluster_df['item_numeric'],
            mode='markers',
            marker=dict(color=cluster_colors[cluster - 1], size=8),
            name=f'Cluster {cluster}',
            visible=True if i == 1 else False
        ))

# Create dropdown menu for selecting experts
dropdown_buttons = [
    dict(label=f"Expert {i}",
         method="update",
         args=[{"visible": [j // 8 == (i - 1) for j in range(26 * 8)]},
               {"title": f"Expert {i} Clusters"}])
    for i in range(1, 27)
]

# Update layout
fig.update_layout(
    title="Expert 1 Clusters",
    xaxis_title="Score",
    yaxis_title="Item",
    yaxis=dict(
        tickmode="array",
        tickvals=list(item_mapping.values()),
        ticktext=list(item_mapping.keys())
    ),
    updatemenus=[dict(
        buttons=dropdown_buttons,
        direction="down",
        showactive=True,
        x=0.17,
        xanchor="left",
        y=1.15,
        yanchor="top"
    )],
    height=800,
    showlegend=True
)

fig.show()
```

In [43]:

```
# print how many items are in each cluster for each expert

for i in range(1, 2):
    df = globals()[f"expert{i}_scores_df"]
    cluster_counts = df.groupby('cluster')['item'].count()
    print(f"Expert {i} Cluster Counts:")
    print(cluster_counts)
    print("Total Items (should be 240):")
    print(sum(cluster_counts))
    print()
```

```
Expert 1 Cluster Counts:
cluster
1    24
2    38
3    31
4    29
5    26
6    31
7    20
8    41
Name: item, dtype: int64
Total Items (should be 240):
240
```

In [44]:

```
for i in range(1, 27):
    df = globals()[f"expert{i}_scores_df"]

    # Group by 'item' and aggregate the lists back
    df = df.groupby('item').agg({
        'score': list,
        'condition': list,
        'cluster': list
    }).reset_index()

    # Rename 'cluster' to 'rankings'
    df = df.rename(columns={'cluster': 'rankings'})

    # Store the updated DataFrame back
    globals()[f"expert{i}_scores_df"] = df
```

In [45]:

```
expert1_scores_df
```

Out[45]:

	item	score	condition	rankings
0	DE_CosmosLandromat_remix1_LD6	[20.0, 36.0, 18.0, 45.0, 55.0, 74.0, 100.0, 85.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 2, 1, 3, 4, 6, 8, 7]
1	DE_CosmosLandromat_remix3_LD3	[26.0, 51.0, 18.0, 35.0, 59.0, 60.0, 82.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 4, 1, 2, 4, 4, 7, 8]
2	DE_ElephantsDream_LD0	[13.0, 63.0, 43.0, 62.0, 59.0, 60.0, 75.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 5, 3, 5, 4, 4, 6, 8]
3	DE_Meridian_remix1_LD3	[59.0, 84.0, 48.0, 62.0, 67.0, 80.0, 87.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[4, 7, 3, 5, 5, 6, 7, 8]

4	DE_Meridian_remix2_LD6	[32.0, 81.0, 33.0, 42.0, 53.0, 74.0, 75.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 6, 2, 3, 4, 6, 6, 8]
5	DE_SitaSings_remix1_LD0	[34.0, 54.0, 37.0, 61.0, 69.0, 79.0, 90.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 4, 2, 5, 5, 6, 7, 8]
6	DE_SitaSings_remix2_LD6	[21.0, 64.0, 29.0, 44.0, 60.0, 74.0, 65.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 5, 2, 3, 4, 6, 5, 8]
7	DE_female_speech_music_1_LD0	[22.0, 52.0, 28.0, 38.0, 28.0, 32.0, 85.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 4, 2, 2, 2, 2, 7, 8]
8	DE_female_speech_music_2_LD9	[17.0, 40.0, 29.0, 76.0, 51.0, 75.0, 100.0, 10...	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 2, 6, 4, 6, 8, 8]
9	DE_female_speech_music_3_LD3	[14.0, 45.0, 25.0, 48.0, 62.0, 56.0, 82.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 2, 3, 5, 4, 7, 8]
10	LP_11_guitar	[47.0, 66.0, 56.0, 76.0, 90.0, 100.0, 91.0, 94.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[3, 5, 4, 6, 7, 8, 7, 8]
11	LP_23_jazz	[17.0, 50.0, 35.0, 46.0, 100.0, 100.0, 100.0, ...	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 2, 3, 8, 8, 8, 8]
12	LP_AmateurOnPurpose	[13.0, 43.0, 35.0, 55.0, 53.0, 100.0, 78.0, 10...	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 2, 4, 4, 8, 6, 8]
13	LP_CreatureFromTheBlackjackTable	[38.0, 60.0, 47.0, 73.0, 83.0, 100.0, 92.0, 92.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 4, 3, 6, 7, 8, 7, 7]
14	PE_27_castanets	[46.0, 72.0, 32.0, 65.0, 37.0, 61.0, 74.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[3, 6, 2, 5, 2, 5, 6, 8]
15	PE_39_clapping	[45.0, 78.0, 15.0, 29.0, 47.0, 37.0, 49.0,	[LP3.5, LP7, Q1, Q2, Q3,	[3, 6, 1, 2, 3, 2,

		100.0]	Q4, Q5, Ref]	3, 8]
16	PE_AmateurOnPurpose	[17.0, 30.0, 63.0, 61.0, 37.0, 78.0, 100.0, 10...	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 2, 5, 5, 2, 6, 8, 8]
17	PE_CreatureFromTheBlackjackTable	[44.0, 63.0, 67.0, 74.0, 80.0, 83.0, 83.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[3, 5, 5, 6, 6, 7, 7, 8]
18	SH_04_choral	[37.0, 65.0, 12.0, 27.0, 32.0, 32.0, 37.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 5, 1, 2, 2, 2, 2, 8]
19	SH_13_glockenspiel	[15.0, 66.0, 18.0, 26.0, 40.0, 52.0, 56.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 5, 1, 2, 3, 4, 4, 8]
20	SH_AmateurOnPurpose	[37.0, 58.0, 49.0, 69.0, 66.0, 78.0, 87.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 4, 3, 5, 5, 6, 7, 8]
21	SH_CreatureFromTheBlackjackTable	[17.0, 42.0, 11.0, 20.0, 29.0, 43.0, 77.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 1, 1, 2, 3, 6, 8]
22	TM_01b_trumpet	[22.0, 53.0, 44.0, 60.0, 69.0, 78.0, 100.0, 82.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 4, 3, 4, 5, 6, 8, 7]
23	TM_02_violin	[25.0, 43.0, 13.0, 50.0, 57.0, 63.0, 68.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 3, 1, 3, 4, 5, 5, 8]
24	TM_AmateurOnPurpose	[11.0, 38.0, 37.0, 54.0, 71.0, 81.0, 79.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 2, 2, 4, 6, 6, 6, 8]
25	TM_CreatureFromTheBlackjackTable	[18.0, 42.0, 28.0, 39.0, 77.0, 49.0, 72.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 3, 2, 3, 6, 3, 6, 8]
26	UN_20c_accordion	[55.0, 74.0, 40.0, 54.0, 62.0, 74.0, 100.0, 85.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[4, 6, 3, 4, 5, 6, 8, 7]
		[35.0, 68.0,	[LP3.5, LP7,	[2, 5, 1,

27	UN_21_violin	16.0, 44.0, 52.0, 87.0, 100.0, 10...	Q1, Q2, Q3, Q4, Q5, Ref]	3, 4, 7, 8, 8]
28	UN_AmateurOnPurpose	[25.0, 42.0, 59.0, 79.0, 75.0, 89.0, 60.0, 100.0]	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[2, 3, 4, 6, 6, 7, 4, 8]
29	UN_CreatureFromTheBlackjackTable	[16.0, 32.0, 64.0, 85.0, 100.0, 100.0, 100.0, ...	[LP3.5, LP7, Q1, Q2, Q3, Q4, Q5, Ref]	[1, 2, 5, 7, 8, 8, 8, 8]

In [46]:

```
# Extract all the 'rankings' column value for each expert and create a

for i in range(1, 27):
    df = globals()[f"expert{i}_scores_df"]

    # Extract the 'cluster' values as a 30x8 matrix
    rankings_matrix = np.array(df['rankings'].tolist())  # Convert lis

    # Store as a variable dynamically
    globals()[f"expert{i}_rankings_kmeans_based"] = rankings_matrix
```

In [47]:

```
expert1_rankings_kmeans_based
```

Out[47]:

```
array([[1, 2, 1, 3, 4, 6, 8, 7],
       [2, 4, 1, 2, 4, 4, 7, 8],
       [1, 5, 3, 5, 4, 4, 6, 8],
       [4, 7, 3, 5, 5, 6, 7, 8],
       [2, 6, 2, 3, 4, 6, 6, 8],
       [2, 4, 2, 5, 5, 6, 7, 8],
       [1, 5, 2, 3, 4, 6, 5, 8],
       [1, 4, 2, 2, 2, 2, 7, 8],
       [1, 3, 2, 6, 4, 6, 8, 8],
       [1, 3, 2, 3, 5, 4, 7, 8],
       [3, 5, 4, 6, 7, 8, 7, 8],
       [1, 3, 2, 3, 8, 8, 8, 8],
       [1, 3, 2, 4, 4, 8, 6, 8],
       [2, 4, 3, 6, 7, 8, 7, 7],
       [3, 6, 2, 5, 2, 5, 6, 8],
       [3, 6, 1, 2, 3, 2, 3, 8],
       [1, 2, 5, 5, 2, 6, 8, 8],
       [3, 5, 5, 6, 6, 7, 7, 8],
       [2, 5, 1, 2, 2, 2, 2, 8],
       [1, 5, 1, 2, 3, 4, 4, 8],
       [2, 4, 3, 5, 5, 6, 7, 8],
       [1, 3, 1, 1, 2, 3, 6, 8],
       [1, 4, 3, 4, 5, 6, 8, 7],
       [2, 3, 1, 3, 4, 5, 5, 8],
       [1, 2, 2, 4, 6, 6, 6, 8],
       [1, 3, 2, 3, 6, 3, 6, 8],
       [4, 6, 3, 4, 5, 6, 8, 7],
       [2, 5, 1, 3, 4, 7, 8, 8],
       [2, 3, 4, 6, 6, 7, 4, 8],
       [1, 2, 5, 7, 8, 8, 8, 8]])
```

In [48]:

```
# # Function to compute rankings with penalty for ties
# def competition_ranking(scores):
#     """Returns competition-style rankings (ascending order), where t

#     sorted_indices = np.argsort(scores)  # Sort in ascending order
#     ranks = np.zeros_like(scores, dtype=int)

#     rank = 1  # Start ranking from 1
#     for i in range(len(scores)):
#         if i > 0 and scores[sorted_indices[i]] == scores[sorted_indi
#             ranks[sorted_indices[i]] = ranks[sorted_indices[i - 1]]
#         else:
#             ranks[sorted_indices[i]] = rank  # Assign new rank

#         rank += 1  # Increment rank, ensuring skipped positions for

#     return ranks
```

In [49]:

```
# # Compute rankings systematically for 26 experts
# for i in range(1, 27):  # Assuming 26 experts
#     expert_scores = globals()[f"expert{i}_scores"]  # Get the score
#     globals()[f"expert{i}_rankings"] = np.array([competition_ranking
```

In [50]:

```
# Perfect ranking
perfect_ranking = np.array([1, 2, 3, 4, 5, 6, 7, 8])
```

In [51]:

```
# Define a distance function (Euclidean distance)
def compute_distance(vec1, vec2):
    return np.linalg.norm(vec1 - vec2)  # Euclidean distance
```

In [52]:

```
# Initialize a 26x30 matrix to store distances
distance_matrix = np.zeros((26, 30))

# Compute distances systematically
for i in range(1, 27):  # 26 experts
    expert_rankings = globals()[f"expert{i}_rankings_kmeans_based"]  #

    for j in range(30):  # 30 ranking vectors per expert
        distance_matrix[i-1, j] = compute_distance(expert_rankings[j],

distance_matrix_df = pd.DataFrame(distance_matrix, columns=items)
```

In [53]:

```
distance_matrix_df
```

Out[53]:

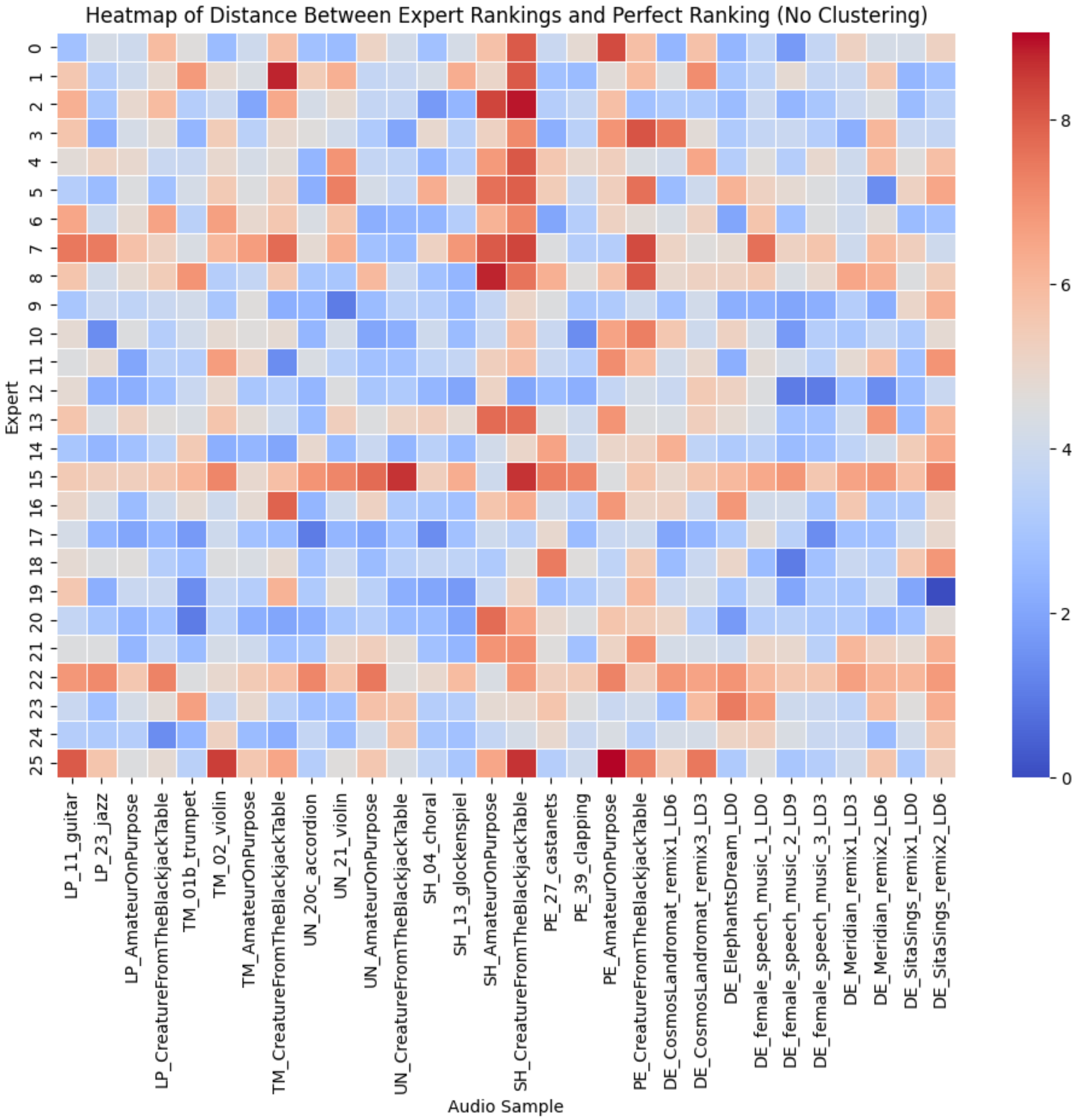
	LP_11_guitar	LP_23_jazz	LP_AmateurOnPurpose	LP_CreatureFromTheBlack
0	2.828427	4.242641	4.000000	
1	5.567764	3.316625	4.000000	
2	6.244998	3.000000	4.898979	
3	5.656854	2.236068	4.242641	
4	4.690416	5.099020	4.898979	
5	3.316625	2.645751	4.472136	
6	6.480741	4.000000	4.795832	
7	7.483315	7.416198	5.744563	
8	5.656854	4.123106	4.795832	
9	3.000000	3.872983	3.605551	
10	4.795832	1.414214	4.472136	
11	4.472136	4.795832	2.000000	
12	4.795832	2.236068	2.236068	
13	5.656854	4.358899	5.196152	
14	3.000000	2.449490	2.828427	
15	5.477226	5.291503	5.291503	
16	5.000000	4.242641	2.645751	
17	4.242641	2.449490	2.000000	
18	4.795832	4.472136	4.582576	
19	5.567764	2.236068	3.872983	
20	3.741657	3.000000	2.449490	
21	4.472136	4.472136	2.449490	
22	6.855655	7.141428	5.567764	
23	3.872983	2.828427	4.242641	
24	3.316625	3.162278	3.316625	
25	8.000000	5.656854	4.472136	

26 rows × 30 columns

In [54]:

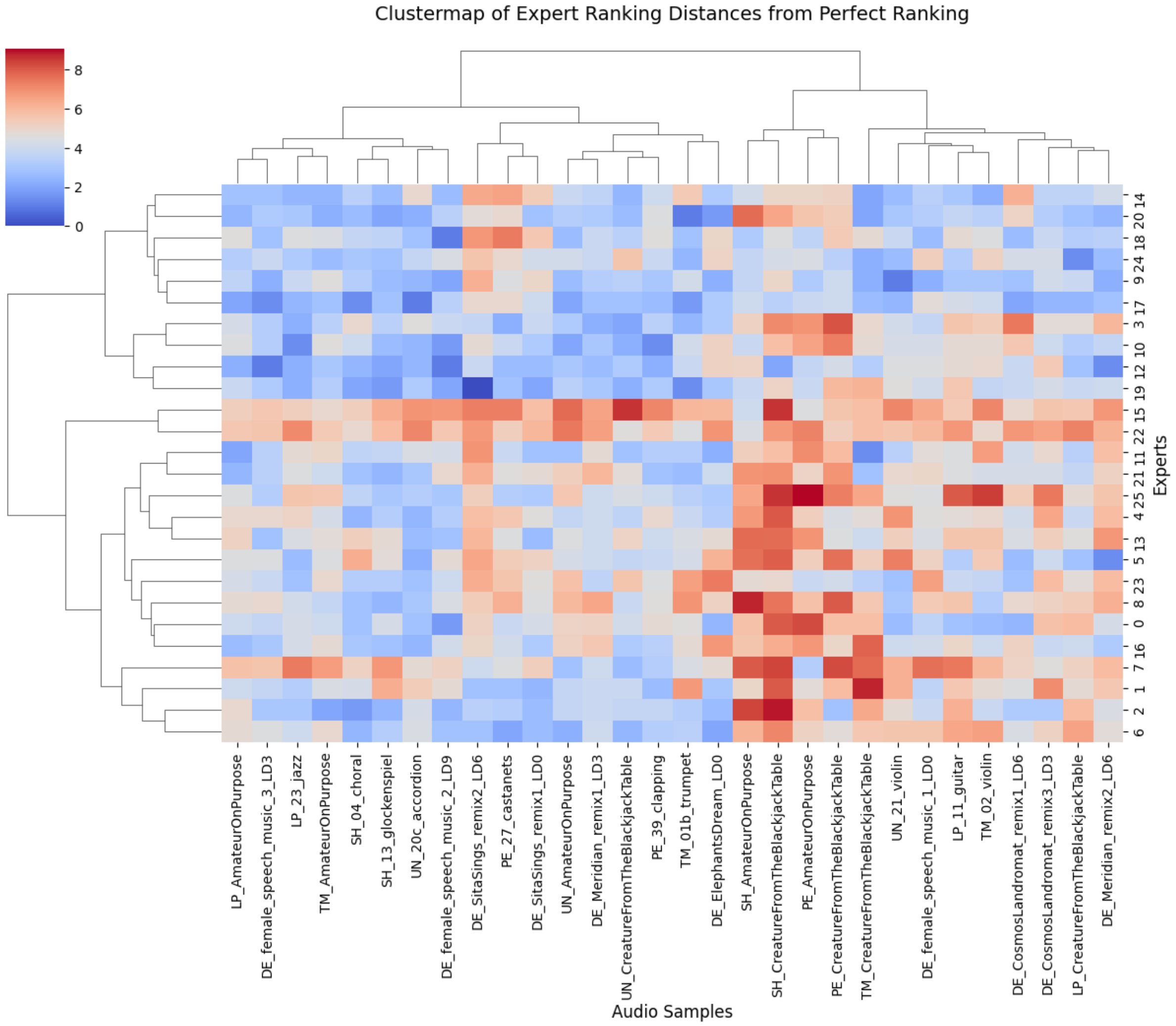
```
# Create a heatmap
plt.figure(figsize=(12, 8))
```

```
sns.heatmap(distance_matrix_df, cmap="coolwarm", annot=False, linewidt

# Labels and title
plt.xlabel("Audio Sample")
plt.ylabel("Expert")
plt.title("Heatmap of Distance Between Expert Rankings and Perfect Ran


plt.show()
```



In [55]:

```
from scipy.cluster.hierarchy import linkage, dendrogram

# Perform hierarchical clustering (using Ward's method)
linkage_matrix = linkage(distance_matrix, method='ward')

# Create a clustermap (heatmap with hierarchical clustering)
clustermap = sns.clustermap(
    distance_matrix_df,
    cmap="coolwarm",
    method="ward",
    figsize=(12, 10),
    xticklabels=True,  # Display column labels (optional)
    yticklabels=True   # Display row labels (optional)
)

# Add axis labels
clustermap.ax_heatmap.set_xlabel("Audio Samples", fontsize=12)
clustermap.ax_heatmap.set_ylabel("Experts", fontsize=12)
clustermap.ax_heatmap.set_title("Clustermap of Expert Ranking Distance


plt.show()
```



In [56]:

```
# PERFORMANCE-BASED CLUSTERING

from scipy.cluster.hierarchy import fcluster

# Extract clusters from the linkage matrix
num_clusters = 5  # Choose the number of clusters (you can adjust)
cluster_labels = fcluster(linkage_matrix, num_clusters, criterion='max
# Create a DataFrame mapping experts to their cluster
cluster_df = pd.DataFrame({'Expert': [f"Expert {i}" for i in range(1,
                           'Cluster': cluster_labels})

cluster_df
```

Out[56]:

	Expert	Cluster
0	Expert 1	4
1	Expert 2	5
2	Expert 3	5
3	Expert 4	2
4	Expert 5	4
5	Expert 6	4
6	Expert 7	5
7	Expert 8	5
8	Expert 9	4
9	Expert 10	1
10	Expert 11	2
11	Expert 12	4
12	Expert 13	2
13	Expert 14	4
14	Expert 15	1
15	Expert 16	3
16	Expert 17	4
17	Expert 18	1
18	Expert 19	1
19	Expert 20	2
20	Expert 21	1
21	Expert 22	4
22	Expert 23	3
23	Expert 24	4
24	Expert 25	1
25	Expert 26	4

In [57]:

```
# order cluster_df by Cluster

cluster_df_ordered = cluster_df.sort_values(by='Cluster')

cluster_df_ordered
```

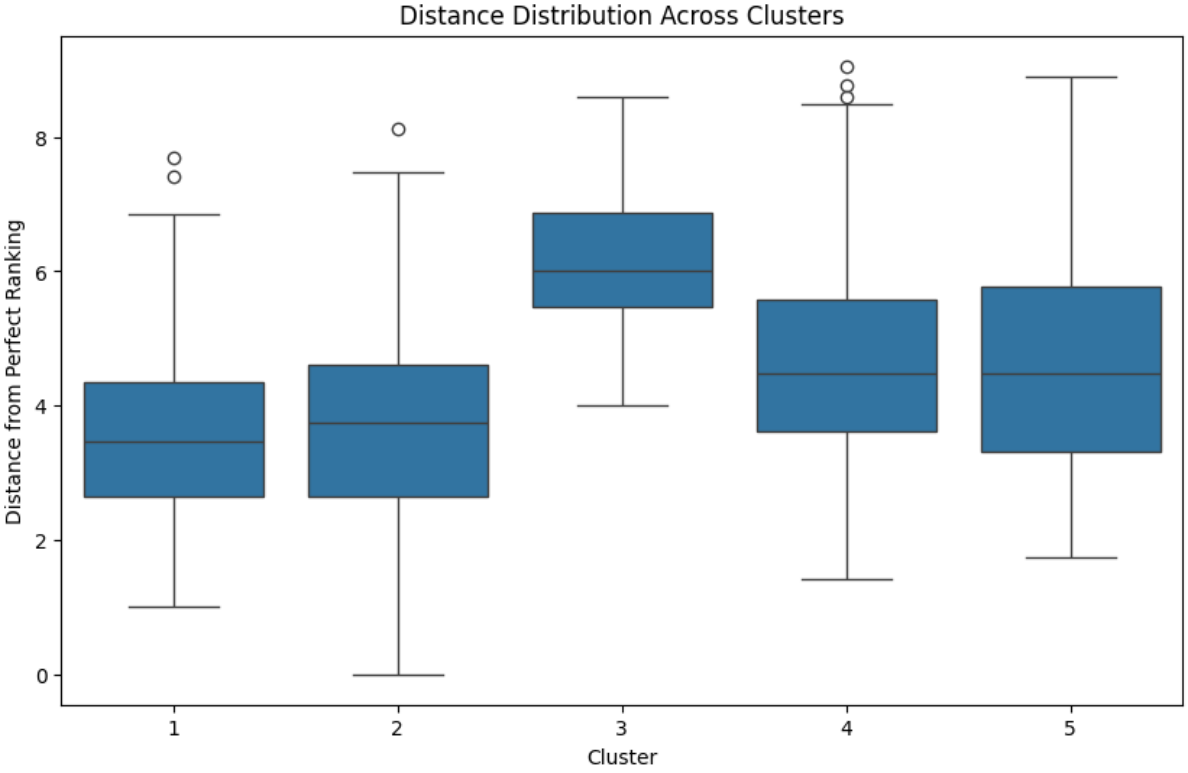
Out[57]:

	Expert	Cluster
20	Expert 21	1
18	Expert 19	1
17	Expert 18	1
9	Expert 10	1
24	Expert 25	1
14	Expert 15	1
12	Expert 13	2
3	Expert 4	2
19	Expert 20	2
10	Expert 11	2
22	Expert 23	3
15	Expert 16	3
23	Expert 24	4
21	Expert 22	4
16	Expert 17	4
0	Expert 1	4
11	Expert 12	4
8	Expert 9	4
5	Expert 6	4
4	Expert 5	4
13	Expert 14	4
25	Expert 26	4
7	Expert 8	5
6	Expert 7	5
2	Expert 3	5
1	Expert 2	5

In [58]:

```
import seaborn as sns
import matplotlib.pyplot as plt

# Add cluster labels to the distance matrix
```

```
distance_matrix_df['Cluster'] = cluster_labels

# Melt data for visualization
melted_df = distance_matrix_df.melt(id_vars=['Cluster'], var_name='Ran

# Plot the distribution of distances per cluster
plt.figure(figsize=(10, 6))
sns.boxplot(x='Cluster', y='Distance', data=melted_df)
plt.xlabel("Cluster")
plt.ylabel("Distance from Perfect Ranking")
plt.title("Distance Distribution Across Clusters")
plt.show()
```



In [59]:

```
# Example: Find which experts belong to Cluster 1
cluster_1_experts = cluster_df[cluster_df['Cluster'] == 1]
print(cluster_1_experts)
```

```
       Expert  Cluster
9   Expert 10        1
14  Expert 15        1
17  Expert 18        1
18  Expert 19        1
20  Expert 21        1
24  Expert 25        1
```