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Step 1: Data Collection

```python
import pandas as pd
import numpy as np

# Set random seed for reproducibility
np.random.seed(0)

# Define student domains and terms
domains = ['CS', 'AI', 'BBA', 'ME', 'Mathematical', 'EE']
terms = [21, 22, 23, 24]

# Select a random number of students between 2400 and 2500
num_students = np.random.randint(2400, 2501)

# Create student data
student_data = pd.DataFrame({
    'Student_ID': range(1, num_students + 1),
    'Domain': np.random.choice(domains, num_students),
    'Term': np.random.choice(terms, num_students)
})

# Number of rooms and capacities
num_rooms = 30
capacities = [30, 35, 25]

# Create room data
room_data = pd.DataFrame({
    'Room_ID': range(101, 101 + num_rooms),
    'Capacity': np.random.choice(capacities, num_rooms)
})

# Check for missing or erroneous data
print(student_data.isnull().sum(), room_data.isnull().sum())
```

[11]

```
Student_ID    0
Domain        0
Term          0
dtype: int64 Room_ID     0
Capacity    0
dtype: int64
```

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Step 2: Data Preprocessing

```python
from sklearn.preprocessing import LabelEncoder

# Convert categorical data to numerical data
# Transform "Domain" column
le_domain = LabelEncoder()
student_data['Domain'] = le_domain.fit_transform(student_data['Domain'])

# Transform "Term" column
le_term = LabelEncoder()
student_data['Term'] = le_term.fit_transform(student_data['Term'])

student_data.head()
```

[13]

	Student_ID	Domain	Term
0	1	3	0
1	2	2	0
2	3	4	3
3	4	4	0
4	5	4	0

Step 3: K-Means Clusterin

```python
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt

# Prepare student data for clustering (use columns other than Student_ID)
X = student_data[['Domain', 'Term']]

# Use the Elbow method to determine the optimal number of clusters
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', max_iter=300, n_init=10, random_state=0)
    kmeans.fit(X)
```

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for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', max_iter=300, n_init=10, random_state=0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)

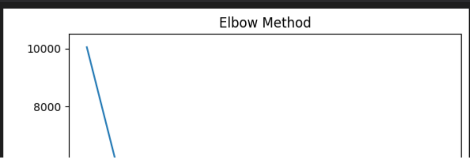
# Plot the Elbow graph
plt.plot(range(1, 11), wcss)
plt.title('Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()

# Determine the optimal number of clusters (e.g., 3)
optimal_cluster_count = 3

# Apply K-means algorithm
kmeans = KMeans(n_clusters=optimal_cluster_count, init='k-means++', max_iter=300, n_init=10, random_state=0)
student_data['Cluster'] = kmeans.fit_predict(X)

# Examine the resulting clusters
student_data.head()
```

[14]



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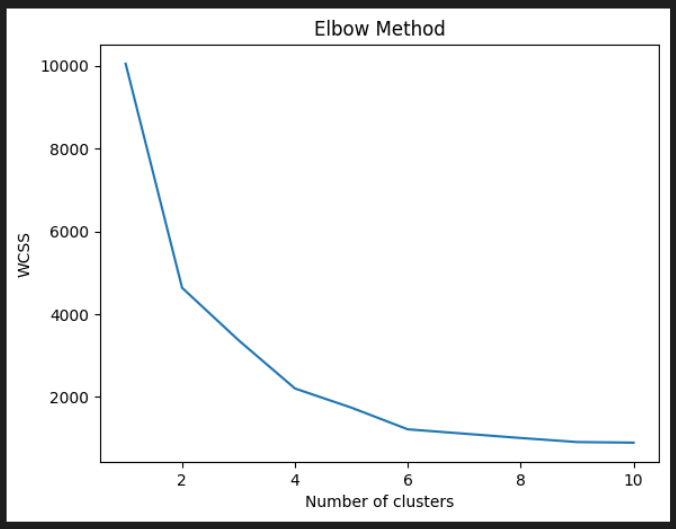
```
student_data['Cluster'] = kmeans.fit_predict(X)

# Examine the resulting clusters
student_data.head()
```

[14]



	Student_ID	Domain	Term	Cluster
0	1	3	0	2
1	2	2	0	2
2	3	4	3	0
3	4	4	0	2
4	5	4	0	2

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Step 4: Creating Seating Plan

```
# Create seating plan based on room capacities and clusters
seating_plan = []
leftover_students = []

room_index = 0
room_capacity = room_data.iloc[room_index]['Capacity']
room_id = room_data.iloc[room_index]['Room_ID']
room_students = []

for i, student in student_data.iterrows():
    if len(room_students) < room_capacity:
        room_students.append(student['Student_ID'])
    else:
        seating_plan.append({
            'Room_ID': room_id,
            'Students': room_students
        })
        room_index += 1
        if room_index < len(room_data):
            room_capacity = room_data.iloc[room_index]['Capacity']
            room_id = room_data.iloc[room_index]['Room_ID']
            room_students = [student['Student_ID']]
        else:
            leftover_students.append(student['Student_ID'])

# Add the last room
if room_students:
    seating_plan.append({
        'Room_ID': room_id,
        'Students': room_students
    })

# Add leftover students
if leftover_students:
    seating_plan.append({
        'Room_ID': 'Leftover Students',
        'Students': leftover_students
    })

seating_plan
```

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Step 5: Faculty Allocation

```
# Create sample faculty data (This data can be fetched from the university system)
faculty_data = pd.DataFrame({
    'Faculty_ID': range(1, 21),
    'Domain': np.random.choice(domains, 20)
})

# Allocate faculty to rooms
faculty_allocation = []

for plan in seating_plan:
    if plan['Room_ID'] == 'Leftover Students':
        faculty_allocation.append({
            'Room_ID': plan['Room_ID'],
            'Faculty_ID': []
        })
        continue

    room_domains = student_data[student_data['Student_ID'].isin(plan['Students'])]['Domain'].unique()
    room_faculty = faculty_data[faculty_data['Domain'].isin(room_domains)]['Faculty_ID'].tolist()

    if len(room_faculty) < 1:
        room_faculty = faculty_data['Faculty_ID'].tolist()[:1]

    faculty_allocation.append({
        'Room_ID': plan['Room_ID'],
        'Faculty_ID': room_faculty
    })

faculty_allocation
```

[16]

```
[{'Room_ID': np.int64(101), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(102), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(103), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(104), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(105), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(106), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(107), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(108), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(109), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(110), 'Faculty_ID': [1]},
 {'Room_ID': np.int64(111), 'Faculty_ID': [1]},
```

⚠ 5 0

Step 6: Reporting

```
# Combine seating plan and faculty allocation into a report
report = []

for i, plan in enumerate(seating_plan):
    report.append({
        'Room_ID': plan['Room_ID'],
        'Students': plan['Students'],
        'Faculty_ID': faculty_allocation[i]['Faculty_ID']
    })

# Display the report as a DataFrame
report_df = pd.DataFrame(report)
report_df.head(10)
```

[17]

	Room_ID	Students	Faculty_ID
0	101	[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14...	[1]
1	102	[36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 4...	[1]
2	103	[61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 7...	[1]
3	104	[91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101,...	[1]
4	105	[121, 122, 123, 124, 125, 126, 127, 128, 129, ...	[1]
5	106	[156, 157, 158, 159, 160, 161, 162, 163, 164, ...	[1]
6	107	[191, 192, 193, 194, 195, 196, 197, 198, 199, ...	[1]
7	108	[221, 222, 223, 224, 225, 226, 227, 228, 229, ...	[1]
8	109	[256, 257, 258, 259, 260, 261, 262, 263, 264, ...	[1]
9	110	[291, 292, 293, 294, 295, 296, 297, 298, 299, ...	[1]