In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```
file_path = "SAMPANN_statewise_dataset_0.csv"  # Update the correct path
df = pd.read_csv(file_path)
```

In [5]:
```
df
```

Out[5]:

	State Name	Total Pensioner	Normal Pensioner	Family Pensioner	CDA Pensioner	CDA Male Pensioner	CDA Female Pensioner	IDA Pensioner	IDA Male Pensioner
0	Andaman and Nicobar	185	111	74	31	29	2	154	137
1	Andhra Pradesh	20007	13158	6849	2494	2426	60	17513	16074
2	Assam	7521	4528	2993	1140	1098	41	6381	5904
3	Bihar	12427	8510	3917	3941	3248	63	8486	7441
4	Chhattisgarh	3478	2048	1430	595	592	3	2883	2667
5	Delhi Region	23708	15900	7808	16595	14338	2088	7113	6568
6	Gujarat	30690	21460	9230	4142	3748	385	26548	23823
7	Himachal Pradesh	3049	2187	862	345	331	12	2704	2536
8	Haryana	6372	4360	2012	827	803	24	5545	5124
9	Jammu and Kashmir	3109	2312	797	440	435	5	2669	2442
10	Jharkhand	4475	3087	1388	889	870	17	3586	3440
11	Karnataka	30259	20563	9696	5544	5047	480	24715	20141
12	Kerala	26974	19031	7943	4880	4351	443	22094	18179
13	Kolkota	17359	11756	5603	3229	2981	221	14130	12269
14	Madhya Pradesh	20125	12670	7455	4150	3973	174	15975	14893
15	Maharashtra	42966	29822	13144	8007	7443	557	34959	30129
16	Mumbai	8159	4191	3968	8158	6500	1064	1	1
17	North East II	482	424	58	5	5	0	477	436
18	North East	2597	1489	1108	372	354	17	2225	1905
19	Orissa	7108	4702	2406	916	907	4	6192	5973
20	Punjab	12008	8486	3522	1597	1522	61	10411	9441
21	Rajasthan	16607	11611	4996	2918	2879	37	13689	13343
22	Tamil Nadu	52032	35409	16623	10643	8908	945	41389	32721
23	Telangana	17235	11633	5602	2375	2152	203	14860	12793
24	UP East	23055	15365	7690	5619	5345	266	17436	16235
25	UP West	12351	8062	4289	2817	2758	57	9534	9109
26	Uttarakhand	3072	2043	1029	440	425	10	2632	2462
27	West Bengal	19039	11393	7646	4627	4456	166	14412	13362

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 28 entries, 0 to 27
Data columns (total 10 columns):
 #   Column               Non-Null Count  Dtype 
---  ------               --------------  ----- 
 0   State Name           28 non-null     object
 1   Total Pensioner      28 non-null     int64 
 2   Normal Pensioner     28 non-null     int64 
 3   Family Pensioner     28 non-null     int64 
 4   CDA Pensioner        28 non-null     int64 
 5   CDA Male Pensioner   28 non-null     int64 
 6   CDA Female Pensioner  28 non-null     int64 
 7   IDA Pensioner        28 non-null     int64 
 8   IDA Male Pensioner   28 non-null     int64 
 9   IDA Female Pensioner  28 non-null     int64 
dtypes: int64(9), object(1)
memory usage: 2.3+ KB
```

In [9]:

```
df.head
```

```
Out[9]: <bound method NDFrame.head of               State Name  Total Pensioner  Normal Pensioner  Fam
ily Pensioner  \
0   Andaman and Nicobar               185               111                74
1        Andhra Pradesh             20007             13158              6849
2                  Assam             7521              4528              2993
3                  Bihar            12427              8510              3917
4           Chhattisgarh             3478              2048              1430
5           Delhi Region            23708             15900              7808
6                Gujarat            30690             21460              9230
7       Himachal Pradesh             3049              2187               862
8                Haryana             6372              4360              2012
9      Jammu and Kashmir             3109              2312               797
10             Jharkhand             4475              3087              1388
11             Karnataka            30259             20563              9696
12                Kerala            26974             19031              7943
13               Kolkota            17359             11756              5603
14        Madhya Pradesh            20125             12670              7455
15           Maharashtra            42966             29822             13144
16                Mumbai             8159              4191              3968
17         North East II              482               424                58
18            North East             2597              1489              1108
19                Orissa             7108              4702              2406
20                Punjab            12008              8486              3522
21             Rajasthan            16607             11611              4996
22            Tamil Nadu            52032             35409             16623
23             Telangana            17235             11633              5602
24               UP East            23055             15365              7690
25               UP West            12351              8062              4289
26           Uttarakhand             3072              2043              1029
27           West Bengal            19039             11393              7646

    CDA Pensioner  CDA Male Pensioner  CDA Female Pensioner  IDA Pensioner  \
0              31                  29                     2            154
1            2494                2426                    60          17513
2            1140                1098                    41           6381
3            3941                3248                    63           8486
4             595                 592                     3           2883
5           16595               14338                  2088           7113
6            4142                3748                   385          26548
7             345                 331                    12           2704
8             827                 803                    24           5545
9             440                 435                     5           2669
10            889                 870                    17           3586
11           5544                5047                   480          24715
12           4880                4351                   443          22094
13           3229                2981                   221          14130
14           4150                3973                   174          15975
15           8007                7443                   557          34959
16           8158                6500                  1064              1
17              5                   5                     0            477
18            372                 354                    17           2225
19            916                 907                     4           6192
20           1597                1522                    61          10411
21           2918                2879                    37          13689
22          10643                8908                   945          41389
23           2375                2152                   203          14860
24           5619                5345                   266          17436
25           2817                2758                    57           9534
26            440                 425                    10           2632
27           4627                4456                   166          14412

    IDA Male Pensioner  IDA Female Pensioner
0                  137                    15
1                16074                  1430
2                 5904                   461
3                 7441                   333
4                 2667                   216
5                 6568                   529
6                23823                  2673
7                 2536                   167
8                 5124                   416
9                 2442                   227
10                3440                   142
11               20141                  4535
12               18179                  3826
```

```
13               12269                 1785
14               14893                 1078
15               30129                 4820
16                   1                    0
17                 436                   41
18                1905                  307
19                5973                  199
20                9441                  960
21               13343                  329
22               32721                 7297
23               12793                 2021
24               16235                 1158
25                9109                  421
26                2462                  146
27               13362                 1021  >
```

```
In [11]: df.describe
```

Out[11]:

```
<bound method NDFrame.describe of               State Name  Total Pensioner  Normal Pensioner  
Family Pensioner  \
0   Andaman and Nicobar               185               111                74
1        Andhra Pradesh             20007             13158              6849
2                  Assam             7521              4528              2993
3                  Bihar            12427              8510              3917
4           Chhattisgarh             3478              2048              1430
5           Delhi Region            23708             15900              7808
6                Gujarat            30690             21460              9230
7       Himachal Pradesh             3049              2187               862
8                Haryana             6372              4360              2012
9      Jammu and Kashmir             3109              2312               797
10             Jharkhand             4475              3087              1388
11             Karnataka            30259             20563              9696
12                Kerala            26974             19031              7943
13               Kolkota            17359             11756              5603
14        Madhya Pradesh            20125             12670              7455
15           Maharashtra            42966             29822             13144
16                Mumbai             8159              4191              3968
17         North East II              482               424                58
18            North East             2597              1489              1108
19                Orissa             7108              4702              2406
20                Punjab            12008              8486              3522
21             Rajasthan            16607             11611              4996
22            Tamil Nadu            52032             35409             16623
23             Telangana            17235             11633              5602
24               UP East            23055             15365              7690
25               UP West            12351              8062              4289
26           Uttarakhand             3072              2043              1029
27           West Bengal            19039             11393              7646

    CDA Pensioner  CDA Male Pensioner  CDA Female Pensioner  IDA Pensioner  \
0              31                  29                     2            154   
1            2494                2426                    60          17513   
2            1140                1098                    41           6381   
3            3941                3248                    63           8486   
4             595                 592                     3           2883   
5           16595               14338                  2088           7113   
6            4142                3748                   385          26548   
7             345                 331                    12           2704   
8             827                 803                    24           5545   
9             440                 435                     5           2669   
10            889                 870                    17           3586   
11           5544                5047                   480          24715   
12           4880                4351                   443          22094   
13           3229                2981                   221          14130   
14           4150                3973                   174          15975   
15           8007                7443                   557          34959   
16           8158                6500                  1064              1   
17              5                   5                     0            477   
18            372                 354                    17           2225   
19            916                 907                     4           6192   
20           1597                1522                    61          10411   
21           2918                2879                    37          13689   
22          10643                8908                   945          41389   
23           2375                2152                   203          14860   
24           5619                5345                   266          17436   
25           2817                2758                    57           9534   
26            440                 425                    10           2632   
27           4627                4456                   166          14412   

    IDA Male Pensioner  IDA Female Pensioner  
0                  137                    15  
1                16074                  1430  
2                 5904                   461  
3                 7441                   333  
4                 2667                   216  
5                 6568                   529  
6                23823                  2673  
7                 2536                   167  
8                 5124                   416  
9                 2442                   227  
10                3440                   142  
11               20141                  4535  
12               18179                  3826  
```

```
13            12269             1785
14            14893             1078
15            30129             4820
16                1                0
17              436               41
18             1905              307
19             5973              199
20             9441              960
21            13343              329
22            32721             7297
23            12793             2021
24            16235             1158
25             9109              421
26             2462              146
27            13362             1021  >
```

In [13]:
```
df.columns
```

Out[13]:
```
Index(['State Name', 'Total Pensioner', 'Normal Pensioner', 'Family Pensioner',
       'CDA Pensioner', 'CDA Male Pensioner', 'CDA Female Pensioner',
       'IDA Pensioner', 'IDA Male Pensioner', 'IDA Female Pensioner'],
      dtype='object')
```

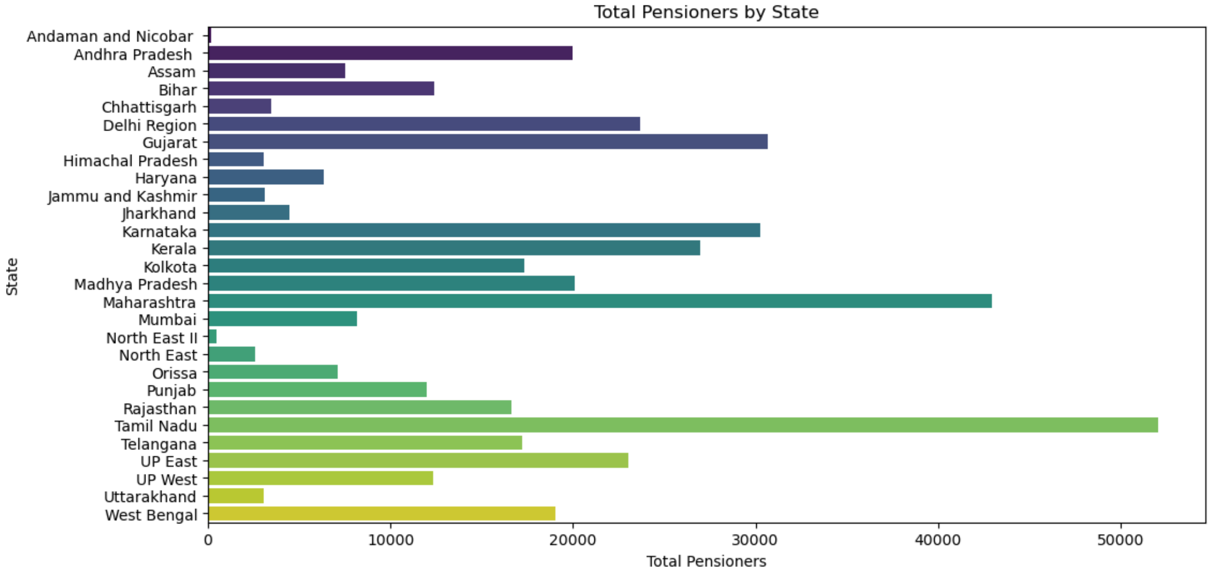
In [15]:
```
df["CDA Percentage"] = (df["CDA Pensioner"] / df["Total Pensioner"]) * 100
df["IDA Percentage"] = (df["IDA Pensioner"] / df["Total Pensioner"]) * 100
df["Male Percentage"] = ((df["CDA Male Pensioner"] + df["IDA Male Pensioner"]) / df["Total Pens
df["Female Percentage"] = ((df["CDA Female Pensioner"] + df["IDA Female Pensioner"]) / df["Tota
```

In [17]:
```
df.columns
```

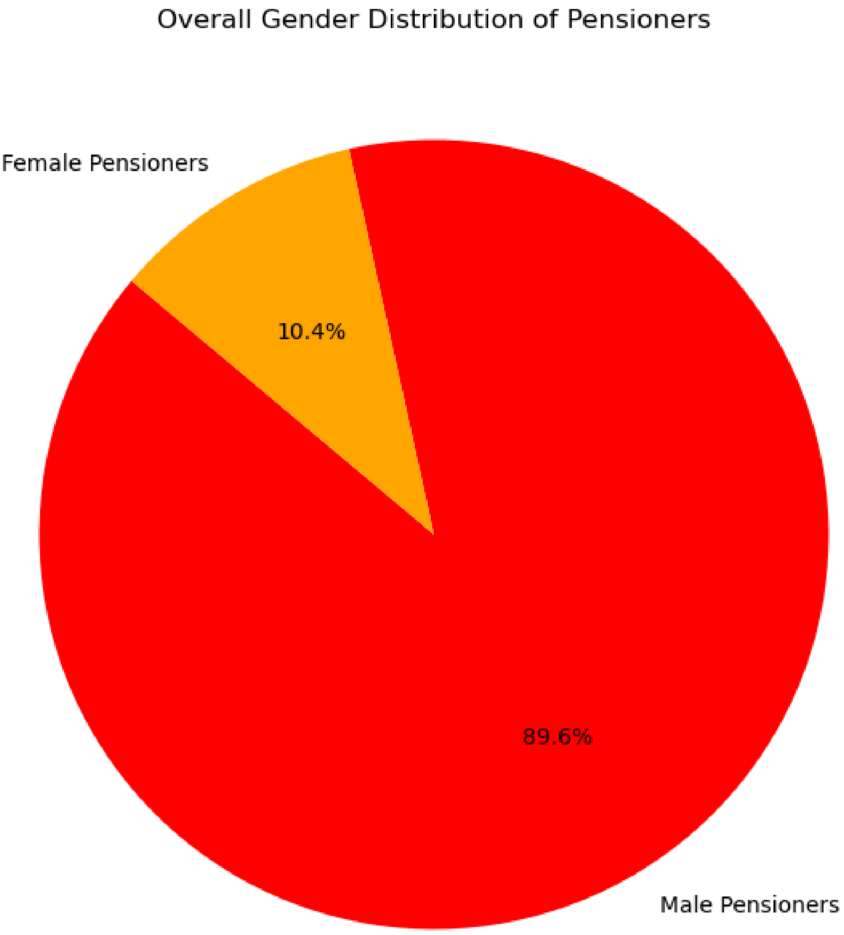
Out[17]:
```
Index(['State Name', 'Total Pensioner', 'Normal Pensioner', 'Family Pensioner',
       'CDA Pensioner', 'CDA Male Pensioner', 'CDA Female Pensioner',
       'IDA Pensioner', 'IDA Male Pensioner', 'IDA Female Pensioner',
       'CDA Percentage', 'IDA Percentage', 'Male Percentage',
       'Female Percentage'],
      dtype='object')
```

In [19]:
```
plt.figure(figsize=(12, 6))
sns.barplot(y=df["State Name"], x=df["Total Pensioner"], palette="viridis")
plt.xlabel("Total Pensioners")
plt.ylabel("State")
plt.title("Total Pensioners by State")
plt.show()
```

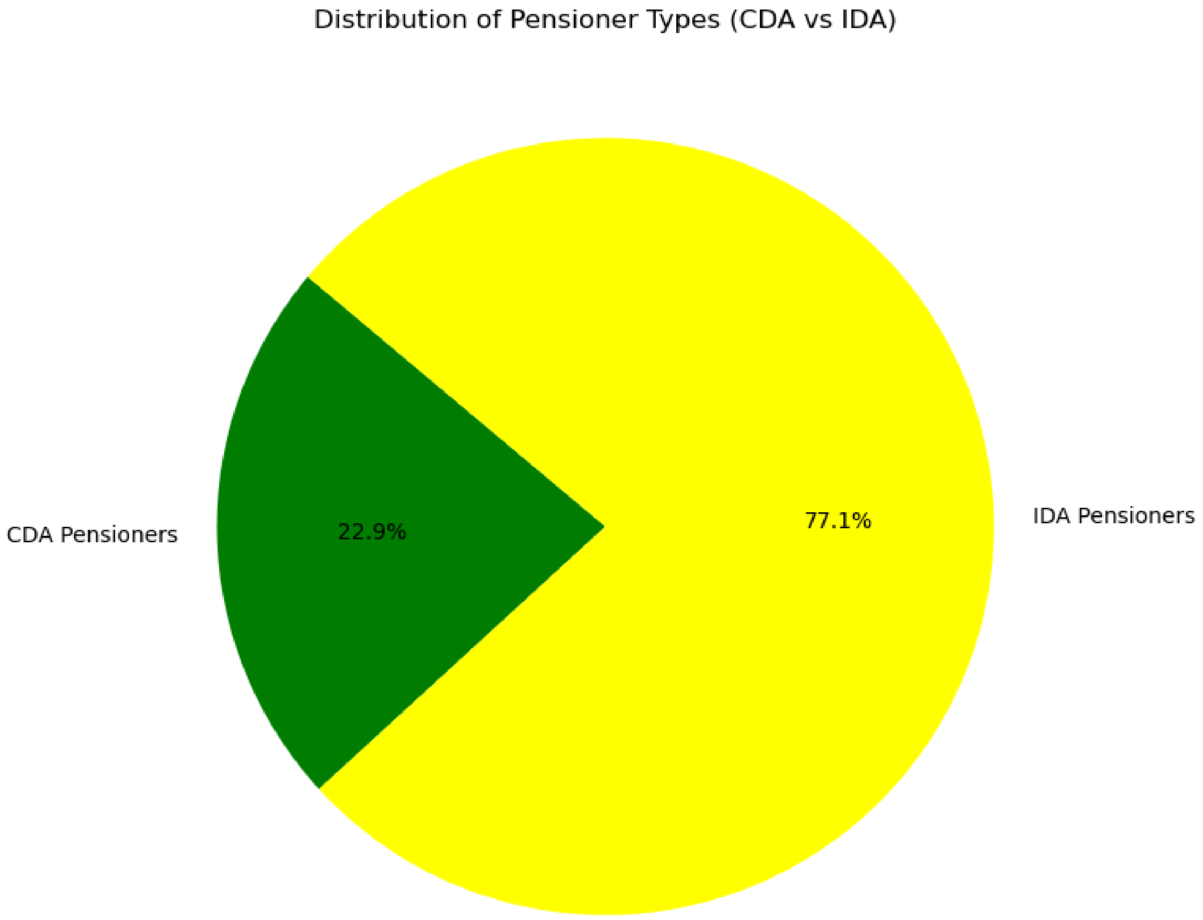
```
C:\Users\ASUS\AppData\Local\Temp\ipykernel_22076\437390100.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign t
he `y` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(y=df["State Name"], x=df["Total Pensioner"], palette="viridis")
```



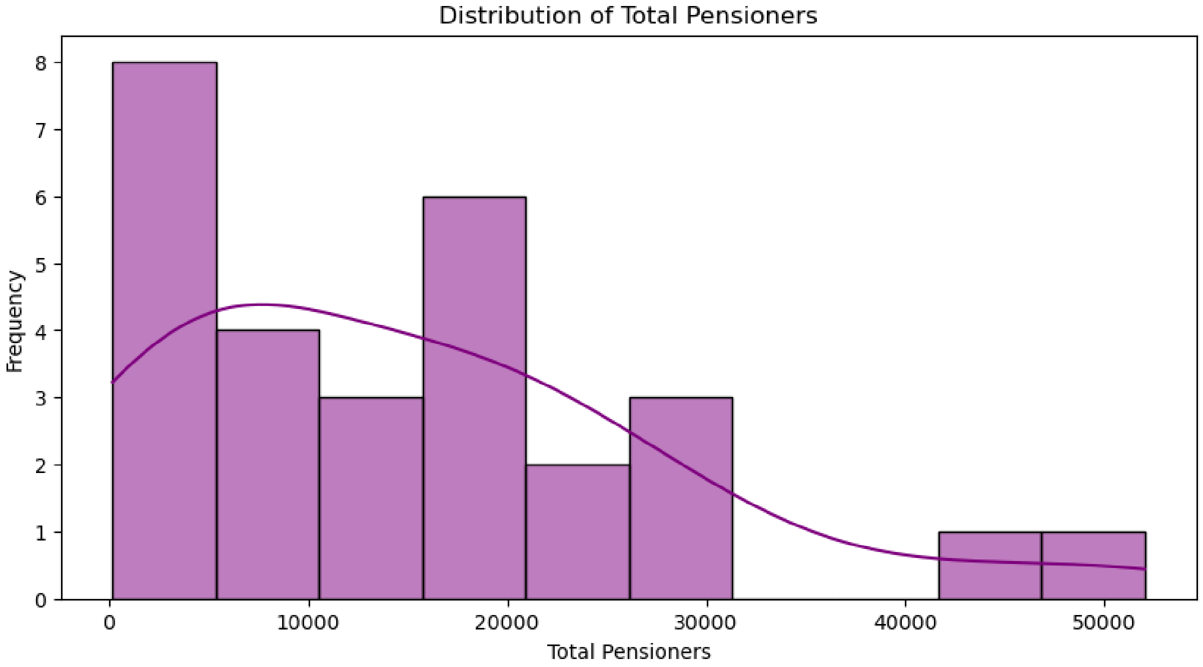
In [23]:
```
plt.figure(figsize=(8, 8))
gender_counts = [df["CDA Male Pensioner"].sum() + df["IDA Male Pensioner"].sum(),
                 df["CDA Female Pensioner"].sum() + df["IDA Female Pensioner"].sum()]
labels = ["Male Pensioners", "Female Pensioners"]
colors = ["red", "orange"]
plt.pie(gender_counts, labels=labels, autopct="%1.1f%%", colors=colors, startangle=140)
plt.title("Overall Gender Distribution of Pensioners")
plt.show()
```



In [27]:
```
plt.figure(figsize=(8, 8))
pensioner_counts = [df["CDA Pensioner"].sum(), df["IDA Pensioner"].sum()]
labels = ["CDA Pensioners", "IDA Pensioners"]
colors = ["green", "yellow"]
plt.pie(pensioner_counts, labels=labels, autopct="%1.1f%%", colors=colors, startangle=140)
plt.title("Distribution of Pensioner Types (CDA vs IDA)")
plt.show()
```

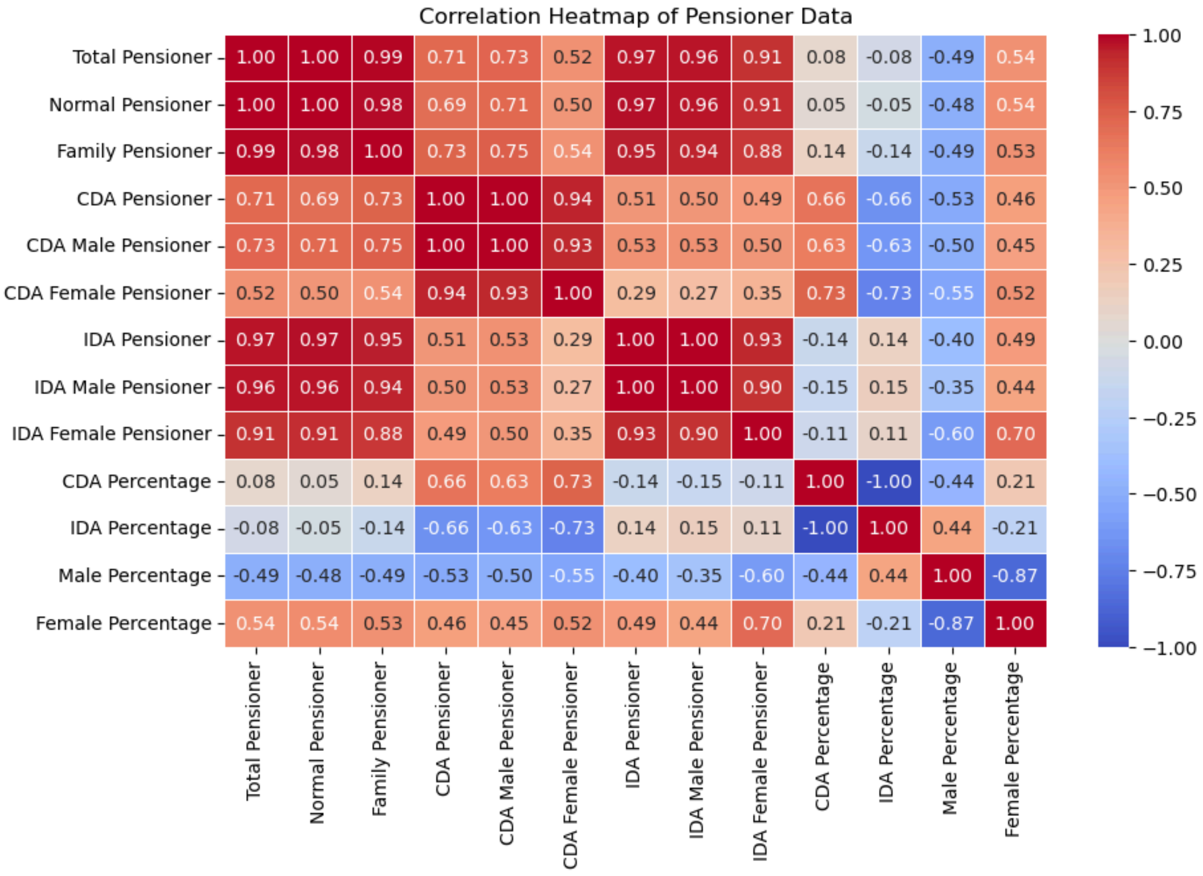


In [29]:
```
plt.figure(figsize=(10, 5))
sns.histplot(df["Total Pensioner"], bins=10, kde=True, color="purple")
plt.xlabel("Total Pensioners")
plt.ylabel("Frequency")
plt.title("Distribution of Total Pensioners")
plt.show()
```



In [33]:
```
numeric_df = df.select_dtypes(include=["number"])
plt.figure(figsize=(10, 6))
corr_matrix = numeric_df.corr()
```

```
sns.heatmap(corr_matrix, annot=True, cmap="coolwarm", fmt=".2f", linewidths=0.5)
plt.title("Correlation Heatmap of Pensioner Data")
plt.show()
```



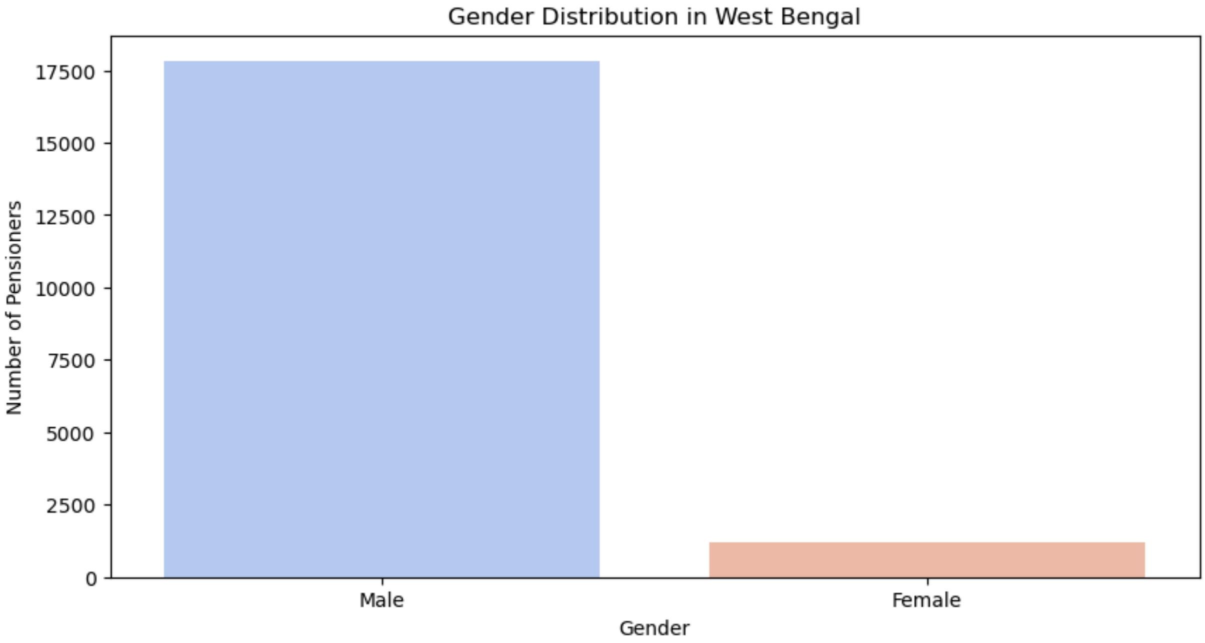
In [39]:

```
plot_features = ["Normal Pensioner", "Family Pensioner", "CDA Pensioner", "IDA Pensioner",
                 "CDA Male Pensioner", "CDA Female Pensioner", "IDA Male Pensioner", "IDA Femal

for state in df["State Name"].unique():
    state_df = df[df["State Name"] == state]

    if not state_df.empty:
        male_pensioners = state_df["CDA Male Pensioner"].values[0] + state_df["IDA Male Pension
        female_pensioners = state_df["CDA Female Pensioner"].values[0] + state_df["IDA Female P
```

In [47]:

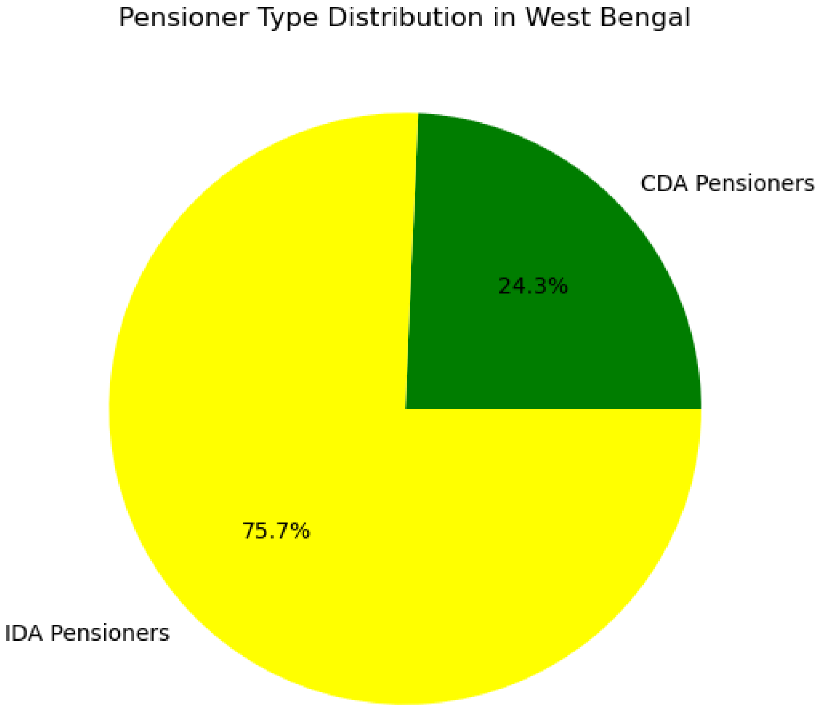
```
import seaborn as sns
plt.figure(figsize=(10, 5))
sns.barplot(x=["Male", "Female"], y=[male_pensioners, female_pensioners], palette="coolwarm")
plt.xlabel("Gender")
plt.ylabel("Number of Pensioners")
plt.title(f"Gender Distribution in {state}")
plt.show()
```

```
C:\Users\ASUS\AppData\Local\Temp\ipykernel_22076\1324546647.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign t
he `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x=["Male", "Female"], y=[male_pensioners, female_pensioners], palette="coolwarm")
```



In [51]:

```
plt.figure(figsize=(6, 6))
plt.pie([state_df["CDA Pensioner"].values[0], state_df["IDA Pensioner"].values[0]],labels=["CDA
plt.title(f"Pensioner Type Distribution in {state}")
plt.show()
```



In [55]:

```
df.to_csv("SAMPANN_statewise_dataset_modified.csv", index=False)#save the modified dataset
```

In [61]:

```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
```

In [65]:

```
numeric_df = df.select_dtypes(include=["number"])
scaler = StandardScaler()
scaled_data = scaler.fit_transform(numeric_df.drop(columns=["Total Pensioner"]))
```

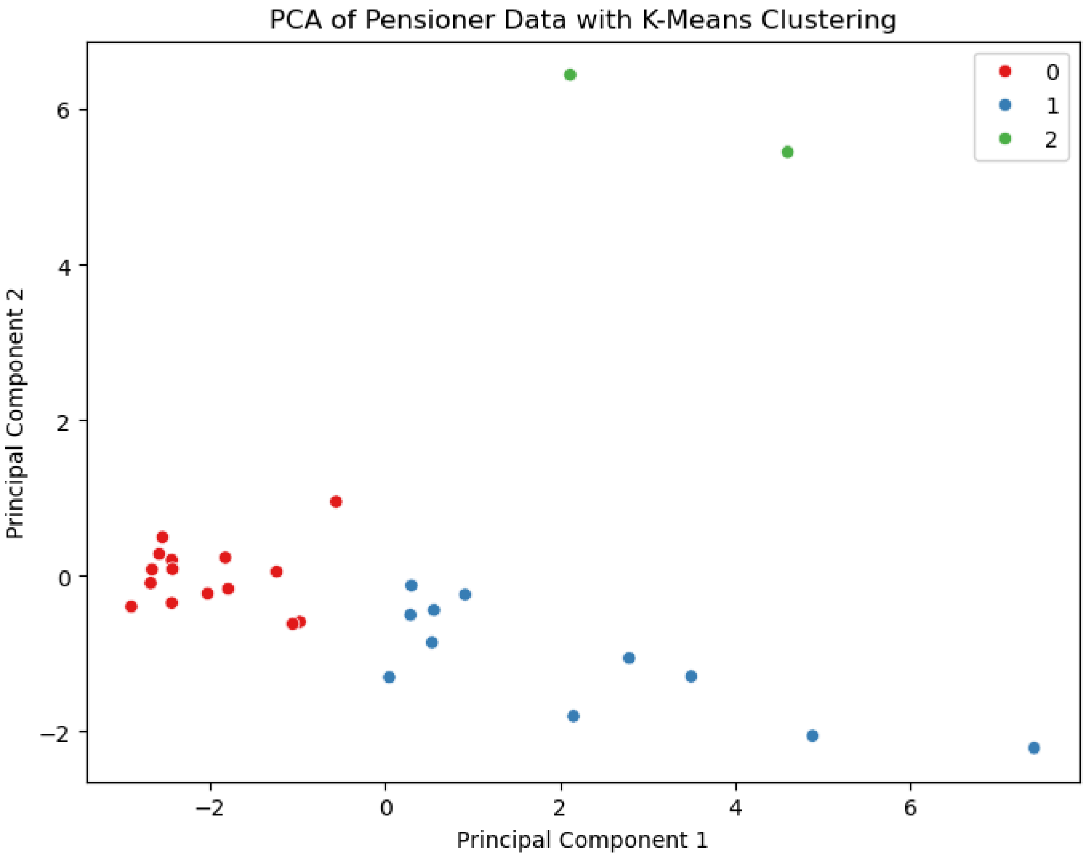
In [69]:

```
kmeans = KMeans(n_clusters=3, random_state=42)
df["Cluster"] = kmeans.fit_predict(scaled_data)
```

```
C:\Users\ASUS\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1429: UserWarning: KMeans i
s known to have a memory leak on Windows with MKL, when there are less chunks than available thr
eads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

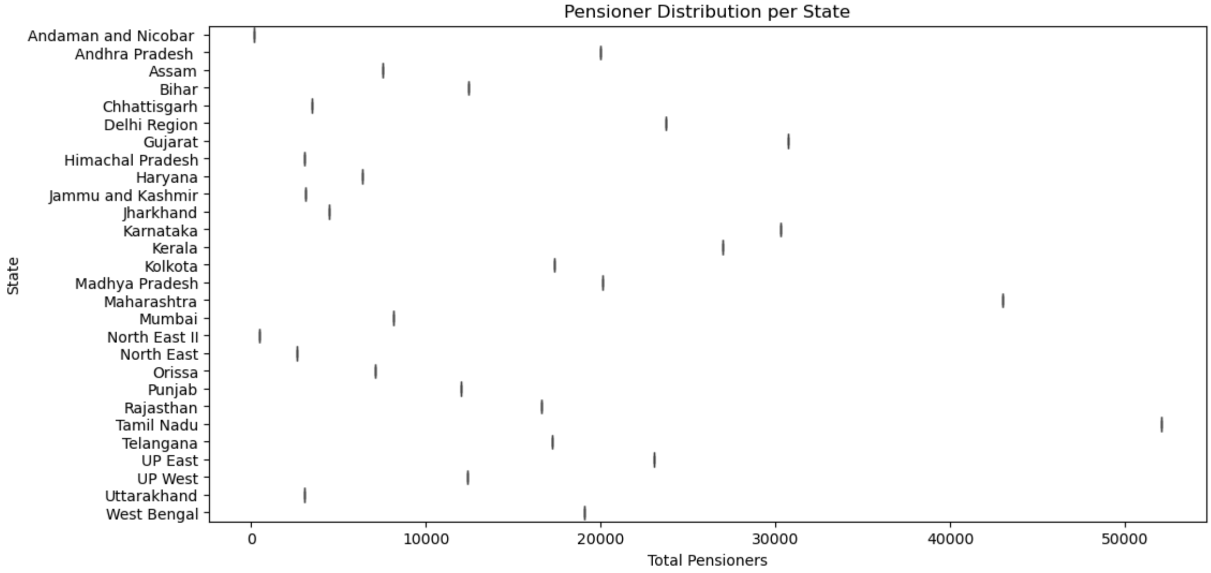
In [71]:
```
pca = PCA(n_components=2)
pca_result = pca.fit_transform(scaled_data)
df["PCA1"] = pca_result[:, 0]
df["PCA2"] = pca_result[:, 1]
```

In [73]:
```
plt.figure(figsize=(8, 6))
sns.scatterplot(x=df["PCA1"], y=df["PCA2"], hue=df["Cluster"], palette="Set1")
plt.xlabel("Principal Component 1")
plt.ylabel("Principal Component 2")
plt.title("PCA of Pensioner Data with K-Means Clustering")
plt.legend()
plt.show()
```



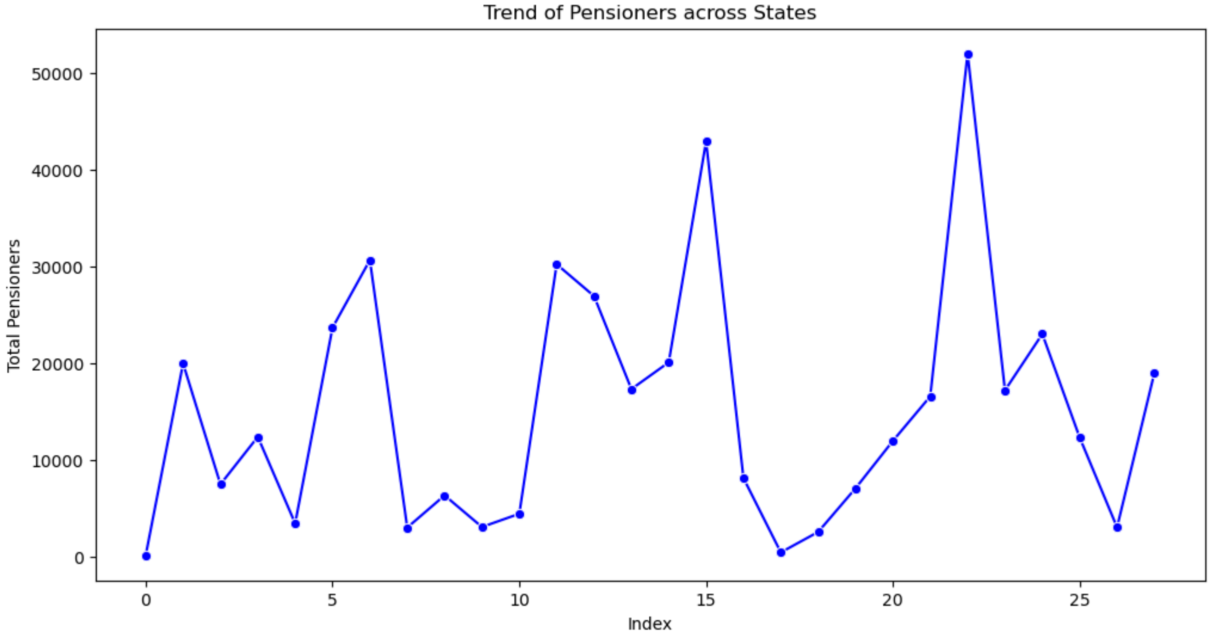
In [77]:
```
plt.figure(figsize=(12, 6))
sns.boxplot(x=df["Total Pensioner"], y=df["State Name"], palette="coolwarm")
plt.xlabel("Total Pensioners")
plt.ylabel("State")
plt.title("Pensioner Distribution per State")
plt.show()
```

```
C:\Users\ASUS\AppData\Local\Temp\ipykernel_22076\2207481037.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign t
he `y` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(x=df["Total Pensioner"], y=df["State Name"], palette="coolwarm")
```



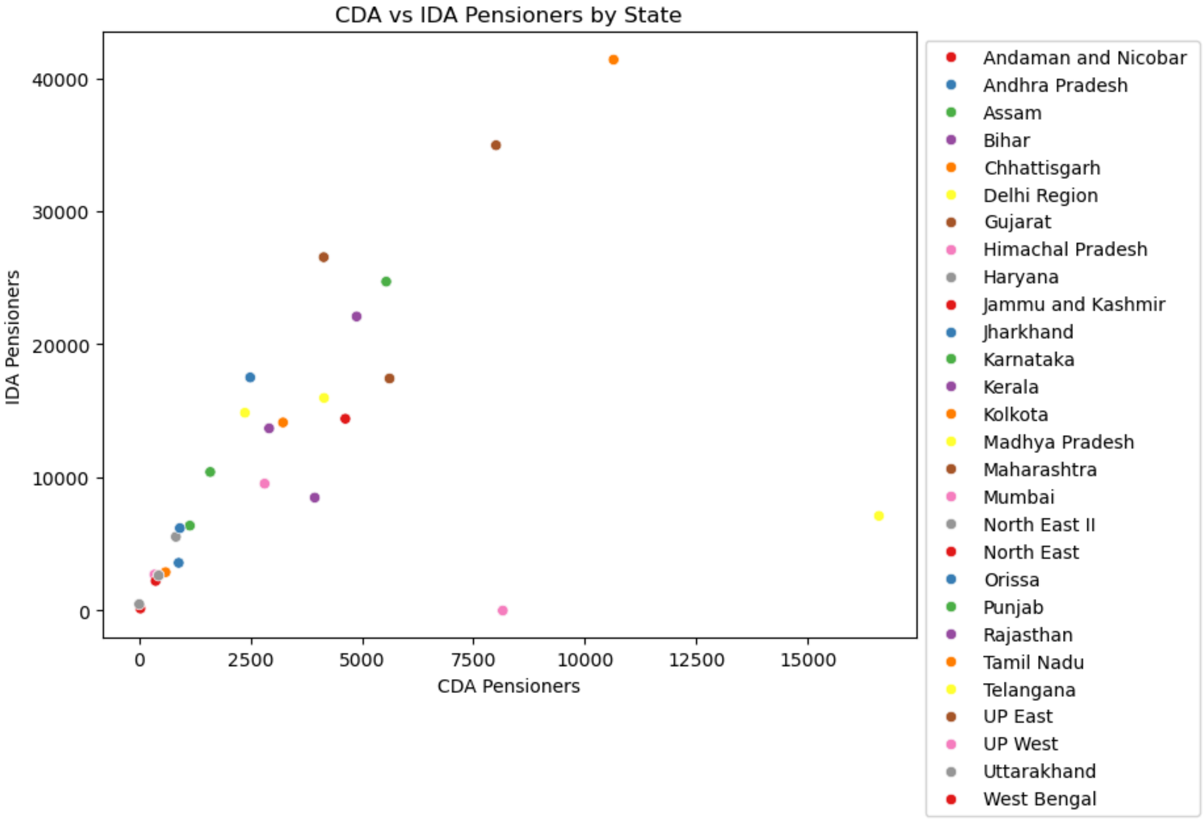
In [79]:

```
plt.figure(figsize=(12, 6))
sns.lineplot(x=df.index, y=df["Total Pensioner"], marker="o", linestyle="-", color="blue")
plt.xlabel("Index")
plt.ylabel("Total Pensioners")
plt.title("Trend of Pensioners across States")
plt.show()
```

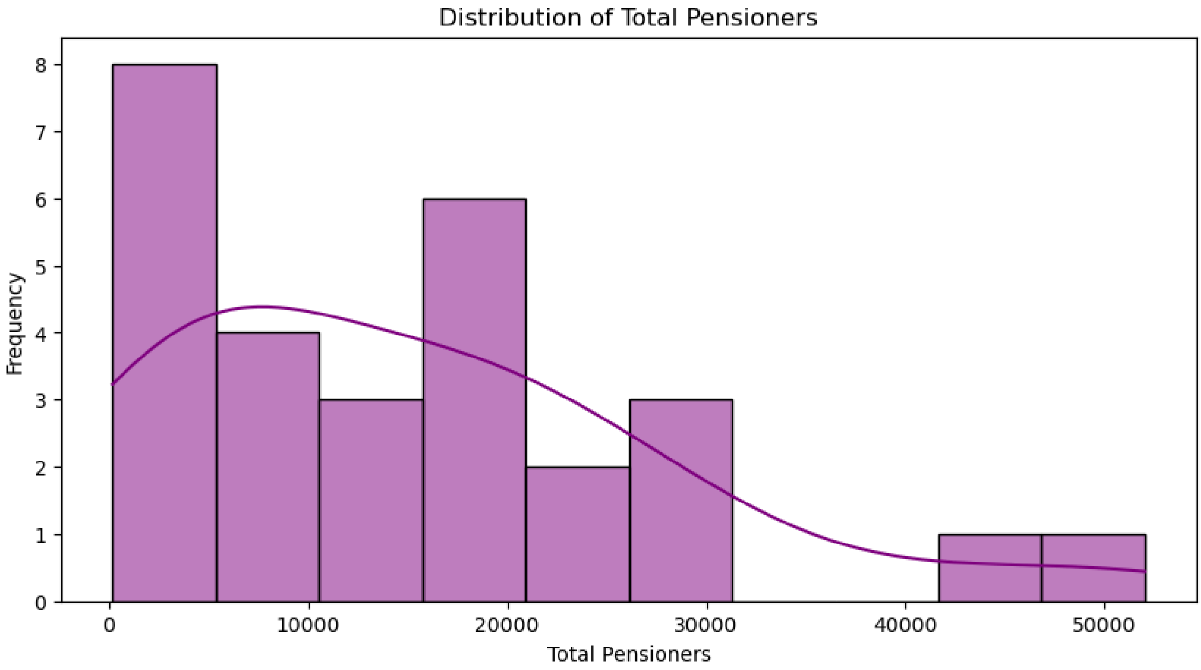


In [81]:

```
plt.figure(figsize=(8, 6))
sns.scatterplot(x=df["CDA Pensioner"], y=df["IDA Pensioner"], hue=df["State Name"], palette="Se
plt.xlabel("CDA Pensioners")
plt.ylabel("IDA Pensioners")
plt.title("CDA vs IDA Pensioners by State")
plt.legend(loc="best", bbox_to_anchor=(1, 1))
plt.show()
```



In [83]:
```
plt.figure(figsize=(10, 5))
sns.histplot(df["Total Pensioner"], bins=10, kde=True, color="purple")
plt.xlabel("Total Pensioners")
plt.ylabel("Frequency")
plt.title("Distribution of Total Pensioners")
plt.show()
```



In [ ]: