Panda|Compare DataFrame

In [1]:
```
import pandas as pd  # For data manipulation and analysis
import numpy as np  # For numerical computations
import matplotlib.pyplot as plt  # For creating static, animated, and interactive visualizations
import seaborn as sns  # For statistical data visualization based on Matplotlib
import scipy  # For scientific and technical computing (including optimization, integration, and statistics)
```

In [3]:
```
import pandas as pd
import numpy as np
# Creating realistic data for employees
data = {
    'Employee ID': np.arange(1001, 1011),
    'Employee Name': ['Satender Kumar', 'data 1', 'Jane Smith', 'Robert Brown', 'Emily Davis', 'Michael Wilson'
    'Department': ['Data Analyst', 'IT', 'Finance', 'Marketing', 'Sales', 'Operations', 'R&D', 'Support', 'Admi
    'Age': [24, np.random.randint(25, 60), np.random.randint(25, 60), np.random.randint(25, 60), np.random.rand
    'Location': ['London, Canada', 'Toronto', 'London', 'Sydney', 'San Francisco', 'Paris', 'Berlin', 'Tokyo',
    'Salary': np.random.randint(50000, 150000, size=10),
    'Years with Company': np.random.randint(1, 15, size=10),
    'Position': ['Data Analyst', 'Developer', 'Analyst', 'Designer', 'Consultant', 'Engineer', 'Scientist', 'Su
    'Performance Score': np.random.randint(1, 5, size=10),
    'Bonus': np.random.randint(1000, 10000, size=10),
    'Gender': ['Male', 'Male', 'Female', 'Male', 'Female', 'Male', 'Female', 'Male', 'Female', 'Male'],
    'Marital Status': ['Single', 'Single', 'Married', 'Single', 'Single', 'Married', 'Married', 'Single', 'Marr
    'Education': ['Bachelor', 'Master', 'PhD', 'Bachelor', 'Master', 'PhD', 'Bachelor', 'Master', 'Bachelor', '
    'Hire Date': pd.to_datetime(['2019-06-12', '2015-07-23', '2012-09-05', '2018-11-30', '2013-05-19', '2019-02
    'Overtime Hours': np.random.randint(0, 20, size=10),
    'Sick Days Taken': np.random.randint(0, 10, size=10),
    'Vacation Days Taken': np.random.randint(5, 20, size=10),
    'Training Hours': np.random.randint(10, 50, size=10),
    'Certifications': ['Yes', 'No', 'Yes', 'No', 'Yes', 'No', 'Yes', 'Yes', 'No', 'Yes'],
    'Supervisor': ['Anna Smith', 'Brian Adams', 'Clara Jones', 'Daniel Martin', 'Eva Rodriguez', 'Frank Bell',
}

# Creating the DataFrame
df = pd.DataFrame(data)
```

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

Out[5]:

	Employee ID	Employee Name	Department	Age	Location	Salary	Years with Company	Position	Performance Score	Bonus	Gender	Marital Status	Educat
0	1001	Satender Kumar	Data Analyst	24	London, Canada	113479	3	Data Analyst	4	9480	Male	Single	Bach
1	1002	data 1	IT	34	Toronto	127453	9	Developer	4	6577	Male	Single	Ma
2	1003	Jane Smith	Finance	27	London	118316	7	Analyst	1	4972	Female	Married	F
3	1004	Robert Brown	Marketing	59	Sydney	109725	10	Designer	3	4624	Male	Single	Bach
4	1005	Emily Davis	Sales	36	San Francisco	99006	14	Consultant	3	3218	Female	Single	Ma
5	1006	Michael Wilson	Operations	36	Paris	123386	8	Engineer	1	4450	Male	Married	F
6	1007	Sarah Taylor	R&D	54	Berlin	77293	13	Scientist	2	2823	Female	Married	Bach
7	1008	David Lee	Support	32	Tokyo	65542	9	Support Agent	2	1486	Male	Single	Ma
8	1009	Laura Johnson	Admin	50	Dubai	87223	9	Admin Assistant	2	1705	Female	Married	Bach
9	1010	James White	Legal	25	Singapore	110051	5	Lawyer	2	8724	Male	Single	Ma

In [6]:
```
# Creating realistic data for a second set of employees
data1 = {
    'Employee ID': np.arange(1011, 1021),
    'Employee Name': ['Satender Kumar', 'data 1', 'Chris Evans', 'Natalie Portman', 'Tom Holland', 'Emma Watson
    'Department': ['Data Analyst', 'HR', 'IT', 'Marketing', 'Finance', 'Sales', 'R&D', 'Operations', 'Legal', '
    'Age': [24, np.random.randint(25, 60), np.random.randint(25, 60), np.random.randint(25, 60), np.random.rand
    'Location': ['London, Canada', 'Los Angeles', 'New York', 'Chicago', 'Houston', 'Phoenix', 'Philadelphia',
    'Salary': np.random.randint(60000, 160000, size=10),
    'Years with Company': np.random.randint(1, 20, size=10),
```

```
    'Position': ['Data Analyst', 'HR Manager', 'IT Specialist', 'Marketing Coordinator', 'Financial Analyst', '
    'Performance Score': np.random.randint(1, 5, size=10),
    'Bonus': np.random.randint(2000, 12000, size=10),
    'Gender': ['Male', 'Male', 'Female', 'Female', 'Male', 'Female', 'Male', 'Female', 'Male', 'Male'],
    'Marital Status': ['Single', 'Married', 'Single', 'Single', 'Married', 'Single', 'Single', 'Married', 'Sing
    'Education': ['Master', 'Bachelor', 'Master', 'PhD', 'Bachelor', 'Master', 'PhD', 'Bachelor', 'Master', 'Phl
    'Hire Date': pd.to_datetime(['2018-07-15', '2014-03-22', '2011-10-12', '2017-04-17', '2015-09-23', '2016-11
    'Overtime Hours': np.random.randint(0, 25, size=10),
    'Sick Days Taken': np.random.randint(0, 8, size=10),
    'Vacation Days Taken': np.random.randint(7, 22, size=10),
    'Training Hours': np.random.randint(15, 55, size=10),
    'Certifications': ['Yes', 'Yes', 'No', 'Yes', 'No', 'Yes', 'No', 'Yes', 'Yes', 'No'],
    'Supervisor': ['John Smith', 'Michael Johnson', 'Patricia Williams', 'Linda Brown', 'Barbara Jones', 'Eliza
}

# Creating the second DataFrame
df1 = pd.DataFrame(data1)
```

In [8]:
```
df1
```

Out[8]:

	Employee ID	Employee Name	Department	Age	Location	Salary	Years with Company	Position	Performance Score	Bonus	Gender	Marital Status	Edu
0	1011	Satender Kumar	Data Analyst	24	London, Canada	125763	9	Data Analyst	4	9043	Male	Single	
1	1012	data 1	HR	29	Los Angeles	149163	18	HR Manager	4	5174	Male	Married	Ba
2	1013	Chris Evans	IT	58	New York	149334	15	IT Specialist	4	4389	Female	Single	
3	1014	Natalie Portman	Marketing	41	Chicago	152579	13	Marketing Coordinator	4	3100	Female	Single	
4	1015	Tom Holland	Finance	55	Houston	87396	11	Financial Analyst	1	5710	Male	Married	Ba
5	1016	Emma Watson	Sales	34	Phoenix	132586	8	Sales Manager	1	2777	Female	Single	
6	1017	Daniel Radcliffe	R&D	56	Philadelphia	143832	10	Research Scientist	2	6264	Male	Single	
7	1018	Scarlett Johansson	Operations	35	San Antonio	61204	1	Operations Manager	4	9008	Female	Married	Ba
8	1019	Robert Downey Jr.	Legal	26	San Diego	69724	17	Legal Advisor	4	7002	Male	Single	
9	1020	Mark Ruffalo	Support	33	Dallas	134630	11	Support Specialist	1	2651	Male	Married	

In [11]:
```
df.head()
```

Out[11]:

	Employee ID	Employee Name	Department	Age	Location	Salary	Years with Company	Position	Performance Score	Bonus	Gender	Marital Status	Educat
0	1001	Satender Kumar	Data Analyst	24	London, Canada	113479	3	Data Analyst	4	9480	Male	Single	Bache
1	1002	data 1	IT	34	Toronto	127453	9	Developer	4	6577	Male	Single	Mas
2	1003	Jane Smith	Finance	27	London	118316	7	Analyst	1	4972	Female	Married	F
3	1004	Robert Brown	Marketing	59	Sydney	109725	10	Designer	3	4624	Male	Single	Bache
4	1005	Emily Davis	Sales	36	San Francisco	99006	14	Consultant	3	3218	Female	Single	Mas

In [13]:
```
df1.head()
```

Out[13]:

	Employee ID	Employee Name	Department	Age	Location	Salary	Years with Company	Position	Performance Score	Bonus	Gender	Marital Status	Educa
0	1011	Satender Kumar	Data Analyst	24	London, Canada	125763	9	Data Analyst	4	9043	Male	Single	Ma
1	1012	data 1	HR	29	Los Angeles	149163	18	HR Manager	4	5174	Male	Married	Bach
2	1013	Chris Evans	IT	58	New York	149334	15	IT Specialist	4	4389	Female	Single	Ma
3	1014	Natalie Portman	Marketing	41	Chicago	152579	13	Marketing Coordinator	4	3100	Female	Single	
4	1015	Tom Holland	Finance	55	Houston	87396	11	Financial Analyst	1	5710	Male	Married	Bach

In [15]:
```
# Check if df and df1 are exactly the same
are_identical = df.equals(df1)
print(f"Are df and df1 identical? {are_identical}")
```

```
Are df and df1 identical? False
```

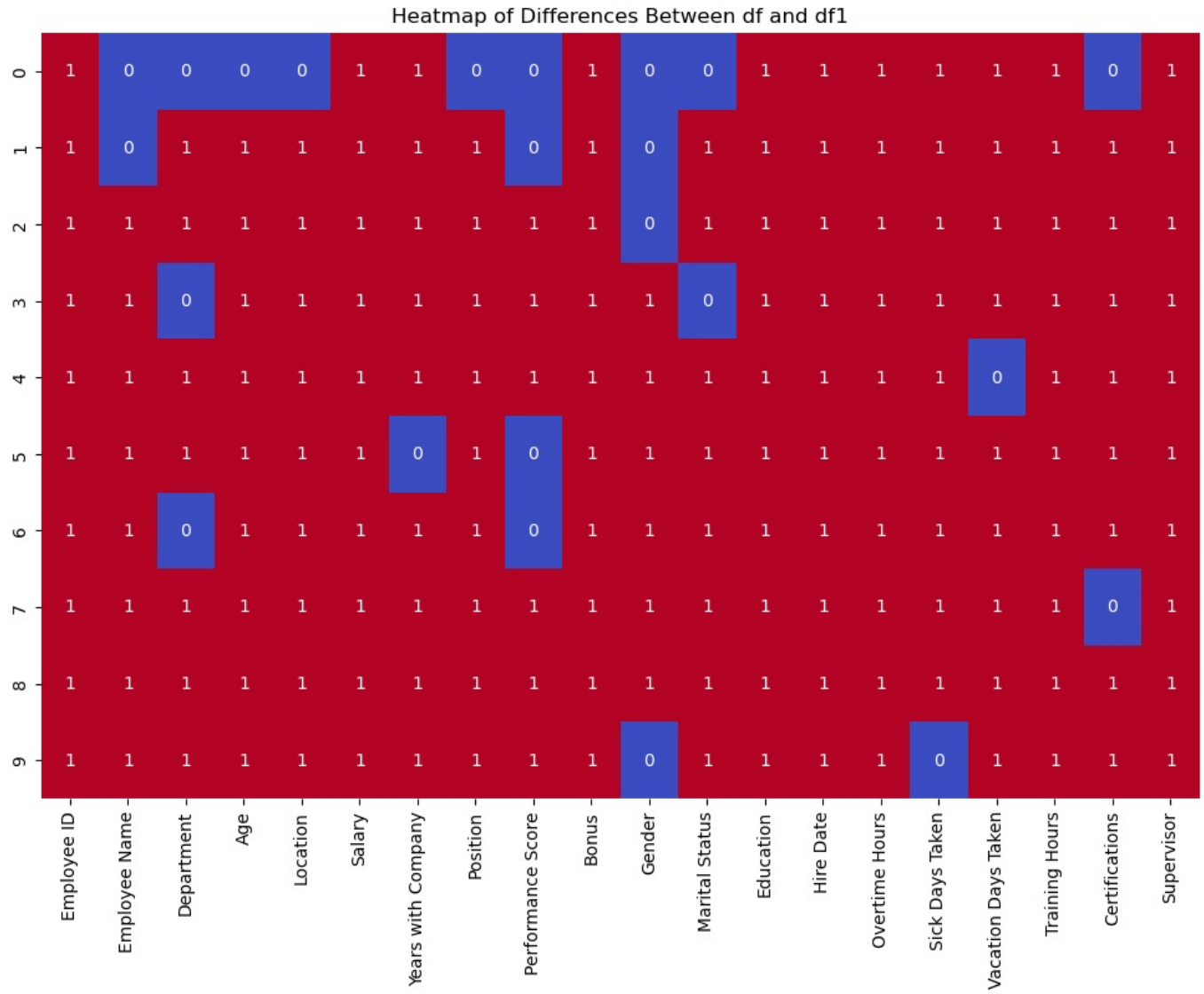
In [17]:
```
# Find differences between df and df1
comparison_df = df.compare(df1, keep_shape=True, keep_equal=True)
print("Differences between df and df1:")
print(comparison_df)
```

```
Differences between df and df1:
  Employee ID         Employee Name                       Department  \
         self other            self                other          self
0        1001  1011  Satender Kumar      Satender Kumar  Data Analyst
1        1002  1012          data 1              data 1            IT
2        1003  1013      Jane Smith         Chris Evans       Finance
3        1004  1014    Robert Brown     Natalie Portman     Marketing
4        1005  1015     Emily Davis         Tom Holland         Sales
5        1006  1016  Michael Wilson         Emma Watson    Operations
6        1007  1017    Sarah Taylor    Daniel Radcliffe           R&D
7        1008  1018       David Lee  Scarlett Johansson       Support
8        1009  1019   Laura Johnson   Robert Downey Jr.         Admin
9        1010  1020     James White        Mark Ruffalo         Legal

                Age             Location                        ...  \
           other self other          self           other       ...
0  Data Analyst   24    24  London, Canada  London, Canada     ...
1            HR   34    29         Toronto     Los Angeles     ...
2            IT   27    58          London        New York     ...
3     Marketing   59    41          Sydney         Chicago     ...
4       Finance   36    55   San Francisco         Houston     ...
5         Sales   36    34           Paris         Phoenix     ...
6           R&D   54    56          Berlin    Philadelphia     ...
7    Operations   32    35           Tokyo     San Antonio     ...
8         Legal   50    26           Dubai       San Diego     ...
9       Support   25    33       Singapore          Dallas     ...

  Sick Days Taken       Vacation Days Taken       Training Hours        \
             self other                self other           self other
0               9     7                12    15            19    53
1               2     5                15    19            31    17
2               2     6                10    13            30    45
3               8     4                14    20            29    34
4               9     1                18    18            14    17
5               3     7                 7    14            14    48
6               5     4                 6     8            11    46
7               4     0                15    16            21    54
8               8     4                15     7            44    18
9               6     6                 6    21            45    31

  Certifications           Supervisor
            self other           self             other
0            Yes   Yes     Anna Smith         John Smith
1             No   Yes    Brian Adams    Michael Johnson
2            Yes    No    Clara Jones  Patricia Williams
3             No   Yes  Daniel Martin        Linda Brown
4            Yes    No  Eva Rodriguez      Barbara Jones
5             No   Yes     Frank Bell   Elizabeth Garcia
6            Yes    No    Grace Moore     Susan Martinez
7            Yes   Yes   Hannah Lewis  Jessica Hernandez
8             No   Yes     Ivan Scott        Sarah Lopez
9            Yes    No    Jake Miller       Karen Wilson

[10 rows x 40 columns]
```

In [20]:
```
# Identify rows that differ between df and df1
differing_rows = df[df.ne(df1).any(axis=1)]
print("Rows that differ between df and df1:")
print(differing_rows)
```

```
Rows that differ between df and df1:
   Employee ID   Employee Name    Department  Age        Location  Salary  \
0         1001  Satender Kumar  Data Analyst   24  London, Canada  113479
1         1002          data 1            IT   34         Toronto  127453
2         1003      Jane Smith       Finance   27          London  118316
3         1004    Robert Brown     Marketing   59          Sydney  109725
4         1005     Emily Davis         Sales   36   San Francisco   99006
5         1006  Michael Wilson    Operations   36           Paris  123386
6         1007    Sarah Taylor           R&D   54          Berlin   77293
7         1008       David Lee       Support   32           Tokyo   65542
8         1009   Laura Johnson         Admin   50           Dubai   87223
9         1010     James White         Legal   25       Singapore  110051

   Years with Company         Position  Performance Score  Bonus  Gender  \
0                   3     Data Analyst                  4   9480    Male
1                   9        Developer                  4   6577    Male
2                   7          Analyst                  1   4972  Female
3                  10         Designer                  3   4624    Male
4                  14       Consultant                  3   3218  Female
5                   8         Engineer                  1   4450    Male
6                  13        Scientist                  2   2823  Female
7                   9    Support Agent                  2   1486    Male
8                   9  Admin Assistant                  2   1705  Female
9                   5           Lawyer                  2   8724    Male

  Marital Status Education  Hire Date  Overtime Hours  Sick Days Taken  \
0         Single  Bachelor 2019-06-12              18                9
1         Single    Master 2015-07-23              11                2
2        Married       PhD 2012-09-05               6                2
3         Single  Bachelor 2018-11-30              17                8
4         Single    Master 2013-05-19              16                9
5        Married       PhD 2019-02-14              14                3
6        Married  Bachelor 2020-08-21               4                5
7         Single    Master 2016-06-03               3                4
8        Married  Bachelor 2014-01-28              13                8
9         Single    Master 2017-03-15               6                6

   Vacation Days Taken  Training Hours Certifications     Supervisor
0                   12              19            Yes     Anna Smith
1                   15              31             No    Brian Adams
2                   10              30            Yes    Clara Jones
3                   14              29             No  Daniel Martin
4                   18              14            Yes  Eva Rodriguez
5                    7              14             No     Frank Bell
6                    6              11            Yes    Grace Moore
7                   15              21            Yes   Hannah Lewis
8                   15              44             No     Ivan Scott
9                    6              45            Yes    Jake Miller
```

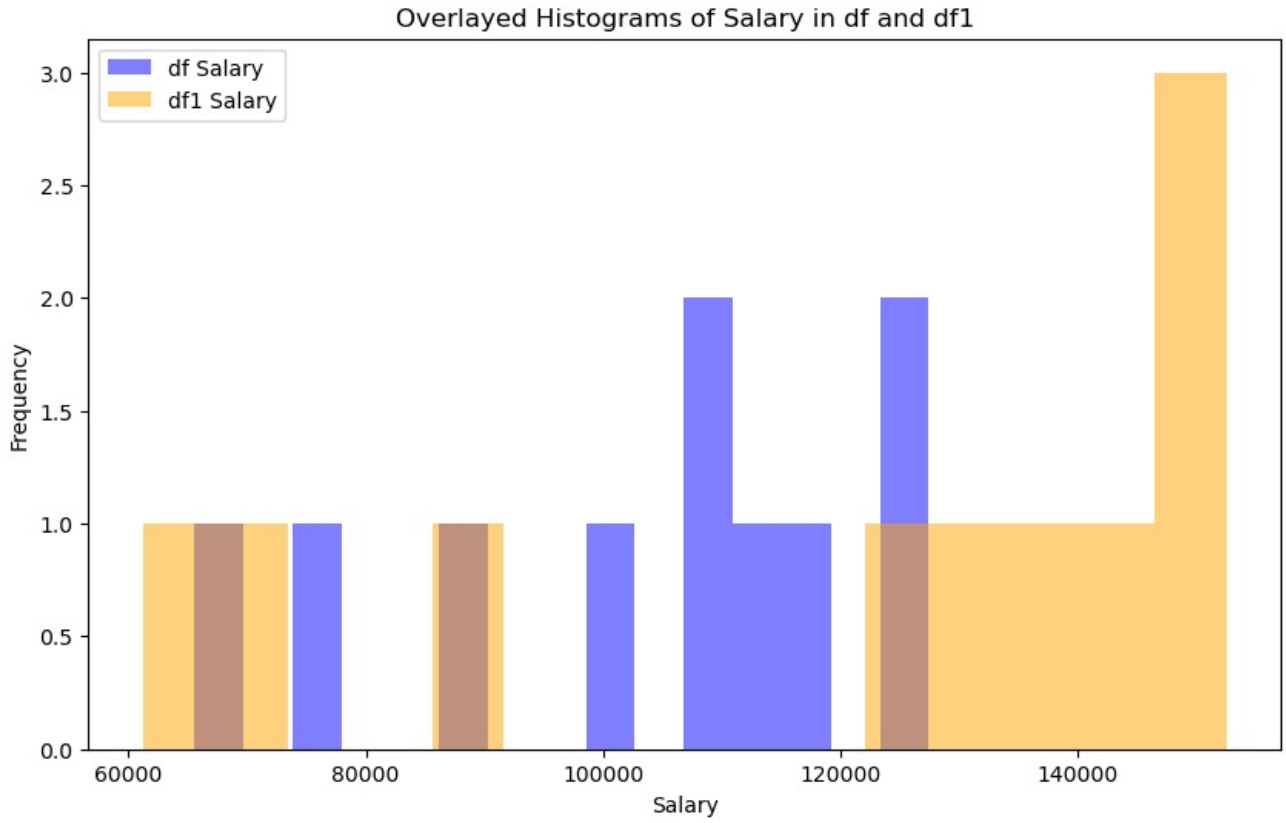
In [22]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Create a heatmap to visualize differences between df and df1
diff = df.ne(df1).astype(int)  # 1 where different, 0 where the same
plt.figure(figsize=(12, 8))
sns.heatmap(diff, cmap='coolwarm', cbar=False, annot=True)
plt.title('Heatmap of Differences Between df and df1')
plt.show()
```



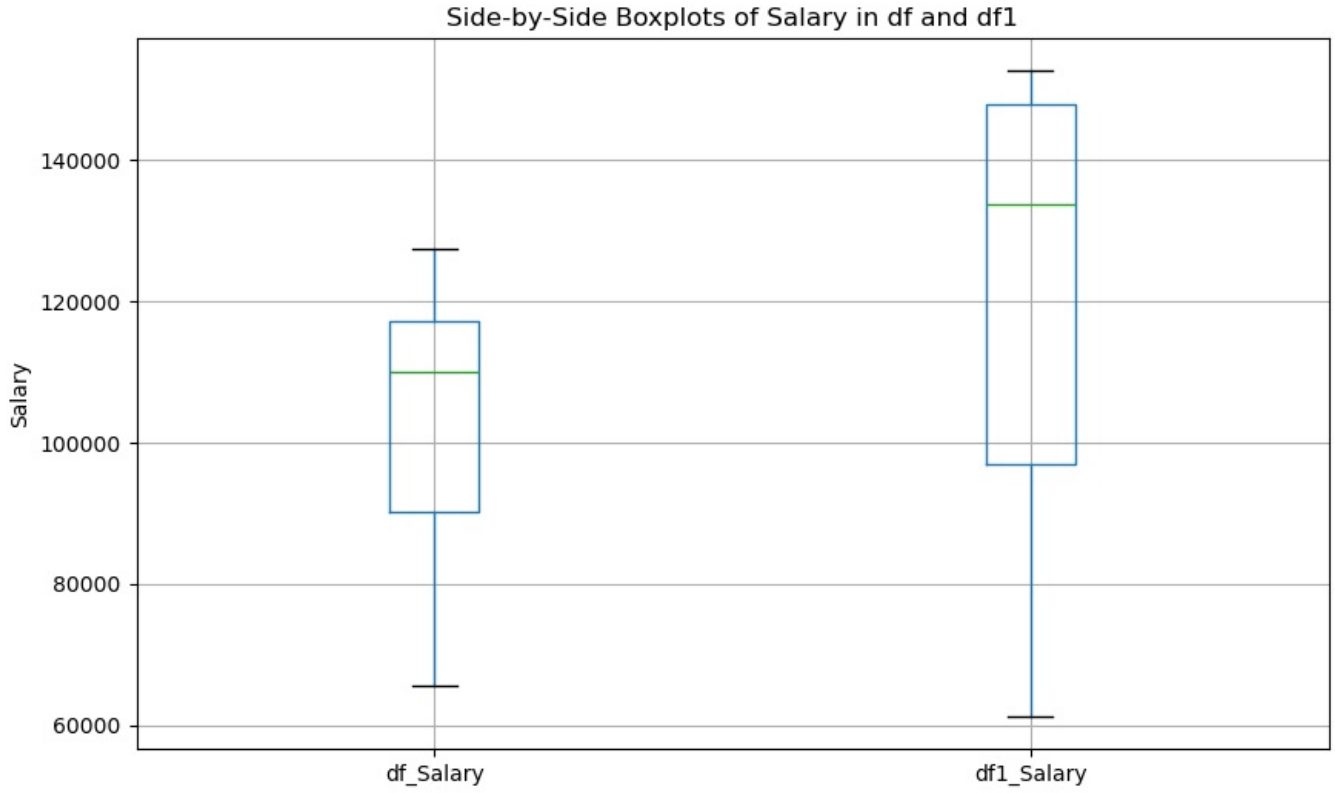
In [24]:
```
# Summarize the number of differences by column
summary = df.ne(df1).sum()
print("Summary of differences by column:")
print(summary)
```

```
Summary of differences by column:
Employee ID            10
Employee Name           8
Department              7
Age                     9
Location                9
Salary                 10
Years with Company      9
Position                9
Performance Score       6
Bonus                  10
Gender                  6
Marital Status          8
Education              10
Hire Date              10
Overtime Hours         10
Sick Days Taken         9
Vacation Days Taken     9
Training Hours         10
Certifications          8
Supervisor             10
dtype: int64
```

In [26]:
```
import matplotlib.pyplot as plt

# Overlayed histograms for 'Salary' in df and df1
plt.figure(figsize=(10, 6))
plt.hist(df['Salary'], bins=15, alpha=0.5, label='df Salary', color='blue')
plt.hist(df1['Salary'], bins=15, alpha=0.5, label='df1 Salary', color='orange')
plt.title('Overlayed Histograms of Salary in df and df1')
plt.xlabel('Salary')
plt.ylabel('Frequency')
plt.legend()
plt.show()
```

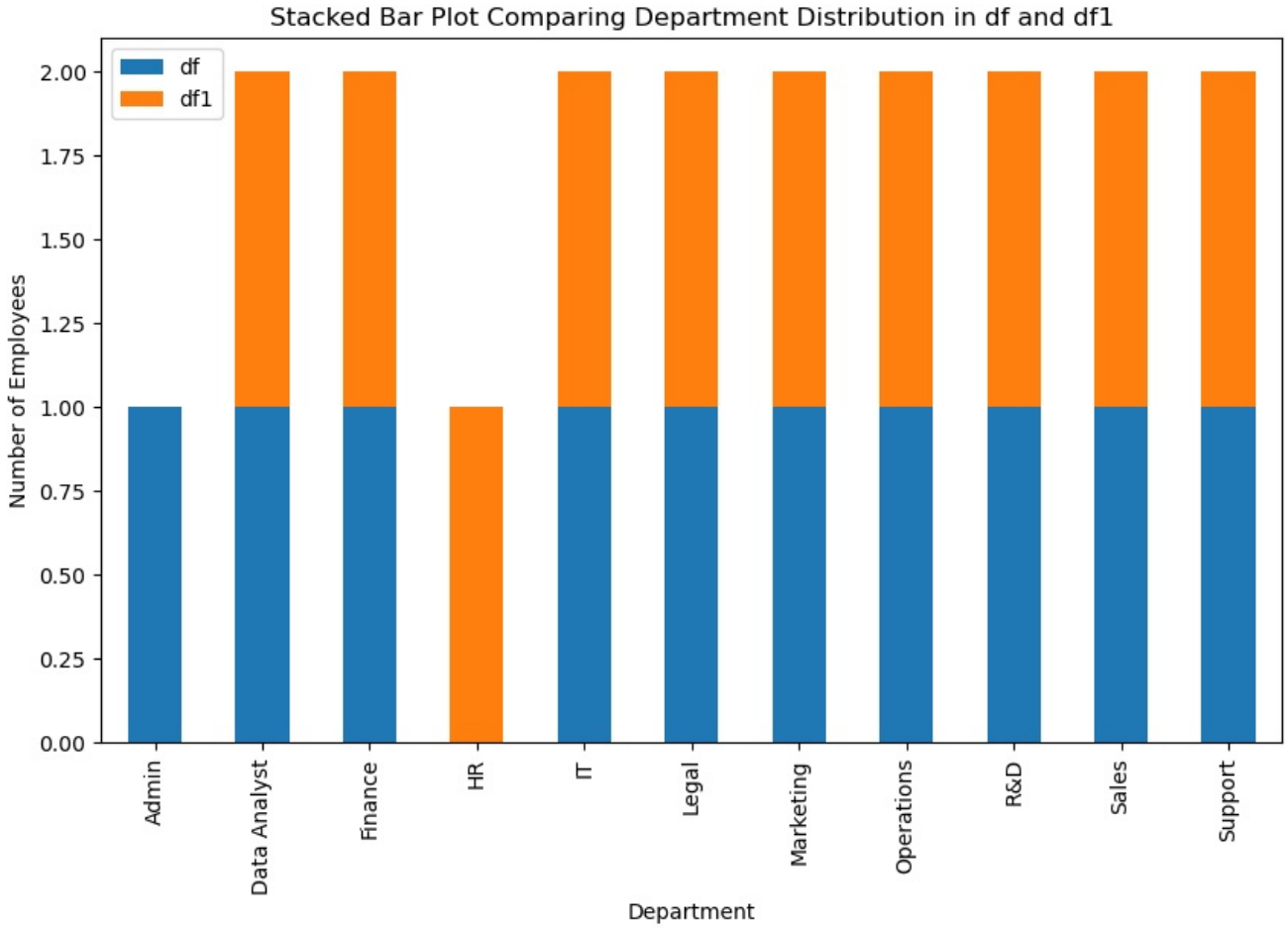


In [29]:
```python
# Combine the data into a single DataFrame for side-by-side boxplots
combined = pd.DataFrame({
    'df_Salary': df['Salary'],
    'df1_Salary': df1['Salary']
})

# Plot the boxplots
plt.figure(figsize=(10, 6))
combined.boxplot()
plt.title('Side-by-Side Boxplots of Salary in df and df1')
plt.ylabel('Salary')
plt.show()
```

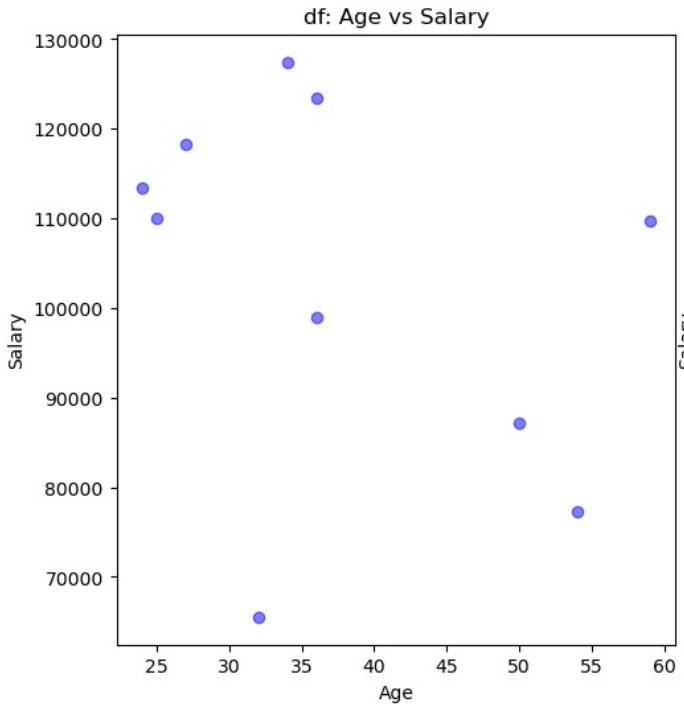


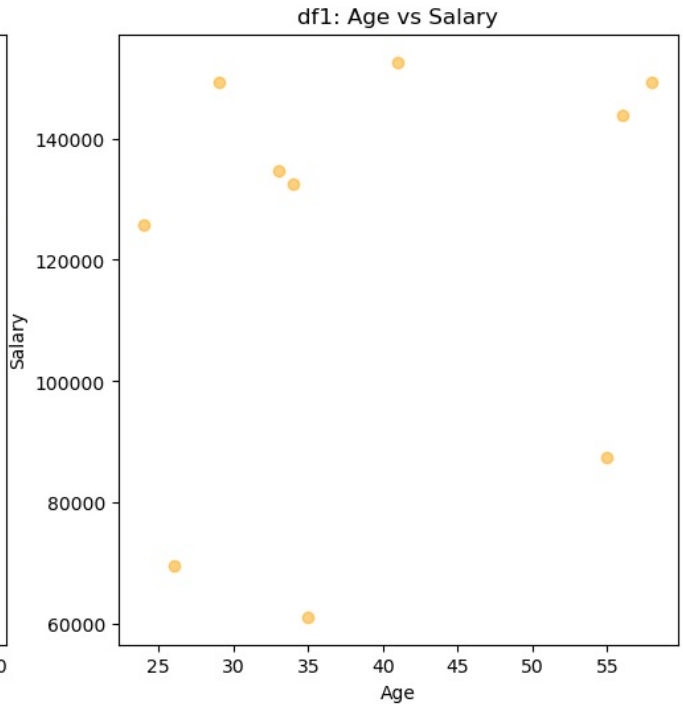
In [31]:
```python
# Group by Department and count in both DataFrames
df_dept_counts = df['Department'].value_counts()
df1_dept_counts = df1['Department'].value_counts()

# Combine into a single DataFrame
```

```
dept_comparison = pd.DataFrame({'df': df_dept_counts, 'df1': df1_dept_counts})

# Plot stacked bar plot
dept_comparison.plot(kind='bar', stacked=True, figsize=(10, 6))
plt.title('Stacked Bar Plot Comparing Department Distribution in df and df1')
plt.ylabel('Number of Employees')
plt.show()
```

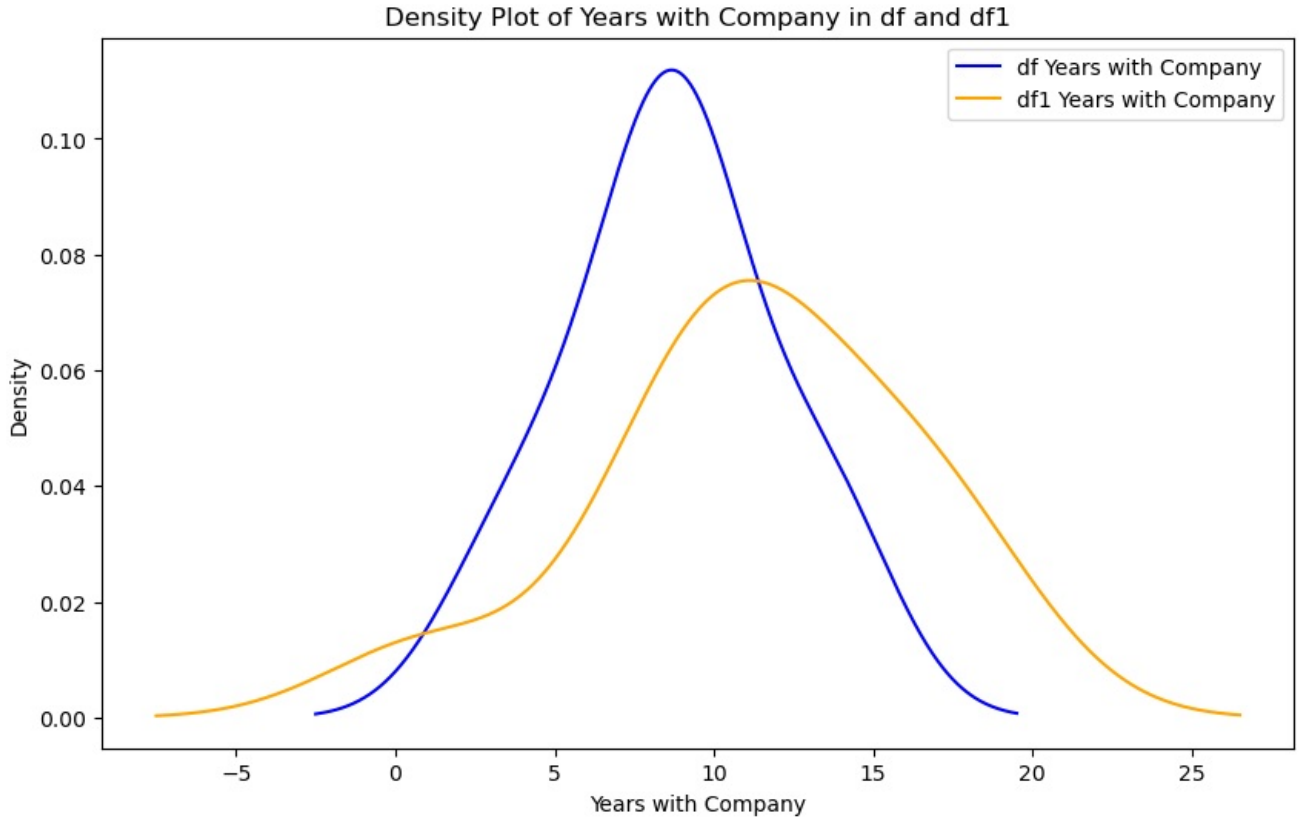


In [33]:
```
# Scatter plot comparison for 'Age' vs 'Salary' in both DataFrames
plt.figure(figsize=(12, 6))

plt.subplot(1, 2, 1)
plt.scatter(df['Age'], df['Salary'], color='blue', alpha=0.5)
plt.title('df: Age vs Salary')
plt.xlabel('Age')
plt.ylabel('Salary')

plt.subplot(1, 2, 2)
plt.scatter(df1['Age'], df1['Salary'], color='orange', alpha=0.5)
plt.title('df1: Age vs Salary')
plt.xlabel('Age')
plt.ylabel('Salary')

plt.show()
```

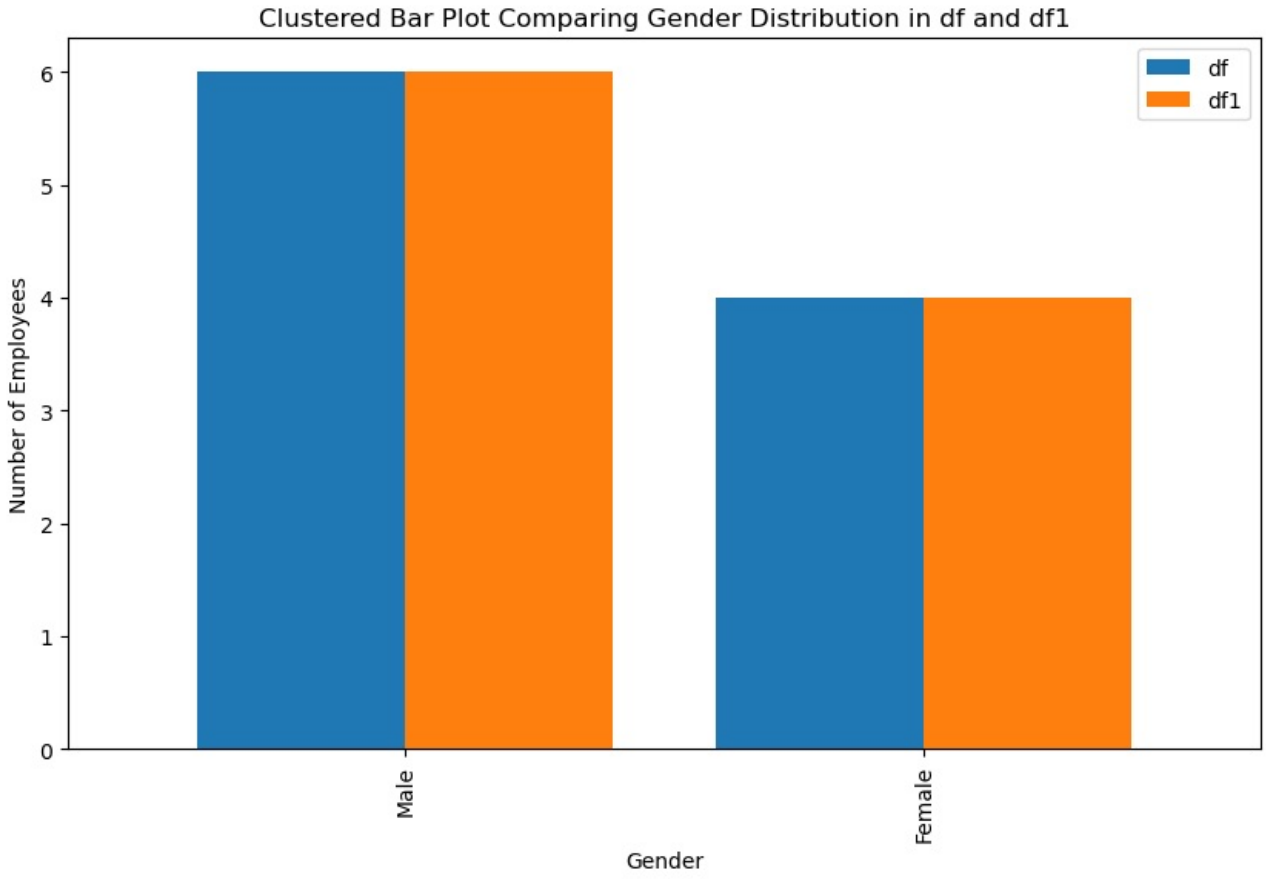




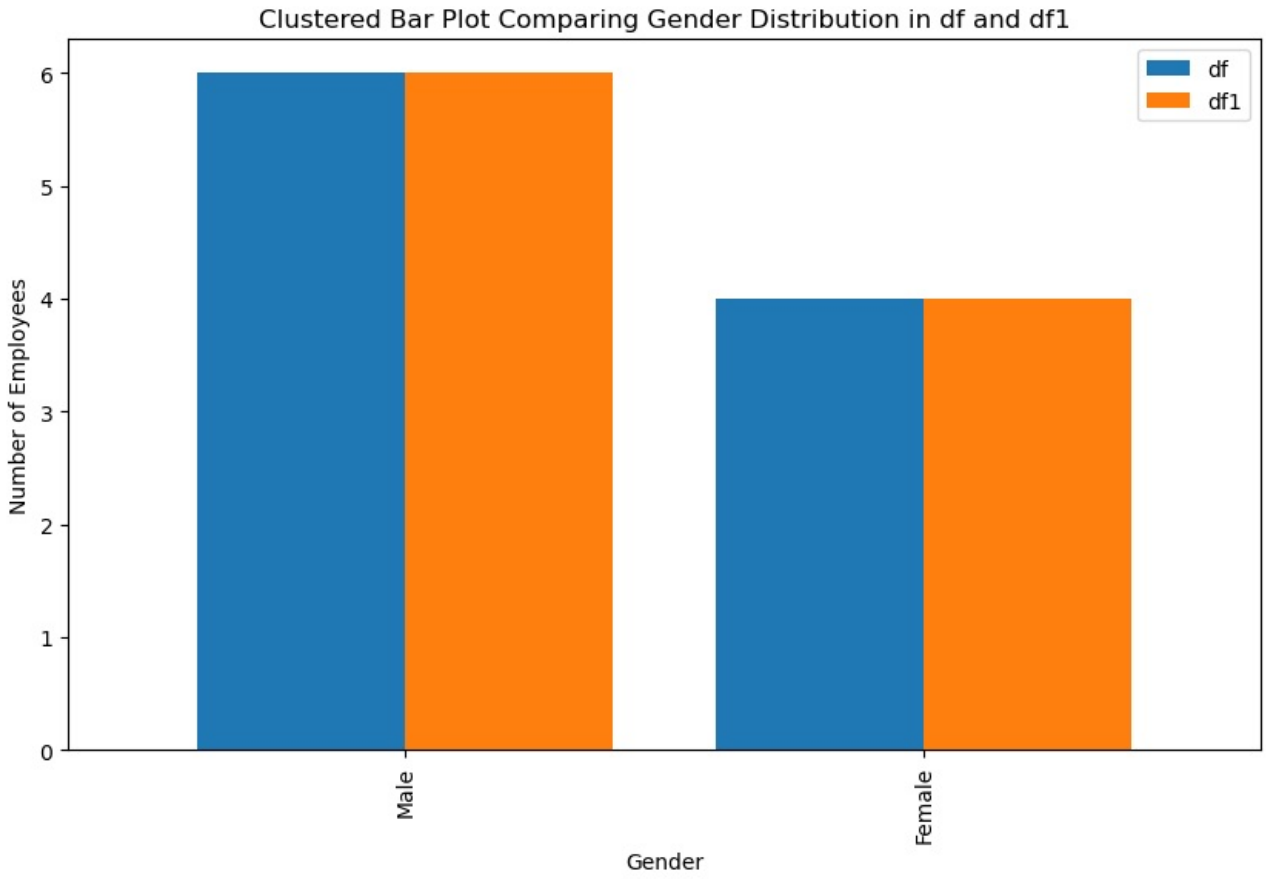
In [35]:
```
# Density plot for 'Years with Company' in df and df1
plt.figure(figsize=(10, 6))
df['Years with Company'].plot(kind='density', label='df Years with Company', color='blue')
df1['Years with Company'].plot(kind='density', label='df1 Years with Company', color='orange')
plt.title('Density Plot of Years with Company in df and df1')
plt.xlabel('Years with Company')
plt.legend()
plt.show()
```



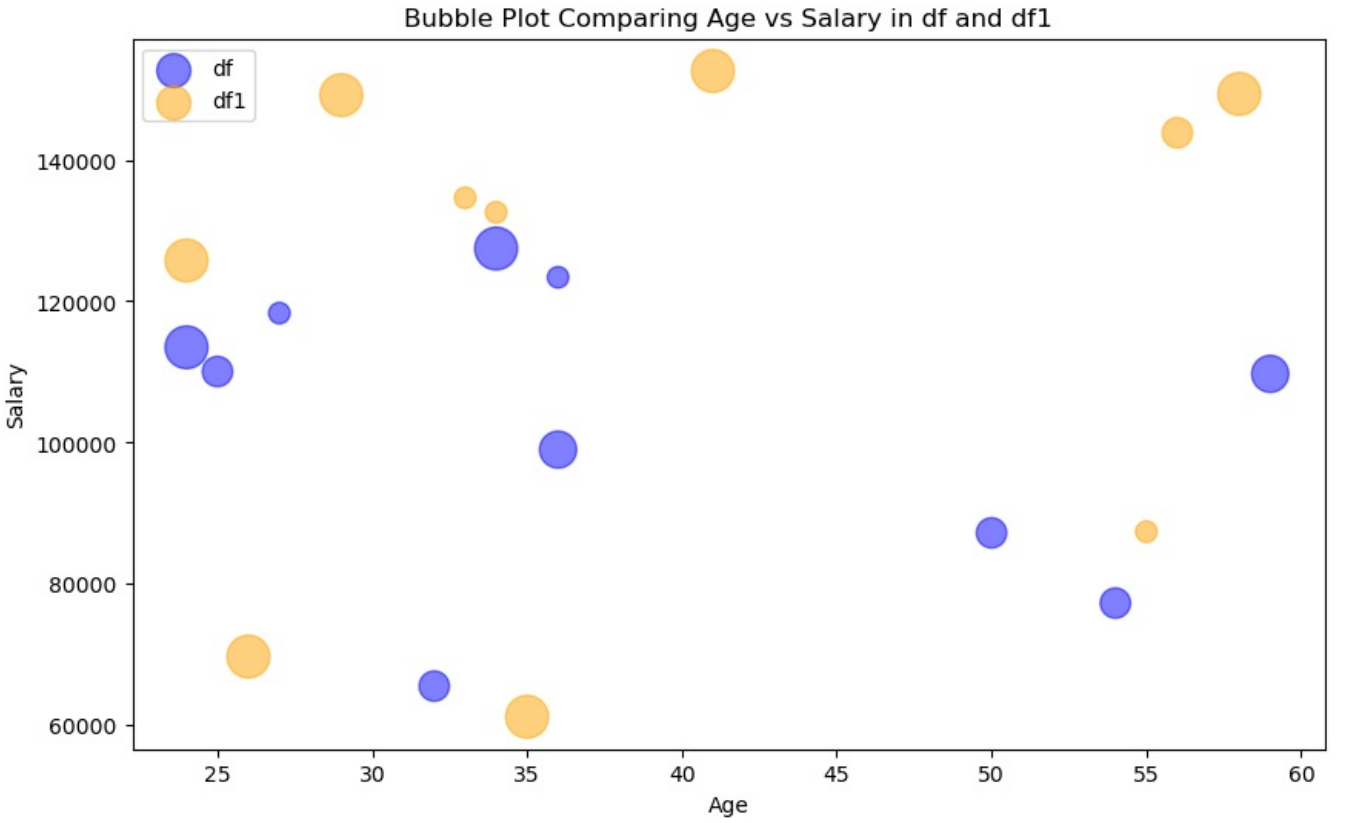
In [37]:
```
# Group by Gender and count in both DataFrames
df_gender_counts = df['Gender'].value_counts()
df1_gender_counts = df1['Gender'].value_counts()

# Combine into a single DataFrame
gender_comparison = pd.DataFrame({'df': df_gender_counts, 'df1': df1_gender_counts})

# Plot clustered bar plot
gender_comparison.plot(kind='bar', width=0.8, figsize=(10, 6))
plt.title('Clustered Bar Plot Comparing Gender Distribution in df and df1')
plt.ylabel('Number of Employees')
plt.show()
```



In [39]:
```
# Group by Gender and count in both DataFrames
df_gender_counts = df['Gender'].value_counts()
df1_gender_counts = df1['Gender'].value_counts()

# Combine into a single DataFrame
gender_comparison = pd.DataFrame({'df': df_gender_counts, 'df1': df1_gender_counts})

# Plot clustered bar plot
gender_comparison.plot(kind='bar', width=0.8, figsize=(10, 6))
plt.title('Clustered Bar Plot Comparing Gender Distribution in df and df1')
plt.ylabel('Number of Employees')
plt.show()
```



In [41]:
```
# Bubble plot for Age vs Salary with Performance Score as bubble size
plt.figure(figsize=(10, 6))

plt.scatter(df['Age'], df['Salary'], s=df['Performance Score']*100, alpha=0.5, label='df', color='blue')
plt.scatter(df1['Age'], df1['Salary'], s=df1['Performance Score']*100, alpha=0.5, label='df1', color='orange')

plt.title('Bubble Plot Comparing Age vs Salary in df and df1')
plt.xlabel('Age')
plt.ylabel('Salary')
plt.legend()
plt.show()
```



In [43]:
```
# Comparing first employee in both DataFrames using a radar chart
categories = ['Age', 'Salary', 'Years with Company', 'Performance Score', 'Bonus']
df_values = df.loc[0, categories].values.flatten().tolist()
df1_values = df1.loc[0, categories].values.flatten().tolist()

# Closing the radar chart by adding the first value at the end
df_values += df_values[:1]
df1_values += df1_values[:1]
angles = np.linspace(0, 2 * np.pi, len(categories), endpoint=False).tolist()
angles += angles[:1]

fig, ax = plt.subplots(figsize=(6, 6), subplot_kw=dict(polar=True))
ax.fill(angles, df_values, color='blue', alpha=0.25, label='df')
ax.plot(angles, df_values, color='blue', linewidth=2)

ax.fill(angles, df1_values, color='orange', alpha=0.25, label='df1')
ax.plot(angles, df1_values, color='orange', linewidth=2)

ax.set_yticklabels([])
ax.set_xticks(angles[:-1])
ax.set_xticklabels(categories)
plt.title('Radar Chart Comparing First Employee in df and df1')
plt.legend()
plt.show()
```