PYTHON PROJECT

SEETHA V

INTRODUCTION

This project focuses on analyzing employee data across different teams and positions within a company. It involves preprocessing and cleaning the data, followed by tasks such as analyzing team distribution, salary expenditure, and employee attributes like age, salary, and position. The goal is to uncover key patterns, correlations, and insights to better understand the workforce structure and dynamics.

IMPORTING MODULES

In [18]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

import warnings
import sys
if not sys.warnoptions:
    warnings.simplefilter("ignore")
```

LOAD DATASET

In [21]:
```
# Load the dataset
data = pd.read_excel("project_dataset.xlsx")

# Display the first few rows to understand the structure of the data
data.head()
```

Out[21]:

	Name	Team	Number	Position	Age	Height	Weight	College	Salary
0	Avery Bradley	Boston Celtics	0	PG	25	2023-02-06 00:00:00	180	Texas	7730337.0
1	Jae Crowder	Boston Celtics	99	SF	25	2023-06-06 00:00:00	235	Marquette	6796117.0
2	John Holland	Boston Celtics	30	SG	27	2023-05-06 00:00:00	205	Boston University	NaN
3	R.J. Hunter	Boston Celtics	28	SG	22	2023-05-06 00:00:00	185	Georgia State	1148640.0
4	Jonas Jerebko	Boston Celtics	8	PF	29	2023-10-06 00:00:00	231	NaN	5000000.0

In [23]:
```
# CREATE COPY OF ORIGINAL DATASET
data_copy = data.copy()
data_copy
```

Out[23]:

	Name	Team	Number	Position	Age	Height	Weight	College	Salary
0	Avery Bradley	Boston Celtics	0	PG	25	2023-02-06 00:00:00	180	Texas	7730337.0
1	Jae Crowder	Boston Celtics	99	SF	25	2023-06-06 00:00:00	235	Marquette	6796117.0
2	John Holland	Boston Celtics	30	SG	27	2023-05-06 00:00:00	205	Boston University	NaN
3	R.J. Hunter	Boston Celtics	28	SG	22	2023-05-06 00:00:00	185	Georgia State	1148640.0
4	Jonas Jerebko	Boston Celtics	8	PF	29	2023-10-06 00:00:00	231	NaN	5000000.0
...	...	...	...	...	...	...	...	...	...
453	Shelvin Mack	Utah Jazz	8	PG	26	2023-03-06 00:00:00	203	Butler	2433333.0
454	Raul Neto	Utah Jazz	25	PG	24	2023-01-06 00:00:00	179	NaN	900000.0
455	Tibor Pleiss	Utah Jazz	21	C	26	2023-03-07 00:00:00	256	NaN	2900000.0
456	Jeff Withey	Utah Jazz	24	C	26	7-0	231	Kansas	947276.0
457	Priyanka	Utah Jazz	34	C	25	2023-03-07 00:00:00	231	Kansas	947276.0

458 rows × 9 columns

PREPROCESSING

In [26]:
```
# Correct the data in the "height" column by replacing it with random numbers betwe
# Ensure data consistency and integrity before proceeding with analysis.

# Replace 'height' column values with random values between 150 and 180
data["Height"] = np.random.randint(150, 181, size=len(data))
```

```
# Verify the change
data.head()
```

Out[26]:

	Name	Team	Number	Position	Age	Height	Weight	College	Salary
0	Avery Bradley	Boston Celtics	0	PG	25	164	180	Texas	7730337.0
1	Jae Crowder	Boston Celtics	99	SF	25	152	235	Marquette	6796117.0
2	John Holland	Boston Celtics	30	SG	27	158	205	Boston University	NaN
3	R.J. Hunter	Boston Celtics	28	SG	22	174	185	Georgia State	1148640.0
4	Jonas Jerebko	Boston Celtics	8	PF	29	160	231	NaN	5000000.0

In [28]:
```
# To find sum of null vales in each column
data.isnull().sum()
```

Out[28]:
```
Name          0
Team          0
Number        0
Position      0
Age           0
Height        0
Weight        0
College      84
Salary       11
dtype: int64
```

In [30]:
```
# Replace null values in "Salary" with Mean

data["Salary"].fillna(data["Salary"].mean(), inplace = True)
data
```

Out[30]:

	Name	Team	Number	Position	Age	Height	Weight	College	Salary
0	Avery Bradley	Boston Celtics	0	PG	25	164	180	Texas	7.730337e+06
1	Jae Crowder	Boston Celtics	99	SF	25	152	235	Marquette	6.796117e+06
2	John Holland	Boston Celtics	30	SG	27	158	205	Boston University	4.833970e+06
3	R.J. Hunter	Boston Celtics	28	SG	22	174	185	Georgia State	1.148640e+06
4	Jonas Jerebko	Boston Celtics	8	PF	29	160	231	NaN	5.000000e+06
...	...	...	...	...	...	...	...	...	...
453	Shelvin Mack	Utah Jazz	8	PG	26	155	203	Butler	2.433333e+06
454	Raul Neto	Utah Jazz	25	PG	24	174	179	NaN	9.000000e+05
455	Tibor Pleiss	Utah Jazz	21	C	26	172	256	NaN	2.900000e+06
456	Jeff Withey	Utah Jazz	24	C	26	178	231	Kansas	9.472760e+05
457	Priyanka	Utah Jazz	34	C	25	157	231	Kansas	9.472760e+05

458 rows × 9 columns

ANALYSIS TASK

1. Determine the distribution of employees across each team and calculate the percentage split relative to the total number of employees.

In [34]:
```
# Count of employees in each team
team_counts = data["Team"].value_counts()

#Total Employee
total_employees = len(data)

# Calculate percentage split
```

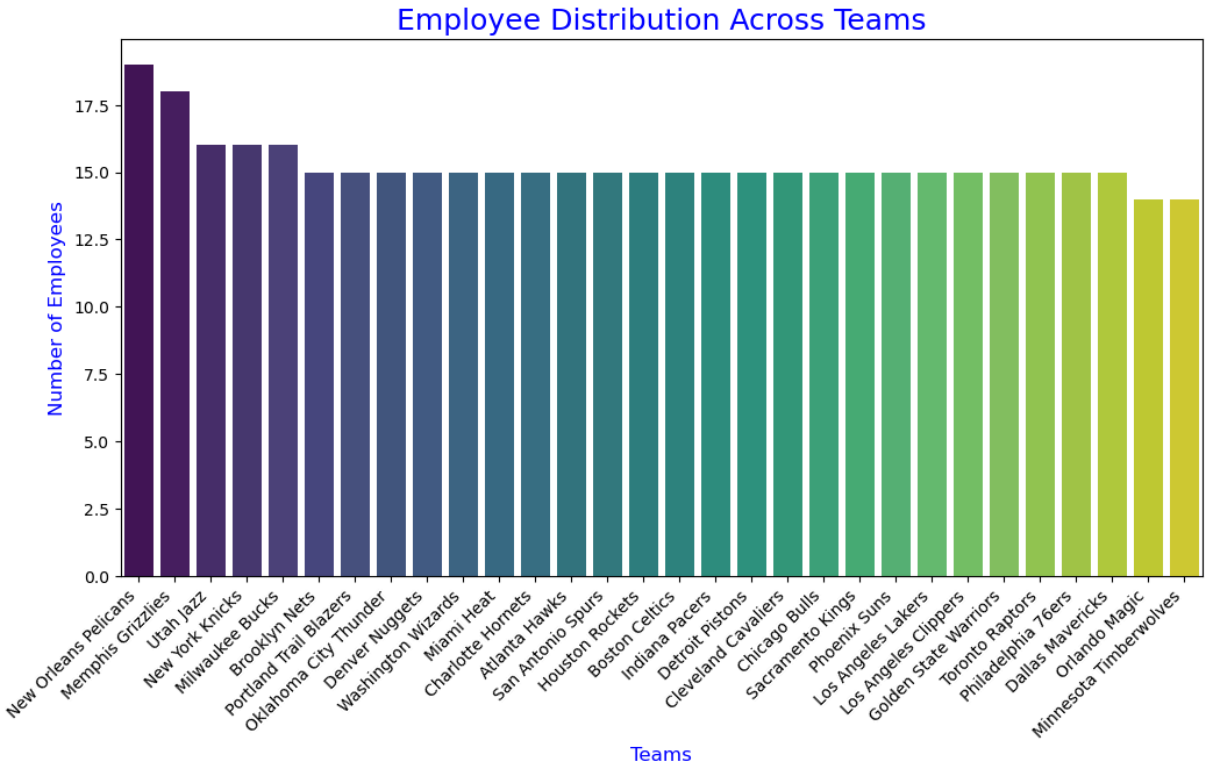
```
team_percentages = (team_counts / total_employees) * 100

# Combine both into a DataFrame
team_distribution = pd.DataFrame({
    "Count": team_counts, "Percentage(%)": team_percentages.round(2)})

# Display the team distribution
team_distribution
```

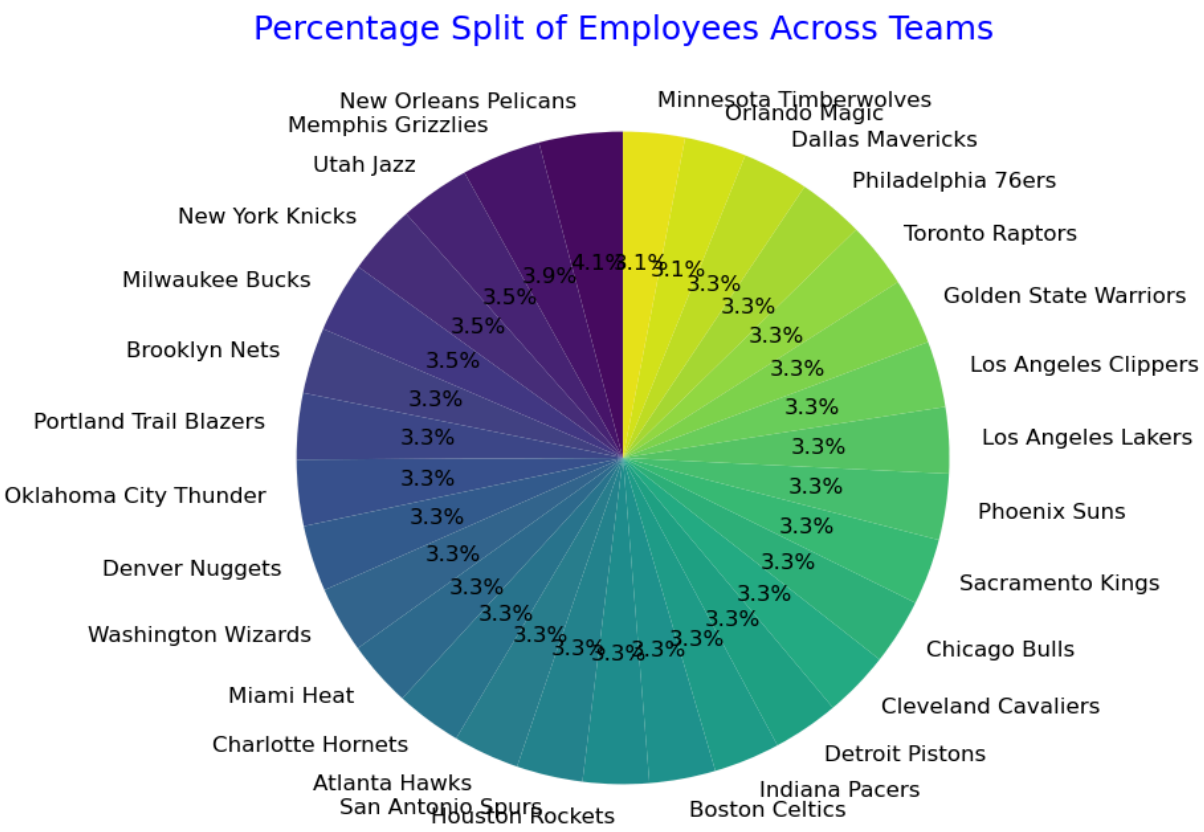
Out[34]:

Team	Count	Percentage(%)
New Orleans Pelicans	19	4.15
Memphis Grizzlies	18	3.93
Utah Jazz	16	3.49
New York Knicks	16	3.49
Milwaukee Bucks	16	3.49
Brooklyn Nets	15	3.28
Portland Trail Blazers	15	3.28
Oklahoma City Thunder	15	3.28
Denver Nuggets	15	3.28
Washington Wizards	15	3.28
Miami Heat	15	3.28
Charlotte Hornets	15	3.28
Atlanta Hawks	15	3.28
San Antonio Spurs	15	3.28
Houston Rockets	15	3.28
Boston Celtics	15	3.28
Indiana Pacers	15	3.28
Detroit Pistons	15	3.28
Cleveland Cavaliers	15	3.28
Chicago Bulls	15	3.28
Sacramento Kings	15	3.28
Phoenix Suns	15	3.28
Los Angeles Lakers	15	3.28
Los Angeles Clippers	15	3.28
Golden State Warriors	15	3.28
Toronto Raptors	15	3.28
Philadelphia 76ers	15	3.28
Dallas Mavericks	15	3.28
Orlando Magic	14	3.06

Team	Count	Percentage(%)
Minnesota Timberwolves	14	3.06

In [36]:
```
# Visualize the team distribution.

# Create a bar plot for team distribution
plt.figure(figsize=(12,6), dpi=100)

# Generate a color palette with different colors for each bar
colors = sns.color_palette("viridis", len(team_distribution))

sns.barplot(x=team_distribution.index, y=team_distribution["Count"], palette=colors
plt.title("Employee Distribution Across Teams", fontsize =18, color = "blue")
plt.xlabel("Teams", fontsize = 12, color ="blue")
plt.ylabel("Number of Employees", fontsize = 12, color = "blue")
plt.xticks(rotation=45, ha = "right")
plt.show()

# Create a pie chart for the percentage split
plt.figure(figsize=(8,8), dpi = 100)
plt.pie(team_distribution["Percentage(%)"], labels=team_distribution.index,
        autopct="%1.1f%%", colors=colors, textprops={'fontsize': 12}, startangle=90
plt.title("Percentage Split of Employees Across Teams", fontsize = 18, color="blue"
plt.ylabel('')  # To remove the 'Teams' label on the side
plt.show()
```





2. Segregate employees based on their positions within the company

In [39]:
```
# Group the data by the "Position" column and count the number of employees in each
position_counts = data["Position"].value_counts()

# Create a DataFrame to display the counts
position_distribution = pd.DataFrame({
    "Position": position_counts.index, "Employee Count": position_counts.values})

# Display the position distribution DataFrame
print(position_distribution)
```

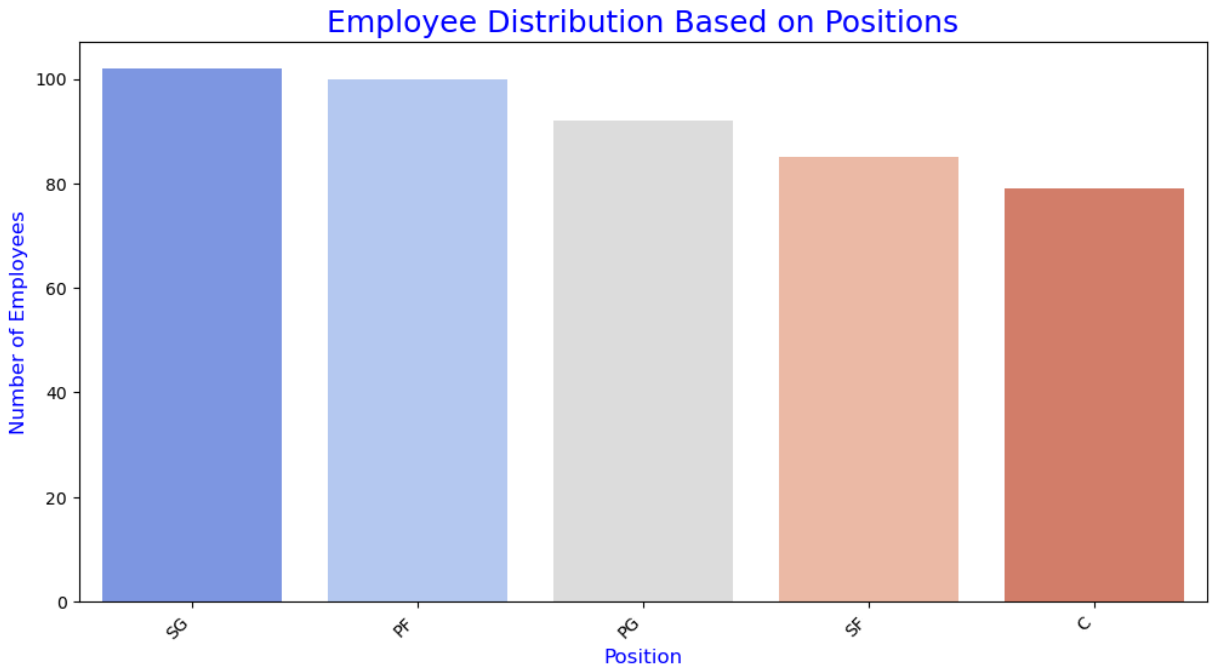
```
  Position  Employee Count
0       SG             102
1       PF             100
2       PG              92
3       SF              85
4        C              79
```

In [41]:
```
# print details of Employees in each positions seperately
positions = data["Position"].unique() # Get unique positions
for position in positions:
    # Filter the data
    employees_in_position = data[data["Position"] == position].head(5)
```

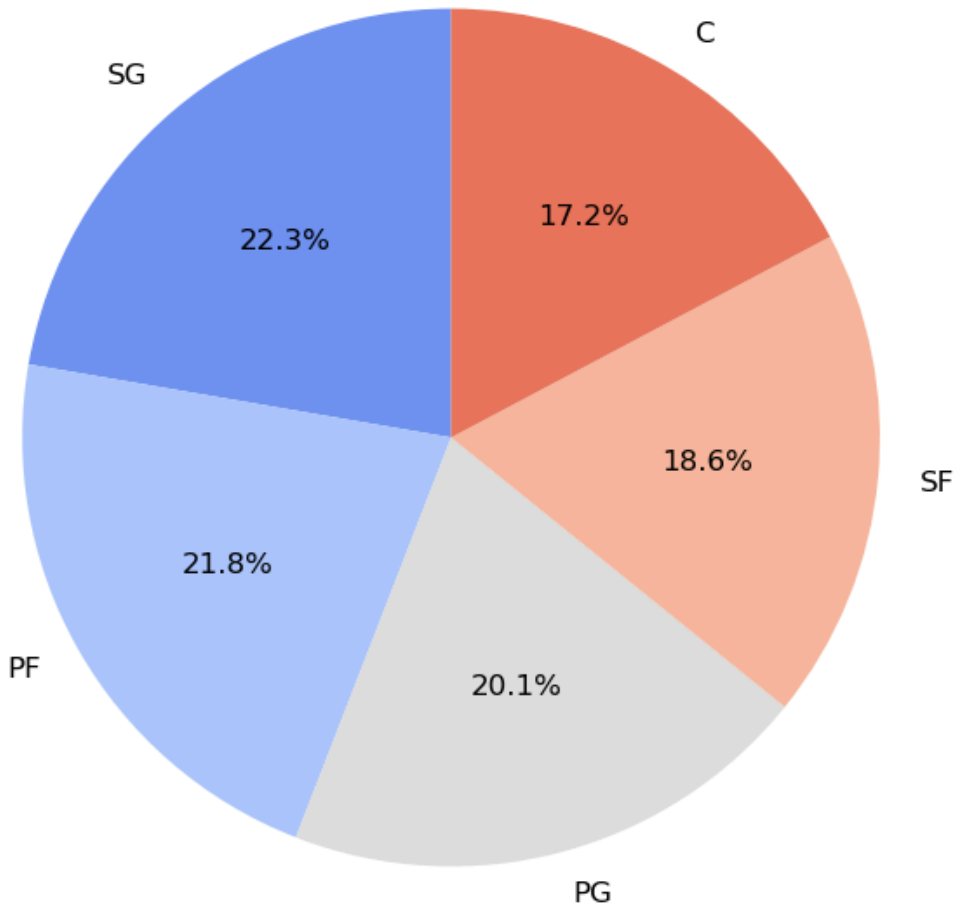
```
    print(f"\nPosition: {position}")
    print(employees_in_position[["Name", "Age", "Salary", "Team", "Height"]])
```

```
Position: PG
             Name  Age     Salary           Team  Height
0   Avery Bradley   25  7730337.0  Boston Celtics     164
8    Terry Rozier   22  1824360.0  Boston Celtics     154
9    Marcus Smart   22  3431040.0  Boston Celtics     171
11  Isaiah Thomas   27  6912869.0  Boston Celtics     174
19   Jarrett Jack   32  6300000.0   Brooklyn Nets     177

Position: SF
                     Name  Age      Salary            Team  Height
1             Jae Crowder   25   6796117.0   Boston Celtics     152
32  Thanasis Antetokounmpo   23     30888.0  New York Knicks     160
33         Carmelo Anthony   32  22875000.0  New York Knicks     166
35        Cleanthony Early   25    845059.0  New York Knicks     159
42            Lance Thomas   28   1636842.0  New York Knicks     164

Position: SG
                Name  Age        Salary           Team  Height
2       John Holland   27  4.833970e+06  Boston Celtics     158
3        R.J. Hunter   22  1.148640e+06  Boston Celtics     174
12       Evan Turner   27  3.425510e+06  Boston Celtics     155
13       James Young   20  1.749840e+06  Boston Celtics     162
15  Bojan Bogdanovic   27  3.425510e+06   Brooklyn Nets     155

Position: PF
                Name  Age      Salary           Team  Height
4      Jonas Jerebko   29   5000000.0  Boston Celtics     160
5       Amir Johnson   29  12000000.0  Boston Celtics     176
6      Jordan Mickey   21   1170960.0  Boston Celtics     162
24  Chris McCullough   21   1140240.0   Brooklyn Nets     162
25       Willie Reed   26    947276.0   Brooklyn Nets     174

Position: C
               Name  Age      Salary           Team  Height
7      Kelly Olynyk   25   2165160.0  Boston Celtics     153
10  Jared Sullinger   24   2569260.0  Boston Celtics     178
14     Tyler Zeller   26   2616975.0  Boston Celtics     160
23      Brook Lopez   28  19689000.0   Brooklyn Nets     177
27       Henry Sims   26    947276.0   Brooklyn Nets     171
```

In [43]:
```
# Visualization: Bar plot of employee counts based on position

plt.figure(figsize=(12, 6), dpi=100)
sns.barplot(x=position_distribution["Position"],
            y=position_distribution["Employee Count"], palette="coolwarm")
plt.title("Employee Distribution Based on Positions", fontsize=18, color="blue")
plt.xlabel("Position",fontsize=12,color="blue")
plt.ylabel("Number of Employees",fontsize=12,color="blue")
plt.xticks(rotation=45, ha="right")
plt.show()
```



In [89]:
```
# Calculate the percentage distribution of employees across positions
position_percentages = (position_counts / len(data)) * 100

# Create a pie chart for the percentage distribution
plt.figure(figsize=(8, 8), dpi=100)
colors = sns.color_palette("coolwarm", len(position_percentages))
plt.pie(position_percentages, labels=position_percentages.index,
        autopct="%1.1f%%", colors=colors,
        startangle=90, textprops={"fontsize": 12})
plt.title("Percentage Distribution of Employees Across Positions",
          fontsize=18, color="blue")
plt.show()
```



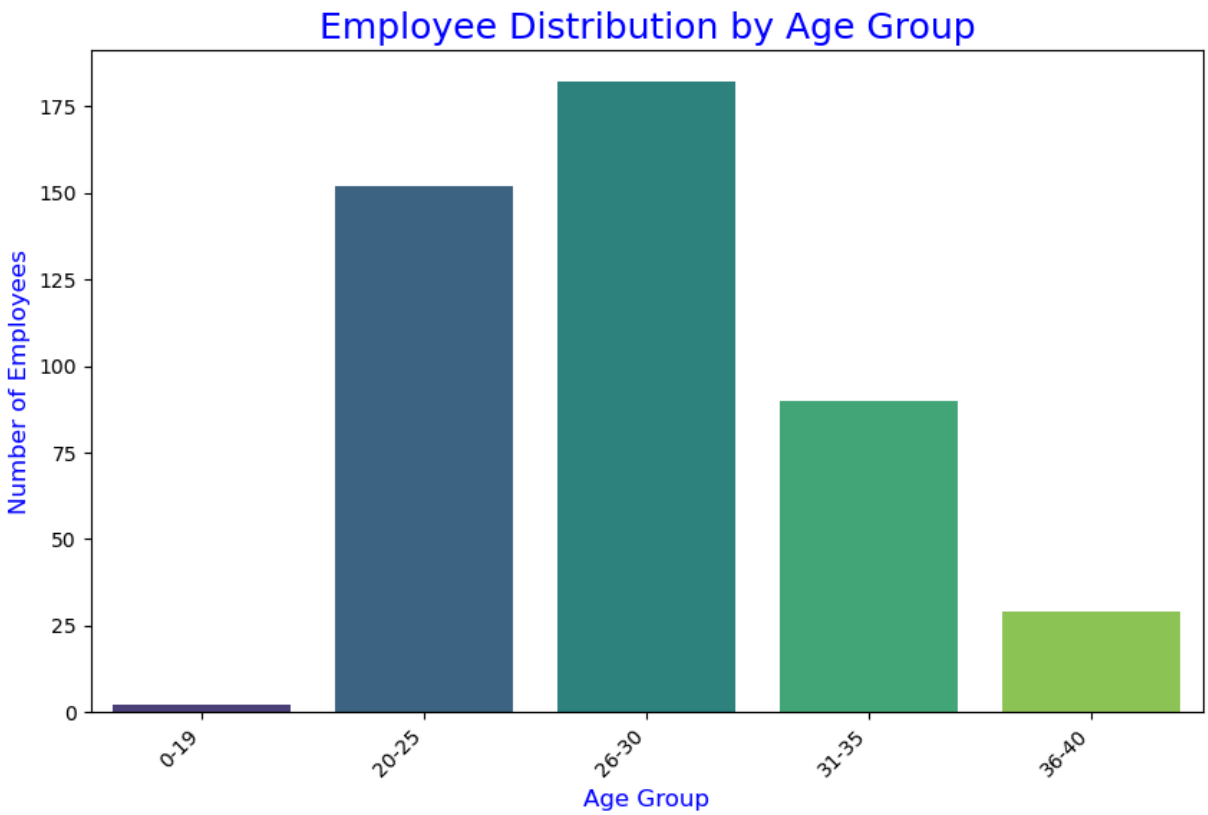
3. Identify the predominant age group among employees.

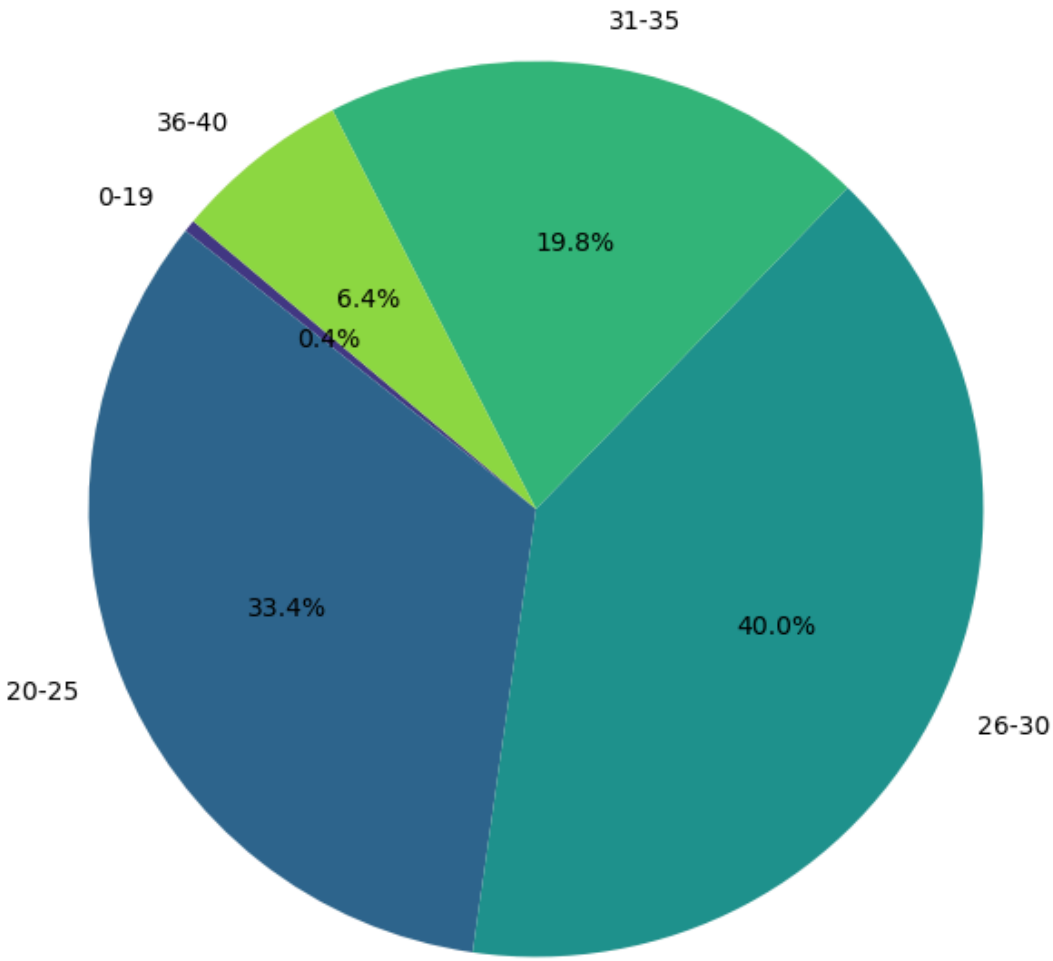
In [46]:
```
# Define the age bins and corresponding labels
age_bins = [0, 20, 25, 30, 35, 40]  # Age bins
age_labels = ["0-19", "20-25", "26-30", "31-35", "36-40"]  # Labels for the bins

# Create a temporary 'Age Group' variable based on 'Age' without modifying the orig
temp_age_group = pd.cut(data["Age"], bins=age_bins, labels=age_labels, right=False)

# Count the number of employees in each age group using the temporary 'Age Group' v
age_group_counts = temp_age_group.value_counts().sort_index()
age_group_counts.name = "Age Distribution"

# Display the distribution of employees across age groups
print(age_group_counts)
```

```
#identify and display the predominant age group
predominant_age_group = age_group_counts.idxmax()
predominant_count = age_group_counts.max()

# Display the predominant age group and the count of employees in that group
print(f"\nPredominant Age Group: {predominant_age_group} with {predominant_count} e
```

```
Age
0-19       2
20-25    152
26-30    182
31-35     90
36-40     29
Name: Age Distribution, dtype: int64

Predominant Age Group: 26-30 with 182 employees
```

In [48]:
```
# Visualization

# Create a barplot for the distribution of employees by age group
plt.figure(figsize=(10, 6), dpi=100)
sns.barplot(x=age_group_counts.index, y=age_group_counts.values, palette="viridis")
plt.title("Employee Distribution by Age Group", fontsize=18, color="blue")
plt.xlabel("Age Group", fontsize=12,color = "blue")
plt.ylabel("Number of Employees", fontsize=12,color = "blue")
plt.xticks(rotation=45, ha = "right")
plt.show()

# Create a pie chart for the percentage distribution of employees by age group
plt.figure(figsize=(8, 8), dpi=100)
plt.pie(age_group_counts, labels=age_group_counts.index, autopct="%1.1f%%",
        startangle=140, colors=sns.color_palette("viridis", len(age_group_counts)))
plt.title("Percentage Distribution of Employees by Age Group", fontsize=18, color="
plt.show()
```


Employee Distribution by Age Group
Number of Employees
0
25
50
75
100
125
150
175
0-19
20-25
26-30
31-35
36-40
Age Group



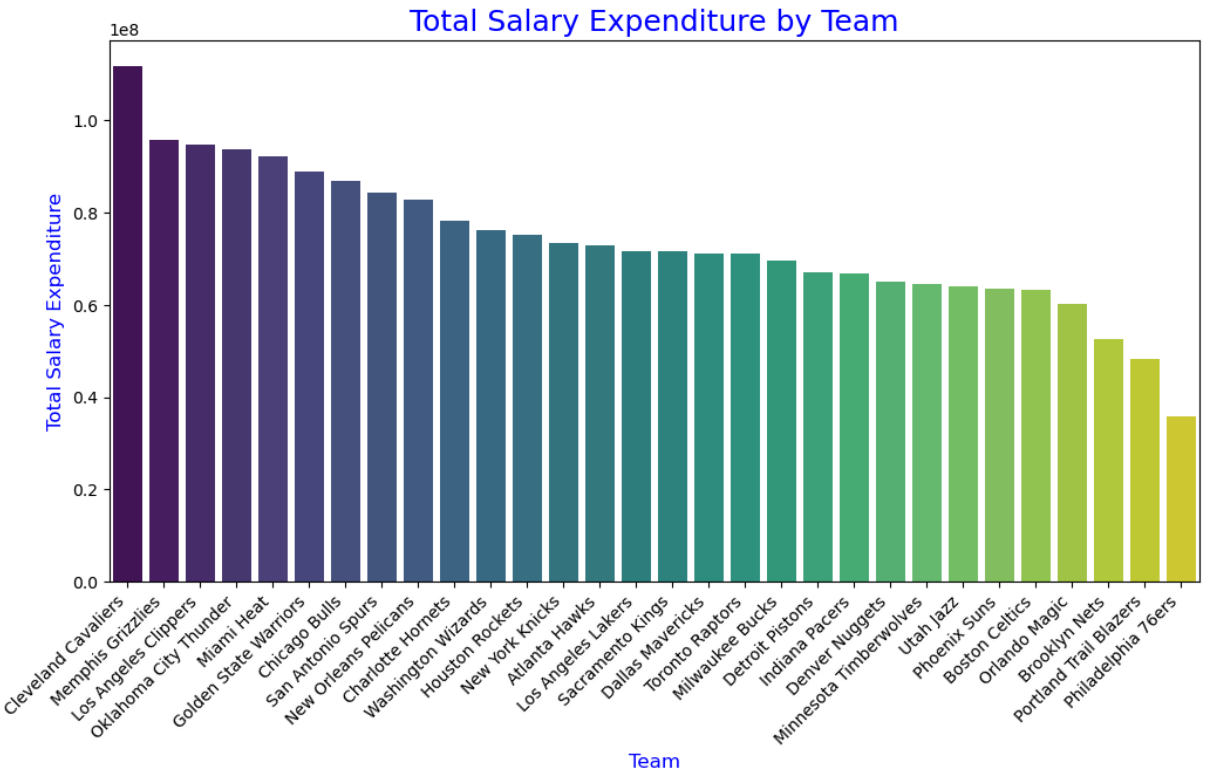
4. Discover which team and position have the highest salary expenditure.

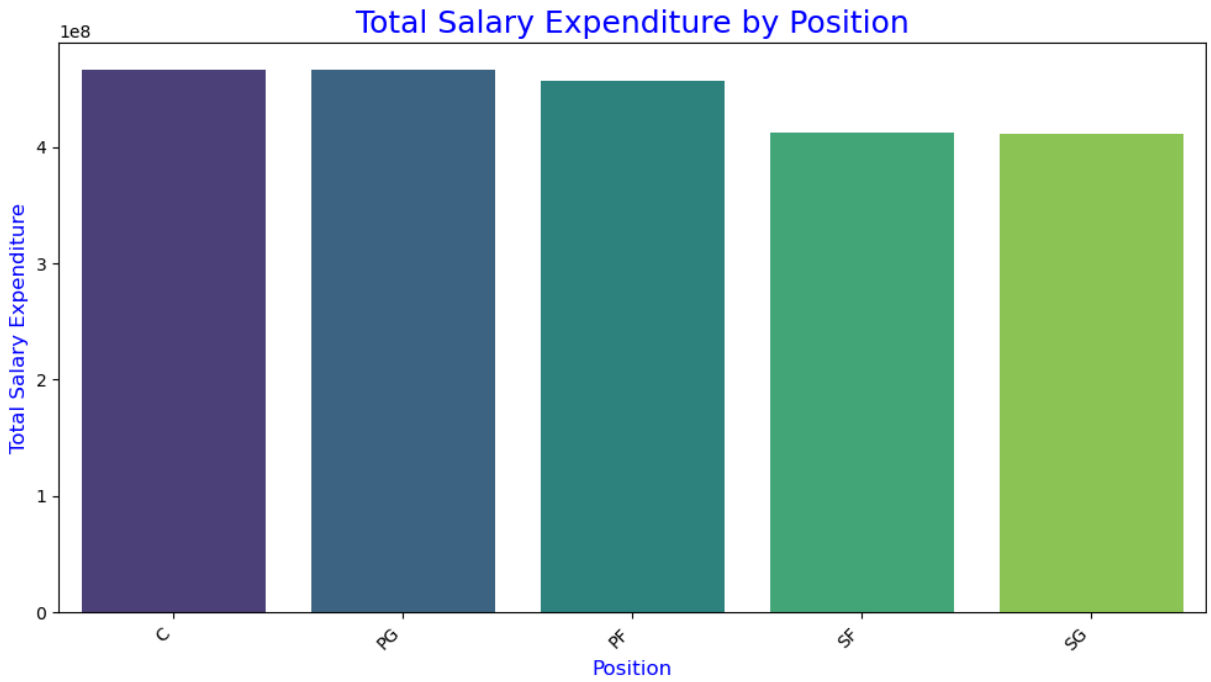
In [53]:
```
# Calculate total salary expenditure by team
team_salary_expenditure = data.groupby("Team")["Salary"].sum().sort_values(ascendin
team_salary_expenditure.name = "Team Salary"

# Calculate total salary expenditure by position
position_salary_expenditure = data.groupby("Position")["Salary"].sum().sort_values(
position_salary_expenditure.name = "Position Salary"

# Find the team and position with the highest salary expenditure
highest_team_salary = team_salary_expenditure.idxmax()
highest_position_salary = position_salary_expenditure.idxmax()

#Display the Result
```

```
print("TOTAL SALARY EXPENDITURE BY TEAM")
print(team_salary_expenditure,"\n")
print(f"Team with the highest salary expenditure:{highest_team_salary} (${team_sala

print("TOTAL SALARY EXPENDITURE BY POSITION")
print(position_salary_expenditure,"\n")
print(f"Position with the highest salary expenditure:{highest_position_salary} (${p
```

```
TOTAL SALARY EXPENDITURE BY TEAM
Team
Cleveland Cavaliers       1.118227e+08
Memphis Grizzlies         9.588676e+07
Los Angeles Clippers      9.485464e+07
Oklahoma City Thunder     9.376530e+07
Miami Heat                9.218361e+07
Golden State Warriors     8.886900e+07
Chicago Bulls             8.678338e+07
San Antonio Spurs         8.444273e+07
New Orleans Pelicans      8.275077e+07
Charlotte Hornets         7.834092e+07
Washington Wizards        7.632864e+07
Houston Rockets           7.528302e+07
New York Knicks           7.330390e+07
Atlanta Hawks             7.290295e+07
Los Angeles Lakers        7.177043e+07
Sacramento Kings          7.168367e+07
Dallas Mavericks          7.119873e+07
Toronto Raptors           7.111761e+07
Milwaukee Bucks           6.960352e+07
Detroit Pistons           6.716826e+07
Indiana Pacers            6.675183e+07
Denver Nuggets            6.495590e+07
Minnesota Timberwolves    6.454367e+07
Utah Jazz                 6.400737e+07
Phoenix Suns              6.344514e+07
Boston Celtics            6.337504e+07
Orlando Magic             6.016147e+07
Brooklyn Nets             5.252848e+07
Portland Trail Blazers    4.830182e+07
Philadelphia 76ers        3.582686e+07
Name: Team Salary, dtype: float64

Team with the highest salary expenditure:Cleveland Cavaliers ($111,822,658.55)

TOTAL SALARY EXPENDITURE BY POSITION
Position
C     4.663773e+08
PG    4.661848e+08
PF    4.570628e+08
SF    4.128549e+08
SG    4.114782e+08
Name: Position Salary, dtype: float64

Position with the highest salary expenditure:C ($466,377,332.00)
```

In [55]:
```
# Visualizing salary expenditure by team
plt.figure(figsize=(12, 6), dpi=100)
sns.barplot(x=team_salary_expenditure.index,
            y=team_salary_expenditure.values, palette='viridis')
plt.title("Total Salary Expenditure by Team", fontsize=18, color='blue')
plt.xlabel("Team", fontsize=12,color = "blue")
plt.ylabel("Total Salary Expenditure", fontsize=12, color = "blue")
plt.xticks(rotation=45, ha = "right")
plt.show()

# Visualizing salary expenditure by position
plt.figure(figsize=(12, 6), dpi=100)
sns.barplot(x=position_salary_expenditure.index,
            y=position_salary_expenditure.values, palette='viridis')
plt.title("Total Salary Expenditure by Position", fontsize=18, color='blue')
plt.xlabel("Position", fontsize=12, color = "blue")
plt.ylabel("Total Salary Expenditure", fontsize=12, color = "blue")
plt.xticks(rotation=45, ha = "right")
plt.show()
```



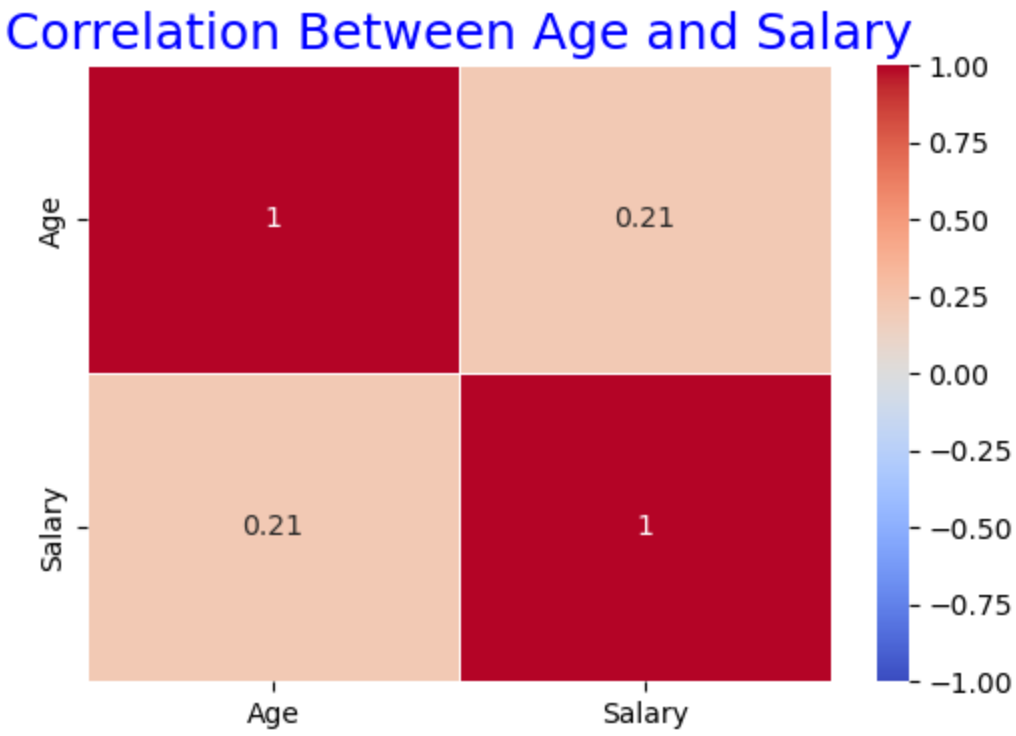


5. Investigate if there's any correlation between age and salary, and represent it visually.

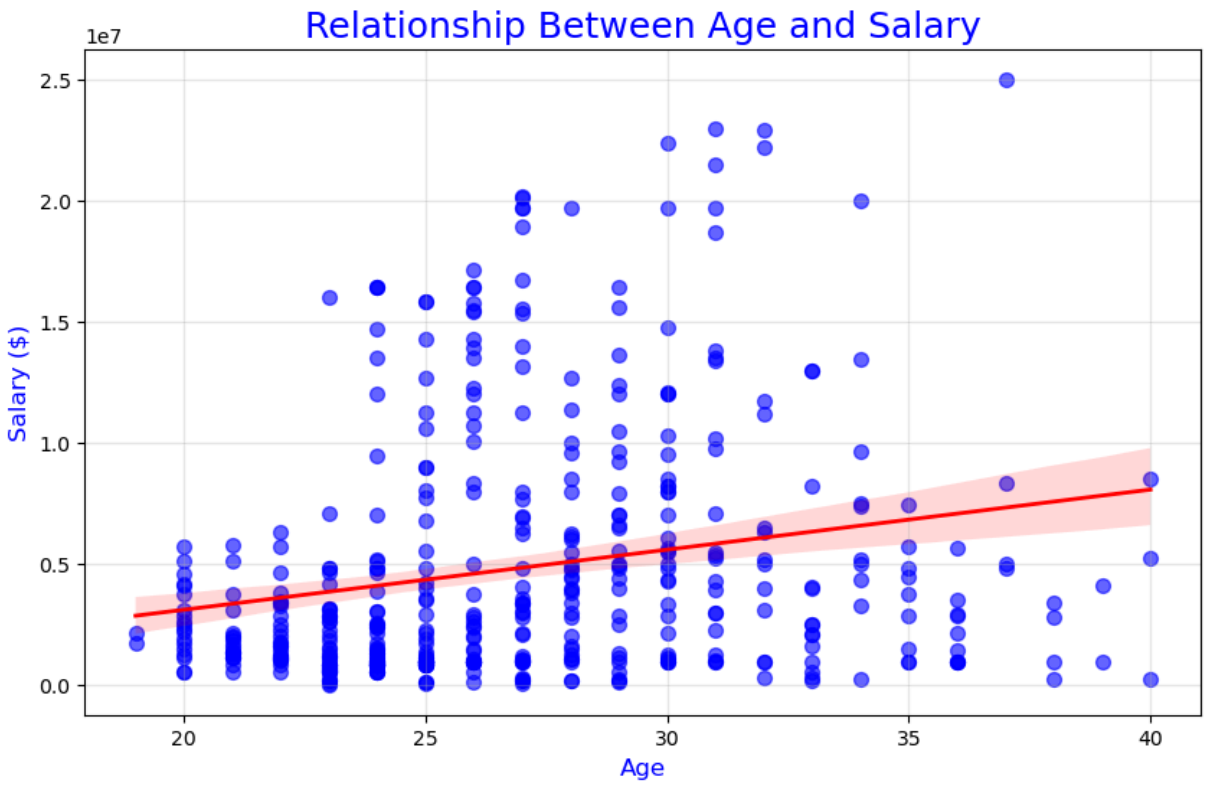
In [58]:
```
# Calculate the correlation between 'Age' and 'Salary'
correlation = data["Age"].corr(data["Salary"])
print(f"Correlation between Age and Salary: {correlation:.2f}")

# Determine the type of correlation
if correlation > 0:
    correlation_type = "Positive Correlation"
elif correlation < 0:
    correlation_type = "Negative Correlation"
else:
    correlation_type = "No Correlation"

# Print the correlation type
print(f"The correlation between Age and Salary is: {correlation_type}")
```

```
Correlation between Age and Salary: 0.21
The correlation between Age and Salary is: Positive Correlation
```

In [60]:
```
# Calculate the correlation matrix between Age and Salary
correlation_matrix = data[["Age", "Salary"]].corr()

# Plot a heatmap of the correlation matrix
plt.figure(figsize=(6, 4))
sns.heatmap(correlation_matrix, annot=True,
            cmap="coolwarm", linewidths=0.5, vmin=-1, vmax=1)
plt.title("Correlation Between Age and Salary", fontsize=18, color="blue")
plt.show()
```



In [62]:
```
# Create a scatter plot with a regression (trend) line
plt.figure(figsize=(10, 6), dpi=100)  # Set the figure size
sns.regplot(x=data["Age"], y=data["Salary"],
            scatter_kws={"color": "blue", "s": 50, "alpha": 0.6},
            line_kws={"color": "red", "linewidth": 2})
plt.title("Relationship Between Age and Salary", fontsize=18, color='blue')
plt.xlabel("Age", fontsize=12, color = "blue")
plt.ylabel("Salary ($)", fontsize=12, color = "blue")
plt.grid(alpha=0.3)
plt.show()
```



PROJECT OVERVIEW

PROPROCESSING

1. Cleaning the "Height" Column

* **Objective:** Ensure that the "height" column contains valid values by replacing any incorrect or inconsistent values with random numbers between 150 and 180.

* **Action:** Identify any invalid height data (e.g., outliers, missing values) and replace them with random values in the specified range.

2. Replacing Null Values in the Salary Column

*** Objective:** Handle missing data in the "salary" column by replacing any null or missing values with the mean salary of the entire dataset.

*** Action:**Calculate the mean salary of the non-null values and replace any missing salary values with this mean.

3. Data Validation and Cleaning

*** Objective:** Ensure the dataset is clean and consistent.

*** Action:**

- **Remove Duplicates:** Identify and remove any duplicate rows in the dataset.
- **Check for Inconsistent Data:** Validate that all columns have consistent data types and correct any anomalies (e.g., text values in numeric columns).
- **Fix Incorrect Data:** Identify and correct any data inconsistencies in other columns (such as negative ages or salaries

ies).

ANALYSIS AND INSIGHTS

1. Distribution of Players Across Teams

* **Objective:** To analyze how players are distributed across different teams and calculate their percentage distribution relative to the total number of players.

* **Insight:** This analysis will help in understanding the team structure and the proportion of players in each team. By identifying the team with the highest number of players, we can highlight which team is most represented in the dataset.

* **Visualization:** A bar chart or pie chart will be used to visualize the distribution of players across different teams, with each teams player count and percentage share displayed.

2. Segregation of Players by Position

* **Objective:** To segregate players based on their position and understand the overall positional breakdown

* **Insight:** Positional roles like "Shooting Guard (SG)" and "Power Forward (PF)" were dominant, while specialized roles such as "Center (C)" had fewer players.

* **Visualization:** A bar chart or pie chart will display the count of players in each position, providing a clear view of position distribution.

3. Predominant Age Group

*** Objective:** To identify the predominant age group among players, understanding which age range has the highest number of players.

*** Insight:** By categorizing players into age groups, we can identify demographic trends within the organization. The majority of players belonged to the 20-30 age group.

*** Visualization:** A bar chart or pie chart will be used to visualize the distribution of players across different age groups, helping to identify the most prominent age group.

4. Salary Analysis by Team and Position

*** Objective:** To analyze the salary expenditure across different teams and positions, identifying which teams and positions have the highest salary expenditures.

*** Insight:** The Cleveland Cavaliers had the highest salary expenditure. Among the positions, "Center (C)" and "Point Guard (PG)" received the highest salary allocations.

*** Visualization:** A grouped bar chart compared team wise and position wise salary expenditure

5. Correlation Between Age and Salary

* **Objective:** To investigate if there is any correlation between player age and salary

* **Insight:** A weak positive correlation was observed, suggesting that salary increased marginally with age, though the relationship was not substantial.

* **Visualization:** The relationship between age and salary will be visualized using a scatter plot, with age on the x-axis and salary on the y-axis. A trend line will be included to highlight the strength and direction of the correlation. Additionally, a heatmap will be used to visualize the correlation matrix, allowing for a clearer understanding of the relationships between multiple variables in the dataset.

FURTHER STEPS FOR ANALYSIS

To expand on the current analysis and gain deeper insights, the following advanced steps can be undertaken:

1. Performance Metrics Analysis Analyze player performance using key metrics such as points per game, assists, rebounds, and defensive stats. Investigate how

these performance indicators correlate with salary, team success, and position.

2. Geographical Analysis Explore the geographic distribution of players (e.g., where players are from, college affiliation) and assess whether there are any notable patterns or trends related to player success or salary.

3. Salary vs Experience Investigate the relationship between player experience (e.g., years in the league) and salary. This analysis will help determine if more experienced players tend to earn higher salaries or if other factors such as position or team play a larger role.

4. Advanced Predictive Modeling Implement predictive models (e.g., linear regression, random forest, or machine learning algorithms) to estimate player salaries based on factors such as age, position, experience, and performance metrics. This will allow for better salary prediction and player valuation.

5. Advanced Visualization Utilize more advanced visualization techniques like heatmaps, pair plots, and 3D visualizations to better understand complex relationships between multiple variables, providing a

more intuitive understanding of salary distribution, player performance, and team dynamics.

6. Player Value Analysis Combine various performance metrics and salary data to assess the overall value of players to their teams. This could help identify underpaid players who are outperforming their salary expectations and vice versa.
These advanced steps will allow for a more comprehensive analysis of the dataset, uncovering deeper insights and enabling more informed decision-making for team management, salary allocations, and player development.

CONCLUSION

This project involved a detailed analysis of the employee dataset, focusing on salary distribution, team composition, and player demographics. Key insights revealed that teams like the Cleveland Cavaliers had the highest salary expenditure, with a concentration of players in the 20-30 age group. The analysis also highlighted weak correlations between age and salary, suggesting that other factors, such as

position and experience, play a more significant role in salary determination.