Least Square **Method**

i. Find and print the slope and intercept by least square method.

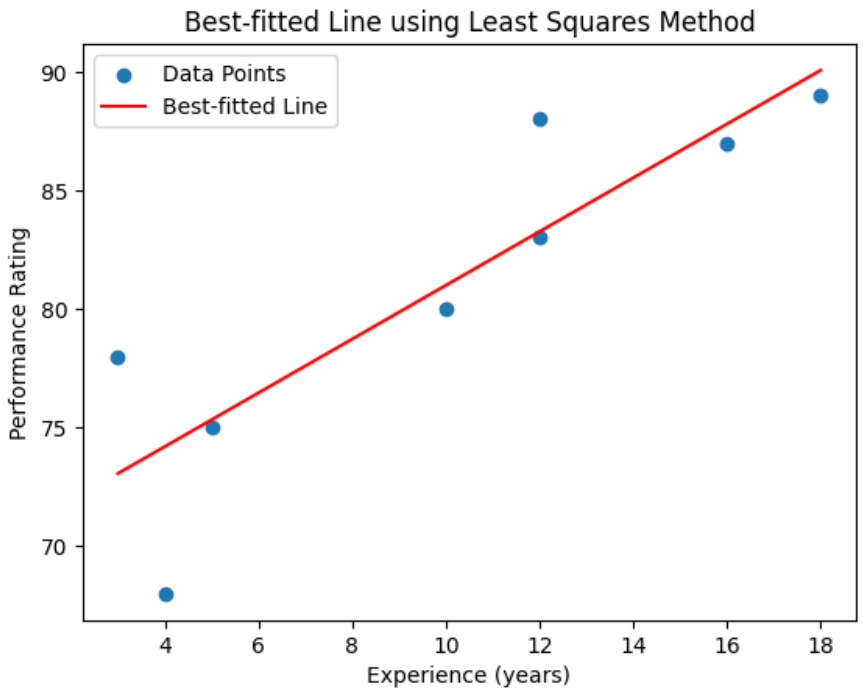
```
# Given data
experience = [16, 12, 18, 4, 3, 10, 5, 12]
performance_rating = [87, 88, 89, 68, 78, 80, 75, 83]

# Step 1: Calculate x^2 and x*y
x_squared = [x ** 2 for x in experience]
xy = [x * y for x, y in zip(experience, performance_rating)]

# Step 2: Calculate sum of x, y, x^2, and x*y
sum_x = sum(experience)
sum_y = sum(performance_rating)
sum_x_squared = sum(x_squared)
sum_xy = sum(xy)

# Step 3: Calculate slope (m)
N = len(experience)
slope = (N * sum_xy - sum_x * sum_y) / (N * sum_x_squared - sum_x ** 2)

# Step 4: Calculate intercept (b)
intercept = (sum_y - slope * sum_x) / N

# Step 5: Assemble the equation of the line
equation = f"y = {slope:.2f}x + {intercept:.2f}"

# Print the results
print("Slope (m):", slope)
print("Intercept (b):", intercept)
print("Equation of the line:", equation)

```

```
Slope (m): 1.1330275229357798
Intercept (b): 69.6697247706422
Equation of the line: y = 1.13x + 69.67
```

ii. Plot the best-fitted line using least square method

```
import matplotlib.pyplot as plt
# Create a range of x values for the line
x_range = np.linspace(min(experience), max(experience), 100)
```

```
# Calculate corresponding y values using the equation of the line
y_range = slope * x_range + intercept

# Plot the data points and the best-fitted line
plt.scatter(experience, performance_rating, label='Data Points')
plt.plot(x_range, y_range, color='red', label='Best-fitted Line')
plt.xlabel('Experience (years)')
plt.ylabel('Performance Rating')
plt.title('Best-fitted Line using Least Squares Method')
plt.legend()
plt.grid(False)
plt.show()

```



iii. Estimate the performance rating for a Faculty with 20 years of experience

```
# Experience for which we want to estimate the performance rating
experience_new = 20

# Calculate the estimated performance rating using the equation of the line
performance_rating_estimated = slope * experience_new + intercept

```

```
# Print the estimated performance rating
print("Estimated performance rating for a faculty with 20 years of experience:", performance_rating_estimated)

```

```
Estimated performance rating for a faculty with 20 years of experience: 92.3302752293578
```

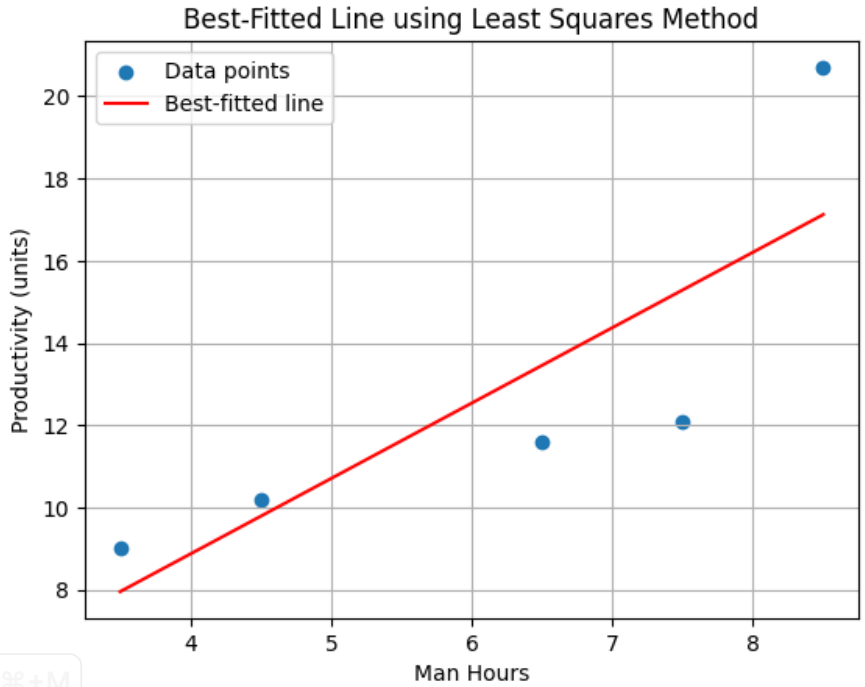
Additionalquestions

```
#i. Find out the value of a and b.

import numpy as np

# Given data
man_hours = np.array([3.5, 4.5, 6.5, 7.5, 8.5])
productivity = np.array([9, 10.2, 11.6, 12.1, 20.7])

# Calculate the values needed for least squares formula
n = len(man_hours)
sum_x = np.sum(man_hours)
sum_y = np.sum(productivity)
sum_xy = np.sum(man_hours * productivity)
sum_x_squared = np.sum(man_hours ** 2)

# Calculate the slope (b) and intercept (a)
b = (n * sum_xy - sum_x * sum_y) / (n * sum_x_squared - sum_x ** 2)
a = (sum_y - b * sum_x) / n

print("Intercept (a):", a)
print("Slope (b):", b)

```

```
Intercept (a): 1.5343023255813748
Slope (b): 1.8337209302325612
```

```
#ii. Plot the best-fitted line using least square method.

import numpy as np
import matplotlib.pyplot as plt

# Given data
man_hours = np.array([3.5, 4.5, 6.5, 7.5, 8.5])
productivity = np.array([9, 10.2, 11.6, 12.1, 20.7])

# Calculate the values needed for least squares formula
n = len(man_hours)
sum_x = np.sum(man_hours)
sum_y = np.sum(productivity)
sum_xy = np.sum(man_hours * productivity)
```

```
sum_xy = np.sum(man_hours * productivity)
sum_x_squared = np.sum(man_hours ** 2)

# Calculate the slope (b) and intercept (a)
b = (n * sum_xy - sum_x * sum_y) / (n * sum_x_squared - sum_x ** 2)
a = (sum_y - b * sum_x) / n

# Generate points for the best-fitted line
x_values = np.linspace(min(man_hours), max(man_hours), 100)
y_values = a + b * x_values

# Plot the original data points and the best-fitted line
plt.scatter(man_hours, productivity, label='Data points')
plt.plot(x_values, y_values, color='red', label='Best-fitted line')

plt.xlabel('Man Hours')
plt.ylabel('Productivity (units)')
plt.title('Best-Fitted Line using Least Squares Method')
plt.legend()
plt.grid()
plt.show()

```



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