$$\beta_1 = \frac{ss_{xy}}{ss_{xx}}$$

$$\beta_0 = \bar{y} - \beta_1 \bar{x}$$

$$ss_{xy} = \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n} y_i x_i - n\bar{x}\,\bar{y}$$

$$ss_{xy} = \sum_{i=1}^{n} (x_i - \bar{x})^2 = \sum_{i=1}^{n} {x_i}^2 - n(\bar{x})^2$$

Double-click (or enter) to edit

```
import numpy as nmp
import matplotlib.pyplot as mtplt

def estimate_coeff(p, q):
# Here, we will estimate the total number of points or observation
    n1 = nmp.size(p)
# Now, we will calculate the mean of a and b vector
    m_p = nmp.mean(p)
    m_q = nmp.mean(q)

# here, we will calculate the cross deviation and deviation about a
    SS_pq = nmp.sum(q * p) - n1 * m_q * m_p
    SS_pp = nmp.sum(p * p) - n1 * m_p * m_p

# here, we will calculate the regression coefficients
    b_1 = SS_pq / SS_pp
    b_0 = m_q - b_1 * m_p

    return (b_0, b_1)

```

```
def plot_regression_line(p, q, b):
# Now, we will plot the actual points or observation as scatter plot
    mtplt.scatter(p, q, color = "m",
            marker = "o", s = 30)

# here, we will calculate the predicted response vector
    q_pred = b[0] + b[1] * p

# here, we will plot the regression line
    mtplt.plot(p, q_pred, color = "g")

# here, we will put the labels
    mtplt.xlabel('p')
    mtplt.ylabel('q')
```

```

# here, we will define the function to show plot
    mtplt.show()

```

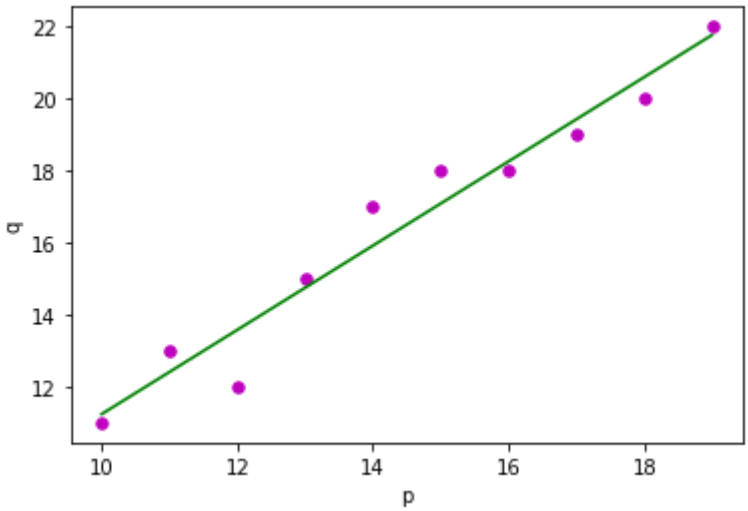
```
def main():
# entering the observation points or data
    p = nmp.array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
    q = nmp.array([11, 13, 12, 15, 17, 18, 18, 19, 20, 22])

# now, we will estimate the coefficients
    b = estimate_coeff(p, q)
    print("Estimated coefficients are :\nb_0 = {},nb_1 = {}".format(b[0], b[1])

# Now, we will plot the regression line
    plot_regression_line(p, q, b)

if __name__ == "__main__":
    main()
```

```
Estimated coefficients are :
b_0 = -0.4606060606060609,nb_1 = 1.1696969696969697
```




```
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```

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