Yadanabon University Research Journal, 2019, Vol-10, No.1

Application of Least Squares Method Finding the Number of Entrance for the Mathematics Students in Yadanabon University

Thidar Lynn*

Abstract

Firstly, we collect, organize and summarize the data from 2013-2014 to 2018-2019 academic years for the entrance of mathematics students. Next, we apply the least squares method and derive the normal line. Finally, we calculate the number for the next 2019-2020 and 2020-2021 academic years.

Introduction

Usually a mathematical equation is fitted to experimental data by plotting the data on a graph paper and then passing a straight line through the data points. The method has the obvious draw back in that the straight line drawn may not be unique. The method of least squares is probably the most systematic procedure to fit a unique curve through given data points and is widely used in practical computations. It can also be easily implemented on a digital computer. This method is the most commonly applied technique in numerical analysis and statistics.

Least Squares Principle

The straight line should be fitted through the given points so that the sum of the squares of the distance of those points from the straight line is minimum, where the distance is measured in the vertical direction (the y-direction).

We have to find the straight line $y = a + bx$ through the given points $(x_1,y_1),(x_2,y_2),\ldots,(x_n,y_n)$ so that the sum of the squares of the distances of those points from the straight line is minimum, where the distance is measured in the vertical direction.

The point on the line with x_j has the ordinate $a + bx_j$. Hence its distance from (x_j,y_j) is $\left|y_j - a - bx_j\right|$ and that sum of squares is

$$q = \sum_{j=1}^{n}(y_j - a - bx_j)^2$$

q depends on a and b.

A necessary condition for q to be minimum is

$$\frac{\partial q}{\partial a} = -2\sum_{j=1}^{n}(y_j - a - bx_j) = 0$$

$$\frac{\partial q}{\partial b} = -2\sum_{j=1}^{n}x_j(y_j - a - bx_j) = 0$$

Then we obtain the result.

* Assistant Lecturer, Dr., Department of Mathematics, Yadanabon University

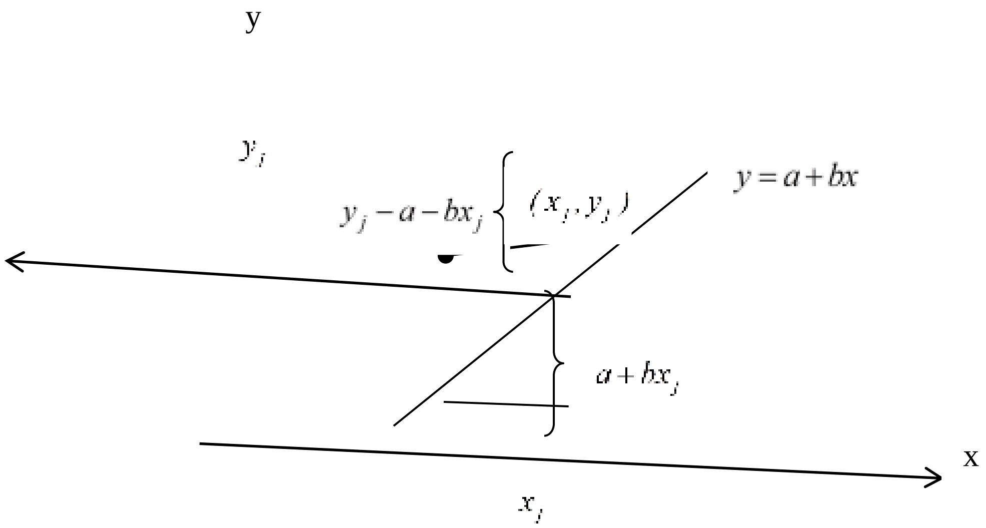

Figure (1)

$$ax + b\sum_{j=1}^{n} x_j = \sum_{j=1}^{n} y_j$$

$$a\sum_{j=1}^{n} x_j + b\sum_{j=1}^{n} x_j^2 = \sum_{j=1}^{n} x_j y_j$$

These equations are normal equations of our problem.

The following table is the number of entrance of mathematics students of Yadanabon University for corresponding academic years.

Academic Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
No. of students	489	418	535	498	551	520

By taking the points (1, 489),(2, 418),(3, 535),(4, 498),(5, 551) and (6,520), we obtain
$6a + 21b = 3{,}011$ and
$21a + 91b = 10{,}797$.
From these equations, we obtain
$a = 450.1$
$b = 14.77$.
Thus we get the least square line
$y = 450.1 + 14.77x$.

Yadanabon University Research Journal, 2019, Vol-10, No.1

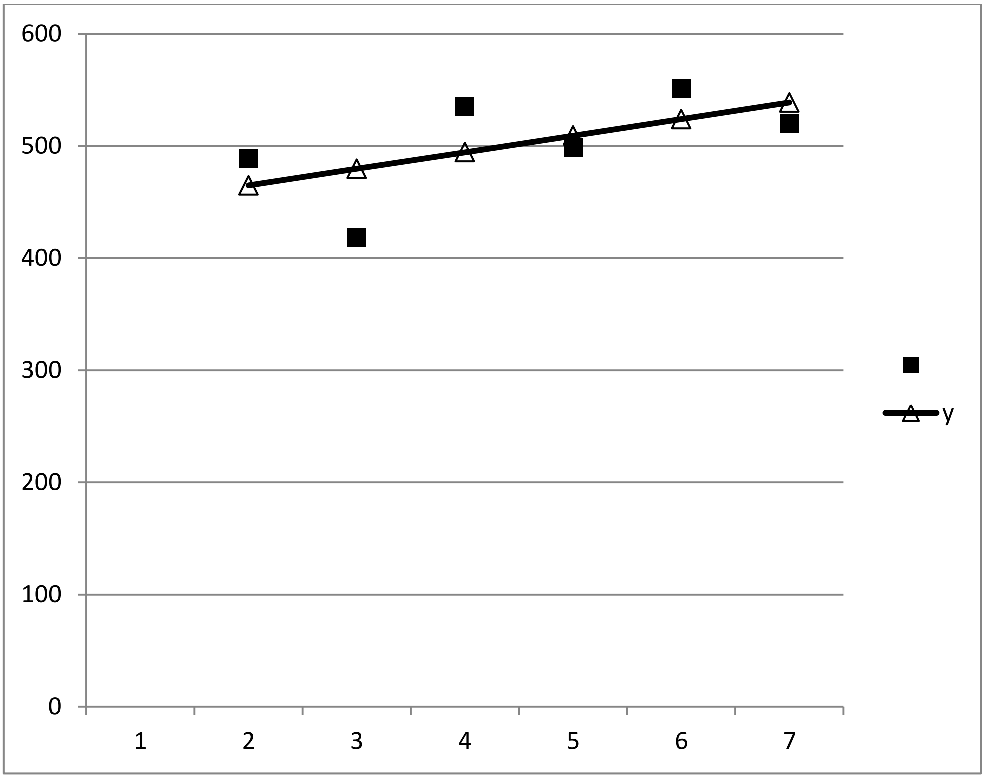

Figure (2)

If $x = 7$,

$y = 450.1 + 14.77(7)$

$= 553.49$

$\approx 554.$

This is the number of entrance of mathematics students of Yadanabon University for 2019-2020 academic year.

If $x = 8$,

$y = 450.1 + 14.77(8)$

$\approx 563.$

This is the number of entrance of mathematics students of Yadanabon University for 2020-2021 academic year.

Sample Correlation Coefficient

The sample correlation coefficient r satisfies $-1 \le r \le 1$. In particular, $r = \pm 1$ if and only if the sample values lie on a straight line.

Now we have to check this number if it is fair or not.

Yadanabon University Research Journal, 2019, Vol-10, No.1

$$S_{xy} = \frac{1}{n-1}\left[\sum_{j=1}^{n} x_j y_j - \frac{1}{n}\left(\sum x_j\right)\left(\sum y_j\right)\right]$$

$$S_{x^2} = \frac{1}{n-1}\left[\sum_{j=1}^{n} x_j^{\,2} - \frac{1}{n}\left(\sum x_j\right)^2\right]$$

$$S_{y^2} = \frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^{\,2} - \frac{1}{n}\left(\sum y_j\right)^2\right]$$

$$r = \frac{S_{xy}}{S_x S_y}.$$

Given Value		Auxiliary Values		
x_j	y_j	x_j^2	y_j^2	$x_j y_j$
1	489	1	248,004	489
2	418	4	174,724	836
3	535	9	286,225	1605
4	498	16	248,004	1992
5	551	25	303,601	2755
6	520	36	270,400	3120
21	3011	91	1,522,075	10,797

$$S_{xy} = \frac{1}{n-1}\left[\sum_{j=1}^{n} x_j y_j - \frac{1}{n}\left(\sum x_j\right)\left(\sum y_j\right)\right]$$

$$= \frac{1}{5}\left[10797 - \frac{1}{6}\times 21\times 3011\right]$$

$$= 51.7$$

$$S_{x^2} = \frac{1}{n-1}\left[\sum_{j=1}^{n} x_j^{\,2} - \frac{1}{n}\left(\sum x_j\right)^2\right]$$

$$= \frac{1}{5}\left[91 - \frac{1}{6}\times 441\right]$$

$$= 3.5$$

$$S_{y^2} = \frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^{\,2} - \frac{1}{n}\left(\sum y_j\right)^2\right]$$

$$= \frac{1}{5}\left[1,522,075 - \frac{1}{6}\times (3011)^2\right]$$

$$= 2211$$

Yadanabon University Research Journal, 2019, Vol-10, No.1

$$r^2 = \frac{{S_{xy}}^2}{{S_x}^2{S_y}^2}$$

$$= \frac{(51.7)^2}{(3.5)(2211)}$$

$$= 0.345401$$

$$r = 0.587$$

$$r \approx 0.59$$

The number of entrance of mathematics students for the next academic year of Yadanabon University, will be corrected nearly 60%.

Conclusion

From this research we had known the number of entrance of the mathematics students of Yadanabon University for the coming academic years. So we are ready to prepare the number of class rooms and practical rooms. And also we can fill the number of teachers we need from workload in time.

Acknowledgements

I would like to express my heartfelt gratitude to Dr Maung Maung Naing, Rector, Dr Si Si Khin, Pro-Rector and Dr Tint Moe Thuzar, Pro-Rector, Yadanabon University for their permission to carry out the research and their encouragement. And then, I would like to thank Dr Win Kyaw, Professor and Head of Department of Mathematics, Dr Hla Win, Professor, Department of Mathematics and Dr Nan Mya Ngwe, Professor, Department of Mathematics, Yadanabon University for their exhortation and helpful comments on this research.

References

[1] Kreyszig, E., 2006. "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons. INC, Singapore.

[2] SASTRY, S.S., 1999. "Introductory Methods of Numerical Analysis", Third edition, Prentice hall of India, New Delhi.