



Business Management Toolkit

15. Simple Linear Regression (HL)

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15. Simple Linear Regression - Introduction

Regression models describe the relationship between variables by fitting a line to the observed data.

Linear regression models use a straight line. Regression allows you to estimate how a dependent variable changes as the independent variable(s) change.

Simple linear regression is used to estimate the relationship between two quantitative variables. e.g. How strong the relationship is between two variables or the value of the dependent variable at a certain value of the independent variable.

An example could be the independent variable to be price and the dependent variable to be sales revenue.

15. Simple Linear Regression - Application in business

Simple linear regression can be used in numerous business cases. Some examples:

- **Sales forecast:** if a company's sales have increased steadily every month for the past few years, by conducting a linear analysis on the sales data with monthly sales, the company could forecast sales in future months.
- **Marketing effectiveness:** if a company has launched a product and has used google ads, it can analyse the relationship between the number of ads paid and the quantities sold
- **Risk assessment:** a bank can use simple linear regression to analyse the relationship between loans that are insolvent and specific characteristics of the businesses that are insolvent (e.g. size of business) in order to assess the risk for loan provision



15. Simple Linear Regression

According to the IB syllabus, we are going to focus on the following three linked aspects of the simple linear regression:

- **Scatter diagrams**
- **Line of best fit**
- **Correlation / Extrapolation**



15. Simple Linear Regression - Scatter diagrams

A scatter diagram is a tool for analysing the relationship between two variables and identifying how closely the two variables are related.

Scatter plots are a way of visualizing the relationship between the two variables;

One variable is plotted on the horizontal axis and the other is plotted on the vertical axis. By plotting the data points you get a scattering of points on a graph.

Correlation: Correlation looks at the strength of a relationship between two variables.

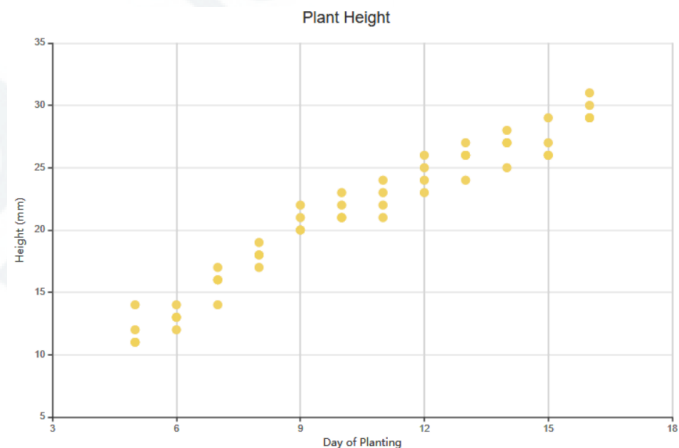
Exam tip! The big danger with correlation is of believing there is really a causal link between two variables when, in fact, they are not related.



15. Simple Linear Regression - Scatter diagrams & Correlation

How and how strongly the two variables are correlated depends on how the points are scattered on the diagram:

- Strong positive correlation:**
The value of Y increases as the value of X increases.

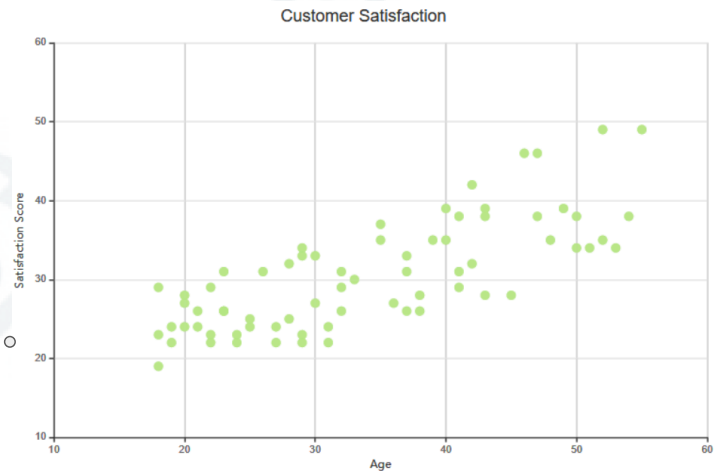


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15. Simple Linear Regression - Scatter diagrams & Correlation

2. Weak Positive correlation:
The value of Y increases slightly as the value of X increases.

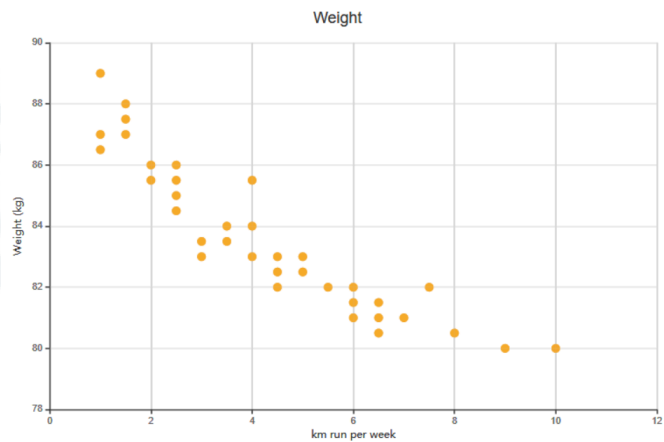


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15. Simple Linear Regression - Scatter diagrams & Correlation

3. Strong Negative correlation:
The value of Y increases slightly as the value of X increases.



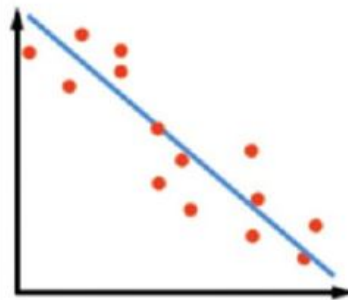
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15. Simple Linear Regression - Scatter diagrams & Correlation

4. Weak Negative correlation:

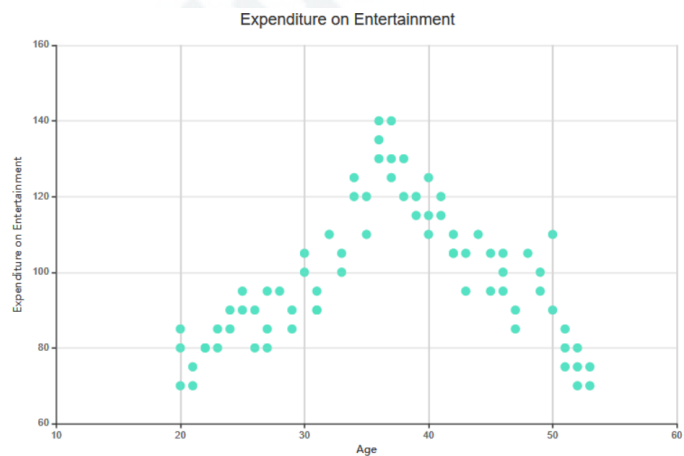
The value of Y decreases slightly as the value of X increases.



What do you observe?

15. Simple Linear Regression - Scatter diagrams & Correlation

5. Complex correlation: The value of Y seems to be related to the value of X, but the relationship is not easily determined.

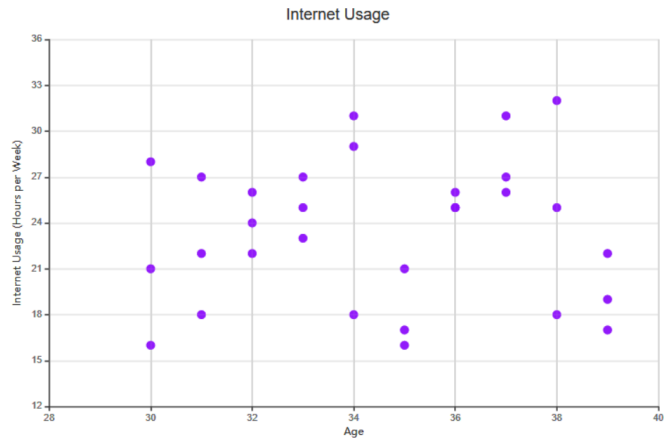


What do you observe?

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15. Simple Linear Regression - Scatter diagrams & Correlation

7. No correlation: There is no demonstrated connection between the two variables.

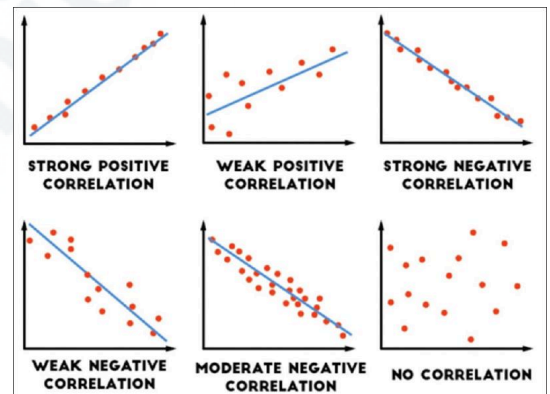


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15. Simple Linear Regression - Scatter diagrams - Evaluation

Advantages	Disadvantages
<ul style="list-style-type: none"> - Easy to create - Allows to quickly see the relation between the two variables 	<ul style="list-style-type: none"> - Difficult to show association between more than two variables - Overwhelming with large quantity of data



15. Simple Linear Regression - Line of best fit

A line of best fit is a straight line that minimizes the distance between it and some data.

The line of best fit is used to express a relationship between data points in a scatter diagram. On a scatter diagram, these points may or may not appear to be organized along a line.

If a linear pattern is apparent, it may be possible to sketch a line of best fit that minimizes the distance of those points from that line.

The line of best fit can be used as a prediction tool for indicators and price movements.



15. Simple Linear Regression - Line of best fit

Why is the line of best fit useful?

1. Summarizes data from a scatter diagram (offers an approximate description of the relationship between the data points).
2. Finds the trend of data (show the correlation between two variables: positive, negative, or zero).
3. Makes predictions for future data points (extrapolation)



15. Simple Linear Regression - Line of best fit

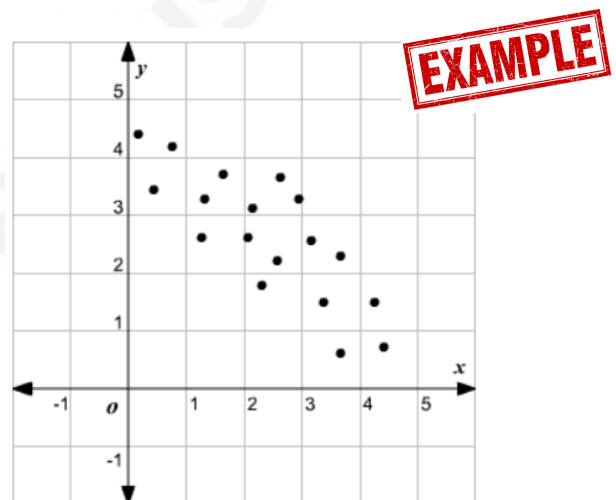


Activity: Observe the scatter diagrams of the previous slides and identify whether there could be a line of best fit.



15. Simple Linear Regression - Line of best fit

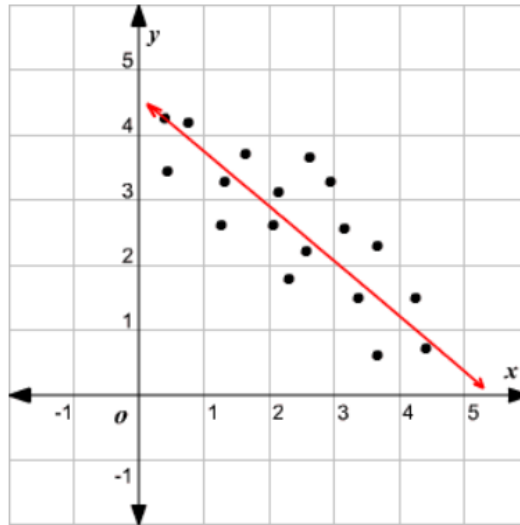
Exam Style Question: Draw a line of best fit for this scatter diagram. (2 marks)



15. Simple Linear Regression - Line of best fit

Answer: How to draw it? Tip!

Draw a line through the maximum number of points, balancing about an equal number of points above and below the line.



EXAMPLE

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15. Simple Linear Regression - Video

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15. Simple Linear Regression - Video

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15. Simple Linear Regression - Video

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15. Simple Linear Regression - Extrapolation

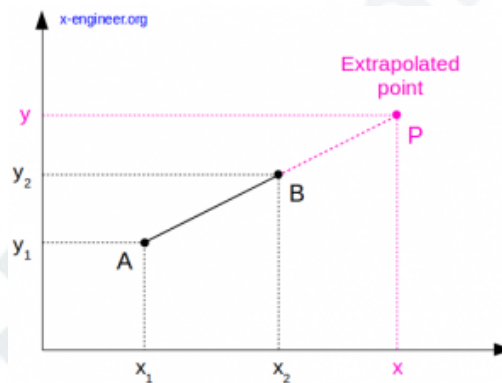
Extrapolation: Extrapolation involves the use of trends established by historical data to make predictions about future values.

The basic assumption of extrapolation is that the pattern will continue into the future. However, unpredictable factors may affect the future data, eventually.



15. Simple Linear Regression - Extrapolation

Extrapolation example: in the following diagram, if the line between A and B is the line of best fit in a scatter diagram then P is the extrapolated point



EXAMPLE



15. Simple Linear Regression - Evaluation of extrapolation

Advantages	Disadvantages
<ul style="list-style-type: none">- A simple method of forecasting- Not much data required	<ul style="list-style-type: none">- Could be unreliable if there are fluctuations in the past data- Assumes that the past trend will continue although there could be unpredictable factors in a market- Does not take into account qualitative aspects



Are you ready for the quizz?

- Do the quiz in the ibGenius platform
- You need 70% to pass!
- Then you are ready to move on to the next Business Management Tool!



15. Simple Linear Regression - References

<https://www.scribbr.com/statistics/simple-linear-regression/#:~:text=What%20is%20simple%20linear%20regression,Both%20variables%20should%20be%20quantitative.>

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