V37 - Simple Linear Regression - Part 2

- Correlation
- Properties of correlation coefficient
- Impact of outliers on the correlation coefficient

Course: Statistical Testing & Regression
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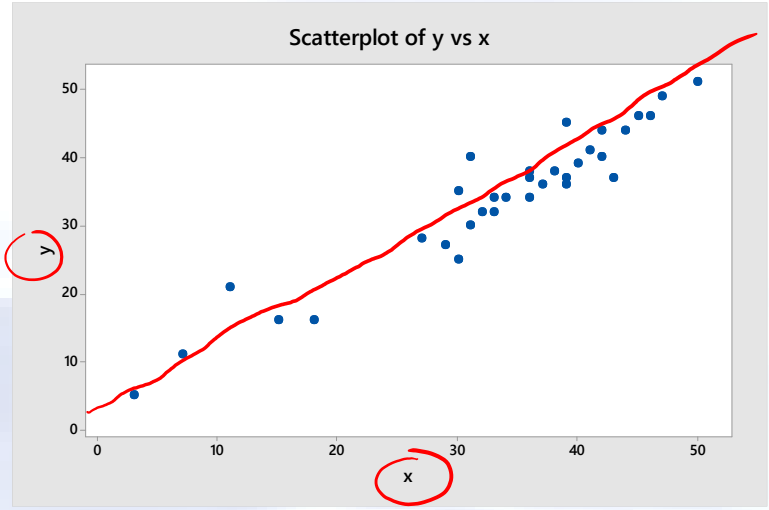
Correlation



- Correlation measures strength of **linear relationship** between two variables

- **Plot** data **first** to assess reasonableness of linearity

- Sample correlation coefficient denoted by _____

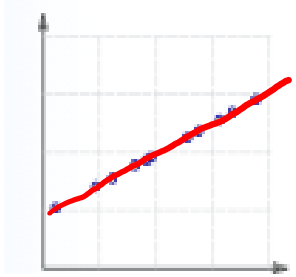
- *r* aka "Pearson Correlation Coefficient"

Properties of Correlation Coefficient *r*

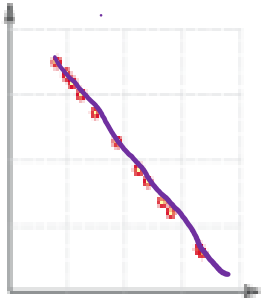
$$-1 \leq r \leq 1$$

Properties of Correlation Coefficient *r*

If $r = 1$ → all (x, y) pairs lie on straight line (with positive slope)

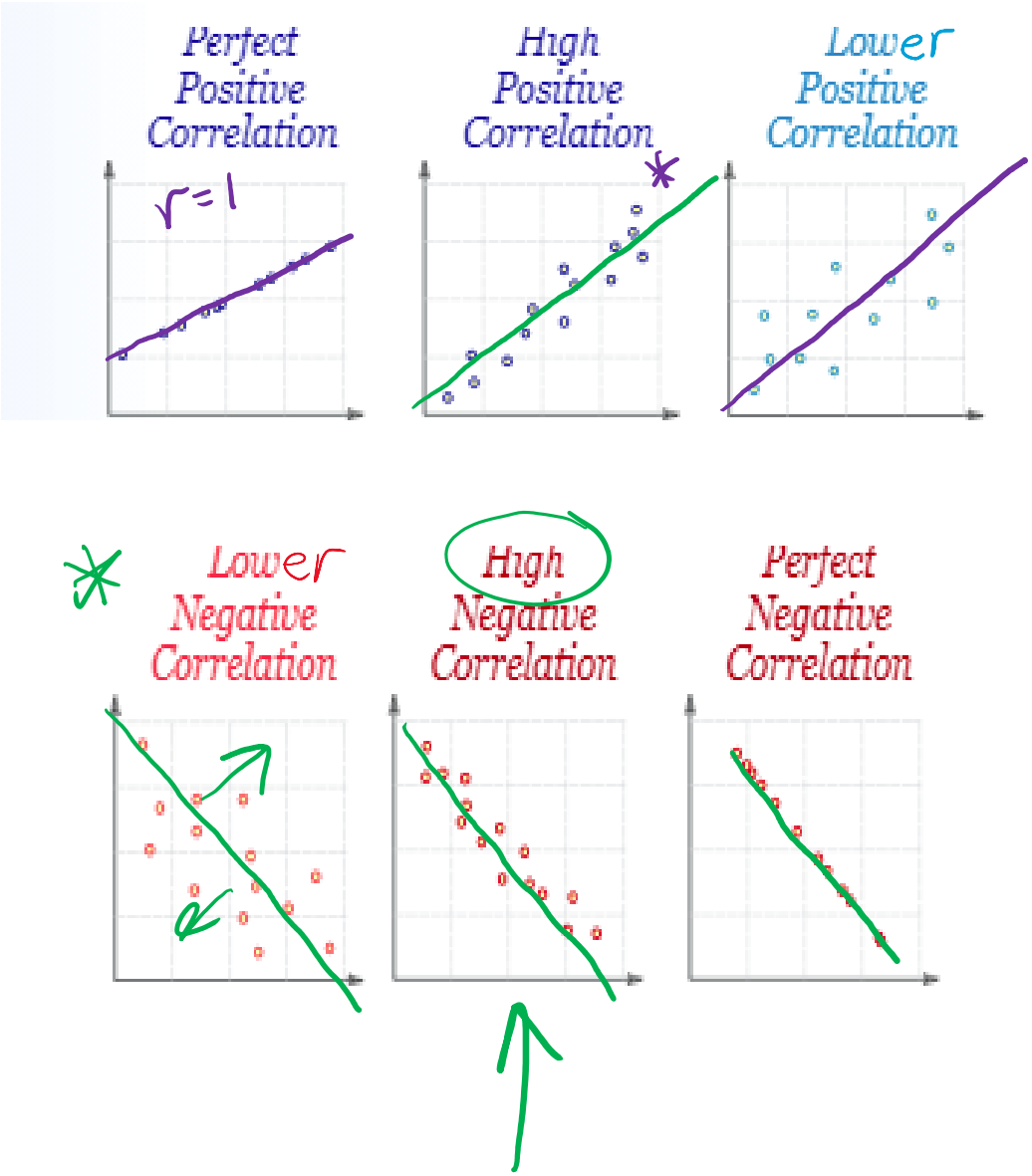


If $r = -1$ → all (x, y) pairs lie on a straight line (with negative slope)



- If $|r| = 1$ → *perfect linear relationship between x and y*
- If $r = 0$ → *no correlation between variables*
- If $r \approx 0$ → *little correlation between variables*

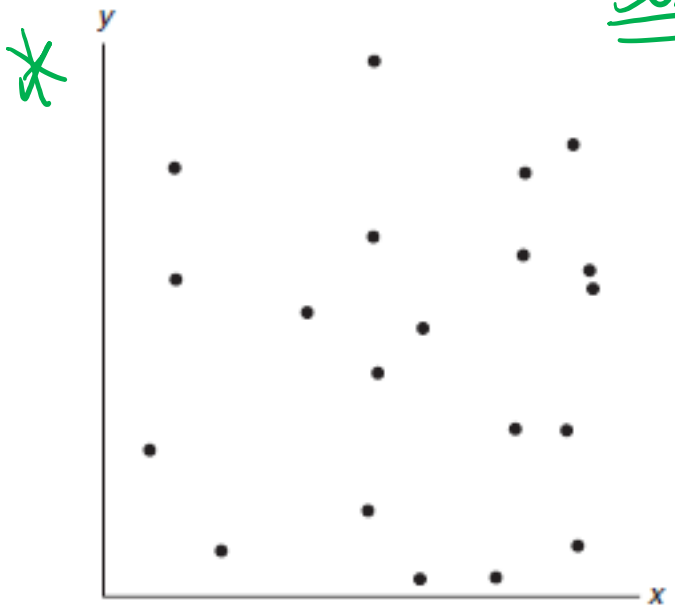
Correlation Cases



Zero Correlation Cases

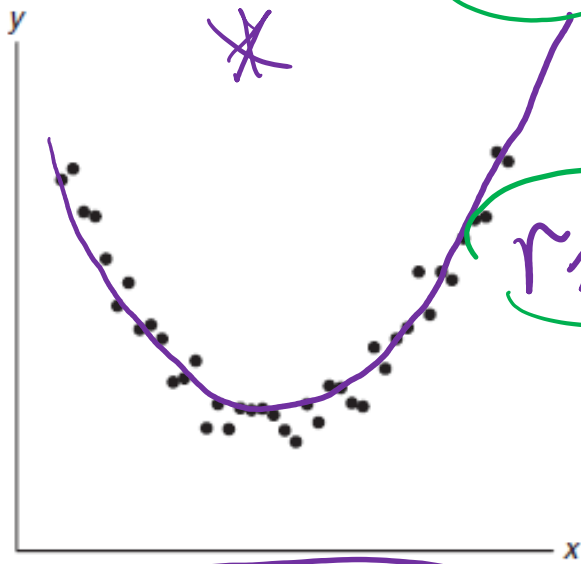
linear Relationship

Plot first!



Random scatter of points; no association

$r \approx 0$

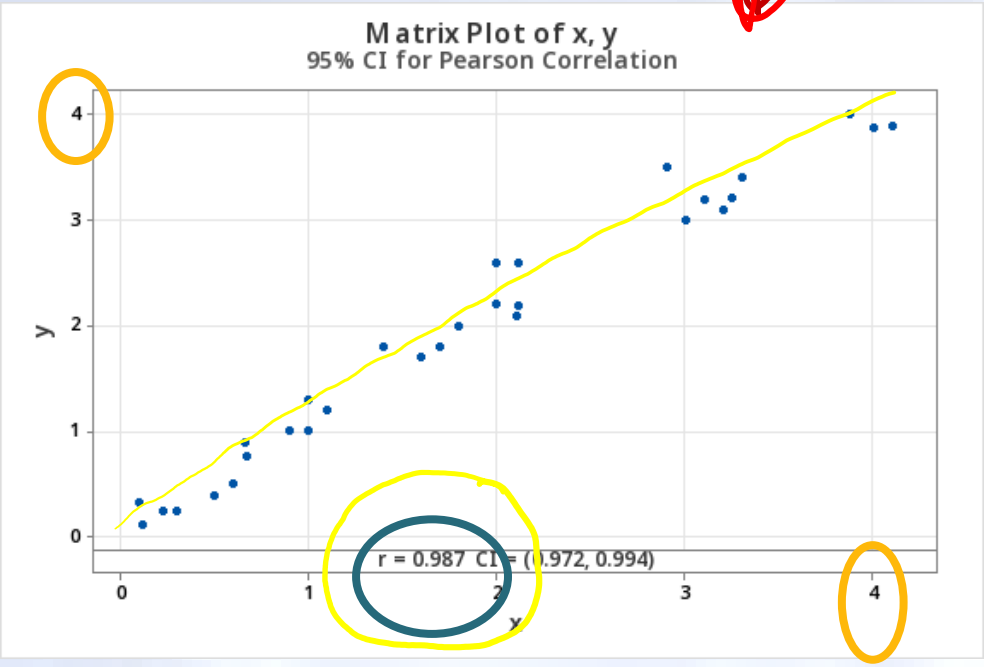


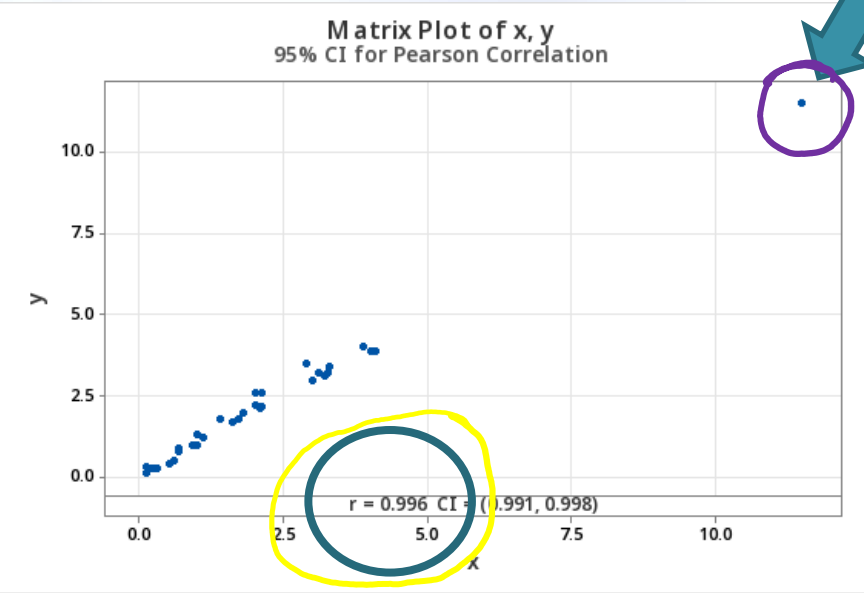
$r \approx 0$

Quadratic relationship; lack of linear relationship

Correlation & Outliers

Same data but with outlier





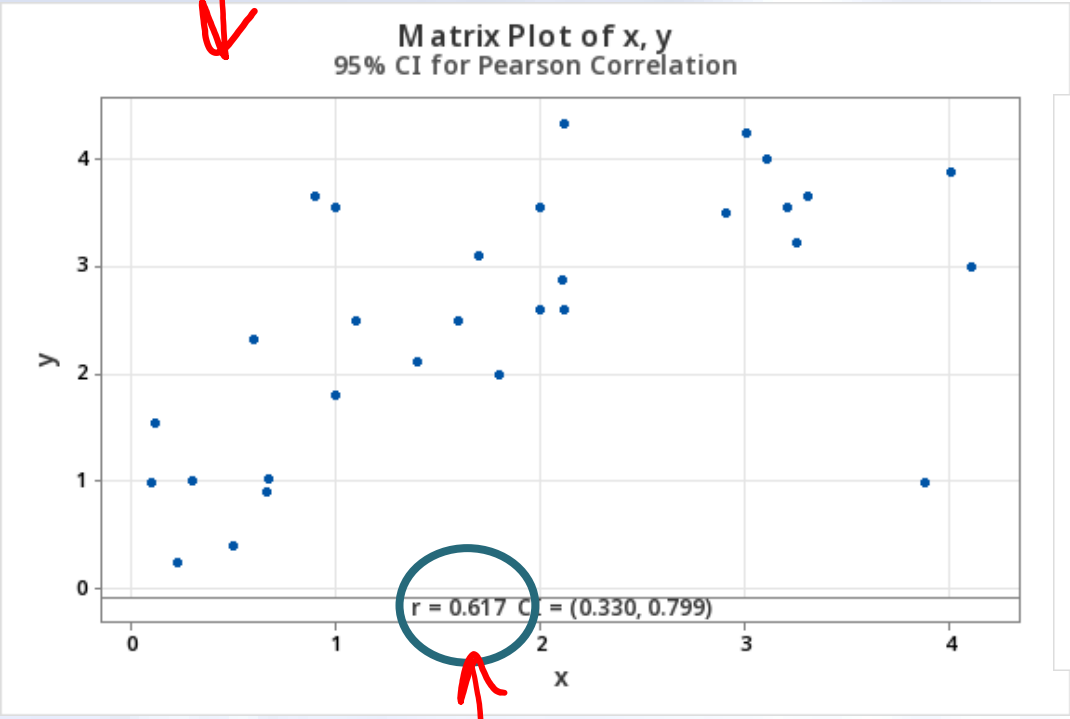
Little-to-no change in r.
Outlier had little influence on r.

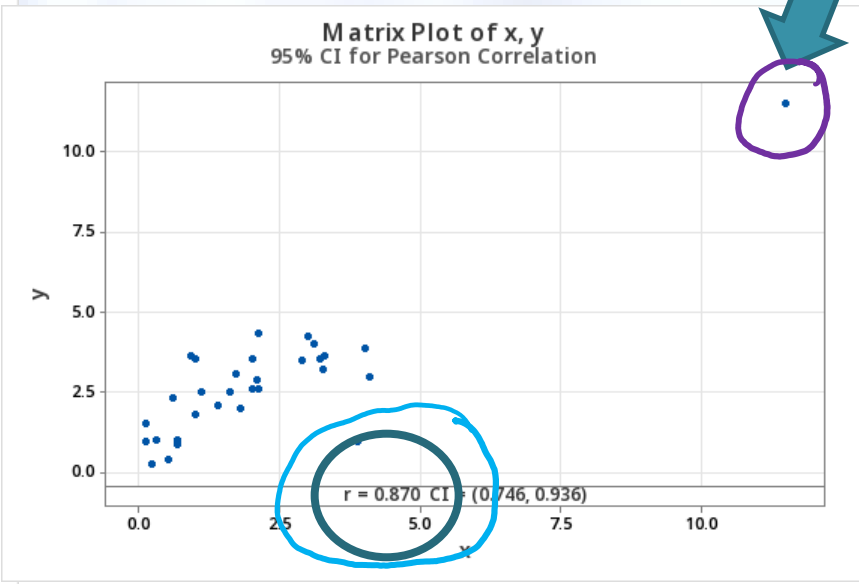
*Outlier: unusual data point
Different from others

r = .987
to
r = .996

Correlation & Outliers

Same data but with outlier

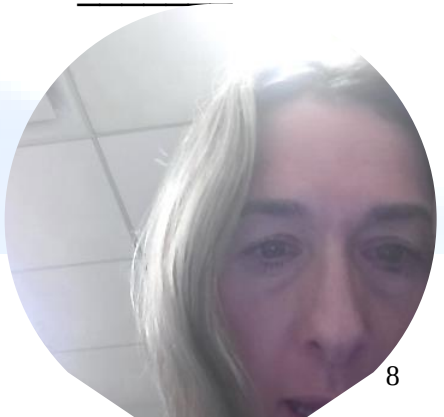




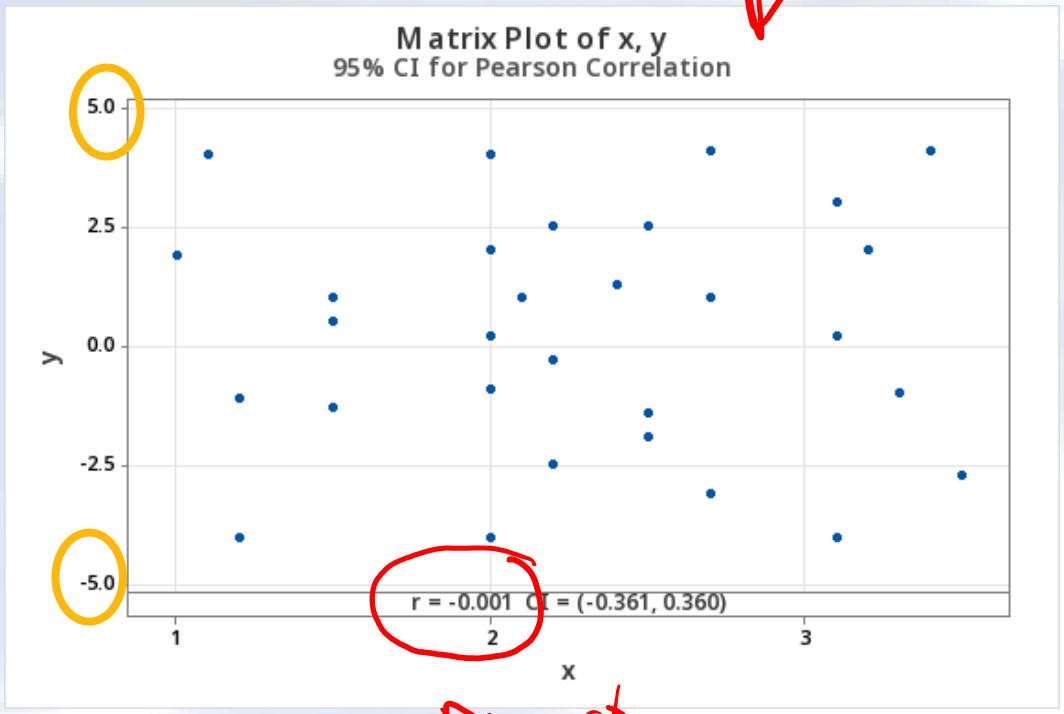
Outlier was more influential. Increase in r from .617 to .870

r = 0.617

r = 0.870



Correlation & Outliers



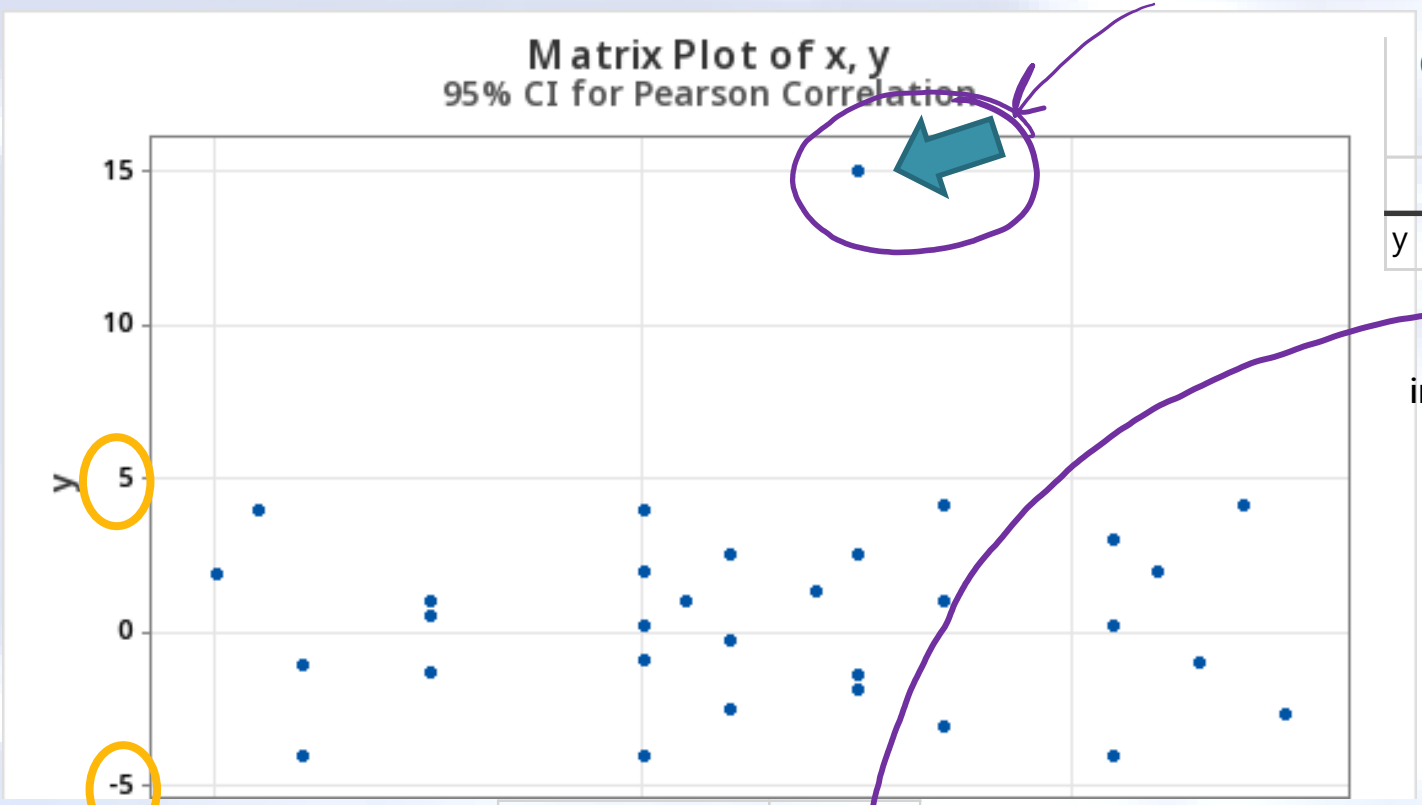
r ≈ 0

Correlations

	x
y	-0.001

Correlation & Outliers

Same data but with outlier



Correlations

	x
y	0.04

Outlier very influential – increase in r by a factor of 40

Correlations

	x
y	-0.001

Acknowledgement

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