Technology Arts Sciences Cologne
Faculty of Economics, Business and Law
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Exercises Quantitative Methods
Worksheet: Measures of association

Example 2.1 (*Human_Resources.sav*)
A Human Resources Department has listed for two years the values of the four variables:

X_1= number of the vacant positions (monthly)

X_2= times absent (days per month)

X_3= labor turnover per month

X_4= long hours per month

Is there a relationship between two of these variables? Interpretation?

Correlations

		Vacant_Positions	Times_Absent	Labour_Turnover	Long_Hours
Vacant_Positions	Pearson Correlation	1	,857**	,008	,839**
	Sig. (2-tailed)		,000	,971	,000
	N	24	24	24	24
Times_Absent	Pearson Correlation	,857**	1	-,059	,968**
	Sig. (2-tailed)	,000		,785	,000
	N	24	24	24	24
Labour_Turnover	Pearson Correlation	,008	-,059	1	,011
	Sig. (2-tailed)	,971	,785		,961
	N	24	24	24	24
Long_Hours	Pearson Correlation	,839**	,968**	,011	1
	Sig. (2-tailed)	,000	,000	,961	
	N	24	24	24	24

**. Correlation is significant at the 0.01 level (2-tailed).

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Example 2.2 (Fiona Mathews, Paul J. Johnson, Andrew Neil)
You are what your mother eats: evidence for maternal preconception diet influencing foetal sex in humans (see Proceedings of the Royal Society, Series B, April 2008)

A total of 721 women with normal singleton pregnancies kept a prospective food diary of their diet in early pregnancy and gave a retrospective food diary of their usual diet in the year prior conception:

Went to test whether particular foods were associated with infant sex.

cereal	female	male	
low	123	93	216
moderate	113	92	205
high	126	174	300
	362	359	721

Müsli_Geschlecht.sav

Results: p-value of Pearson's Chi-Square Test $= 0{,}000\,918\,5$
this means that the infant sex depends on the particular food.
$\gamma = 0{,}215$; a weak trend that women producing male infants consumed more breakfast cereal than those who ate less than or equal to one bowlful per week.

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Example 2.3 (*Module exam in Quantitative Methods, January 23rd, 2006*)
An observational study on gender bias in admissions was done by the Graduate Division at the University of California, Berkeley. Assuming that men and women are on the whole equally well qualified, the difference in admission rates looks like a strong piece of evidence to show that men and women are treated differently in the admission procedure. Does the university seem to prefer men?

Admissions data for the graduate programs in the two largest majors at the University of California, Berkeley:

<table>
<tr><th colspan="4" style="text-align:center">Major A</th><th colspan="4" style="text-align:center">Major B</th></tr>
<tr><th></th><th>Applicants not admitted</th><th>Applicants admitted</th><th>$\sum$</th><th></th><th>Applicants not admitted</th><th>Applicants admitted</th><th>$\sum$</th></tr>
<tr><td>female</td><td>21</td><td>87</td><td>108</td><td>female</td><td>8</td><td>17</td><td>25</td></tr>
<tr><td>male</td><td>313</td><td>512</td><td>825</td><td>male</td><td>207</td><td>353</td><td>560</td></tr>
<tr><td></td><td>334</td><td>559</td><td>933</td><td></td><td>215</td><td>370</td><td>585</td></tr>
</table>

The university policy does not allow these majors to be identified by name.

Open the file *Applicants_UC.sav*

1. Does the university seem to prefer women? Check it for

   a) major A

   b) major B

   c) major A and B together

2. Find the direction of the association between the gender and admission:

   a) major A

   b) major B

   c) major A and B together

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Exercises Quantitative Methods Ws 2016/2017
Worksheet: Correlation

Example 2.4 (*sales_profits_2016.sav*)
The following table is a list of the world-wide twenty-five leading public companies
in the year 2016 (see: Forbes Global 2000). The ranking is based on a mix of four
metrics: sales, profit, assets and market value. The revenue in billion US $ (auf
Deutsch: Milliarden US $) and the profit in billion US $ are listed:

Rank	Corporation	Revenue	Profits
1	ICBC	171.1	44.2
2	China Construction Bank	146.8	36.4
3	Agricultural Bank of China	131.9	28.8
4	Berkshire Hathawy	210.8	24.1
5	JPMorgan Chase	99.9	23.5
6	Bank of China	122.0	27.2
7	Wells Fargo	91.4	22.7
8	Apple	233.3	53.7
9	Exxon Mobil	236.8	16.2
10	Toyota Motor	235.8	19.3
11	Bank of America	91.5	15.8
12	AT&T	146.8	13.2
13	Citigroup	85.9	15.8
14	HSBC	70.3	13.5
15	Verizon Communications	131.8	18.0
16	Wal-Mart Stores	482.1	14.7
17	Petro China	274.6	5.7
18	China Mobile	107.8	17.1
19	Samsung Electronics	177.3	16.5
20	Ping An Insurance	98.7	8.7
21	Allianz SE	115.4	7.3
22	Volkswagen AG	246.2	7.1
23	Microsoft	86.6	10.2
24	BNP Paribas	74.9	7.4
25	Daimler	165.7	9.3

a) Construct a scatter plot with sales as the x-axis and profits as the y-axis. The
   points in the scatter plot should have the case name of the corporation.

b) Compute and comment the correlation between the sales and the profits of the twenty corporations.

c) The company Apple is based in Ireland. In 2015 the corporation tax in Ireland on profits was 12.5 percent, but Apple paid only 0.005 percent. What is the difference in billion US-Dollar?

$53\,700\,000\,000 \cdot \frac{0.005}{100} = 2\,685\,000$ paid tax

$53\,700\,000\,000 \cdot \frac{12.5}{100} = 6\,712\,500\,000$ tax to be paid

difference $= 2\,685\,000 - 6\,712\,500\,000 = -6\,709\,815\,000 \approx -6.7$ billion US-Dollar

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Example (Washington Post 10/04/2014)
On March 28-31, 2014, the American scientist Joshua Tucker and his team asked 2,066 Americans, what action they wanted the U.S. to take in Ukraine. In addition they asked the survey respondents to locate Ukraine on a map. Each dot in the following map depicts the location where a respondent situated Ukraine; the dots are colored based on how far removed they are from the actual country, with the most accurate responses in red and the least accurate ones in blue.

Findings: The less Americans know about Ukraine's location, the more they want U.S. to intervene with military force.

Where is Ukraine? (Lack in miles)	What to do?		
	Nothing	Boycotting G8 summit	Intervene with military forces
0			
⋮			
11,000			