Decision Support Systems
Homework 3 - Group 0

Nuno Aniceto	Waldo
IST n. ?????	IST n. ?????
nuno.aja@gmail.com	???@??.com

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1) (7pts) Defining Calculations

Link to the *'Lesson 6: Defining Calculations'*:
http://technet.microsoft.com/en-us/library/db55e226-601a-4026-8651-573195555a59

After performing the *'Lesson 6'* define calculations using `AdventureWorksDW2012` to perform the following query:

Internet Sales-Unit Price	Column Labels					Mean	Stdev
Row Labels	CY 2005	CY 2006	CY 2007	CY 2008	Grand Total		
Bikes	$3 266 373,66	$6 530 343,53	$9 359 102,62	$9 162 324,85	$28 318 144,65	?	?
Grand Total	$3 266 373,66	$6 530 343,53	$9 359 102,62	$9 162 324,85	$28 318 144,65	?	?

a) (1.5pts) To compute the **mean value** of 'Bike Unit Price' over four years as shown in the table, define calculations using the `CALCULATE` for `Internet Sales - Unit Price Amount`.
Indicate your script.

(...answer here...)

b) (2.5pts) To compute the **standard deviation** of the sample value of 'Bike Unit Price' over four years as shown in the table, define calculations using the `CALCULATE` for `Internet Sales - Unit Price Amount`.
Indicate your script.

(...answer here...)

c) (1pt) Expand `Bikes` to `Mountain Bikes, Road Bikes, Touring Bikes` in the excel table with the `Grand Total, Mean Value, Standard deviation`.
Indicate the excel Table.

(...answer here...)

2) (1pt) Normalization

Use **min-max** normalization to transfer the value 11 of age into the range $[1249]$.

The normalization will map then values from the range $A : [A_{min}, A_{max}]$ to the range
$B : [B_{min}, B_{max}]$.
We assume that A_{min} is of 0 years - the aging of a person starts at the value of 0.
And that A_{max} is 11 - considering the given value as the maximum value for the starting range.
The values of the counter domain B are based on the given range.
Therefore we assume that the domain (A) and counter-domain (B) of this normalization are defined
with the ranges: $A : [0, 11] \quad B : [12, 49]$.

The min-max normalization calculation is defined by the formula:
$$b = \frac{B_{max} - B_{min}}{A_{max} - A_{min}} \cdot (a - A_{min}) + B_{min}$$

Then we have:

$$b = \frac{49 - 12}{11 - 0} \cdot (11 - 0) + 12 = 49.$$

This value is expected to be 49 (the maximum of B) as the min-max makes a linear interpolation
between values from A to values from B.
Because 11 was considered the highest value A could take, then it's mapping must be the highest
value that B could take: 49.

3) (5pts) PCA

Suppose we have the following points:

$$\vec{x}_i = \left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 9 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 15 \\ 1 \end{pmatrix}, \begin{pmatrix} 11 \\ 2 \end{pmatrix}, \begin{pmatrix} 15 \\ 3 \end{pmatrix} \right\}$$

a) (2pts) Compute the covariance matrix.

(...answer here...)

b) (2pts) What is the matrix of the K-L transformation ?

(...answer here...)

c) (1pt) Which of the two eigenvectors is more significant? Can we reduce the dimension?

(...answer here...)