Différence's Addin User Guide

Last update : 2022-09-22



Obtaining the addin

 \equiv General presentation of the features:

difference-gcs.com/en/services/excel-addin/

= Download and installation instructions:

difference-gcs.com/en/services/excel-addin-installation/



General presentation

O Toolbar items



Install or update the addin

In Windows Explorer, double-click on the file





- Update: close all Excel instances, download the xl_difference.xlam file, overwrite the existing one (that simple!)
- The license is maintained during this process since it is store outside the addin file

Acquire a license

© Différer

= Send an email to licenses@difference-gcs.com and wait for connection credentials

	License manager	×
	Statistics, optimization and simulation add Différence	in by
	©2019 Différence S.E.N.C. Versi	nn 5.02
Enter credentials received by email	License details	
Click on Acquire to	Password XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
(if there is an available license left in the pool)	User's license is valid	 inquire about license status
rence	Acquire Release Refresh Hel	Différence's addin user o

6

Cloud-based license system

 Différence will send by email license credentials (cluster, instance, password)



Proper data structure

- = To ensure proper analysis, data must be organized in a table following this convention:
 - Row 1: column headers
 - Row 2 and + : the data
 - A column = a variable (Y or X, qualitative or quantitative)
 - A row = an observation : at one moment, these are all the values corresponding to one observation
 - To have names of the variables appearing on a report, make sure they are located in first cell (row) of a range
 - Cells with nothing, wrong data type or Excel error codes will be excluded during data reading process
 - Well conditioned and filtered data ensures reliable analyzes

Row exclusion mechanism

- = To exclude particular rows from an analysis, use an indicator column (instead of deleting!)
 - In an empty column, put a "0" (zero) on rows to be excluded
 - On a form, indicate this column in the "Exclusions" field
 - The entire row will be ignored during the data reading process, even if it is a multivariate row. Example :



Here, column D designates which rows to exclude.

Rows 4 and 10 will be ignored during data import

General principles and shortcuts

- Example Click on (b) to reset the entire application before starting a new analysis or after an crash
- = Result tabs are not linked to any feature requiring the addin on the computer; they can be shared!

= Keyboard shortcuts: CRTL + SHIFT +...

U : univariate analyzes B : bivariate analyzes (compare means) L : simple regression D : statistical distributions X : workbook explorer C : calendar

R : reset the application

Common icons on forms

lcon	Feature	associated	with	the	icon
------	---------	------------	------	-----	------

- Reset current platform
- Help and additional explanations
- Save settings on an Excel worksheet
- Load settings saved on an Excel worksheet
- Select a mandatory data range
- Select an optional data range
- Extra parameters for this analysis
- Erase/disable selected parameter/property
- Add a property or an item
- A Rename/edit selected property
- X Delete/remove selected property



Analyzes with 1 variable

Main univariate platform CPA settings, ImR and EWMA settings Pareto analysis Time series analysis Statistical distributions

Main univariate platform





Use the < to disable/erase selected property

CPA, ImR and EWMA settings



Refer to literature for more information on the algorithm.

© Différence

Différence's addin user guide | 14

Apply ImR decision rules



Modify histogram appearance



Pareto analysis



Statistical distributions



Time series analysis

\equiv Make a diagnosis:



Time series analysis

= Build a predictive model:





Analyzes with 2 variables

Means comparison Power and sample size Contingency analysis Simple linear regression Simple nonlinear regression

Means comparison



Power and sample size calculations



Note:

With 1 and 2 groups: use of non-central Student distribution With K groups, use of non-central Fisher distribution

Contingency analysis, Mosaic plot



Simple linear regression



Simple nonlinear regression





Experimentation and simulation

Plan a Measurement System Analysis (MSA) Analyze the results of a MSA Monte-Carlo simulation

*P*lan a MSA



Analyze a MSA

= Define variables and historical process variation:

Experiment	Process	Report				
Testers	a:a		슢			
Samples	b:b		企			
Response	c:c ☆					
	🔽 title in fi	irst cell				
Exdude			슙			
↑						



If data on historical process variation is available:

Provided known values (at least average and standard deviation)

or

Specify data range (1 column) and addin will calculate de values

Specify the three columns required for the analysis. Testers and samples are qualitative data.

It is also possible to exclude specific measurements

Analyze a MSA

\equiv Report options:



<u>Acceptance</u> : decision thresholds (internal, producer accepts or rejects item)

\equiv Prerequisites to simulation with Excel

- Setup of the Y responses (formulas)
 - Each response cell must have a formula with references to X cells. Formula can be an Excel built-in or custom VBA function
 - Specifications and target are used to perform a classical capability analysis; it's a post-processing of simulation results
 - Standard deviation is the white noise amplitude added to simulated results (for example: RMSE from regression analysis)

Setup of the X decision variables (or assumptions, values)

- Each cell must have a number value. The value will be modified during simulation; actual (initial) value is not important and will be put back at the end
- Lower and upper specifications are used to limit (truncate) the range of generate pseudo-random values from statistical distributions
- The distribution and its parameters are mandatory information for each X
- Simulator will edit X values and re-calculate all Y functions at the same time

= Configure the Y responses (in-cell formulas)



\equiv Configure the X variables (in-cell values)



= Simulation and report options:







Optimization

- = Available algorithms:
 - Evolutionary: direct search heuristic (genetic algorithm)
 - Fletcher-Reeves: conjugated gradients (Polak-Ribeire variant)
 - MADS: mesh adaptive direct searches (random patterns)
 - Nelder-Mead: simplex lattices direct search
 - Simulated annealing: direct search heuristic
 - VNS: variable neighborhood search (global optimization method)
- Managed variable types:
 - Continuous: all algorithms
 - Discrete : evolutionary, MADS, simulated annealing, VNS
 - Ordering: evolutionary, simulated annealing
- = Handling of bounds and constraints:
 - Bounds on variables: all excepted Fletcher-Reeves
 - Relaxable constraints: evolutionary, MADS, simulated annealing, VNS

- \equiv Organizing the spreadsheet
 - The cell with the objective function must have a formula. Formula can be an Excel built-in or custom VBA function referencing "variables" cells
 - Same principle for each of constraint functions g(x)
 - The vertical range of "variables" cells must have numbers
 - Ordering variable: number of cells = n, all values from 1 to n appear only once
 - If required, lower and upper bounds, and inequality constants a (in g(x) ≤ a) must be vertical ranges of numbers
 - Hint: if all lower/upper bound values are identical, specify the bound's value instead of specifying a range
 - Range for X contains initial solution (starting point); it is recommended to use a feasible one...
 - The solver will iteratively modify the X values and calculate *f*(*x*) and *g*(*x*) functions; this is the black-box approach.

\equiv Configure the problem



\equiv Configure the solver

Check the box to perform an initial random search.

The search will be a latin hypercube covering all space within bounds (or within unbounded radius).

Specify number of points to use for the initial search.



Refer to scientific literature for more information on these algorithms. Training also available at info@difference-gcs.com



Note: default values are robust recommendations. Modifying them is for advanced users.



Différence's addin user guide | 39



Stability Analyis

Stability Analysis

\equiv The analysis process:

- The Y (1 column) is mandatory. An instance of the Change Point Analysis is executed to determine the Y change points
- If Xs (multiple columns) are provided, a simple regression is made between the before-after median changes around the moments of the Y change points. Statistically significant regressors are reported.
- All reports are generated using the significant Xs sorted in ascending order of p-value
- All trend chart phases are defined by the Y change points

Stability Analysis





Tools and Accessories

"Worksheets utilities" section on the toolbar Workbook explorer and date picker Interval calculator

Worksheets utilities in the toolbar



Workbook explorer and date picker





Insert a date into the selected cell...



- 1) Select year and month
- 2) Select the day
- 3) Click on "OK" (or double-click on desired day)

Interval calculator



Adjust number of decimals if needed.