Robust Solutions

for

Efficient & Sufficient

Testing

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- Testing Challenges
- Wipro’s Solution – Robust Test Methodology
    - DSM/SCE/SCIM for Test Strategy & Planning
        - Essence of these techniques
        - Examples
    - Orthogonal Array for Test Case Design
        - What is OA Based Testing
        - Walkthrough of the Wipro OA tool
        - Sample Case studies with Benefits
    - Reliability Modeling for Residual Defect Estimation
        - About Reliability Modeling
        - Assumptions behind the Wipro Reliability Tool
        - Demo of Wipro Reliability Tool
    - Summary of Solutions to Address Testing Challenges
    - Q & A

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Business Challenges

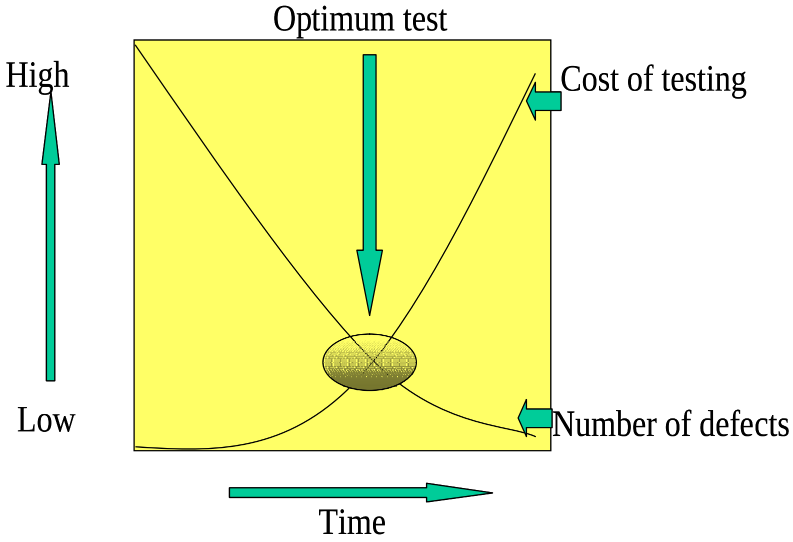
Testing Cost Curve

Tight Budget

Demanding Customer

Schedule Pressure

Testing cost curve: by William Perry



The Key to success is to address these Challenges as well as to ensure quality!!

lenges

Å How to detect most of defects early in the testing lifecycle?

Å How to prioritize on Test Areas?

Å How to Map resources to Test Areas?

Å How to Allocate proportionate time to test different test Areas?

Test Strategy & Planning

Å Are all the paths covered?
(Unit Testing or white box testing)

Å Are all interfaces tested?
(Integration Testing)

Å Is the system functionality validated?
(System Testing)

Å Are all single mode and double mode faults detected?

Å It is next to impossible to do exhaustive testing
(100% possible test cases)

Å How to ensure that there is no redundancy in test cases?

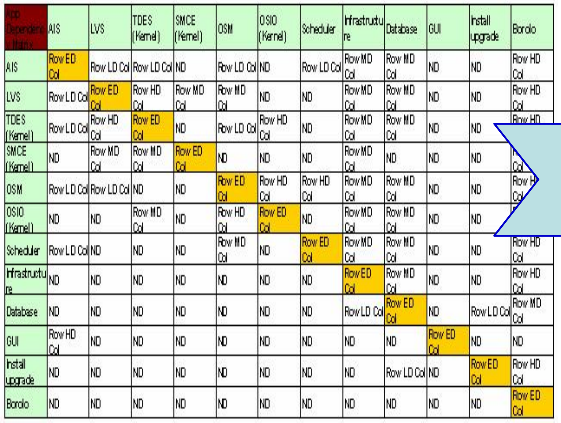
Test Design & Execution

Å When to Stop Testing?

Test Results Analysis

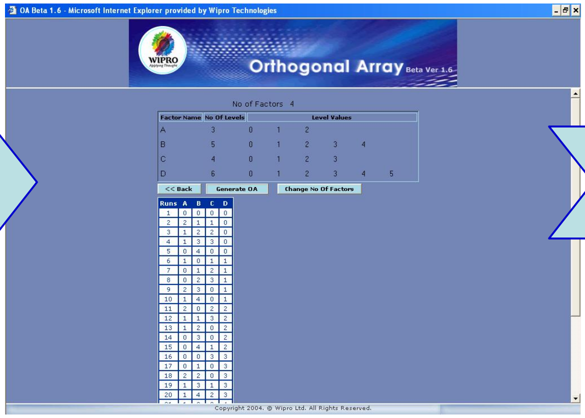
Robust Test Methodology

DSM/SCE



App Dependency Matrix	AIS	LVS	TDES (Kernel)	SMCE (Kernel)	OSM	OSIO (Kernel)	Scheduler	Infrastructure	Database	GUI	Install upgrade	Bordolo
AIS	Row ED Col	Row LD Col	Row LD Col	ND	Row LD Col	ND	Row LD Col	Row MD Col	Row MD Col	ND	ND	Row HD Col
LVS	Row LD Col	Row ED Col	Row HD Col	Row MD Col	Row MD Col	ND	ND	Row MD Col	Row MD Col	ND	ND	Row HD Col
TDES (Kernel)	Row LD Col	Row HD Col	Row ED Col	ND	Row LD Col	Row HD Col	ND	Row MD Col	Row MD Col	ND	ND	Row HD
SMCE (Kernel)	ND	Row MD Col	Row MD Col	Row ED Col	ND	ND	ND	Row MD Col	ND	ND	ND	Col
OSM	Row LD Col	Row LD Col	ND	ND	Row ED Col	Row HD Col	Row HD Col	Row MD Col	Row MD Col	ND	ND	Row H Col
OSIO (Kernel)	ND	ND	Row MD Col	ND	Row HD Col	Row ED Col	ND	Row MD Col	Row MD Col	ND	ND	[illegible]
Scheduler	Row LD Col	ND	ND	ND	Row MD Col	ND	Row ED Col	Row MD Col	Row MD Col	ND	ND	Row HD Col
Infrastructure	ND	ND	ND	ND	ND	ND	ND	Row ED Col	Row MD Col	ND	ND	Row HD Col
Database	ND	ND	ND	ND	ND	ND	ND	Row LD Col	Row ED Col	ND	Row LD Col	Row MD Col
GUI	Row HD Col	ND	ND	ND	ND	ND	ND	ND	ND	Row ED Col	ND	ND
Install upgrade	ND	ND	ND	ND	ND	ND	ND	ND	Row LD Col	ND	Row ED Col	Row HD Col
Bordolo	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Row ED Col

OA Technique



OA Beta 1.6 - Microsoft Internet Explorer provided by Wipro Technologies

No of Factors 4

Factor Name	No Of Levels	Level Values					
A	3	0	1	2			
B	5	0	1	2	3	4	
C	4	0	1	2	3		
D	6	0	1	2	3	4	5

Runs	A	B	C	D
1	0	0	0	0
2	2	1	1	0
3	1	2	2	0
4	1	3	3	0
5	0	4	0	0
6	1	0	1	1
7	0	1	2	1
8	0	2	3	1
9	2	3	0	1
10	1	4	0	1
11	2	0	2	2
12	1	1	3	2
13	1	2	0	2
14	0	3	0	2
15	0	4	1	2
16	0	0	3	3
17	0	1	0	3
18	2	2	0	3
19	1	3	1	3
20	1	4	2	3

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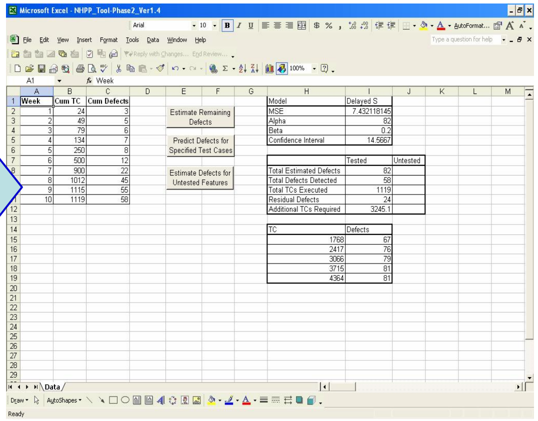
Reliability



Microsoft Excel - NHPP_Tool-Phase2_Ver1.4

Week	Cum TC	Cum Defects
1	24	3
2	49	5
3	79	6
4	134	7
5	250	8
6	500	12
7	900	22
8	1012	45
9	1115	55
10	1119	58

Estimate Remaining Defects
Predict Defects for Specified Test Cases
Estimate Defects for Untested Features

Model	Delayed S
MSE	7.432118145
Alpha	82
Beta	0.2
Confidence Interval	14.5667

	Tested	Untested
Total Estimated Defects	82	
Total Defects Detected	58	
Total TCs Executed	1119	
Residual Defects	24	
Additional TCs Required	3245.1	

TC	Defects
1768	67
2417	76
3066	79
3715	81
4364	81

Lean Management & Six sigma Techniques

Test Strategy & Planning

ÅSystematic Test Strategy
ÅPrioritizing Test Areas
ÅEarly Defect Detection
ÅEffective Time & Resource Allocation

Test Design & Execution

ÅMaximize Test Coverage
ÅMinimize Test Cases
ÅFoundation for Defect Correlation

Test Results Analysis

ÅWhen to stop testing
ÅCertify S/w Quality Levels
ÅFacilitate to Plan Maintenance Resources

DSM – Dependency Structure Matrix SCE – Software Complexity Estimate OA – Orthogonal Array

SCE

ing to

- ✓ Prioritize the Test Areas by identifying the most complex Test Area to facilitate early defect detection.
- ✓ Sequence the Order of Testing of Different Test Areas so that there is minimal delay or waiting time between activities which will facilitate in Schedule adherence.
- ✓ Prioritize the Test Area & Test Cases in case of Regression Testing for optimal use of Testing effort.

Input/Output Summary for DSM tool

Objective/Tool	Inputs	Output
Sequencing/DSM	1. No of Components/Activities 2. Dependencies Between Components (Dependency on a binary scale)	1. New Sequence for activities 2. Cyclic Dependency blocks 3. Components/activities that can be done in parallel
Test Area Prioritization/SCE	1. No of Components/Activities & Names 2. Dependencies Between Components (Dependency on a 5 point scale)	1. Total Relative Complexity of the System 2. Individual Relative Complexity of Modules/Components 3. Components/activities that can be done in parallel
Test Area Prioritization/SCIM **(Software Change Impact Matrix for** Regression Testing)	1. No of Components/Modules & Names 2. No of Change Requests/Requirements 3. Impact of each Change on each of the component/Module (On a 5 point scale)	1. Relative Impact of each Change on the whole system 2. Relative Impact on each component 3. Total Software Change Impact Metric

Inputs to DSM for Sequencing

Component Name		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Client Maintenance	1	1								1			1							1
Consortium	2		2										1							1
CP Maintenance	3			3		1							1							1
Escalation Matrix	4				4								1							1
HP Customization	5					5		1					1							1
Keyword Maintenance	6						6	1		1			1							1
Nugget Maintenance	7						1	7		1			1							1
Password Reset	8								8				1							1
Search	9						1	1		9			1							1
User Collections	10									1	10		1							1
TAF	11											11	1							0
Employee NT/XP Login	12												12							1
Alias	13												1	13						1
POINT SSO	14		1										1		14					0
Announcement	15							1					1			15				1
EmployeeNet	16												1				16			0
LL Tasks	17												1					17		1
LL Admin	18												1						18	1
ClearTrust	19		1							1			1							19

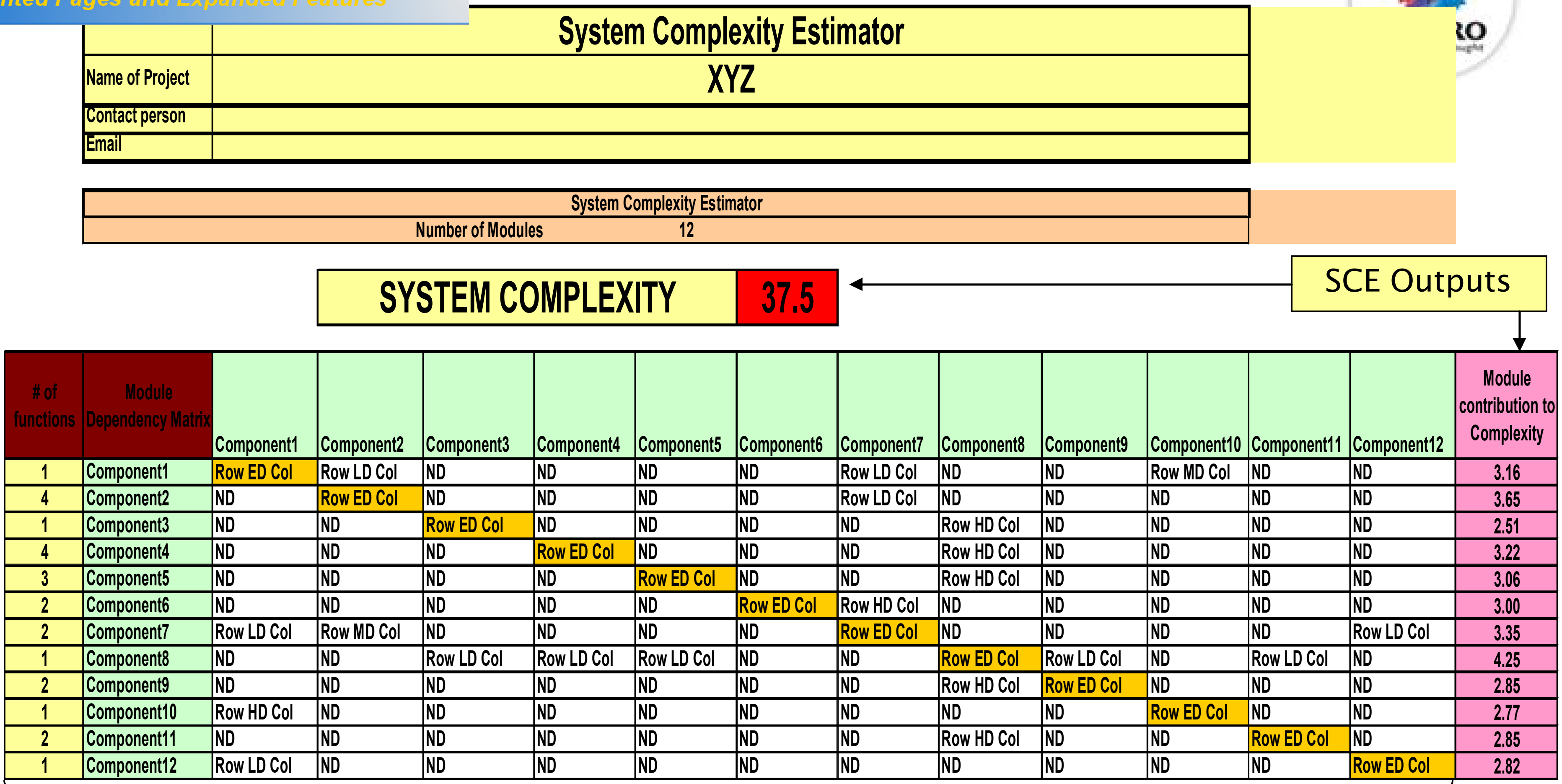
Output of DSM – New Sequence

Component Name		Consortium	Keyword Mainter	Nugget Maintena	Search	Employee NT/XF	ClearTrust	Client Maintenar	Escalation Matrix	HP Customizatio	Password Reset	User Collections	TAF	Alias	POINT SSO	Announcement	EmployeeNet	LL Tasks	LL Admin	CP Maintenance
		2	6	7	9	12	19	1	4	5	8	10	11	13	14	15	16	17	18	3
Consortium	2	2				1	1													
Keyword Maintenance	6		6	1	1	1	1													
Nugget Maintenance	7		1	7	1	1	1													
Search	9		1	1	9	1	1													
Employee NT/XP Login	12					12	1													
ClearTrust	19	1			1	1	19													
Client Maintenance	1				1	1	1	1												
Escalation Matrix	4					1	1		4											
HP Customization	5			1		1	1			5										
Password Reset	8					1	1				8									
User Collections	10				1	1	1					10								
TAF	11					1	0						11							
Alias	13					1	1							13						
POINT SSO	14	1				1	0								14					
Announcement	15			1		1	1									15				
EmployeeNet	16					1	0										16			
LL Tasks	17					1	1											17		
LL Admin	18					1	1												18	
CP Maintenance	3					1	1			1										3

Output of DSM – New Sequence Table

Sequence	2	6	7	9	12	19	1	4	5	8	10	11	13	14	15	16	17	18	3
levels																			
1	2	6	7	9	12	19													
2	1	4	5	8	10	11	13	14	15	16	17	18							
3	3																		

Helps in identifying components for concurrent engineering resulting in optimizing schedule



System Complexity Estimator

Name of Project	XYZ
Contact person	
Email	

System Complexity Estimator

Number of Modules 12

SYSTEM COMPLEXITY 37.5

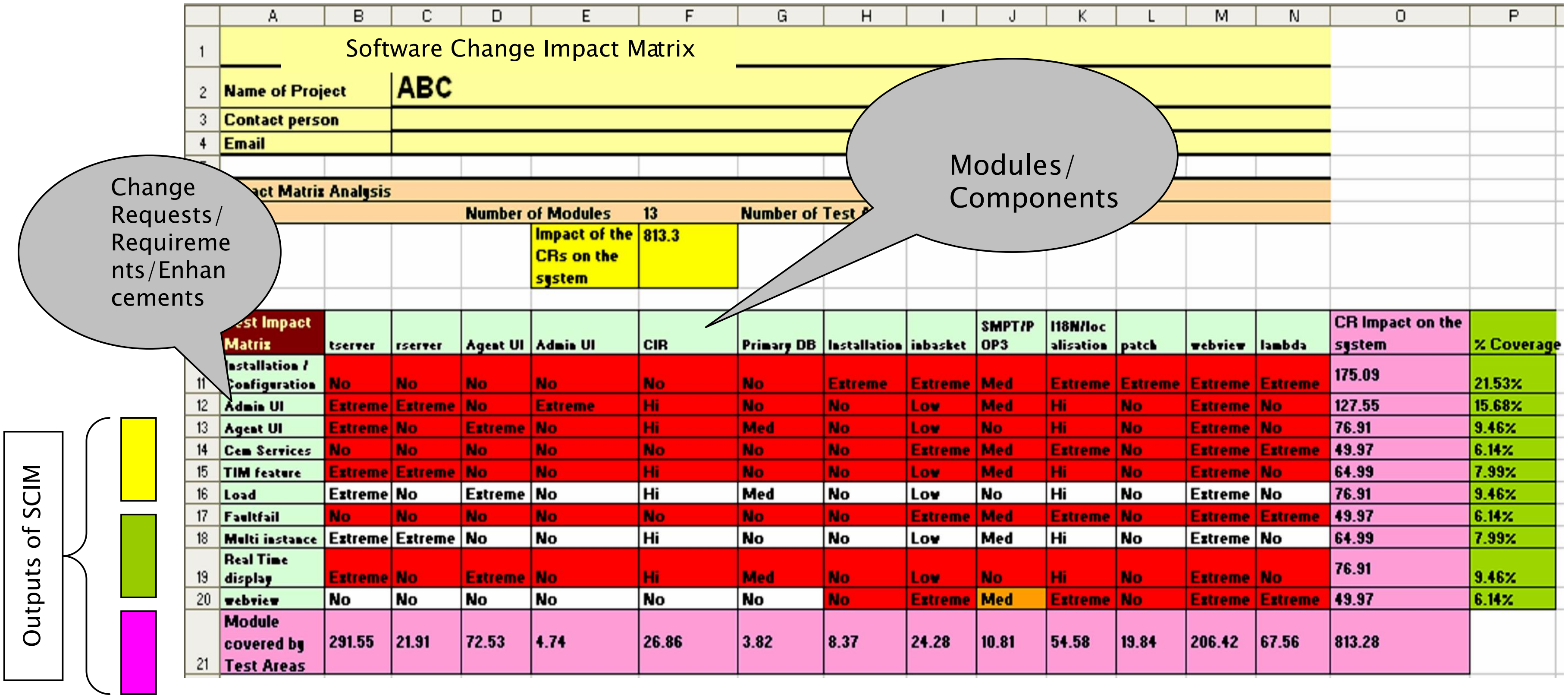
SCE Outputs

# of functions	Module Dependency Matrix	Component1	Component2	Component3	Component4	Component5	Component6	Component7	Component8	Component9	Component10	Component11	Component12	Module contribution to Complexity
1	Component1	Row ED Col	Row LD Col	ND	ND	ND	ND	Row LD Col	ND	ND	Row MD Col	ND	ND	3.16
4	Component2	ND	Row ED Col	ND	ND	ND	ND	Row LD Col	ND	ND	ND	ND	ND	3.65
1	Component3	ND	ND	Row ED Col	ND	ND	ND	ND	Row HD Col	ND	ND	ND	ND	2.51
4	Component4	ND	ND	ND	Row ED Col	ND	ND	ND	Row HD Col	ND	ND	ND	ND	3.22
3	Component5	ND	ND	ND	ND	Row ED Col	ND	ND	Row HD Col	ND	ND	ND	ND	3.06
2	Component6	ND	ND	ND	ND	ND	Row ED Col	Row HD Col	ND	ND	ND	ND	ND	3.00
2	Component7	Row LD Col	Row MD Col	ND	ND	ND	ND	Row ED Col	ND	ND	ND	ND	Row LD Col	3.35
1	Component8	ND	ND	Row LD Col	Row LD Col	Row LD Col	ND	ND	Row ED Col	Row LD Col	ND	Row LD Col	ND	4.25
2	Component9	ND	ND	ND	ND	ND	ND	ND	Row HD Col	Row ED Col	ND	ND	ND	2.85
1	Component10	Row HD Col	ND	ND	ND	ND	ND	ND	ND	ND	Row ED Col	ND	ND	2.77
2	Component11	ND	ND	ND	ND	ND	ND	ND	Row HD Col	ND	ND	Row ED Col	ND	2.85
1	Component12	Row LD Col	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Row ED Col	2.82

SCE Inputs

Relative System Complexity & Component level Complexity is calculated for prioritization.

Real Life example from Telecom Domain



Change Requests/ Requirements/Enhancements

Modules/ Components

Software Change Impact Matrix

Name of Project ABC

Contact person

Email

ct Matrix Analysis

Number of Modules 13 Number of Test

Impact of the CRs on the system 813.3

est Impact Matrix	tserver	rserver	Agent UI	Admin UI	CIR	Primary DB	Installation	inbasket	SMPT/POP3	I18N/localisation	patch	webview	lambda	CR Impact on the system	% Coverage
nstallation / Configuration	No	No	No	No	No	No	Extreme	Extreme	Med	Extreme	Extreme	Extreme	Extreme	175.09	21.53%
Admin UI	Extreme	Extreme	No	Extreme	Hi	No	No	Low	Med	Hi	No	Extreme	No	127.55	15.68%
Agent UI	Extreme	No	Extreme	No	Hi	Med	No	Low	No	Hi	No	Extreme	No	76.91	9.46%
Cem Services	No	No	No	No	No	No	No	Extreme	Med	Extreme	No	Extreme	Extreme	49.97	6.14%
TIM feature	Extreme	Extreme	No	No	Hi	No	No	Low	Med	Hi	No	Extreme	No	64.99	7.99%
Load	Extreme	No	Extreme	No	Hi	Med	No	Low	No	Hi	No	Extreme	No	76.91	9.46%
Faultfail	No	No	No	No	No	No	No	Extreme	Med	Extreme	No	Extreme	Extreme	49.97	6.14%
Multi instance	Extreme	Extreme	No	No	Hi	No	No	Low	Med	Hi	No	Extreme	No	64.99	7.99%
Real Time display	Extreme	No	Extreme	No	Hi	Med	No	Low	No	Hi	No	Extreme	No	76.91	9.46%
webview	No	No	No	No	No	No	No	Extreme	Med	Extreme	No	Extreme	Extreme	49.97	6.14%
Module covered by Test Areas	291.55	21.91	72.53	4.74	26.86	3.82	8.37	24.28	10.81	54.58	19.84	206.42	67.56	813.28	

Outputs of SCIM: 🟨 🟩 🟪

Inputs To SCIM: 🟥 ⬜

A Quantitative Framework for Test Area Prioritization & Effort Allocation.

d Testing?

OA Based Testing is a methodology which facilitates in ensuring a higher coverage of Testing the Possible causes of failure with a lower number of Test Cases

The first Step in OA based Test design is to parameterize the Test Area into Factors & levels

Once factors & levels identified are fed into Wipro’s OA tool, Test Runs are automatically generated which reduces the test case writing time.

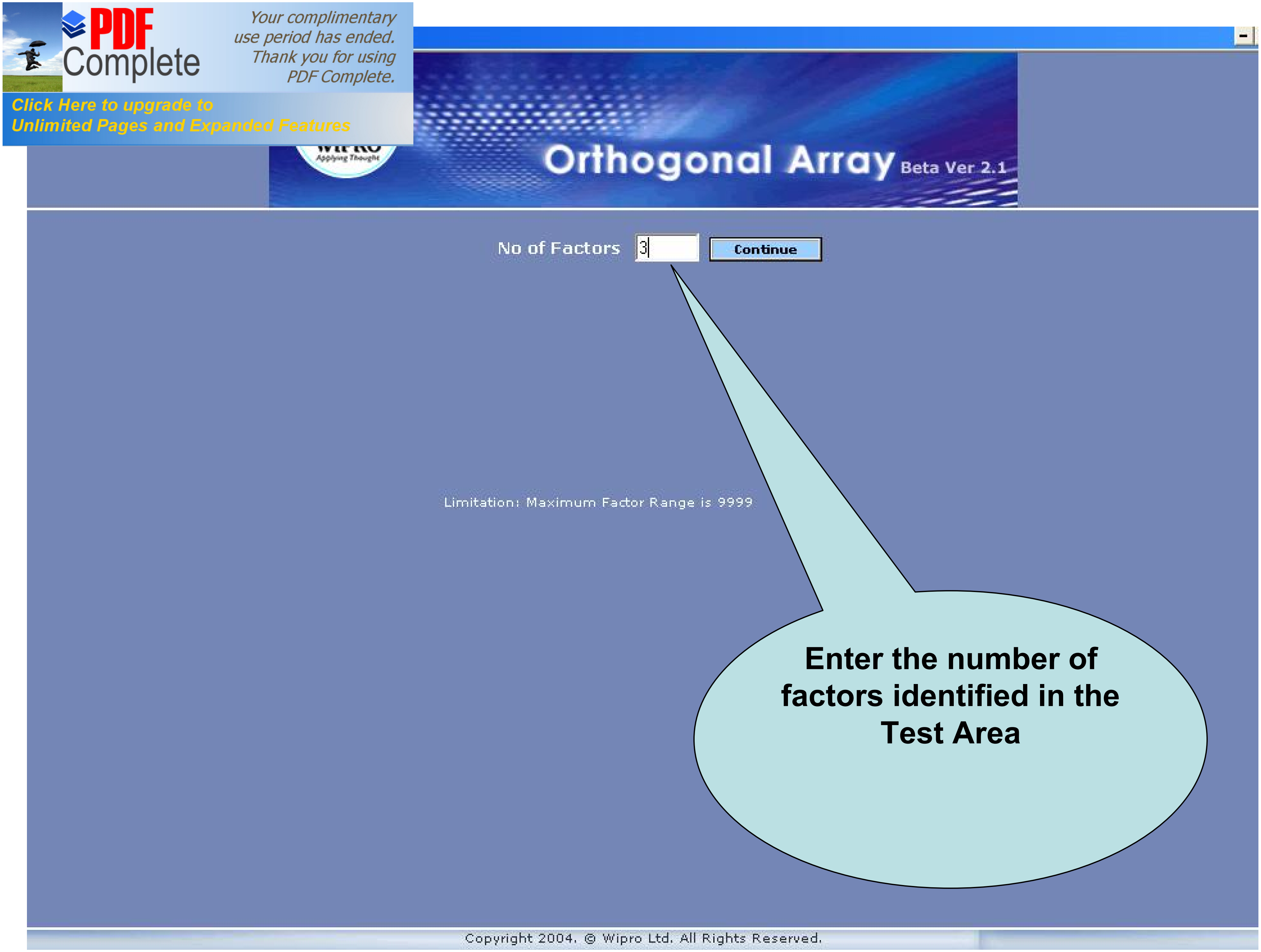
OA ensures that all levels of each factors are tested at least once & all possible pair wise combinations of factors are tested at least once.

Wipro’s OA application experience indicate benefits of significant reduction in total testing effort or significant improvement in test coverage of possible failure modes.

Walk Through

Of

Wipro OA Tool



No of Factors 3

Limitation: Maximum Factor Range is 9999

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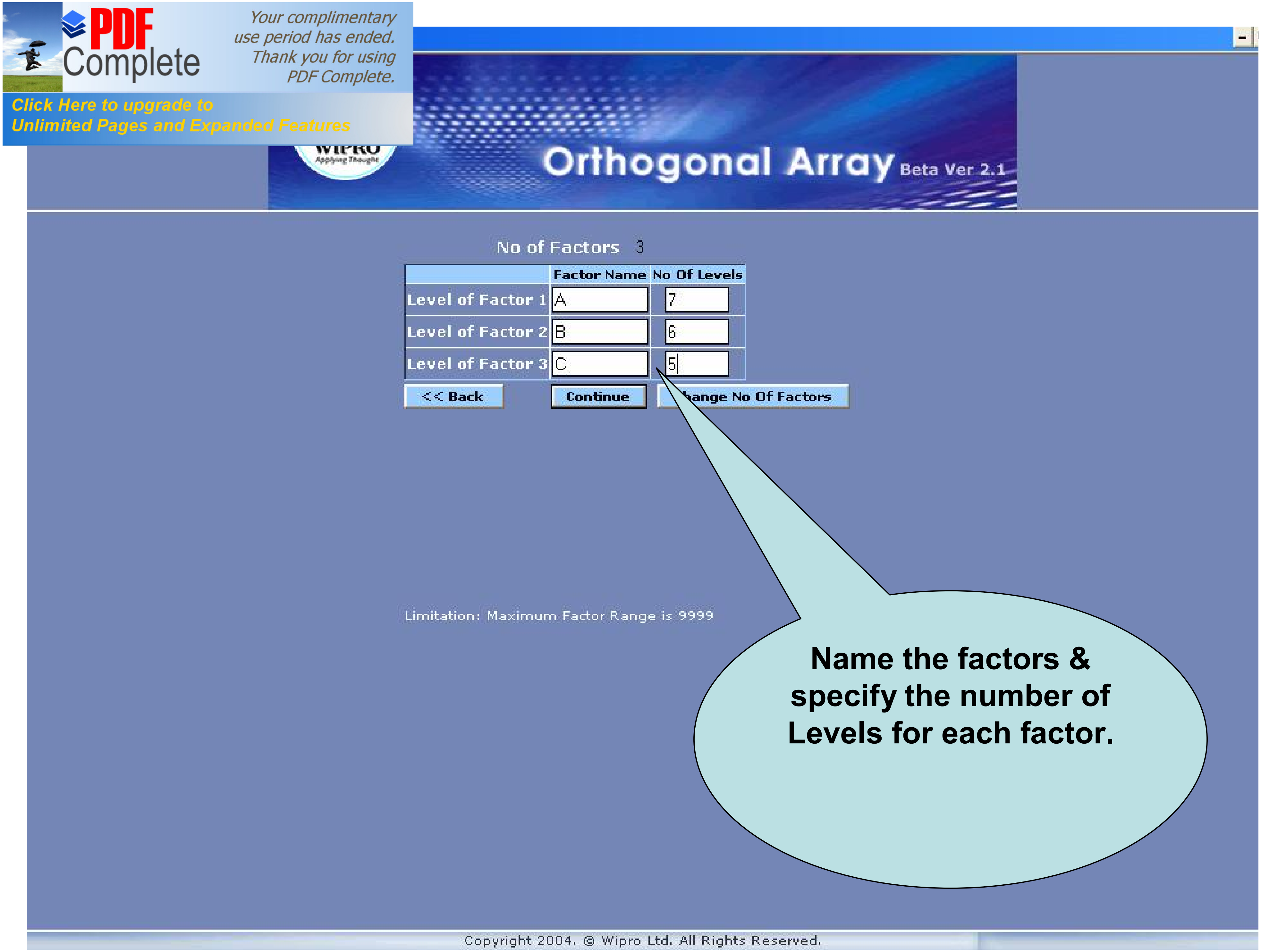
Enter the number of factors identified in the Test Area



No of Factors 3

	Factor Name	No Of Levels
Level of Factor 1	A	7
Level of Factor 2	B	6
Level of Factor 3	C	5

Limitation: Maximum Factor Range is 9999

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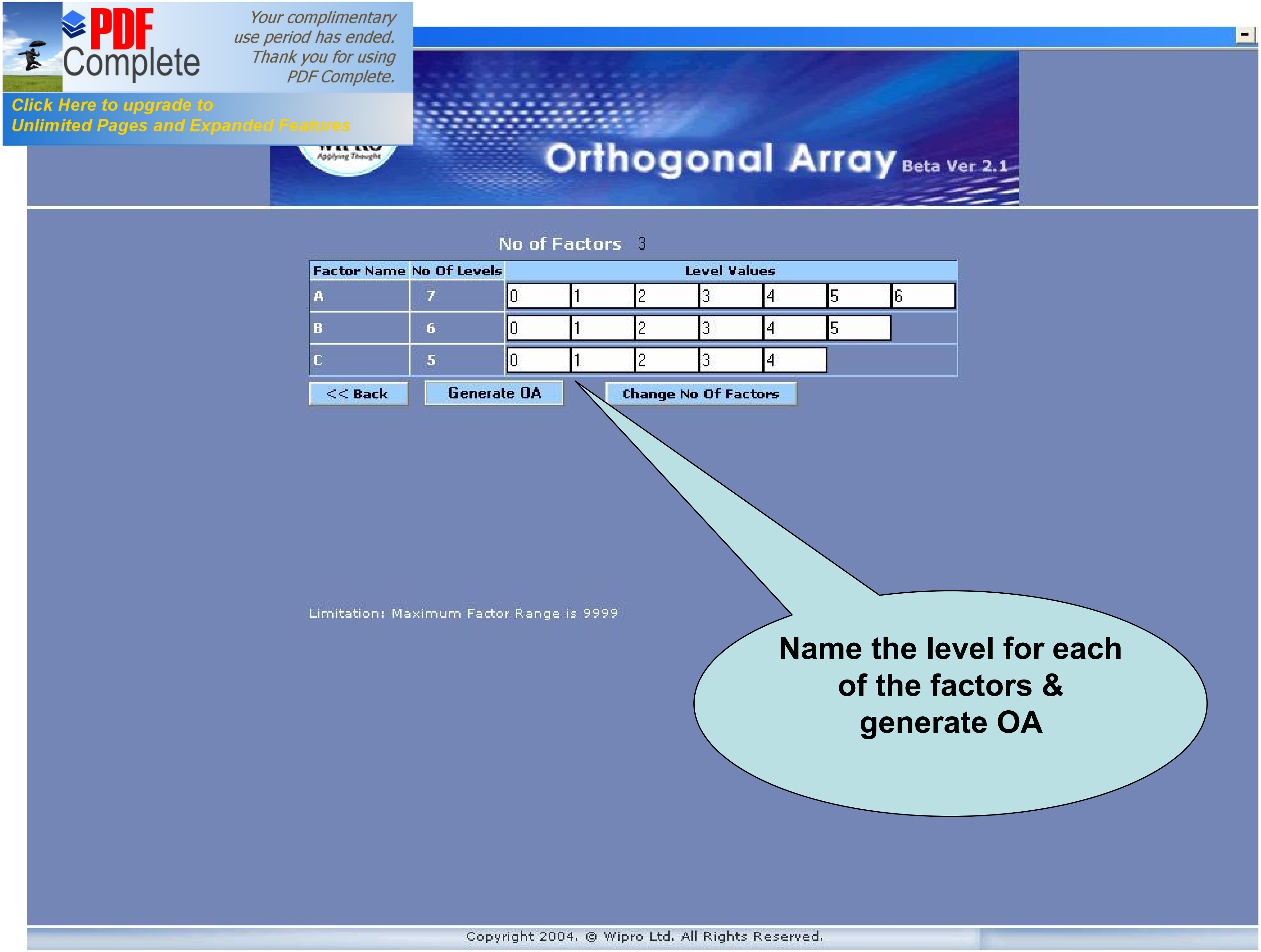
Name the factors & specify the number of Levels for each factor.



No of Factors 3

Factor Name	No Of Levels	Level Values						
A	7	0	1	2	3	4	5	6
B	6	0	1	2	3	4	5	
C	5	0	1	2	3	4		

Limitation: Maximum Factor Range is 9999

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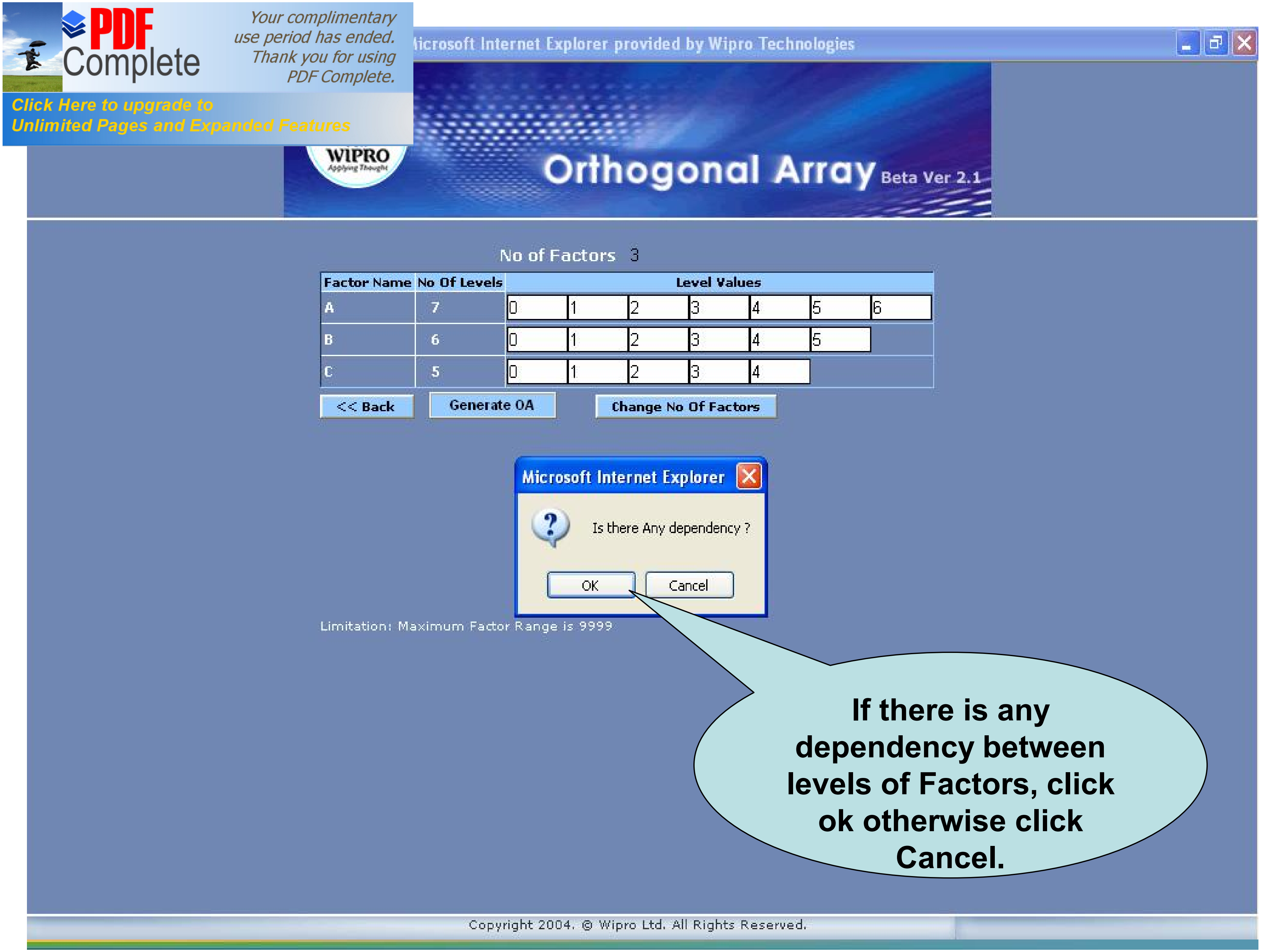
Name the level for each of the factors & generate OA



icrosoft Internet Explorer provided by Wipro Technologies

No of Factors 3

Factor Name	No Of Levels	Level Values						
A	7	0	1	2	3	4	5	6
B	6	0	1	2	3	4	5	
C	5	0	1	2	3	4		

Microsoft Internet Explorer

Is there Any dependency ?

Limitation: Maximum Factor Range is 9999

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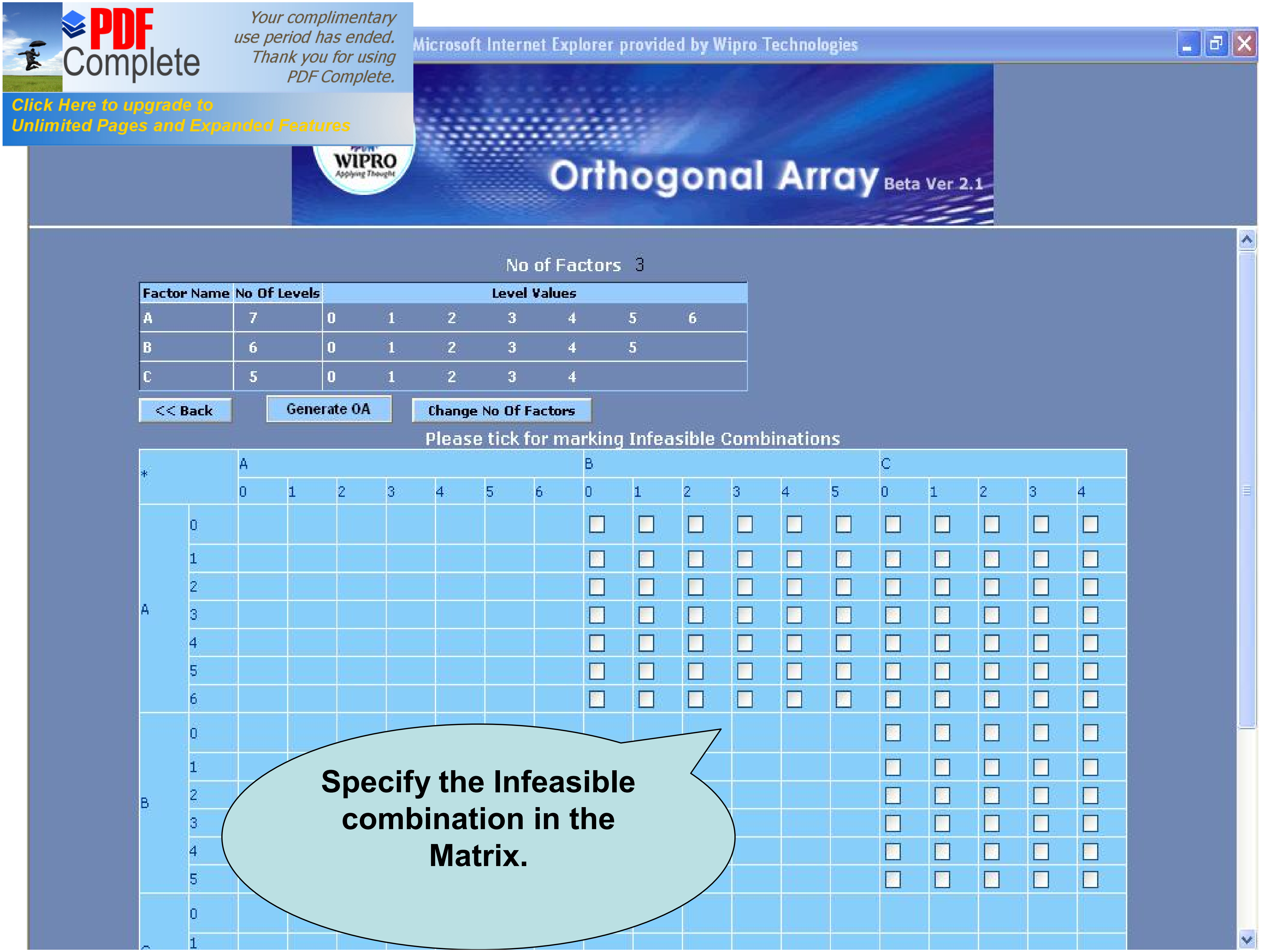
If there is any dependency between levels of Factors, click ok otherwise click Cancel.


Microsoft Internet Explorer provided by Wipro Technologies
WIPRO
Applying Thought
Orthogonal Array Beta Ver 2.1

No of Factors 3

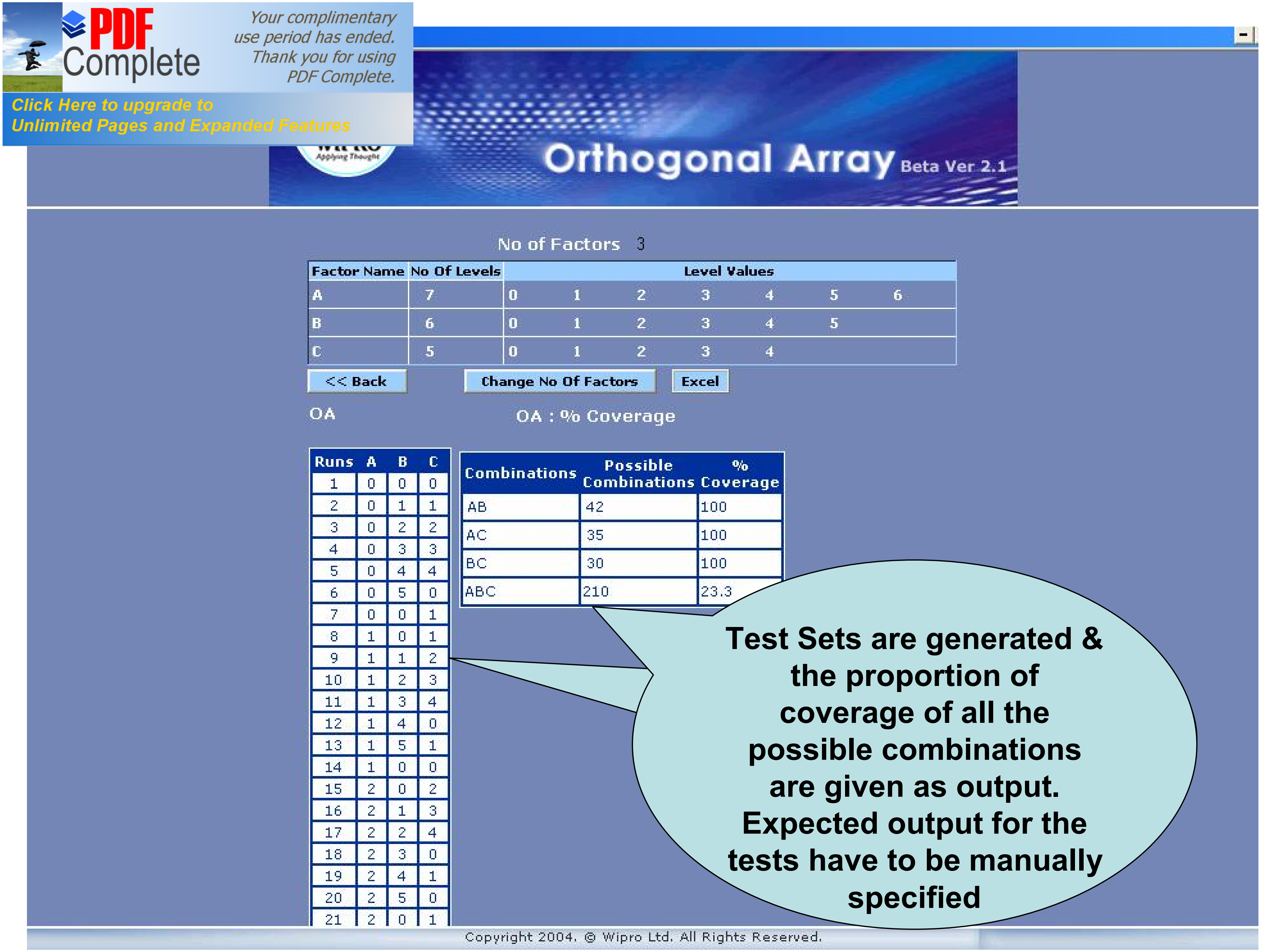
Factor Name	No Of Levels	Level Values						
A	7	0	1	2	3	4	5	6
B	6	0	1	2	3	4	5	
C	5	0	1	2	3	4		

<< Back
Generate OA
Change No Of Factors

Please tick for marking Infeasible Combinations

*		A							B						C				
		0	1	2	3	4	5	6	0	1	2	3	4	5	0	1	2	3	4
A	0								□	□	□	□	□	□	□	□	□	□	□
	1								□	□	□	□	□	□	□	□	□	□	□
	2								□	□	□	□	□	□	□	□	□	□	□
	3								□	□	□	□	□	□	□	□	□	□	□
	4								□	□	□	□	□	□	□	□	□	□	□
	5								□	□	□	□	□	□	□	□	□	□	□
	6								□	□	□	□	□	□	□	□	□	□	□
B	0														□	□	□	□	□
	1														□	□	□	□	□
	2														□	□	□	□	□
	3														□	□	□	□	□
	4														□	□	□	□	□
	5														□	□	□	□	□
C	0																		
	1																		

Specify the Infeasible combination in the Matrix.



No of Factors 3

Factor Name	No Of Levels	Level Values						
A	7	0	1	2	3	4	5	6
B	6	0	1	2	3	4	5	
C	5	0	1	2	3	4		

OA

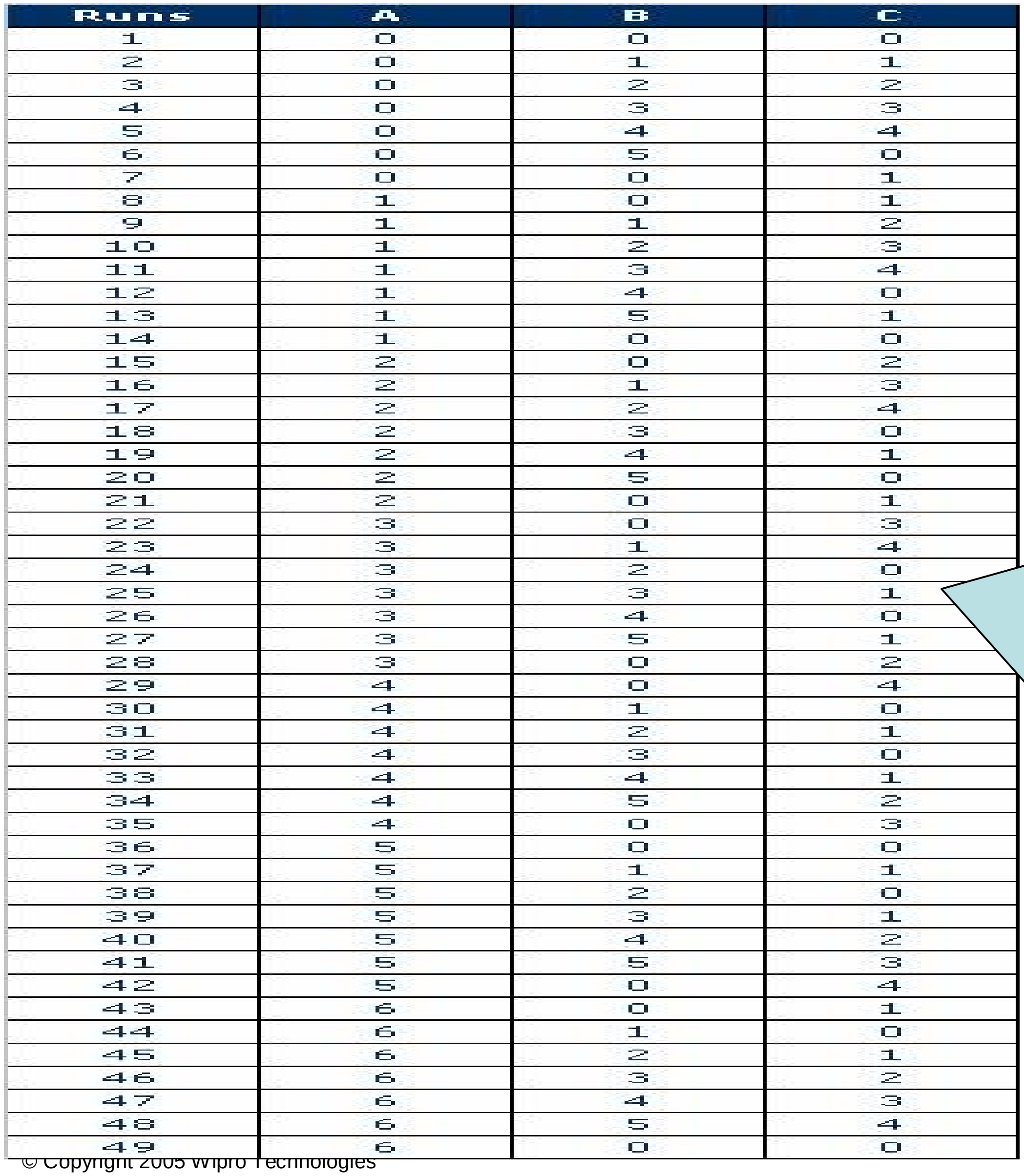
Runs	A	B	C
1	0	0	0
2	0	1	1
3	0	2	2
4	0	3	3
5	0	4	4
6	0	5	0
7	0	0	1
8	1	0	1
9	1	1	2
10	1	2	3
11	1	3	4
12	1	4	0
13	1	5	1
14	1	0	0
15	2	0	2
16	2	1	3
17	2	2	4
18	2	3	0
19	2	4	1
20	2	5	0
21	2	0	1

OA : % Coverage

Combinations	Possible Combinations	% Coverage
AB	42	100
AC	35	100
BC	30	100
ABC	210	23.3

Test Sets are generated & the proportion of coverage of all the possible combinations are given as output. Expected output for the tests have to be manually specified

tput



Runs	A	B	C
1	0	0	0
2	0	1	1
3	0	2	2
4	0	3	3
5	0	4	4
6	0	5	0
7	0	0	1
8	1	0	1
9	1	1	2
10	1	2	3
11	1	3	4
12	1	4	0
13	1	5	1
14	1	0	0
15	2	0	2
16	2	1	3
17	2	2	4
18	2	3	0
19	2	4	1
20	2	5	0
21	2	0	1
22	3	0	3
23	3	1	4
24	3	2	0
25	3	3	1
26	3	4	0
27	3	5	1
28	3	0	2
29	4	0	4
30	4	1	0
31	4	2	1
32	4	3	0
33	4	4	1
34	4	5	2
35	4	0	3
36	5	0	0
37	5	1	1
38	5	2	0
39	5	3	1
40	5	4	2
41	5	5	3
42	5	0	4
43	6	0	1
44	6	1	0
45	6	2	1
46	6	3	2
47	6	4	3
48	6	5	4
49	6	0	0

ÅOnce Factors & Levels are identified, test sets are generated by the tool

ÅAll levels of each factor are tested at least once. (All single mode failures re covered)

ÅAll possible pair wise combinations are tested at least once (All Double mode failures are covered at least once)

dies – OA

OA Applied in Telecom - Project 1

□ **Project Objective:**
 ï To optimize test cases

□ **Project Goal :**
 ï To Improve test coverage, defect detection

□ **Methodology Used** : DSSS**+**
 ï Orthogonal Array

Å **Results:**
 ï Full factorial test cases : 58632
 ï OA based test cases :535
 ï After adding a few more test cases : 563

Å Business Benefits

 ï Test case reduction by 35%
 ï New bugs found using OA ï 6
 ï All Defects found in previous releases detected

OA Applied in Telecom - Project 2

□ Project Objective:
 ï To optimize test cases

□ Project Goal **:**
 ï To Improve test coverage, defect detection

□ Methodology Used : DSSS**+**
 ï Orthogonal Array

Å **Business Benefits**
 ï Earlier release had 17 test cases and did not detect any bugs

 ï For the same release with OA generated 24 test cases, the test coverage and defect detection improved drastically
 ï Test Coverage improved from
  Å 25 to 51 % in service option.
  Å 50 to 70% in protocol revision
  Å .40 to 100 % in service negotiation. 2
  Å 5 to 40 % in service handoff

OA Applied in retail domain

□ **Project Objective:**
 ï Optimize the number of test cases

□ **Project Goal :**
 □ Reduce testing effort
 □ 100% functionality coverage

□ **Methodology Used :** DSSS+
 □ Orthogonal Array

Å **Results**
 ï 848 test cases reduced to 167

Å Business Benefits
 ï Able to complete 2 complete cycles of testing in planned time

 ï Test case reduction by 80%

 ï 100% functionality covered

 ï Validated with requirements trace ability matrix

OA Applied in Finance domain

□ **Project Objective:**
 ï Optimize the number of test cases

□ **Project Goal :**
 ï Reduce testing effort

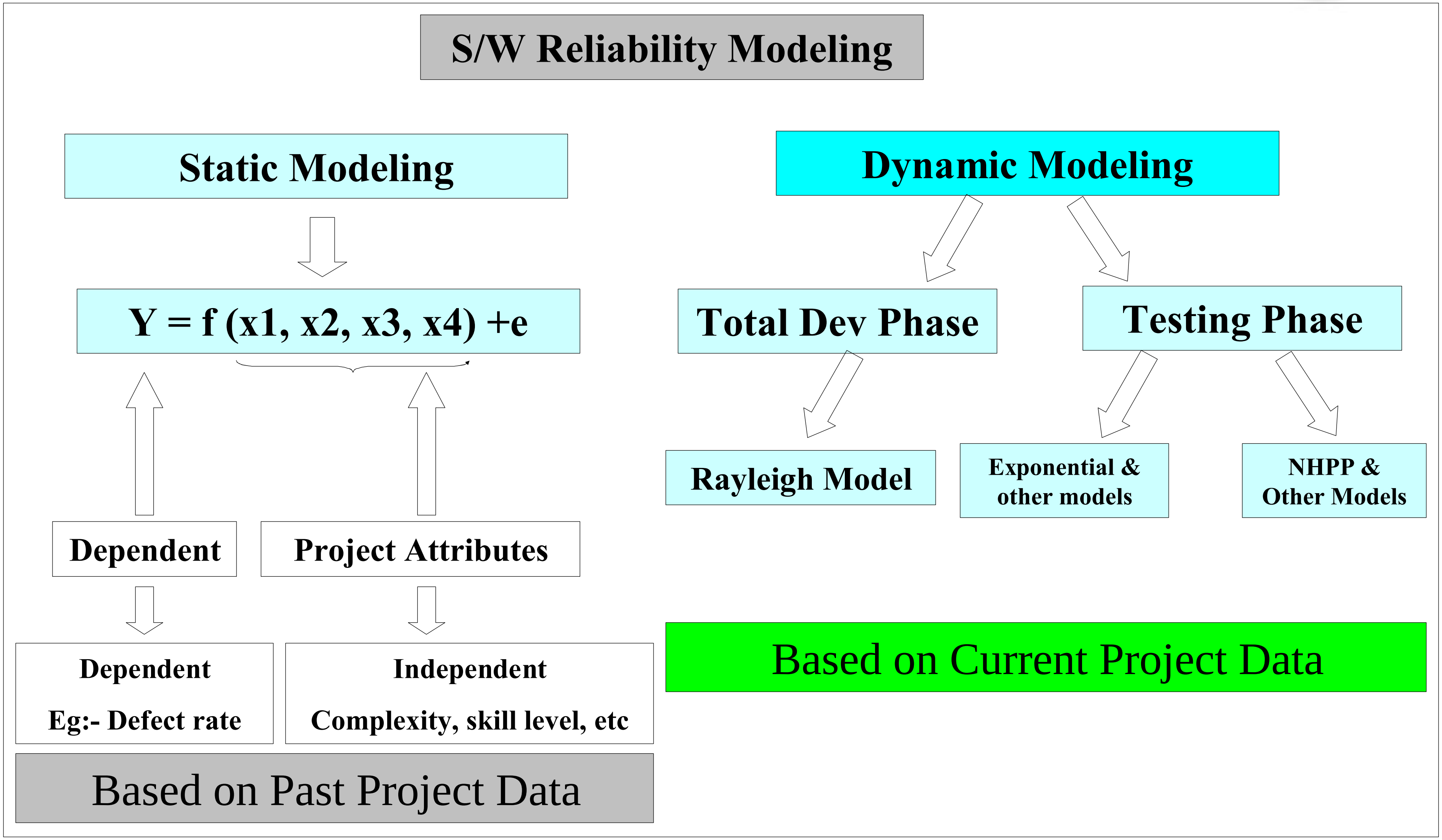
□ **Methodology Used :** DSSS+
 ï Orthogonal Array

□ **Results**
 ï Full factorial : 548 test cases
 ï rdExpert (industry product) : 290tc
 ï Wipro OA tool : 236tc

Å **Business Benefits**
 ï Reduced testing effort by 56%

Å **Concluding remarks of the practioner**
 ï Wipro's OA tool generated lower test cases when the factors and levels are high
 ï Despite the lower number of test cases the coverage is more when compared with rdExpert (industry standard tool)

Estimation – Reliability Modeling



ind The Wipro Reliability Tool

□ Effort in Testing is homogeneous throughout the testing phase.

□ Since this assumption is not always applicable, normalization of defect data wrt test cases is required.

□ An acceptable amount of coverage is achieved by the test cases under use (Use of OA based test case design or other robust methods is assumed)

□ The time sequence of the defect data should be maintained

□ At least 75% of the testing(test case execution) should be complete for predictive validity AND

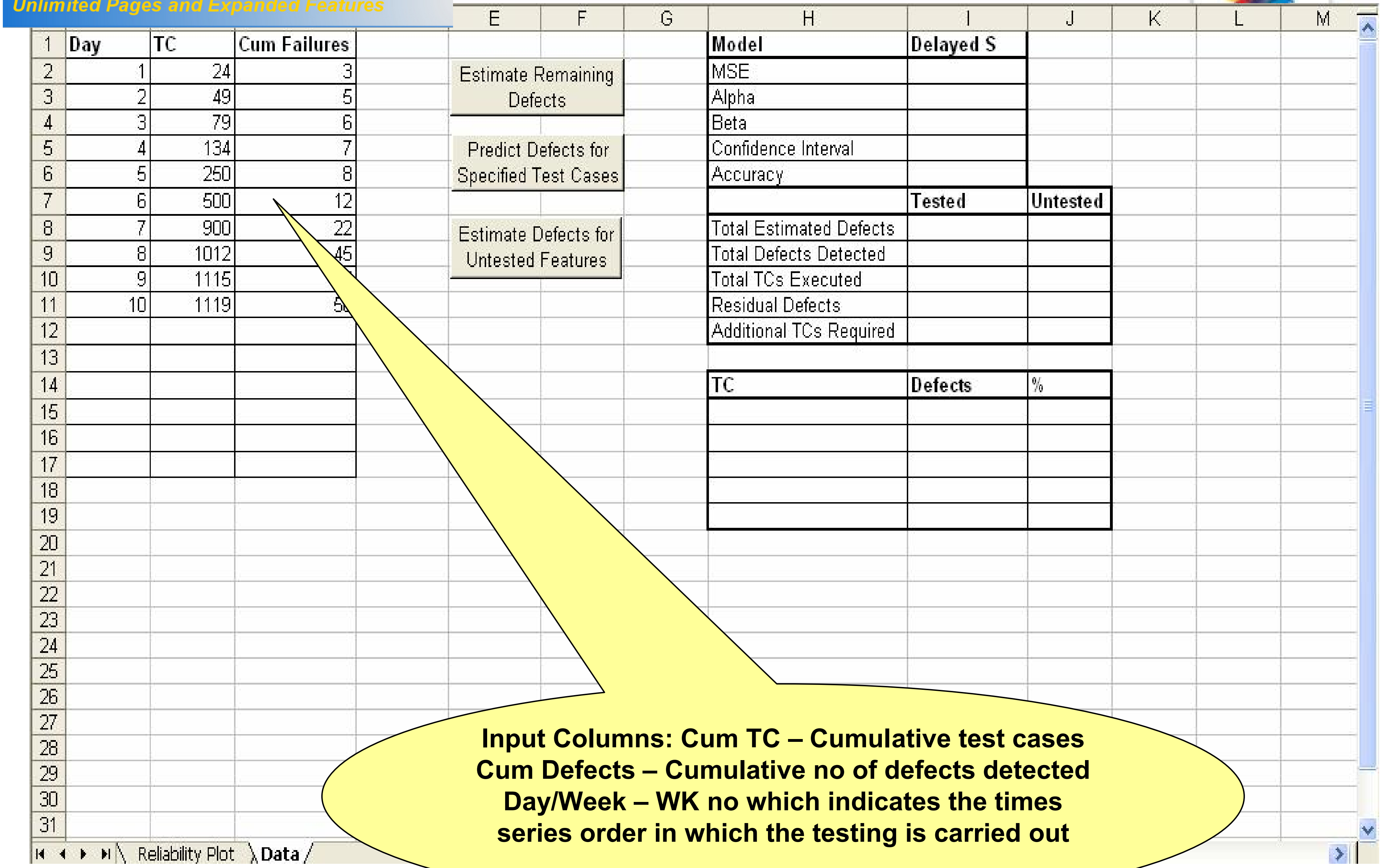
□ A plot of the defect rate should indicate a declining defect trend

Tool is not to be used for defect estimation without Test Execution.

Wipro Reliability

Tool Walkthrough/Demo

gh the tool



	Day	TC	Cum Failures
2	1	24	3
3	2	49	5
4	3	79	6
5	4	134	7
6	5	250	8
7	6	500	12
8	7	900	22
9	8	1012	45
10	9	1115	
11	10	1119	5

Estimate Remaining Defects
Predict Defects for Specified Test Cases
Estimate Defects for Untested Features
Reliability Plot
Data

Model	Delayed S
MSE	
Alpha	
Beta	
Confidence Interval	
Accuracy	

	Tested	Untested
Total Estimated Defects		
Total Defects Detected		
Total TCs Executed		
Residual Defects		
Additional TCs Required		

TC	Defects	%

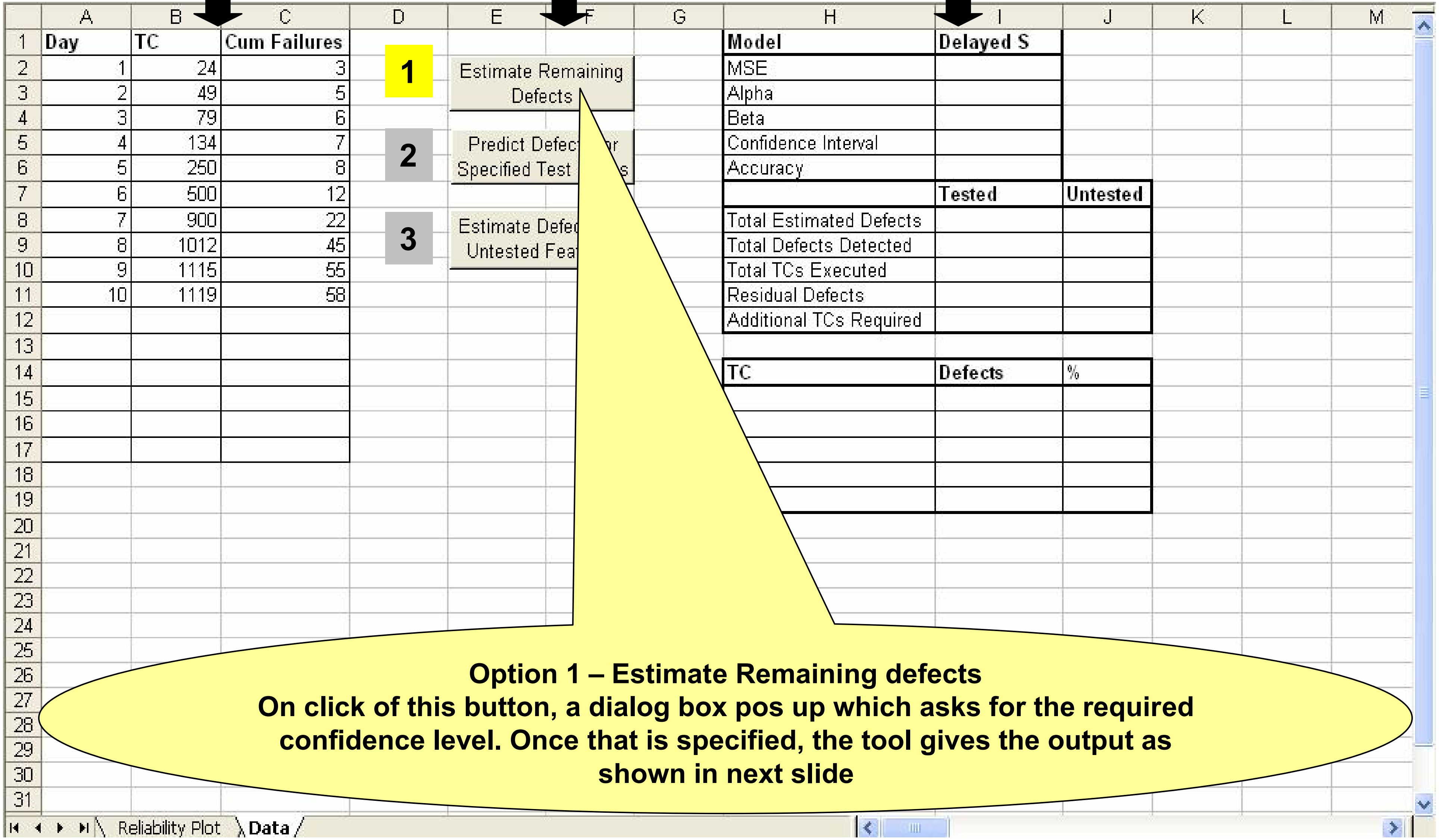
Input Columns: Cum TC – Cumulative test cases
Cum Defects – Cumulative no of defects detected
Day/Week – WK no which indicates the times series order in which the testing is carried out

gh the tool

Input Data Here

Options available

Output Display



Day	TC	Cum Failures
1	24	3
2	49	5
3	79	6
4	134	7
5	250	8
6	500	12
7	900	22
8	1012	45
9	1115	55
10	1119	58

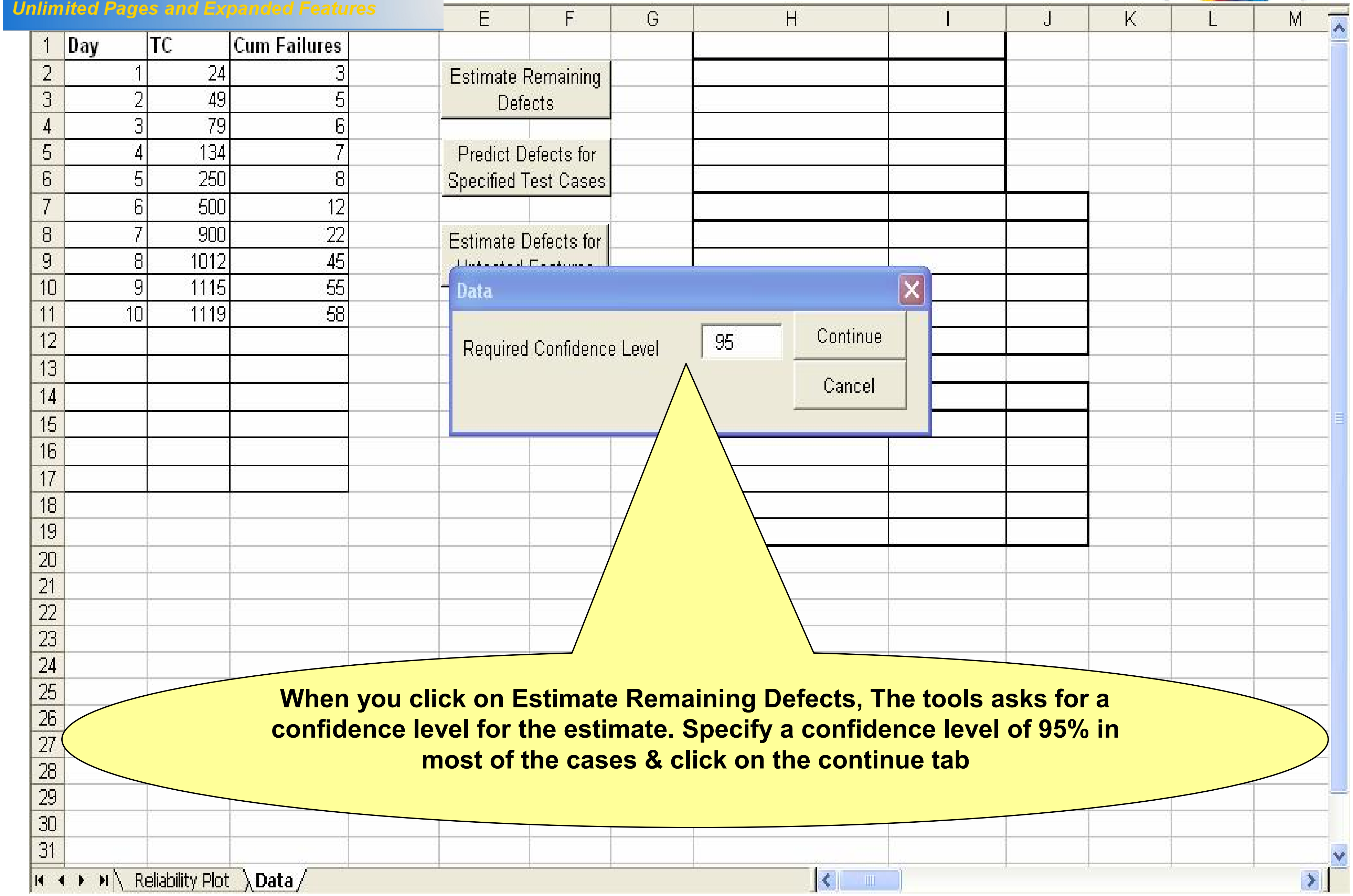
Model	Delayed S
MSE	
Alpha	
Beta	
Confidence Interval	
Accuracy	

	Tested	Untested
Total Estimated Defects		
Total Defects Detected		
Total TCs Executed		
Residual Defects		
Additional TCs Required		

TC	Defects	%

Option 1 – Estimate Remaining defects
On click of this button, a dialog box pos up which asks for the required confidence level. Once that is specified, the tool gives the output as shown in next slide

gh the tool



Day	TC	Cum Failures
1	24	3
2	49	5
3	79	6
4	134	7
5	250	8
6	500	12
7	900	22
8	1012	45
9	1115	55
10	1119	58

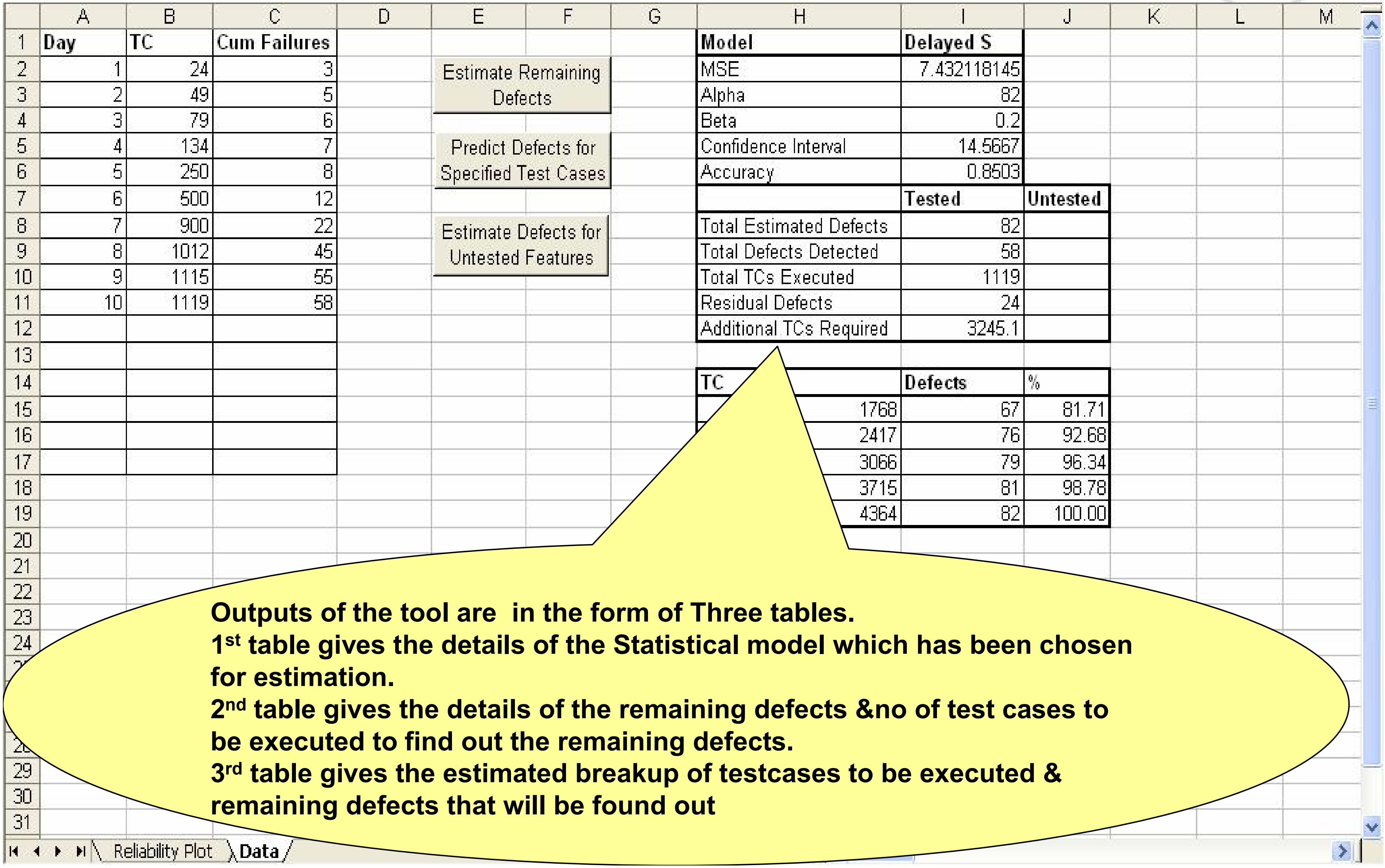
Data

Required Confidence Level: 95

Estimate Remaining Defects
Predict Defects for Specified Test Cases
Estimate Defects for
Continue
Cancel
Reliability Plot
Data

When you click on Estimate Remaining Defects, The tools asks for a confidence level for the estimate. Specify a confidence level of 95% in most of the cases & click on the continue tab

gh the tool


Estimate Remaining Defects
Predict Defects for Specified Test Cases
Estimate Defects for Untested Features
Reliability Plot
Data

Day	TC	Cum Failures
1	24	3
2	49	5
3	79	6
4	134	7
5	250	8
6	500	12
7	900	22
8	1012	45
9	1115	55
10	1119	58

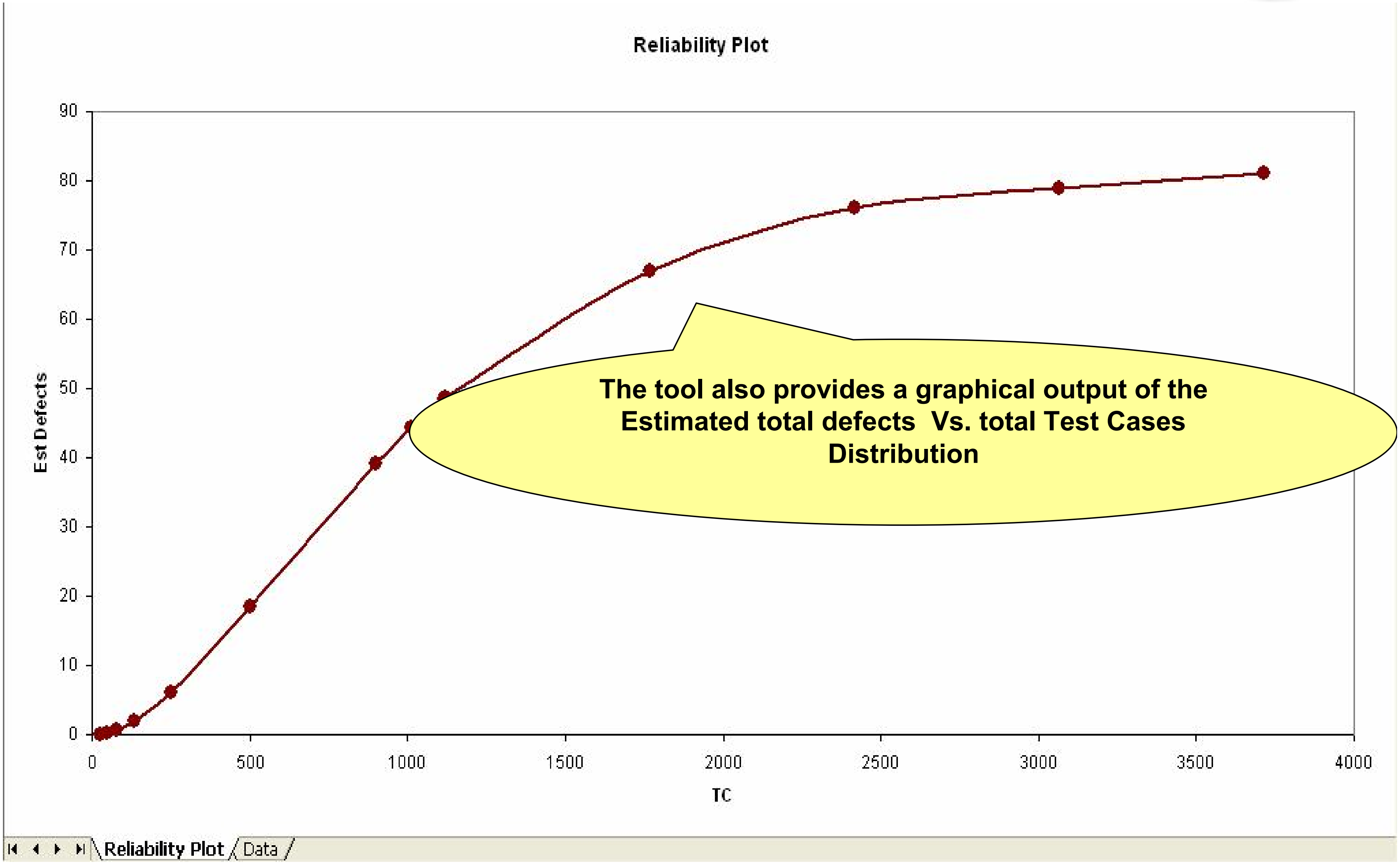
Model	Delayed S
MSE	7.432118145
Alpha	82
Beta	0.2
Confidence Interval	14.5667
Accuracy	0.8503

	Tested	Untested
Total Estimated Defects	82	
Total Defects Detected	58	
Total TCs Executed	1119	
Residual Defects	24	
Additional TCs Required	3245.1	

TC	Defects	%
1768	67	81.71
2417	76	92.68
3066	79	96.34
3715	81	98.78
4364	82	100.00

Outputs of the tool are in the form of Three tables.
1st table gives the details of the Statistical model which has been chosen for estimation.
2nd table gives the details of the remaining defects &no of test cases to be executed to find out the remaining defects.
3rd table gives the estimated breakup of testcases to be executed & remaining defects that will be found out

gh the tool



The tool also provides a graphical output of the Estimated total defects Vs. total Test Cases Distribution

Summary

of

Solutions to Address

Testing Challenges

OA Tool

Orthogonal Array

Test Phase : Test Optimization

Features

Å Systematic and statistical method of pair-wise combinations of selected factors or variables across their levels.

Å Creates an optimized test suite with lesser test cases.

Å Detects all single mode and double mode defects.

Å Increases confidence level in the system by executing a concise set of tests and uncovering most of the bugs.

Benefits

Å Helps in productivity improvement with cycle time reduction.

Å Helps in improving the test coverage.

Å Helps in minimizing the size of test suite by eliminating the redundant test cases from the test suite.

Å Test effort reduction in terms of test case writing and execution.

Case Study

Client Name : A large North American telecom equipment manufacturer

Project Scope:

Å Testing of a large IP-PBX system.

Å Live Communication Version features to be incorporated.

Å Initial test suite contains more than 800 test cases.

Challenges :

Optimizing the test suite without compromising on the test coverage.

Benefits :

Considerable amount of saving in terms of test effort and time.

- The number of test cases was reduced from 800 to 170 .
- There was a reduction in approx. 75% of the testing effort.
- No compromise on test coverage

CoDeC Tool

Complexity **De**pendency **C**hange impact

CoDeC is an integrated tool consists of DSM, SCE and SCIM features

DSM Tool (Dependency Structure Matrix)

Test Sequencing

Dependency Structure Matrix analyses the dependencies among the modules and Helps project managers in

- Determining the sequence of test execution of the modules.
- Deciding which modules should be kept under a single team.
- Deciding which modules can be executed in parallel without any dependency clash.

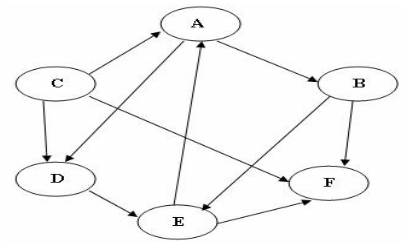
Which modules should be tested first?

SCE Tool (System Complexity Estimator)

Effort Estimation

System Complexity Estimator analyses the complexity and the dependency of modules in a system and helps project managers in estimating testing effort distribution across the modules.

Which module requires maximum testing effort?



SCIM Tool (System Change Impact Matrix)

Maintenance Phase

System Change Impact Matrix analyses the system complexity, and the impact of each Change Request (CR) on all the modules in a system and helps project managers in

- Estimating the relative test effort distribution across modules during maintenance phase.
- Estimating the relative test effort distribution across different CRs.

Which module requires maximum attention from a change perspective?

CASE STUDY

Client: A large North American server and storage manufacturer.

Project: Asset Management Systems (Maintenance Project)

Project Scope

- to reduce the test execution cycle time of the release.
- to avoid unnecessary repetition of test cases.
- to ensure that there is no defect slippage because of the reduced set of regression test cases.

Challenges

- to find the correct sequence of execution of modules.

Benefits

- Helped in determining the sequence of execution without any dependency clash
- Before using DSM around 871 regression test cases were executed. However during the beta testing conducted in Feb 2007, only 208 optimized (DSM) regression test cases were executed by avoiding duplication.
- The test cycle time got reduced from 20 person days to 12 person days.

DFA Tool

Defect Flow Analysis

DFA Tool has 2 features: Metric Analysis and Reliability Analysis

Metric Analysis

Reliability Estimation

Test Reporting

This tool helps project managers in

- systematically analyzing various metrics applicable in a testing project faster and thus with less effort.

- standardizing reports generated across projects by providing graphical and tabular representation of

ÅDefect Trend

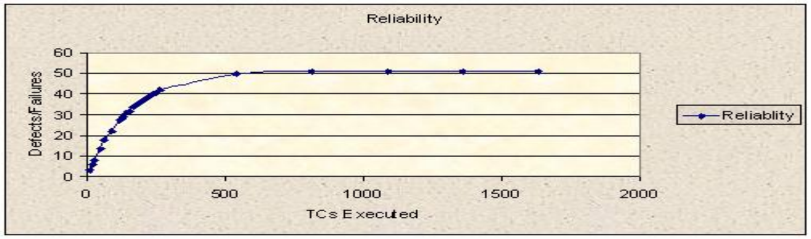
ÅTest case productivity, Pass rate, test efficiency

ÅDefect priority analysis etc.

Reliability Analysis

This tool analyses the trends of Defect Detection in a test cycle and helps the test manager in

- Estimating residual defects in the system.
- Deciding when to stop Testing of a system.



Case Study

Client: A large North American Telecom Equipment manufacturer.

Project Scope

- verification of leading north American equipment vendorâs element management system for his broad band access products.

Challenges

- whether to release product or continue testing.
- to release products in the field with a level of confidence.

Benefits

- Predicted number of defects in the past were validated by the response from the field.
- Helped in taking a decision on whether to continue testing or release the feature.
- Based on the reliability output, recommendation was given to stop the general availability of one of the release.

Thank You