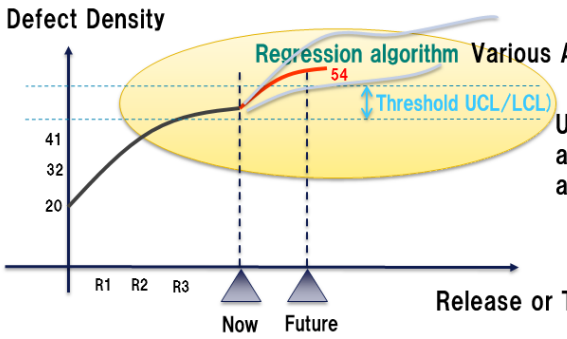
NTT DATA

CRESTA

Comprehensive Robotic Engine for Software Test Acceleration

MVP (Min Value Product) Usecases – An Overview

Usecase 1 – Prediction(故障予測)



UCL and LCL are predicted by the application.

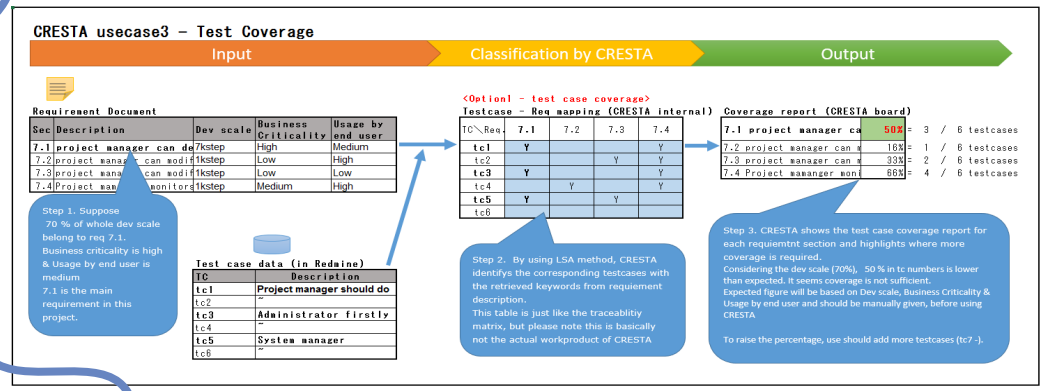
Derived from “Dell Statistica” and basic machine learning theory

Usecase 3 – Test Coverage （試験項目の妥当性）

High Risk	Risk	Normal
Module 3	Module 2	Module 1
Module 5		Module 4

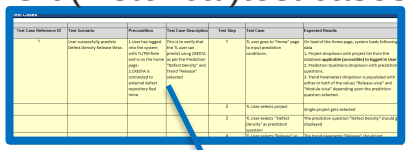
1 Unique to CRESTA

2 Unique to CRESTA

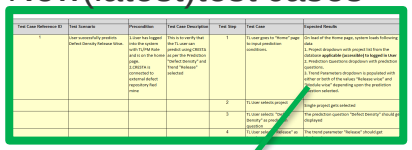


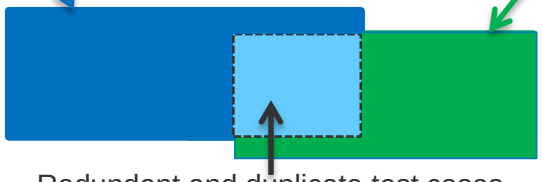
Usecase 2 – Test Optimization （試験項目最適化）

Old(historical)test cases



New(latest)test cases

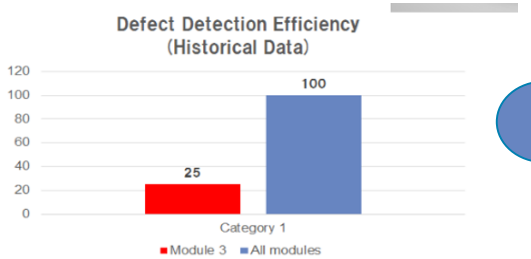




Functional test cases

Redundant and duplicate test cases

Derived from “Conformiq”, Tosca concepts Implementation Jubatus



Derived from Tosca

3

(1) Regression Testing Minimisation, Selection and Prioritisation : A Survey
(2) How AI Will Change Software Development And Applications : Forrester research

Adobe Acrobat Document

Adobe Acrobat Document

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UC1: PREDICTION OF SOFTWARE QUALITY

October, 2016

UC1: Base Minimum Value Product Use Case. (MVP)

(1) Select a Project

(2) Select a Metric for prediction

(3) Select Trend

- Result :

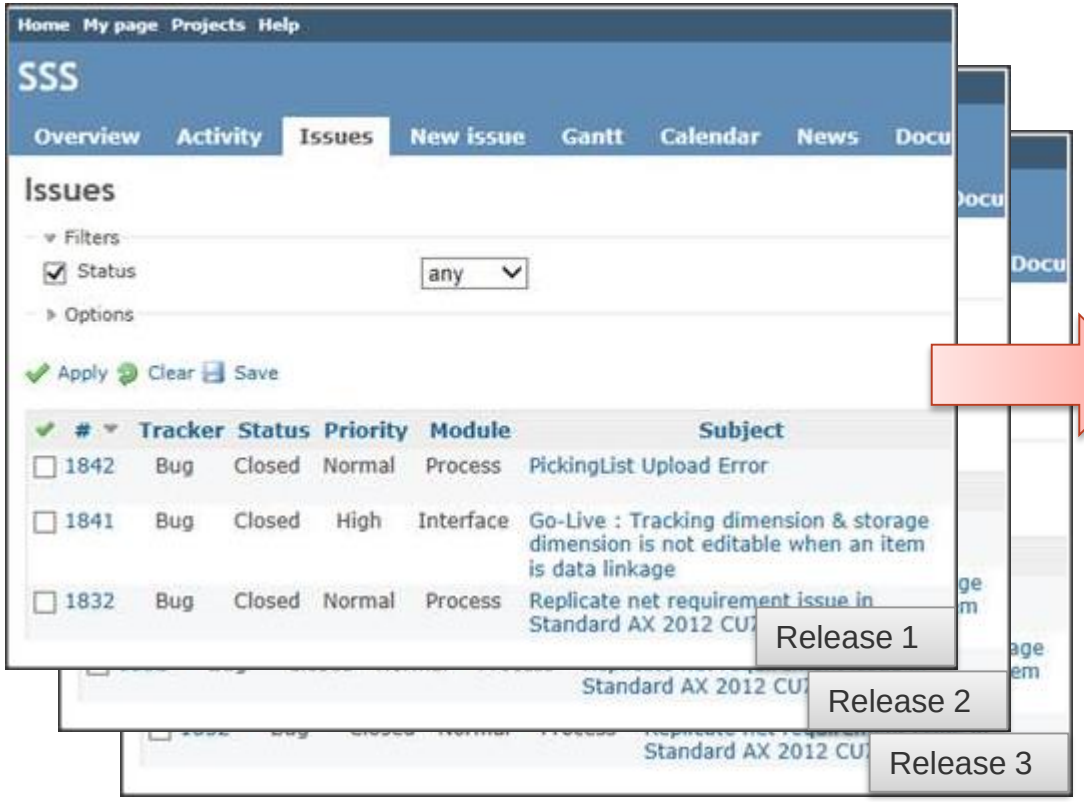
(1) Statistical UCL and LCL are calculated

(2) Metric for future release is predicted

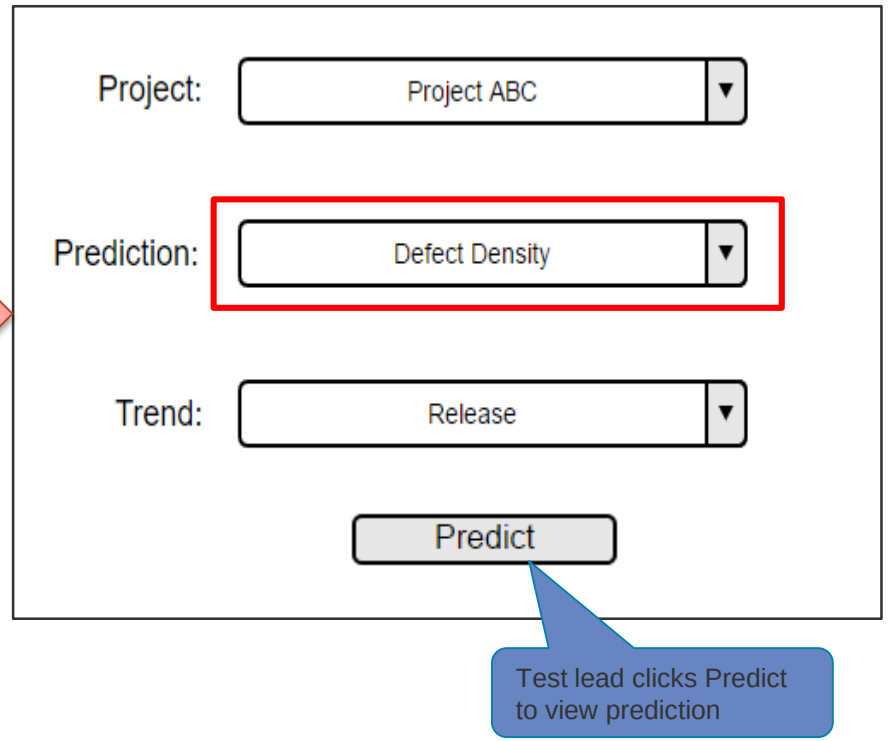
(3) Predictions are given by various algorithms

MVP: Predict defect density(バグ密度の予測)

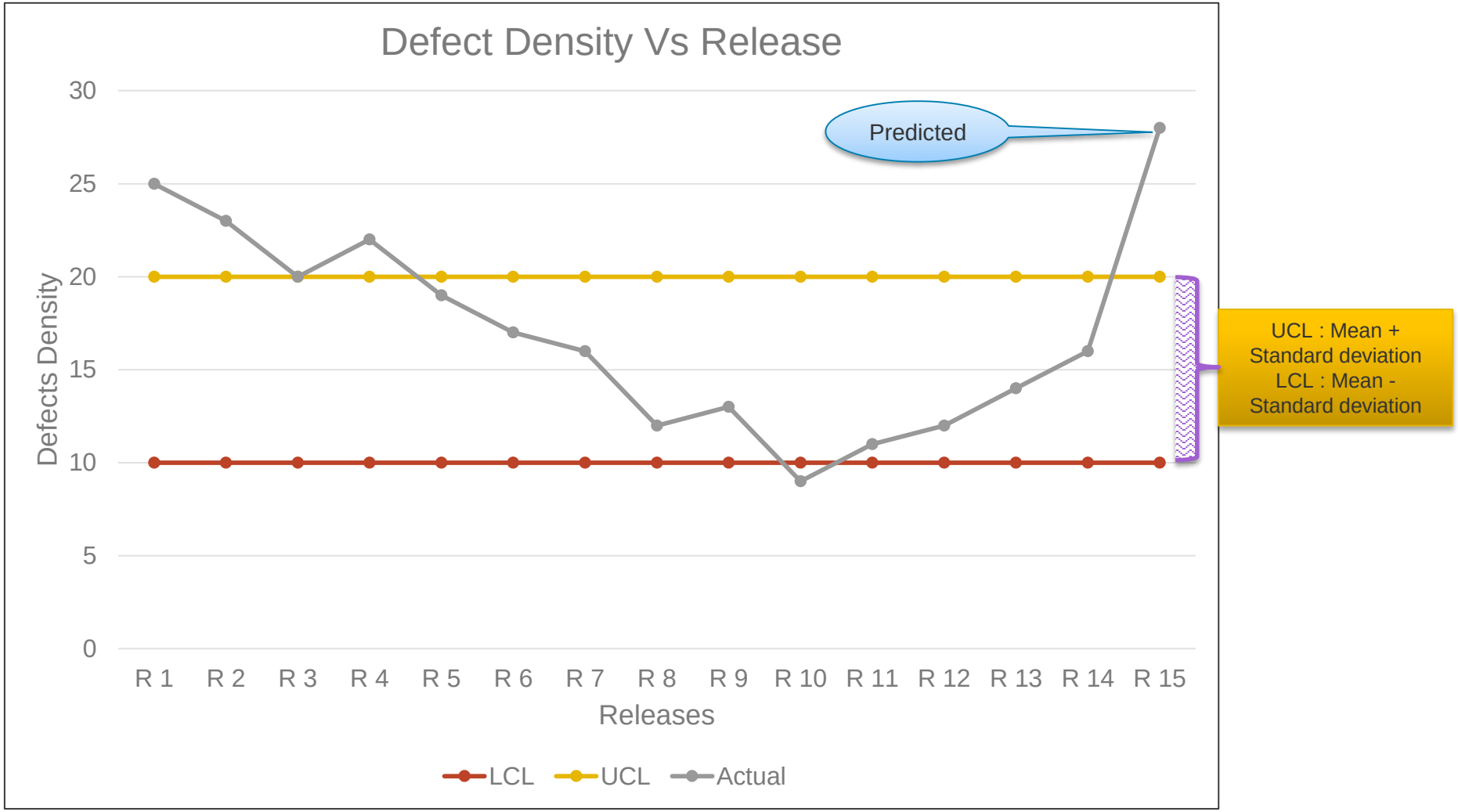
What will be the defect density in future?



Historical defects data release wise



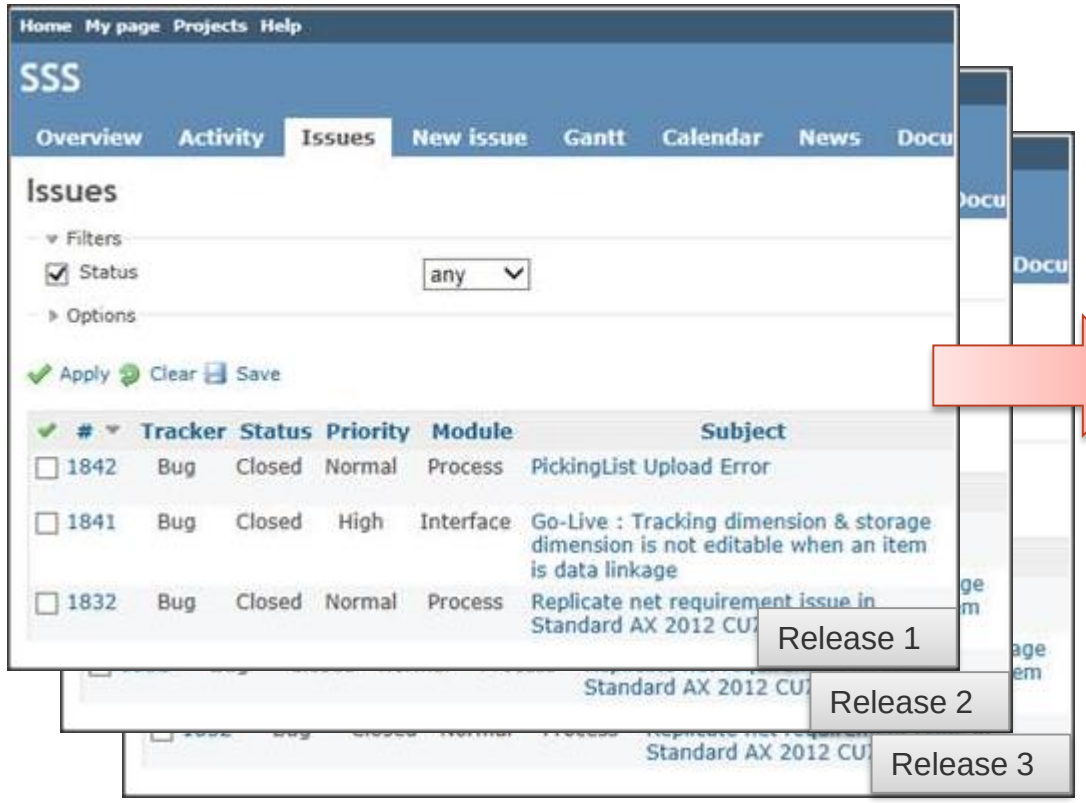
MVP: Predict defect density

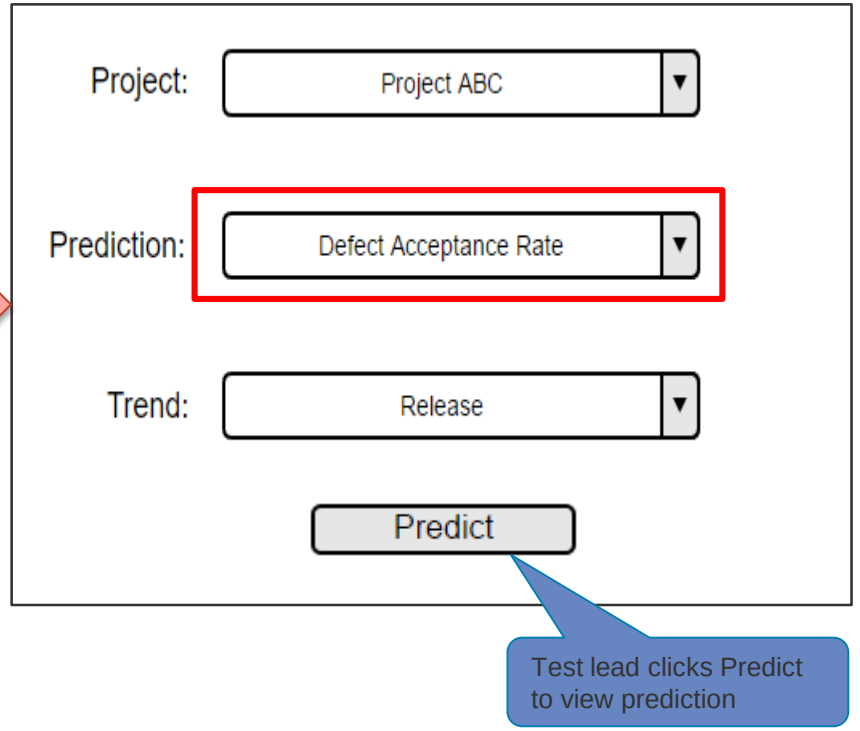


Note – Test lead will analyze based on above predictions

UC1A: Predict defect acceptance rate
（潜在バグ率の予測）

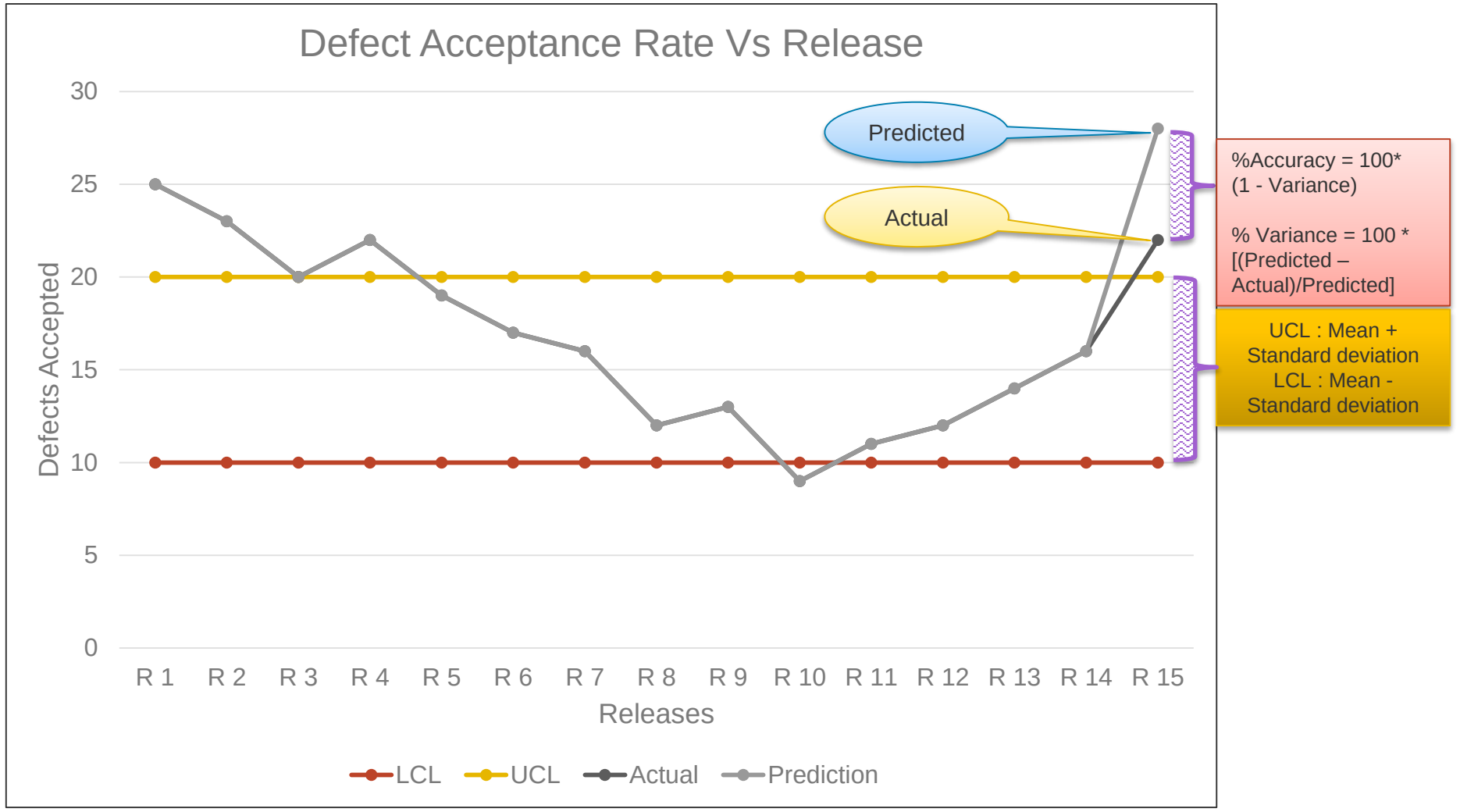
What will be the defect acceptance rate in future?





Historical defects data release wise

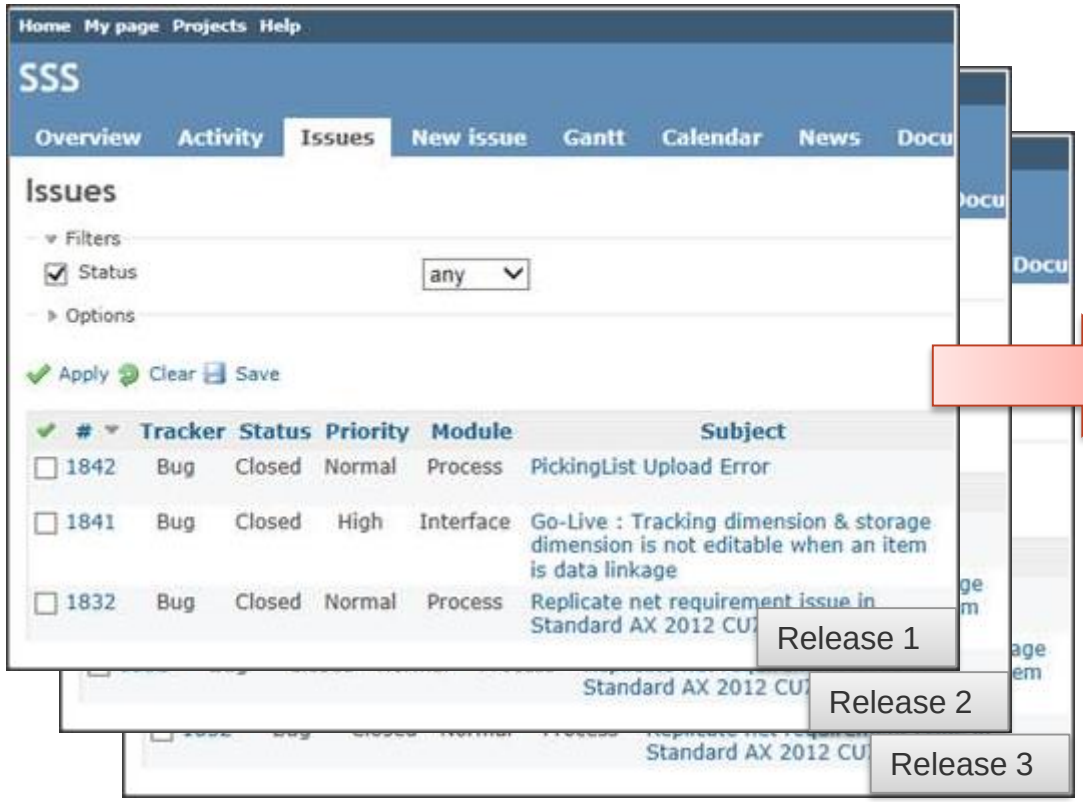
UC1A: Predict defect acceptance rate

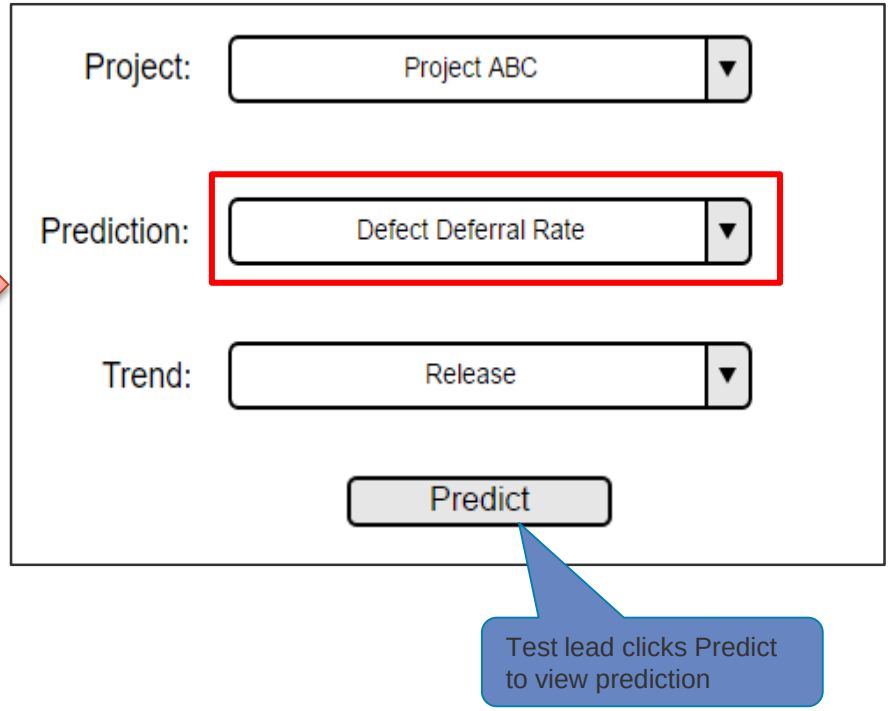


Note – Test lead will analyze based on above predictions

UC1B: Predict defect deferral rate （故障改修遅延率）

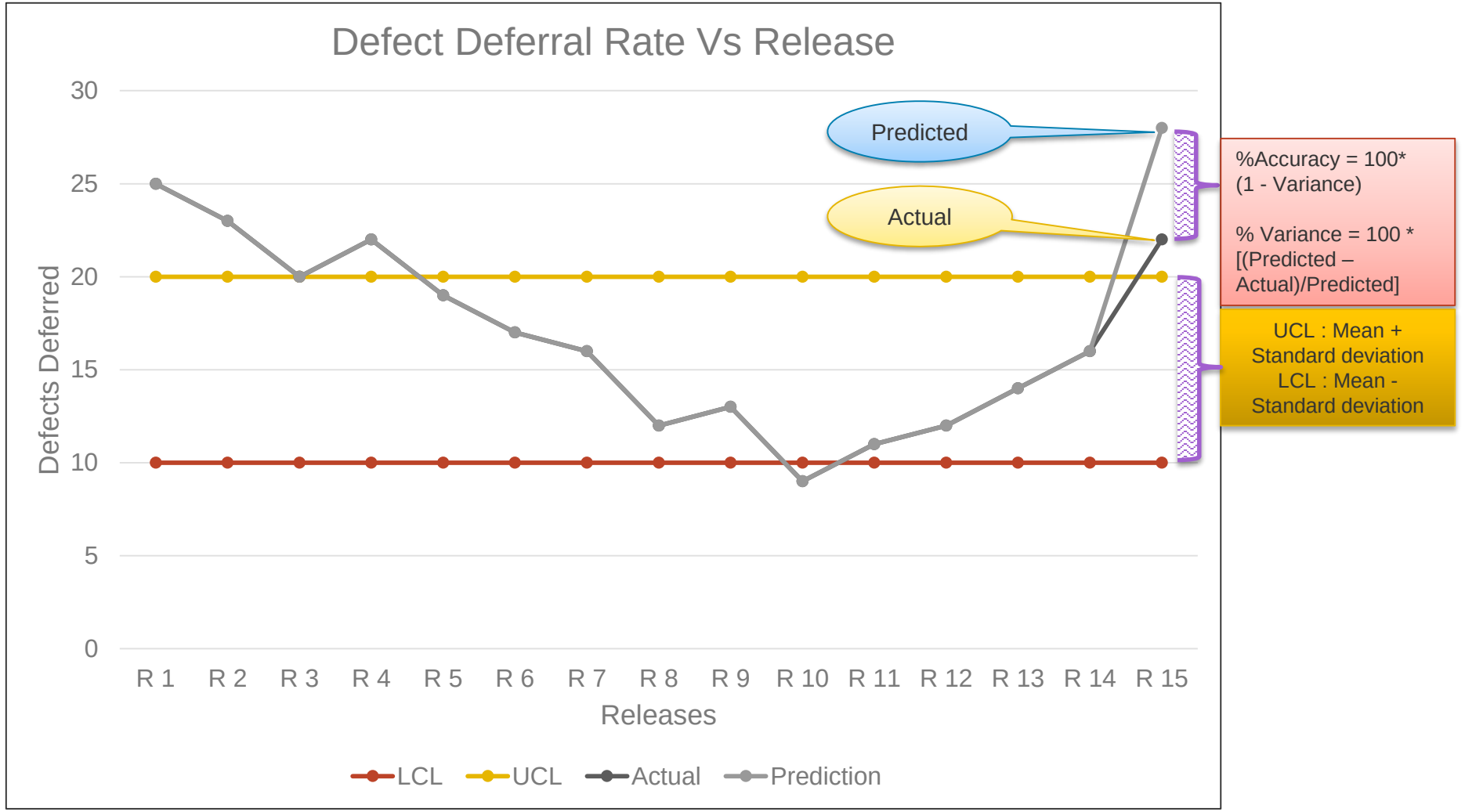
What will be the defect deferral rate in next release?





Historical defects data release wise

UC1B: Predict defect deferral rate

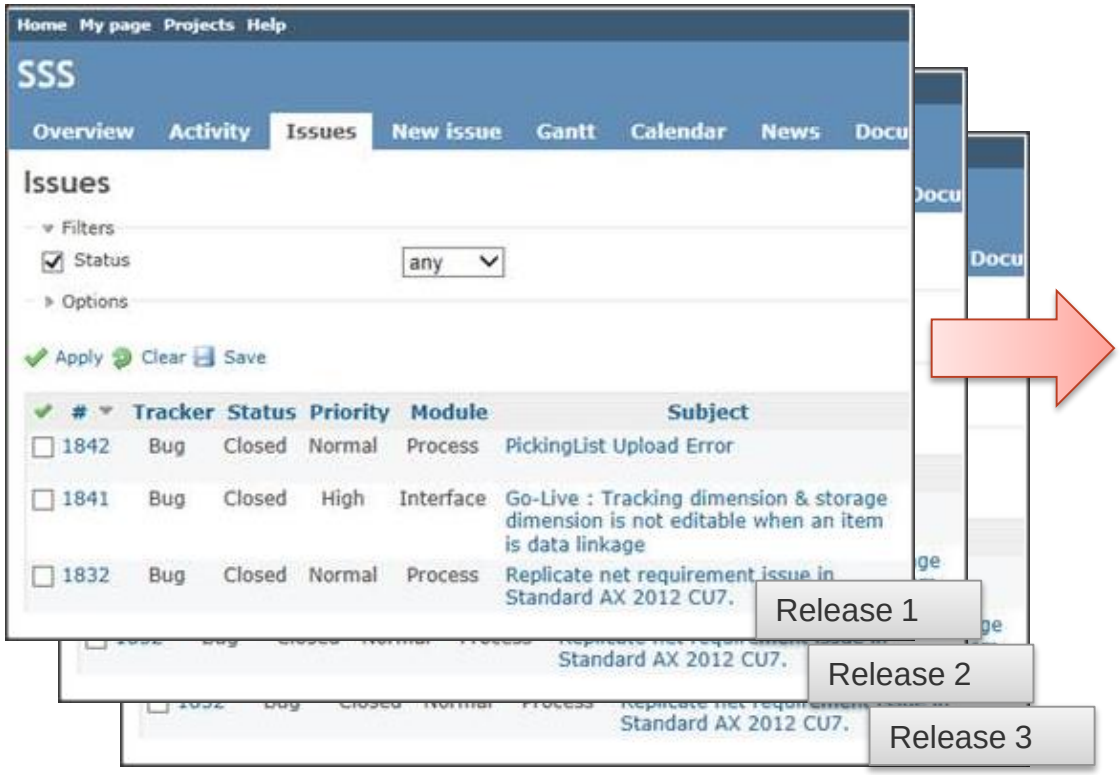


Note – Test lead will analyze based on above predictions

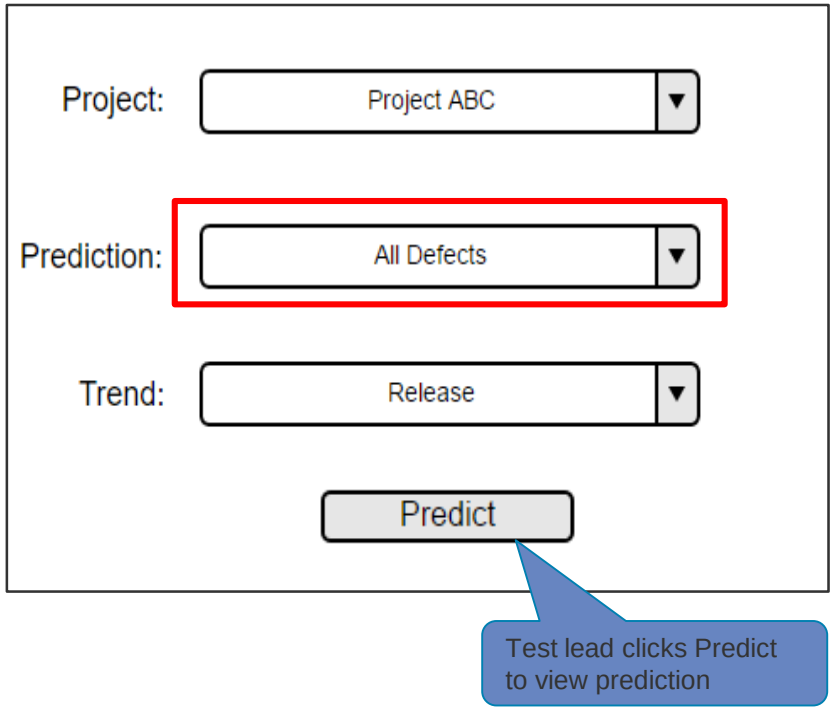
UC1C: Predicted all defects vs. Actual all defects (故障数)

What will be the overall defects count in future?

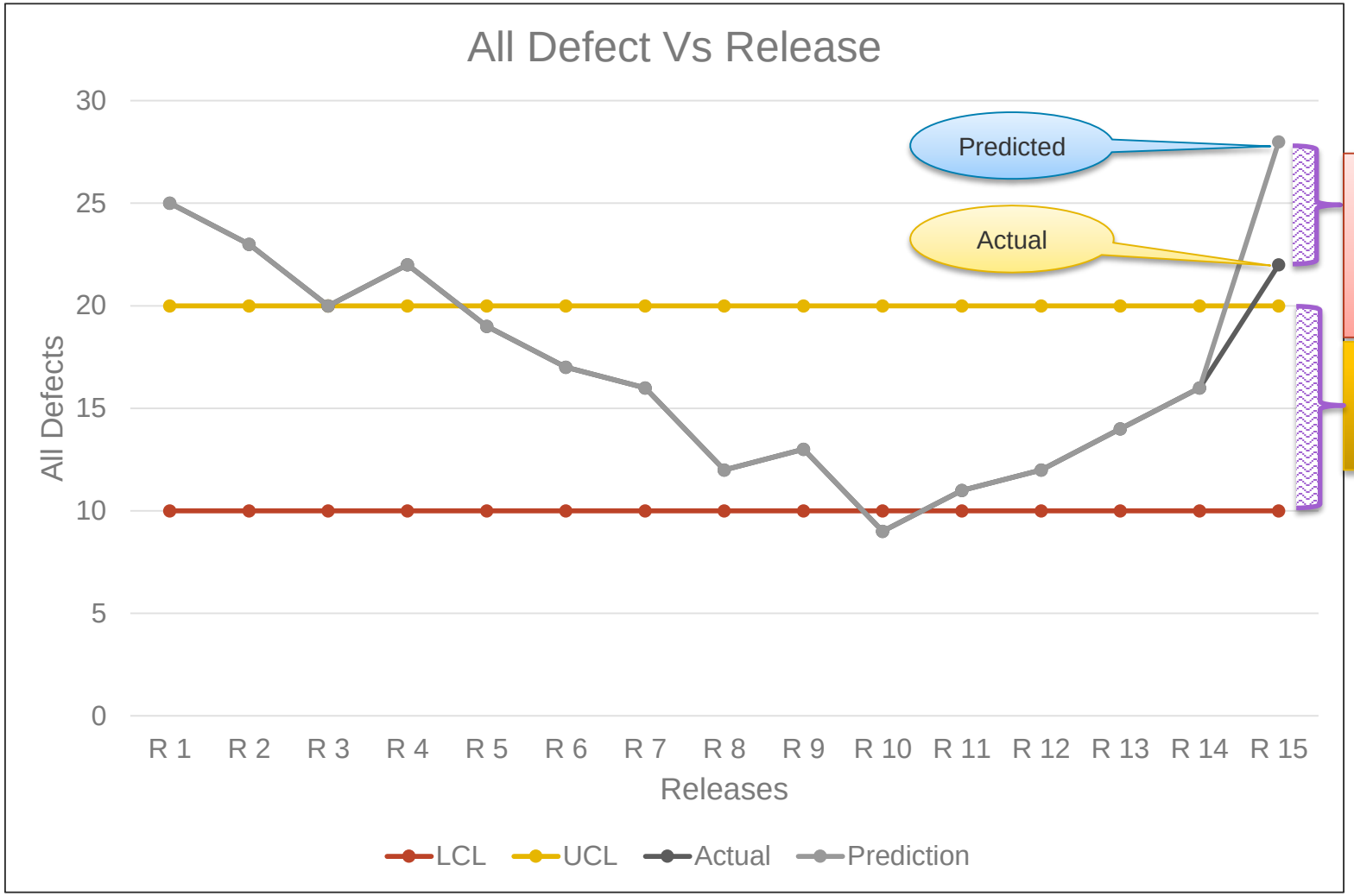
All defects
-nonfunctional
-functional
-performance
-usability etc…



Historical defects data release wise



UC1C: Predicted all defects vs. Actual all defects

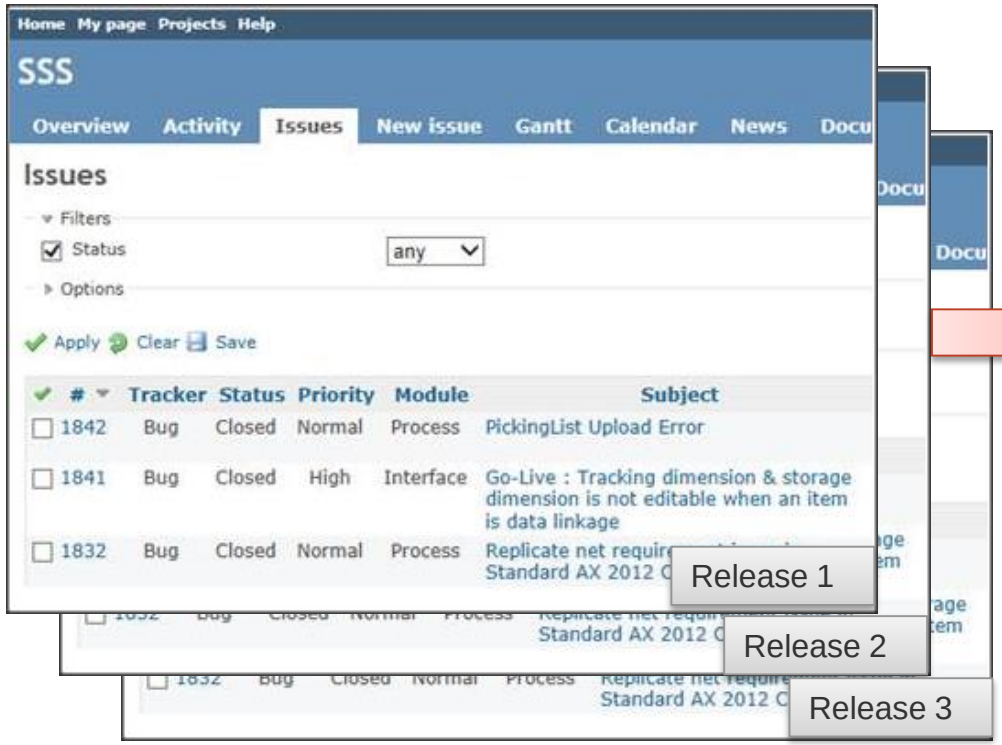


Note – Test lead will analyze based on above predictions

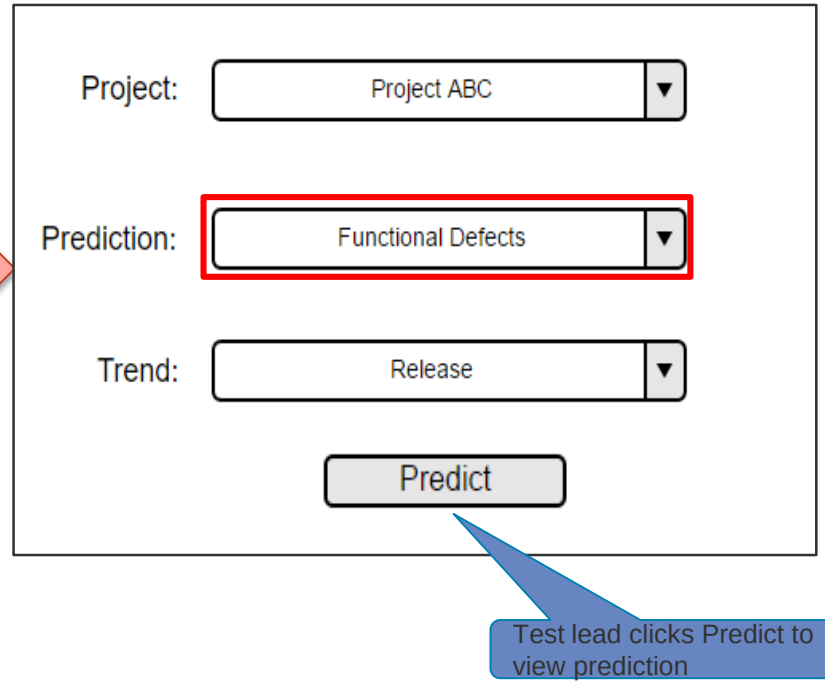
UC1D: Predicted functional defects vs. Actual functional defects (機能試験の故障数)

What will be the functional defects count in future?

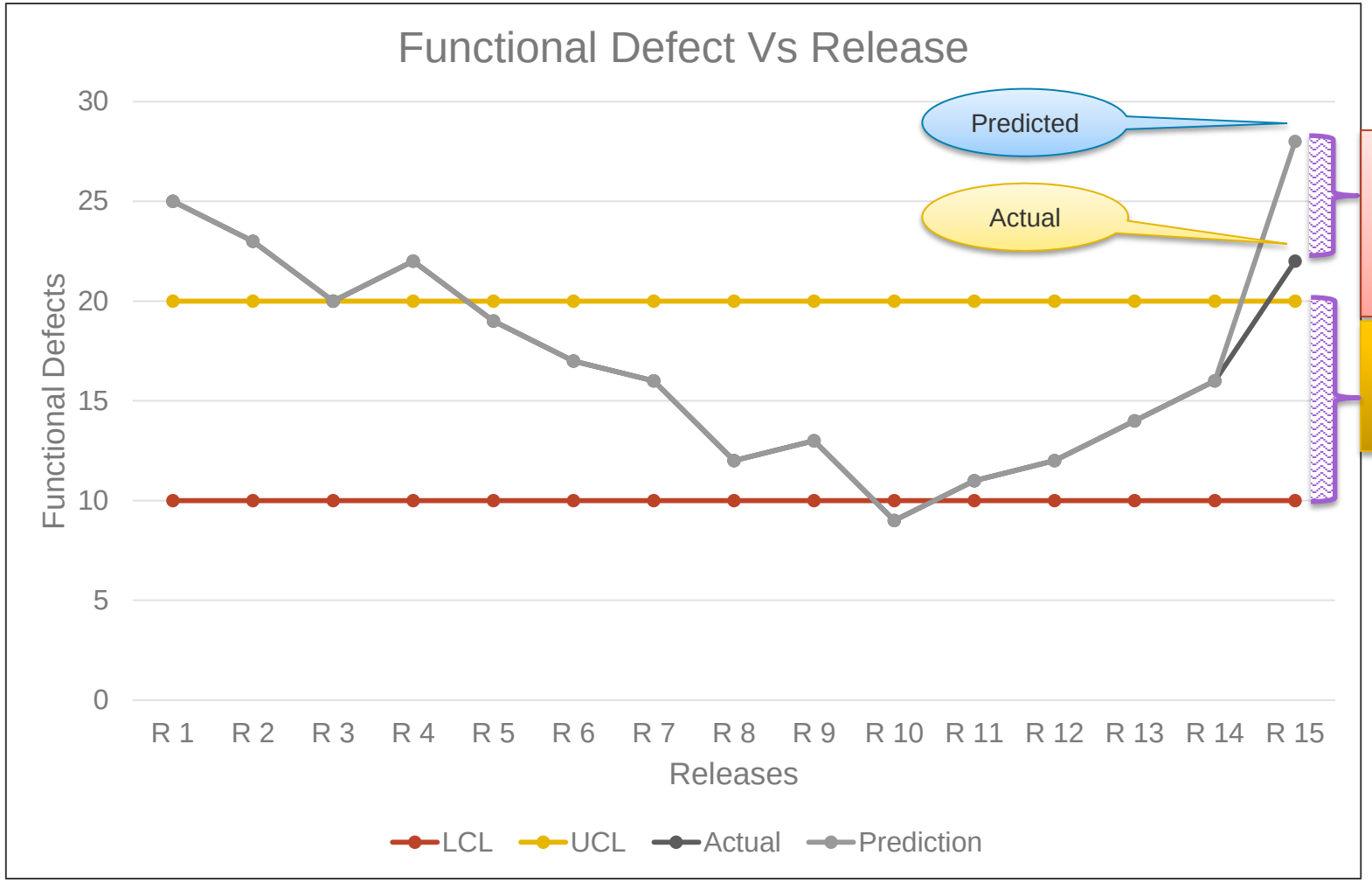
Classify for defect type
-nonfunctional
-functional
-performance
-usability etc…



Historical defects data release wise



UC1D: Predicted functional defects vs. Actual functional defects



Note – Test lead will analyze based on above predictions

NTT DATA

UC3: IMPROVE TEST COVERAGE

November, 2016

UC3: Base Minimum Value Product Use Case. (MVP)

(1) Select a project

(2) Select the module under consideration

(3) Enter relevant requirement

- Result :

(1) Predict which module is defective.

(2) Find out requirements for which test coverage is poor.

Requirements Specification document

7.1. CRESTA should provide interface to setup users & roles.
7.2. CRESTA should provide four static roles(refer section 3.4 for actors list):
  7.2.1. Project Manager(PM)
  7.2.2. Test Lead(TL)
  7.2.3. CRESTA Admin(CA)
  7.2.4. Guest User(GU)
7.3. These 4 roles should be 'READ ONLY'. The Permissions of those CANNOT be modified (Edit/Remove) even by CRESTA Admin
7.4. Project Manager
  7.4.1. Project manager should have permissions to define metrics for a project
  7.4.2. Project manager should have permissions to configure UCL & LCL for various metrics
  7.4.3. Project manager should have permissions to monitor metrics & predictions given by CRESTA
7.5. Test Lead
  7.5.1. Test lead should have permissions to configure UCL & LCL for various metrics
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7.6. CRESTA Admin
  7.6.1. Only one user should be assigned to CRESTA Admin role
  7.6.2. CRESTA admin should have permissions to create new project

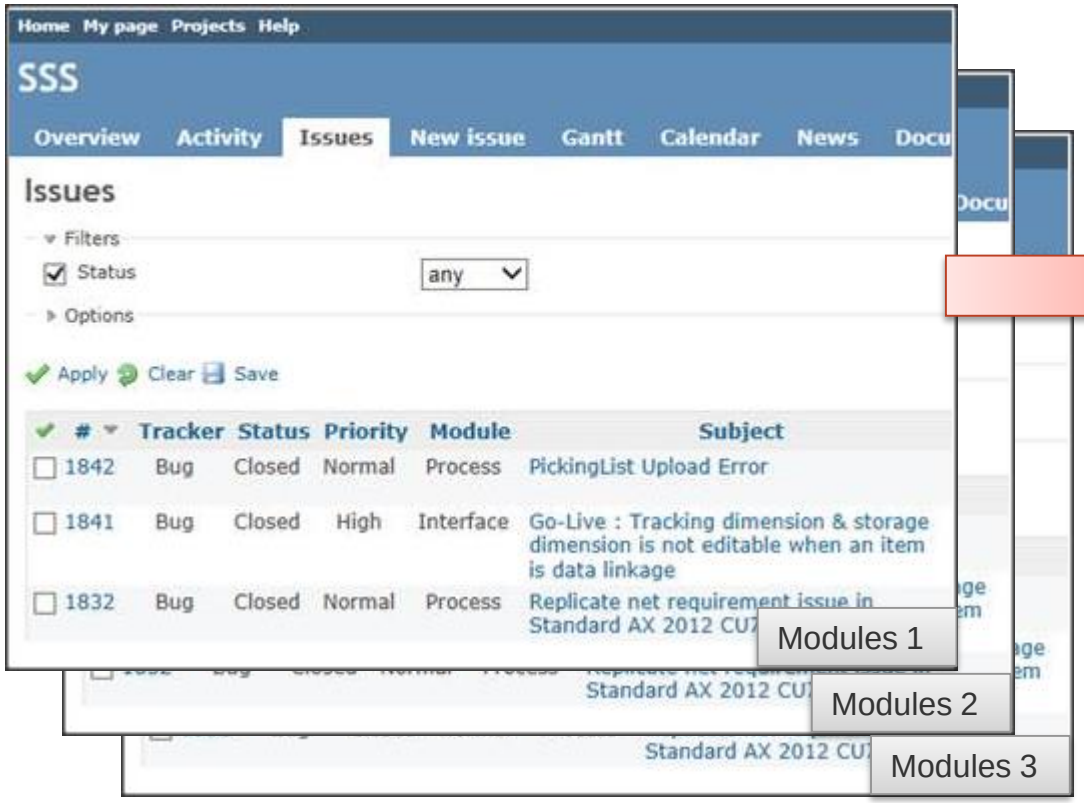
Test cases document

Test Cases

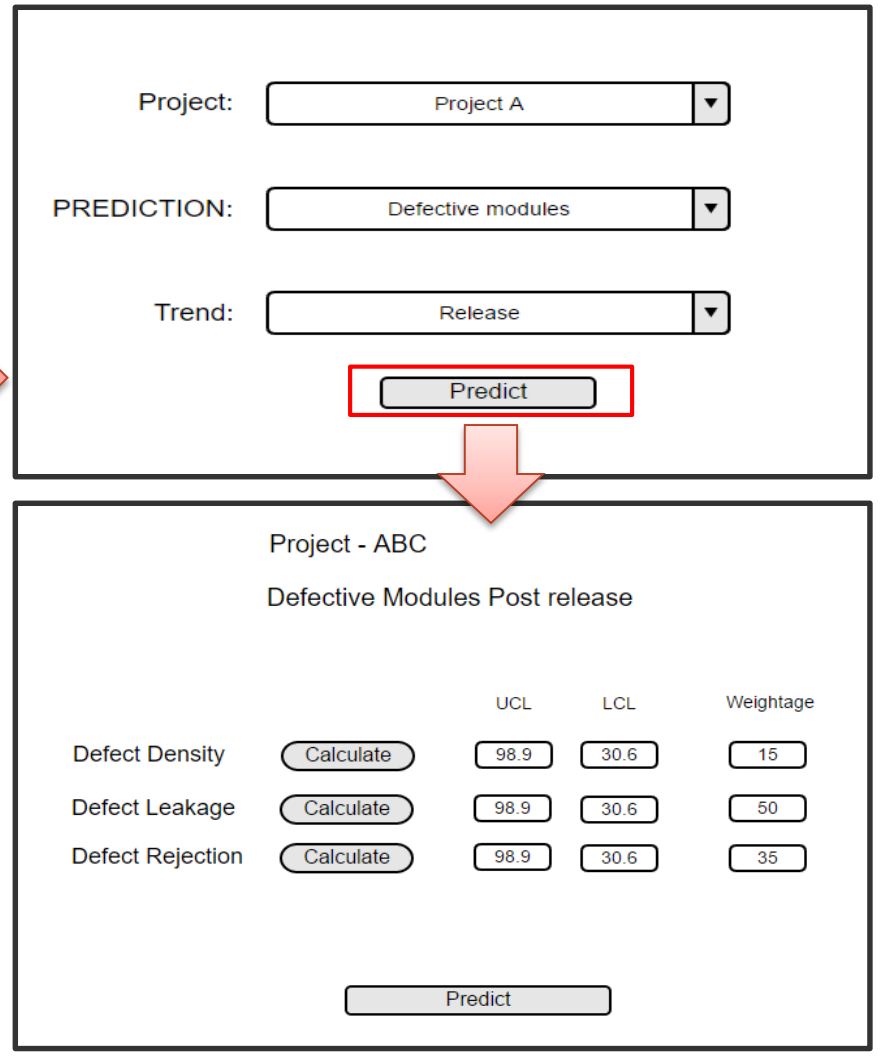
Test Case Reference ID	Test Scenario	Precondition	Test Case Description	Test Step	Test Case	Expected Results
1	User successfully predicts Defect Density Release Wise.	1.User has logged into the system with TL/PM Role and is on the home page. 2.CRESTA is connected to external defect repository Red mine	This is to verify that the TL user can predict using CRESTA as per the Prediction "Defect Density" and Trend "Release" selected	1	TL user goes to "Home" page to input prediction conditions.	On load of the Home page, system loads following data 1. Project dropdown with project list from the database **applicable (accessible) to logged in User** 2. Prediction Questions dropdown with prediction questions. 3. Trend Parameters dropdown is populated with either or both of the values "Release wise" and "Module wise" depending upon the prediction question selected.
				2	TL User selects project	Single project gets selected
				3	TL User selects "Defect Density" as prediction question	The prediction question "Defect Density" should get displayed
				4	TL User selects "Release" as trend parameter	The trend parameter "Release" should get displayed.

MVP: Predict Defective Modules
(モジュール毎、モジュール全体の故障係数予測)

Which modules will have difficulties during and after release?



Historical defects data module wise



MVP: Predict Defective Modules

Modules 2

Module2
Weighted average prediction Score = [(DD * Weight) + (DL * Weight) + (DR * Weight)]/No of metrics

High Risk	Risk	Normal
Module 3	Module 2	Module 1
Module 5		Module 4

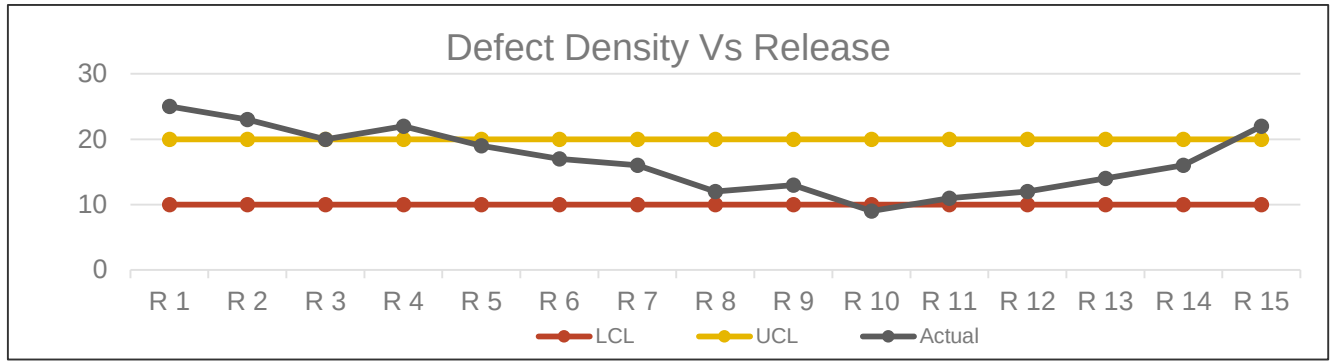
Project manager selects a module to see details

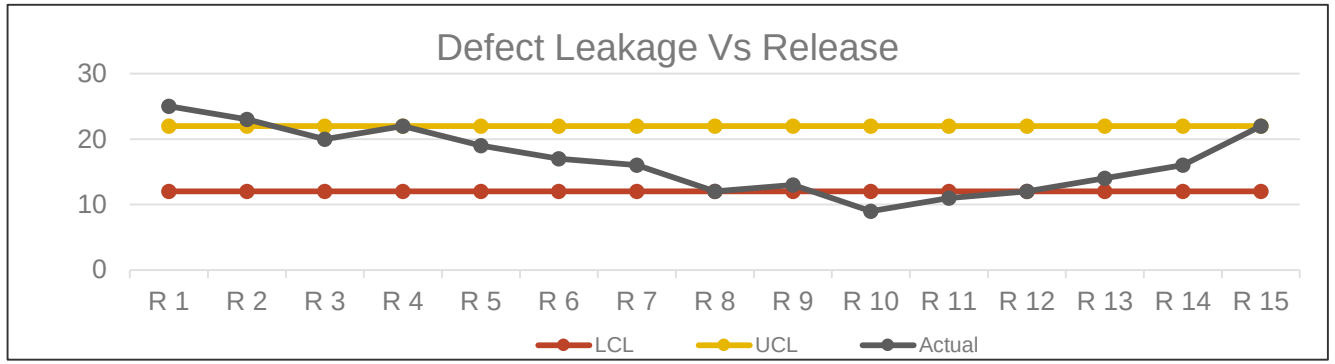
Mean + standard deviation

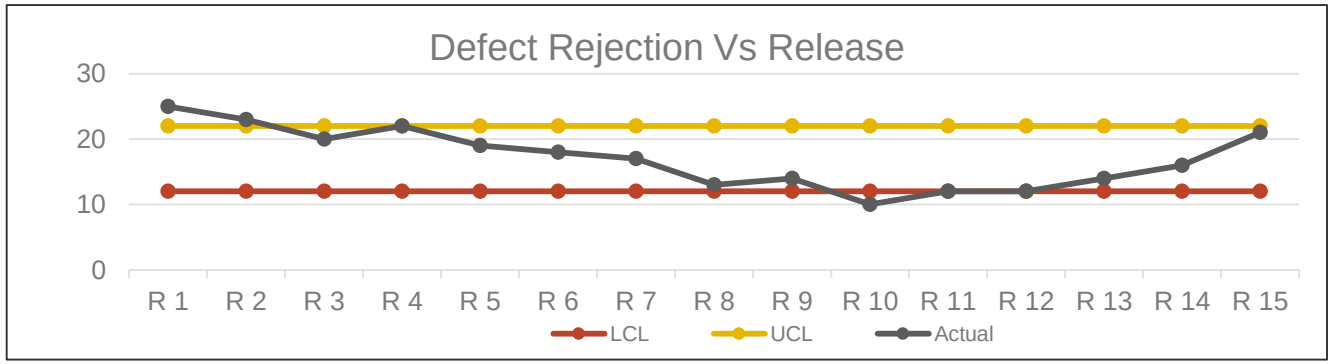
Mean + 2 * standard deviation

Mean + 3 * standard deviation

Note – R15 data is predicted data







UC3: Identify scope for adequate test coverage of defective modules (故障モジュールの関連試験項目の特定)

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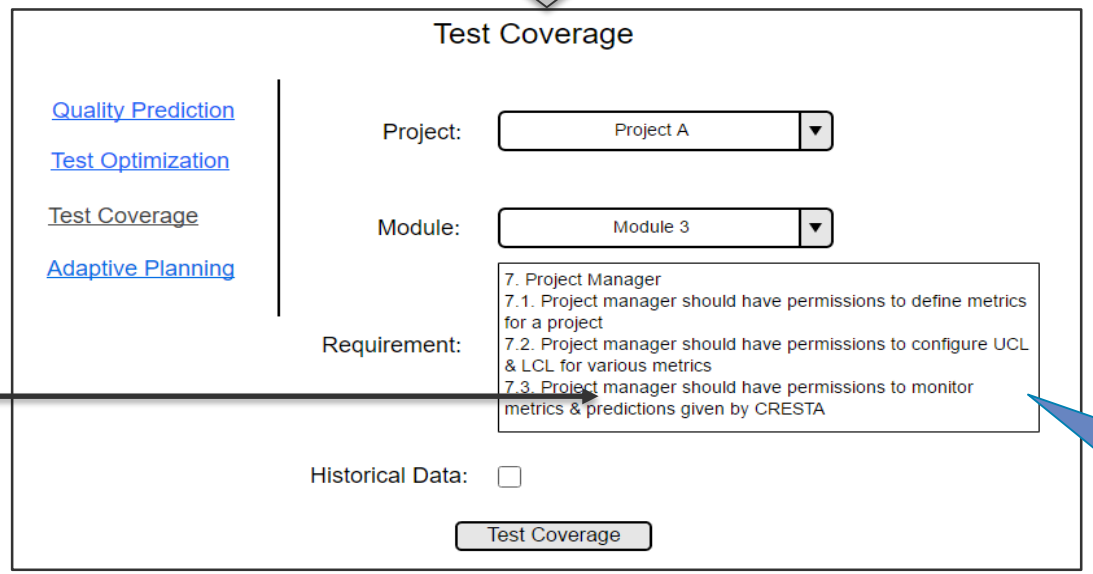
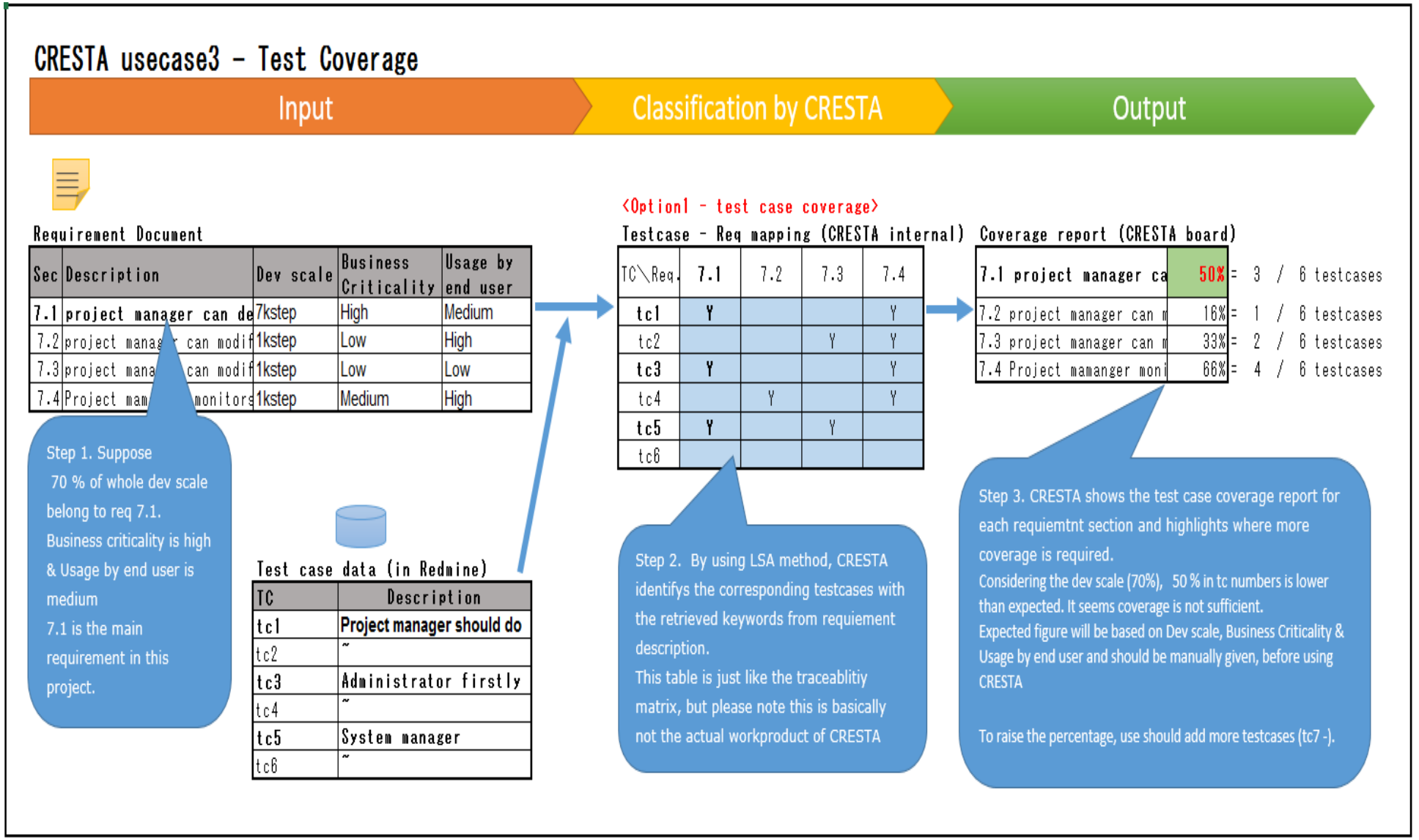
				2	TL User selects project	Single project gets selected
				3	TL User selects "Defect Density" as prediction question	The prediction question "Defect Density" should get displayed
				4	TL User selects "Release" as trend parameter	The trend parameter "Release" should get displayed.

Test case Database



User writes \ copies requirement of Module 3.

UC3: Identify scope for adequate test coverage of defective modules



UC3A, B: Measure adequacy & efficiency of test cases (試験項目の充足性・有効性の検証)

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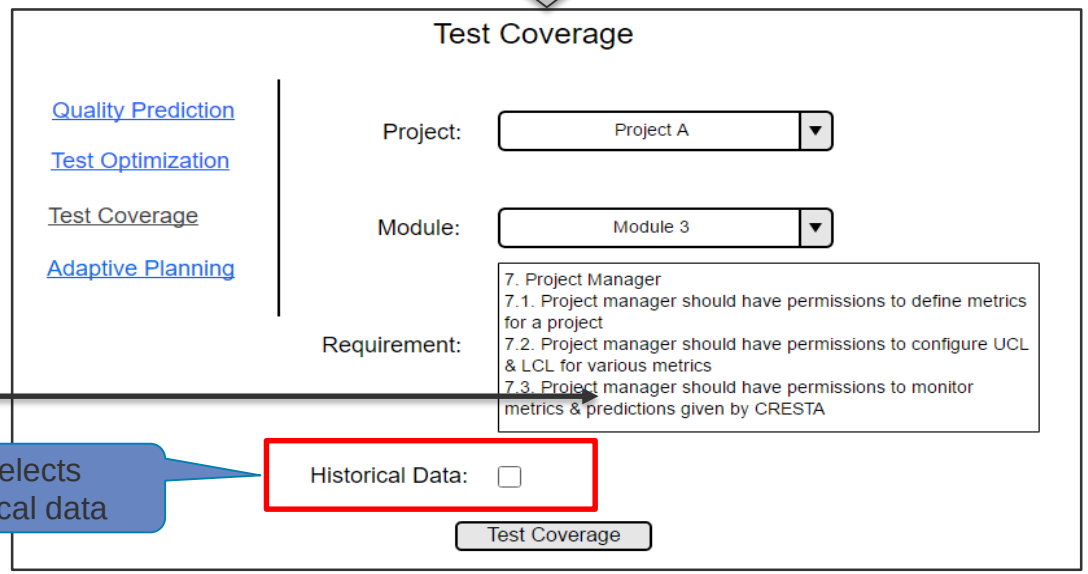
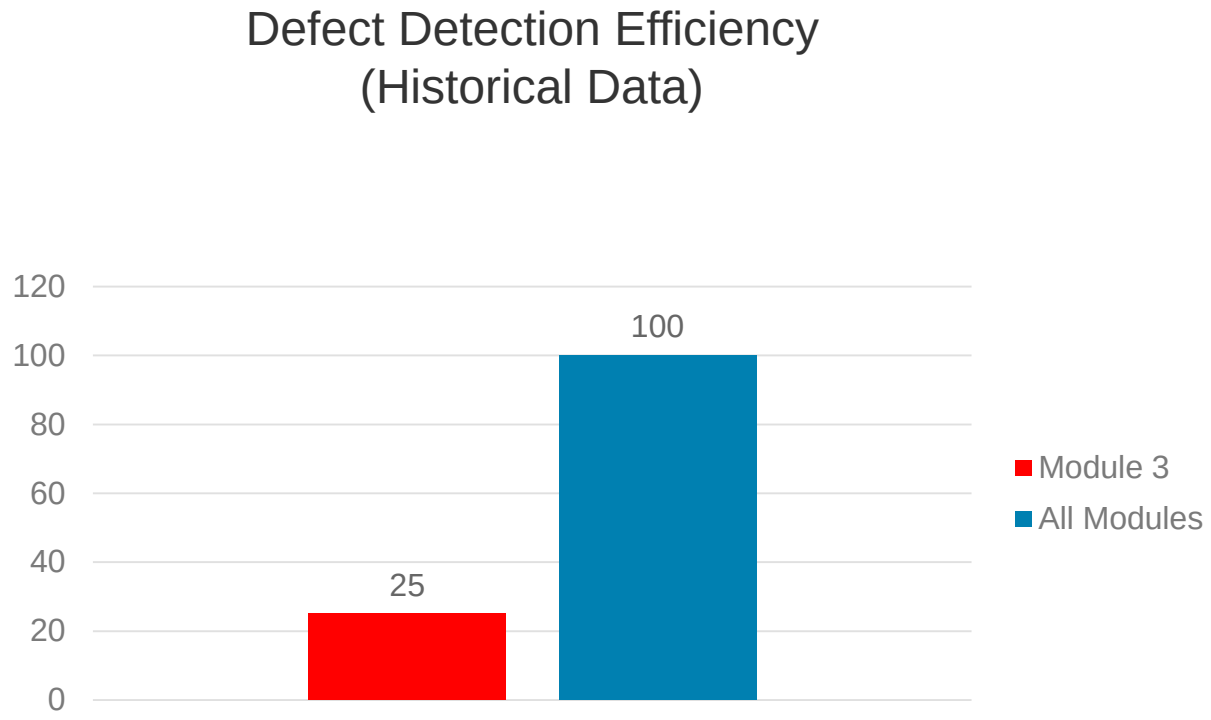
Test case Database



UC3A, B: Measure adequacy & efficiency of test cases

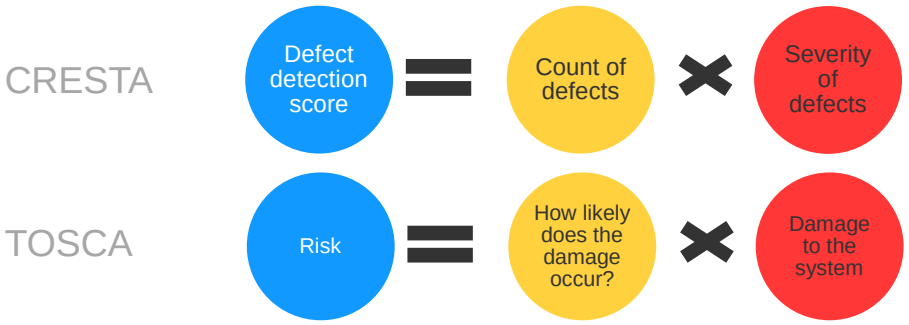


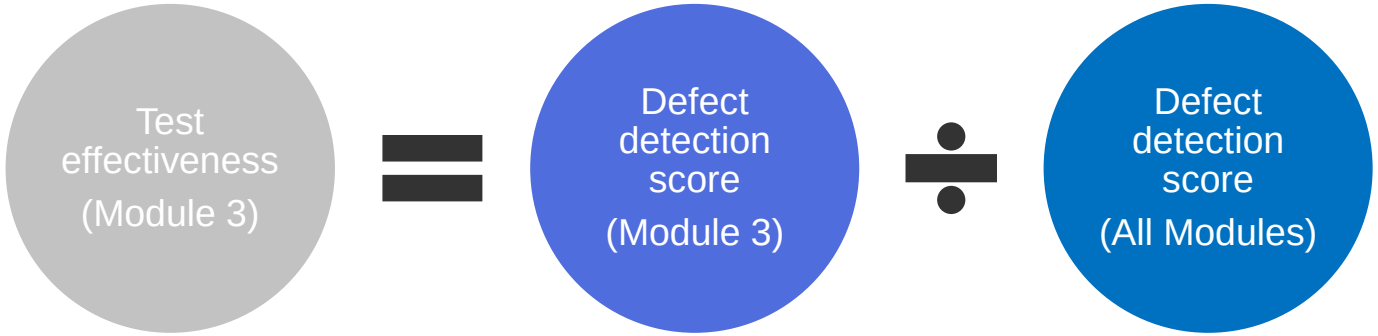
UC3A, B: Analyse efficiency of test cases from historical data

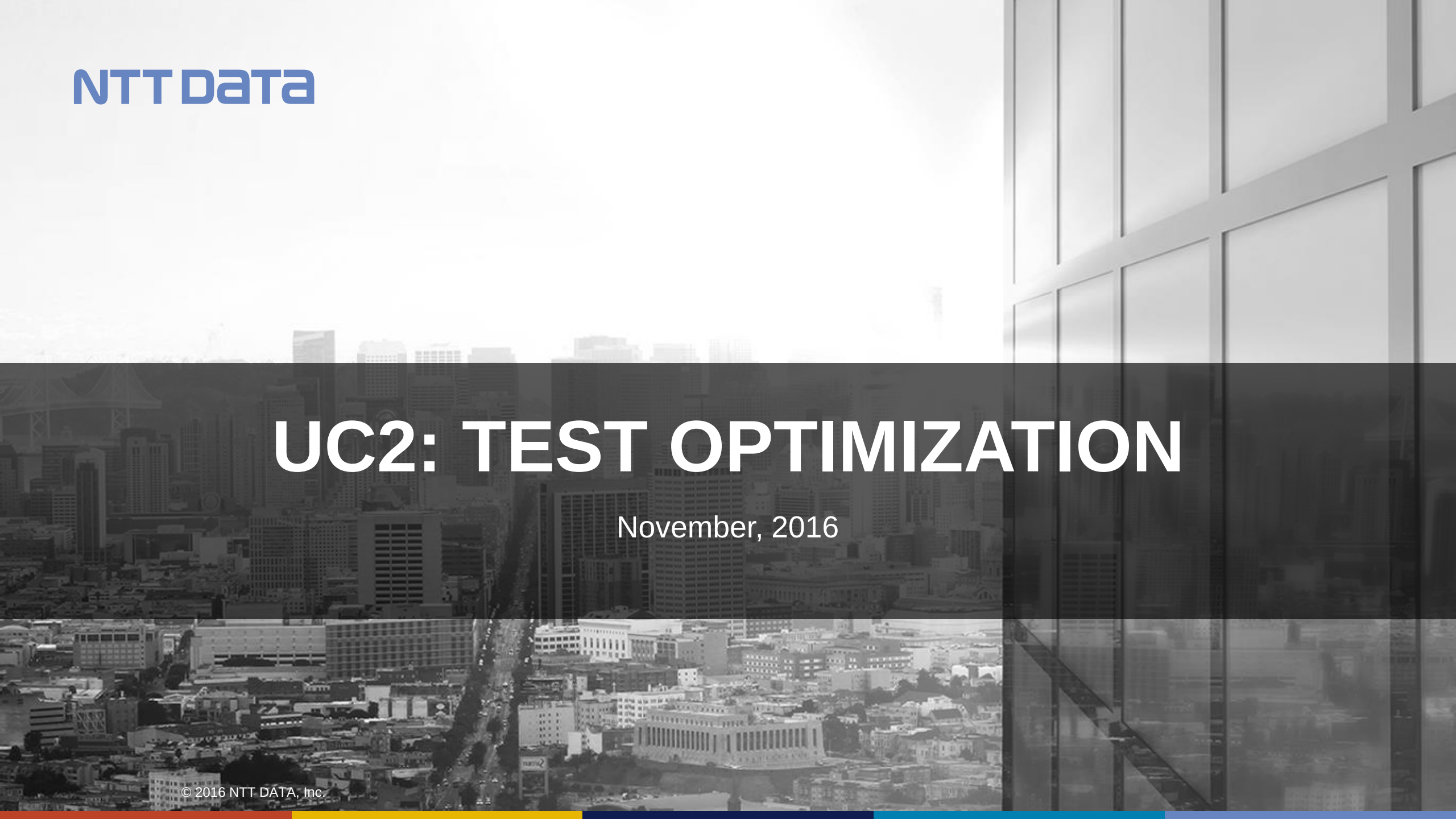
Test Case ID	Test Scenario	Defect Detection score
TC0012	User successfully predicts Defect Density Release Wise.	31
TC0032	User ends up in error message when mandatory validation checks are not performed in home page	37

Historical
Test execution data

Severity	Weight age
Minor	1
Major	2
Severe	3
Critical	4







UC2: TEST OPTIMIZATION

November, 2016

UC2: Base Minimum Value Product Use Case. (MVP)

(1) Select a project

(2) Select the module under consideration

- Result :

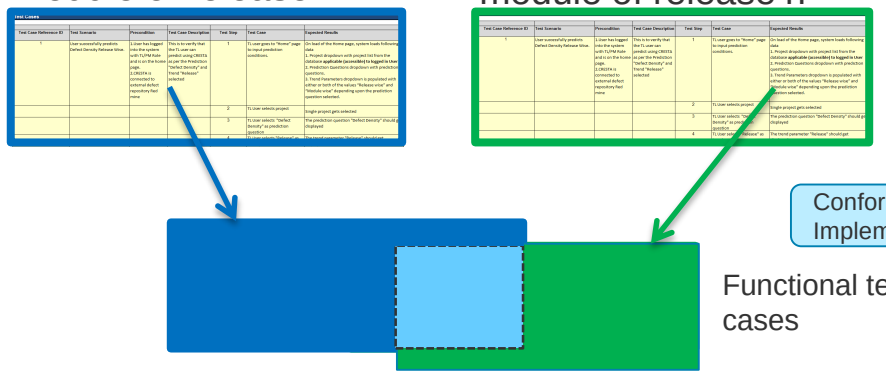
(1) Classify Test cases and segregate the Test cases according to various categories.

(2) Identify duplicate and redundant test cases.

Identify Duplicate and Redundant Test cases.

Old test cases of a module of release n-1

New test cases of a module of release n



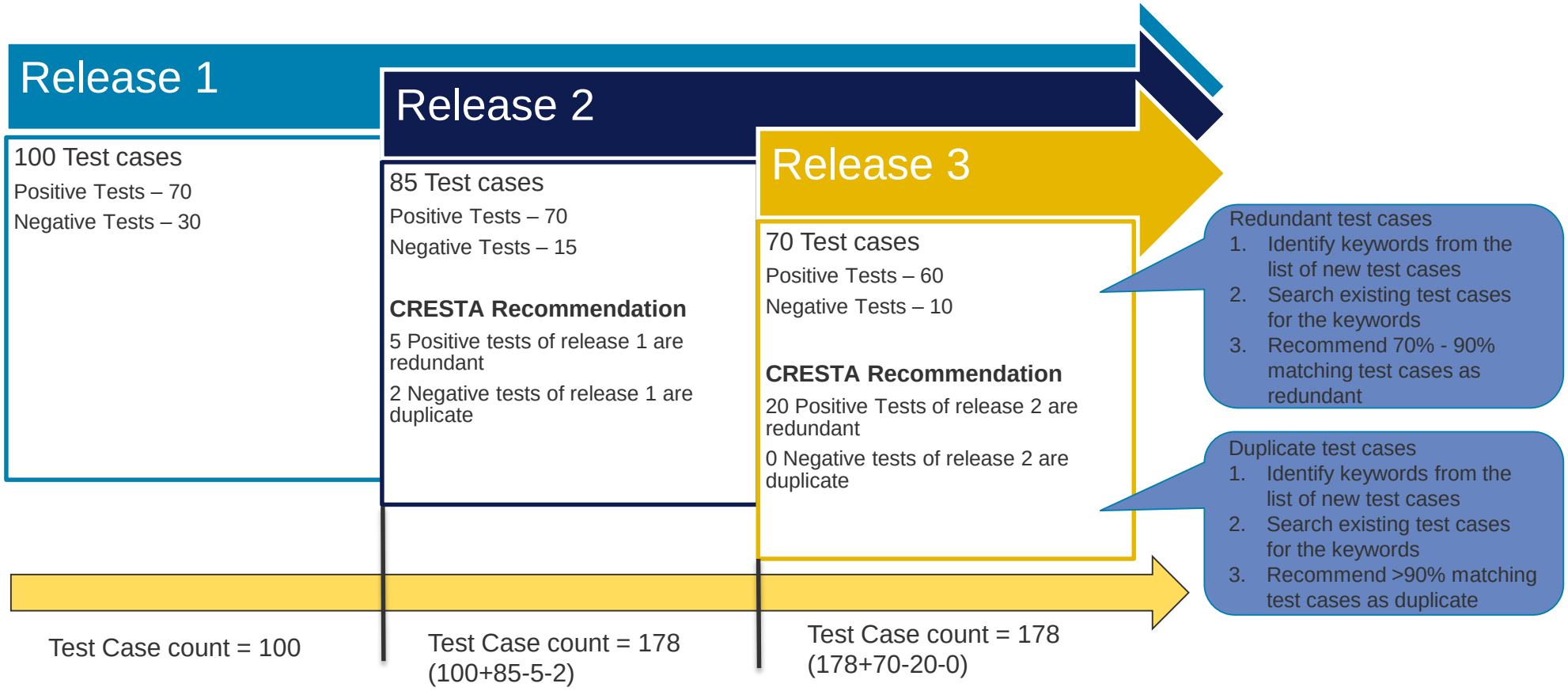
Functional test cases

Conformiq, Tosca concepts Implementation Jubatus

Classify Test Cases

NTT DATA

UC2: Identify testing overlaps



Before increasing test suite size, CRESTA will identify & recommend to eliminate duplicate & redundant test cases with the help of text analytics classification algorithms of machine learning
Accomplished by comparing new test cases (current release n) with existing suite of test cases (up to previous release n-1)

UC2A: Reduce duplicate testing efforts across teams (複数モジュール間の重複・冗長試験項目の特定)

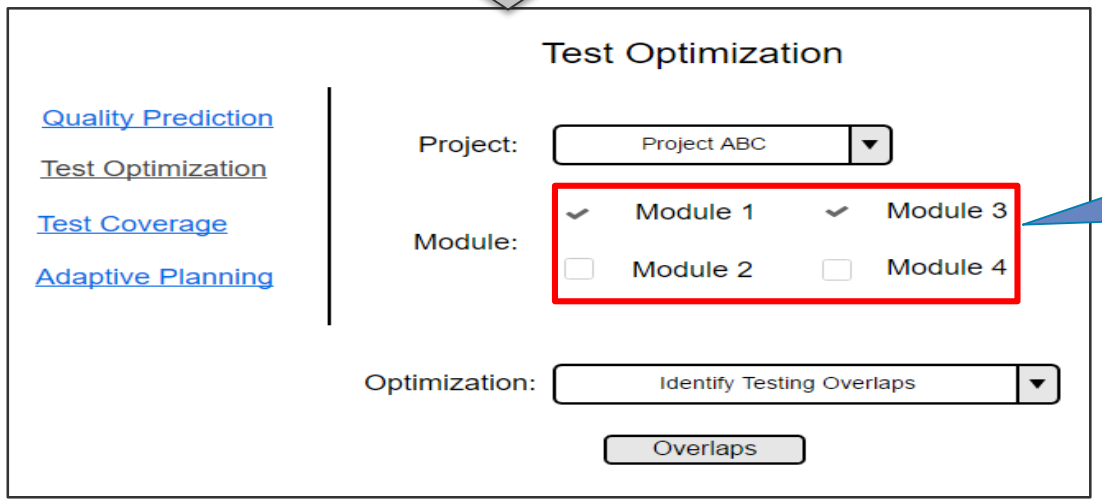
Test Cases

Test Cases

Test Case Reference ID	Test Scenario	Precondition	Test Case Description	Test Step	Test Case	Expected Results
1	User successfully predicts Defect Density Release Wise.	1.User has logged into the system with TL/PM Role and is on the home page. 2.CRESTA is connected to external defect repository Red mine	This is to verify that the TL user can predict using CRESTA as per the Prediction "Defect Density" and Trend "Release" selected	1	TL user goes to "Home" page to input prediction conditions.	On load of the Home page, system loads following data 1. Project dropdown with project list from the database **applicable (accessible) to logged in User** 2. Prediction Questions dropdown with prediction questions. 3. Trend Parameters dropdown is populated with either or both of the values "Release wise" and "Module wise" depending upon the prediction question selected.
				2	TL User selects project	Single project gets selected
				3	TL User selects "Defect Density" as prediction question	The prediction question "Defect Density" should get displayed
				4	TL User selects "Release" as trend parameter	The trend parameter "Release" should get displayed.

Module 1 test cases

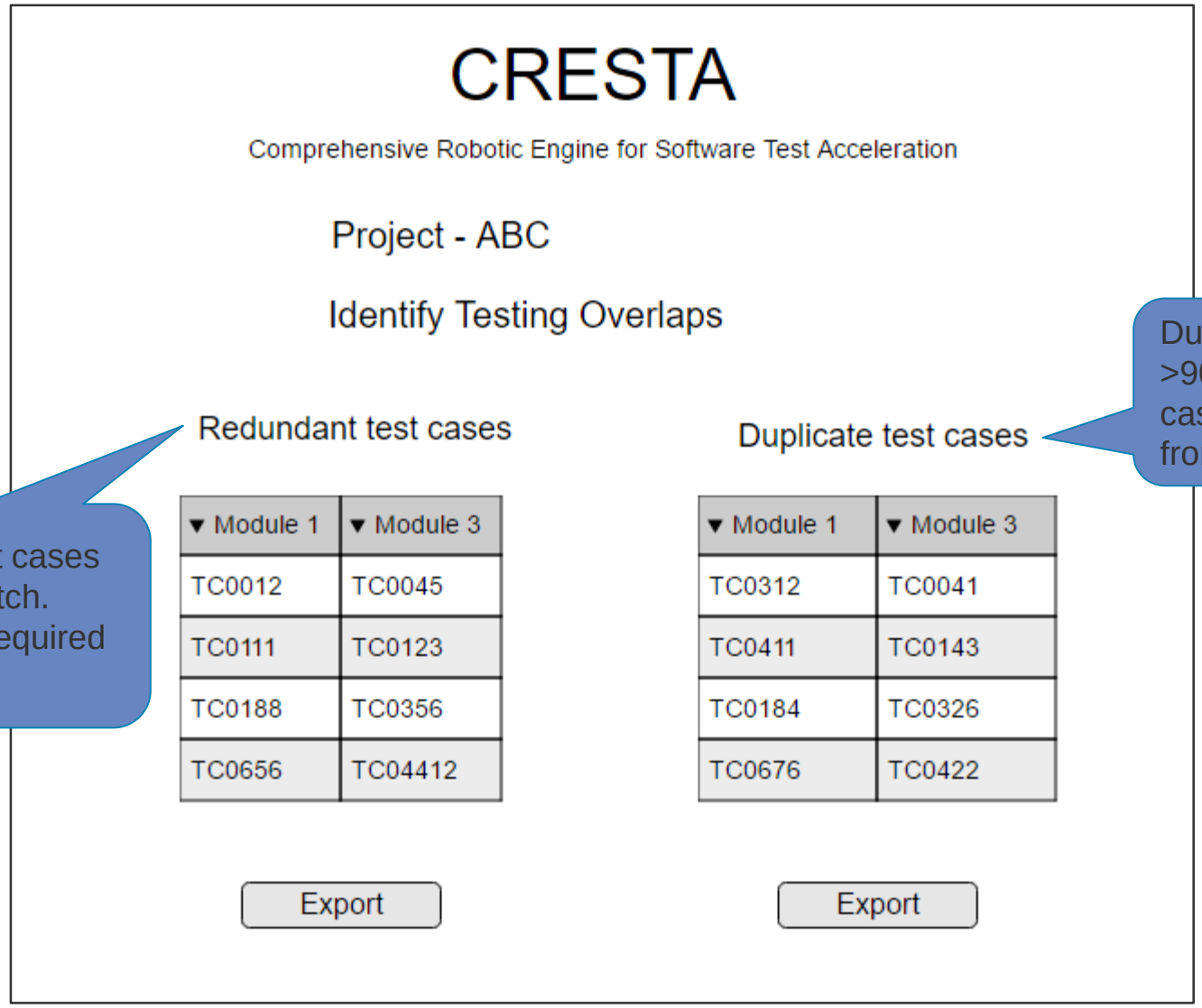
Module 3 test cases



Select more than one module

UC2A: Reduce duplicate testing efforts across teams

Overlap between Module 1 & Module 3



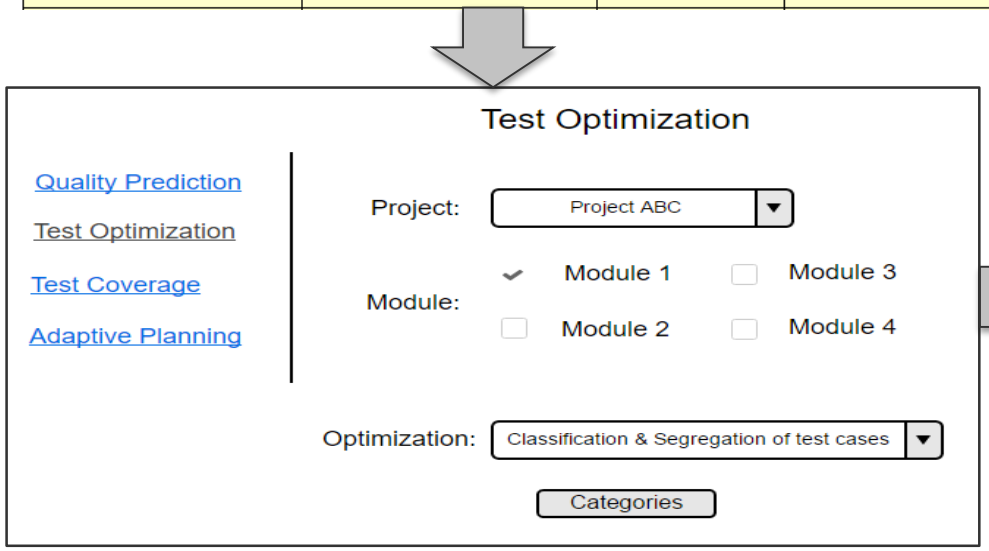
Redundant test cases 70% - 90% match. Some rework required on test cases.

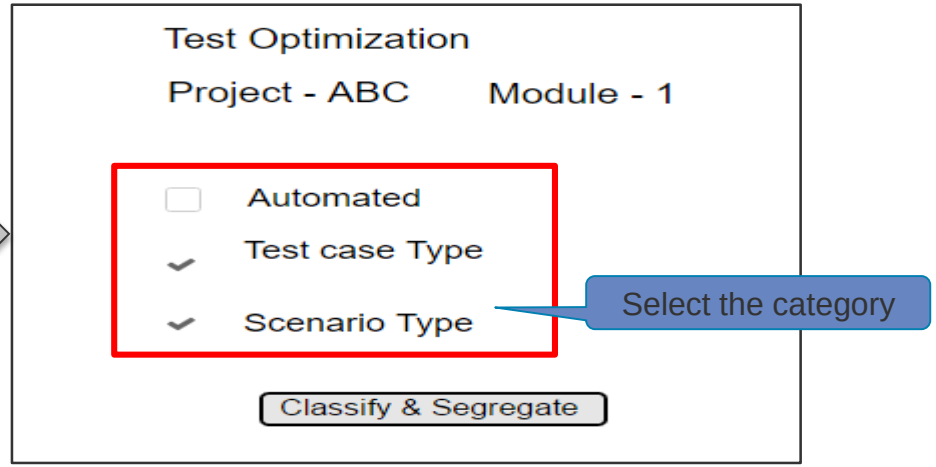
Duplicate test cases >90% match. Test cases can be removed from test suite.

MVP: Classify and Segregate Test cases

Test Cases

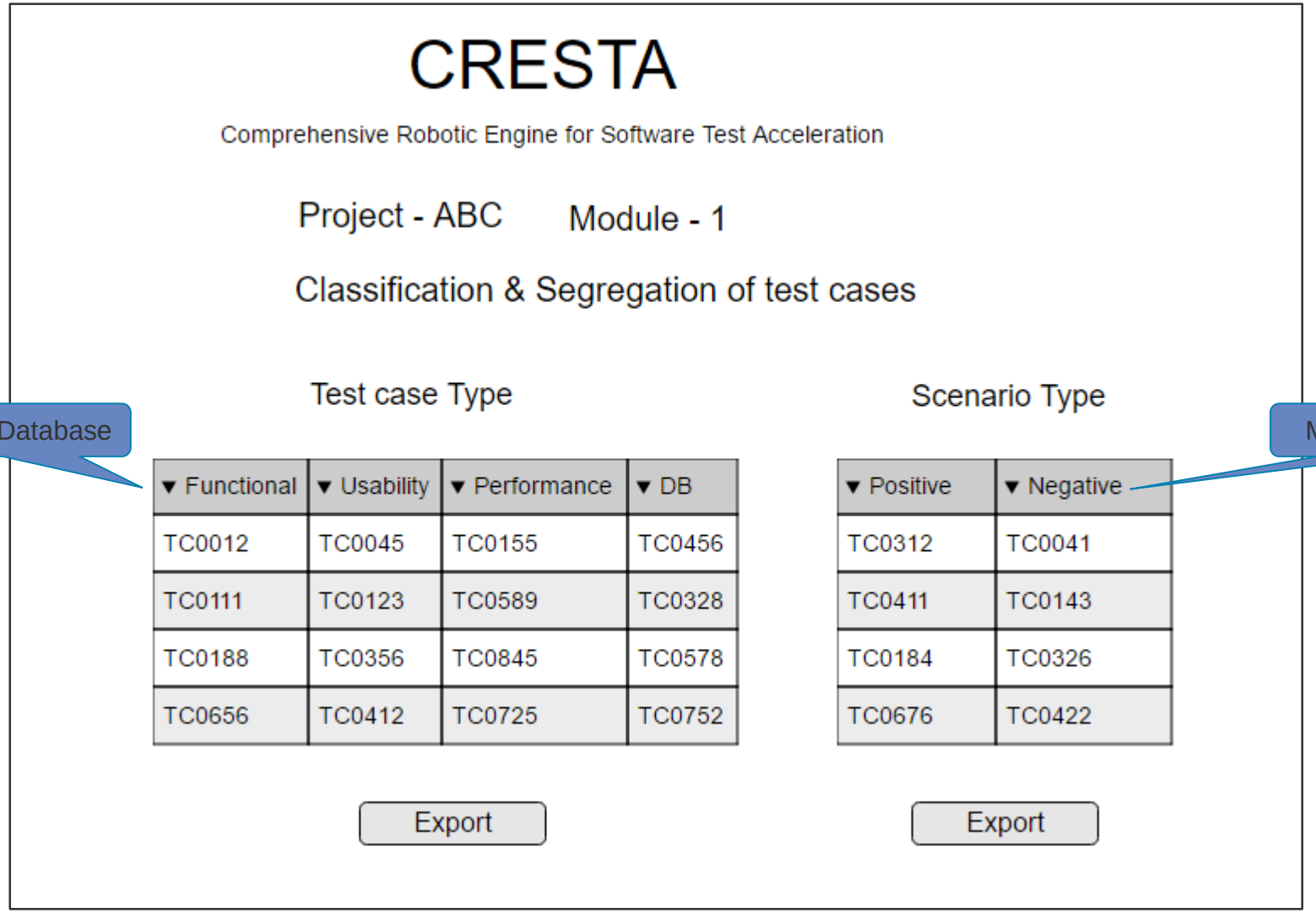
Test Case Reference ID	Test Scenario	Precondition	Test Case Description	Test Step	Test Case	Expected Results
1	User successfully predicts Defect Density Release Wise.	1.User has logged into the system with TL/PM Role and is on the home page. 2.CRESTA is connected to external defect repository Red mine	This is to verify that the TL user can predict using CRESTA as per the Prediction "Defect Density" and Trend "Release" selected	1	TL user goes to "Home" page to input prediction conditions.	On load of the Home page, system loads following data 1. Project dropdown with project list from the database **applicable (accessible) to logged in User** 2. Prediction Questions dropdown with prediction questions. 3. Trend Parameters dropdown is populated with either or both of the values "Release wise" and "Module wise" depending upon the prediction question selected.
				2	TL User selects project	Single project gets selected
				3	TL User selects "Defect Density" as prediction question	The prediction question "Defect Density" should get displayed
				4	TL User selects "Release" as trend parameter	The trend parameter "Release" should get displayed.





MVP: Classify and Segregate Test cases

Each test case of the module is classified to selected categories



NTT DATA

UC4: ADAPTIVE PLANNING

December, 2016

UC4: Adaptive Planning

- Adaptive Planning Premise : This use case considers various Program parameters which can be altered to correct the course of the program.

- Use Case : The user inputs the following program data
    a) Program Size(Person Months)
    b) Timelines(Months)
    c) Resources (Count)
    d) Program Overheads $)
    e) Schedule Variance(Days)
    f) Effort Variance(Days)

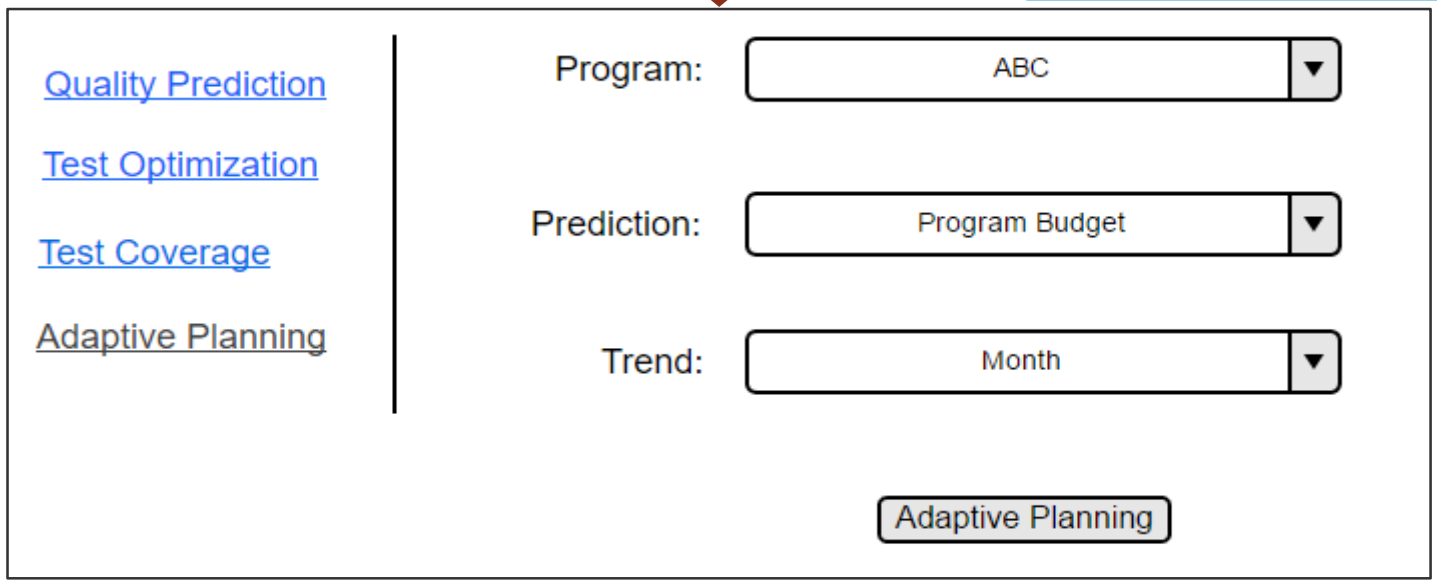
- CRESTA predicts approximate Budget required for the program, using historical data.

UC4, 4A: Adaptive Planning

Historical Data

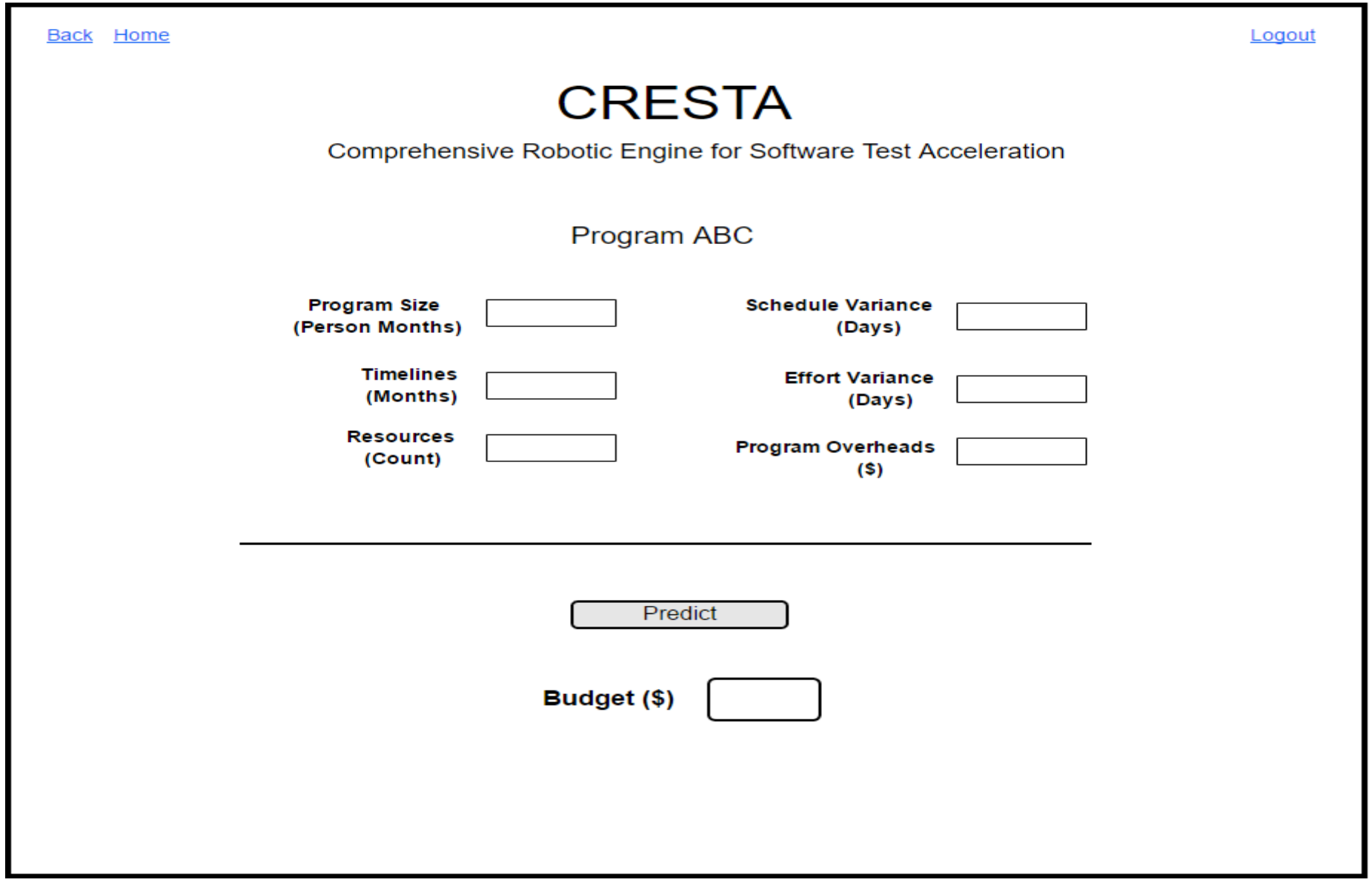
Program Size (Person Months)	Timelines (Months)	Resources (Count)	Program Overheads ($)	Schedule Variance (Days)	Effort Variance (Days)	Program Budget ($)
6	2	6	1000	1	0	250000
12	4	4	5000	0	5	500000
10	2.5	6	2500	5	5	500000
20	6	10	2500	5	5	800000
30	5	6	1000	2	0	900000

User can predict any one of the above parameters based on other parameters



Note – Data shown above is indicative

UC4, 4A: Adaptive Planning



UC4B: Adaptive Planning

Program ABC

Analyse

	Quality Parameters			Project Parameters			Status	Weight age
	Defect Leakage	Defects deferred	Q3	Budget burnout (USD)	Schedule overrun (Days)	Project Size (Person Months)		
Project A	10	5		1K	2	20		75
Project B	5	0		0	0	10		15
Project C	2	1		0	0	5		10

Program ABC

References

Document Name	URL
A Prediction Model for System Testing Defects using Regression Analysis	https://www.researchgate.net/profile/Suhaimi_Ibrahim/publication/259874862_A_Prediction_Model_for_System_Testing_Defects_using_Regression_Analysis/links/54f94b4b0cf210398e9805b9.pdf?origin=publication_detail
Using In-Process Metrics to Predict Defect Density in Haskell Programs.pdf	https://www.cs.virginia.edu/~sherriff/papers/ISSRE-FA-SWV04.pdf
The Evolution of Analytics Opportunities and Challenges for Machine Learning in Business	http://www.sas.com/en_us/whitepapers/evolution-of-analytics-108240.html
Regression Testing Minimisation, Selection and Prioritisation : A Survey	http://www0.cs.ucl.ac.uk/staff/M.Harman/stvr-shin-survey.pdf
Defect Density Measurement	http://www.ifpug.org/ISMA6/Thomas-Defect%20Density%20Measurement-Sept14.pdf
How AI Will Change Software Development And Applications	Forrester
Introducing Software Testing Author – Louise Tamres	Chapter 8: Reducing the number of test cases Section 8.4: Risk Analysis