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Conformance Characteristic Curve for IT Project Quality Management

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System testing or conformance testing is a critical phase in Software Development Life Cycle. The developed software must be evaluated and tested to ensure its conformance with the specifications which translates the customer business requirements.

Objective

The testing of the software incurs cost and the objective of the "Sample Testing" is to minimize the cost of testing with certain acceptable risk levels.

Conformance Characteristic Curve (CCC) can be defined as the probability of accepting the software in compliance with the business requirements specified.

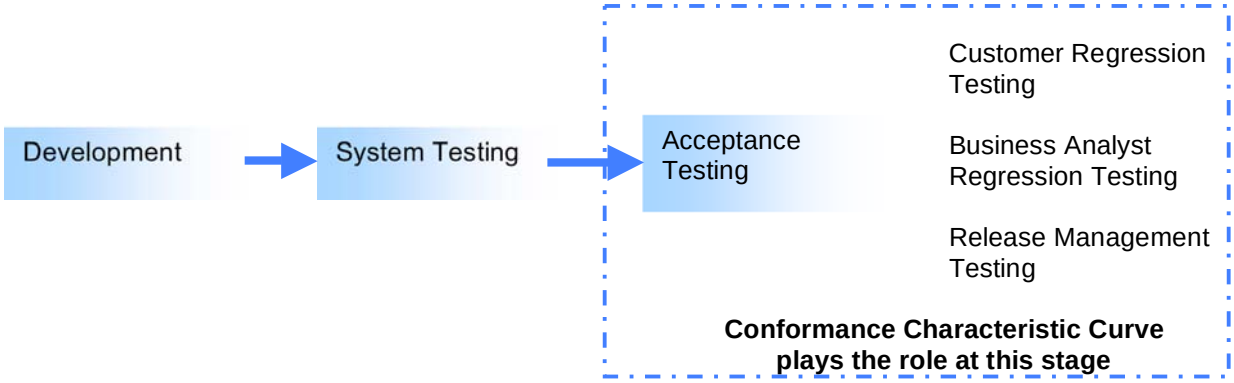


Fig 1. SDLC phase in which CCC can be relied upon

The above figure shows the areas in which the CCC can be relied upon. Once the acceptance testing is completed at the Service provider end, the fixes are rolled in and packaged to the Customer which is routed through the Release Management team. The testing strategy and plans for User acceptance testing is done at the customer end to evaluate the software that is delivered. The Conformance Characteristic Curve plays a key role in identifying the testing strategy at this stage of User Acceptance testing.

The customer could be an internal customer like Onsite team / Release management team or external customer like End Customer or Beta version testing of the software.

Every phase of SDLC incurs costs to the project irrespective of whether the time is invested at the vendor end or at the customer end. The tested and certified software by the software provider again goes through a series of testing phases at the customer end (internal or external) and this adds up to the inspection cost which in turn adds up to the project cost.

The benefits of the Conformance Characteristic Curve

- Reducing the efforts in testing
- Design a testing strategy plan to keep the risk low
- Evaluating quickly on the conformance of the software to requirements
- Inspection costs come down
- Reduced time for delivery or Go live

There are two kinds of risk involved in going by Sample testing on the delivered software

Alpha – Risk

This is the risk to the Vendor. Based on the optimal sampling of test cases, the risk of rejecting a better quality software

Assume that the software had 500 test cases and the acceptance level by the customer for the component or GUI was fixed as 2. The Customer takes 50 sample test cases for execution. The Vendor had shipped the product with 2 defects which might have been induced in the software at a later stage or not identified during internal testing. During execution of these 50 cases, if the customer finds these 2 defects then the software will be rejected despite all the other 498 cases working perfectly. This is the risk to the vendor as a good quality product will be rejected based on these two defects which were trapped in the sampling. This costs the vendor for rework and costs of the project will increase and on the other hand, the customer will be benefited in his view that he did not waste time in executing all the test cases as the software did not comply with the expectations

Beta – Risk

This is the risk to the customer. Based on the optimal sampling of test cases, the risk of accepting a poor quality software

Assume that the software had 500 test cases and the acceptance level by the customer for the component or GUI was fixed as 2. The Customer takes 50 sample test cases for execution. The Vendor had shipped the product with 20 defects which might have been induced in the software at a later stage or not identified during internal testing. During execution of these 50 cases, if the customer does not find these 20 defects then the software will be accepted despite the fact that there are 20 defects in the product which will be seen at a later stage after GOLIVE. This is the risk to the customer as a poor quality product will be accepted based on these test cases sampling.

RISK MATRIX ON SAMPLE BASED TESTING		Decision	
		Accept the Software	Reject the Software
Sampling Quality of Test cases	Good Quality	No problem Zone	Vendor Risk Zone
	Bad Quality	Customer Risk Zone	No Problem Zone

Fig 2. Risk matrix for sample testing

In order to avoid such risks in Sample testing or acceptance testing by the customer (Internal or External), the selection of the sample test cases plays an important role. The risk is always there in Sample testing due to the fact that all the test scenarios are not evaluated. This is where the test strategy of what to be tested plays a critical role. The test cases or scenario selection must be done based on business cycle criticality, impact on cost from vendor as well as customer side etc.

CC Curve Interpolation

This is followed in the industrial production for the **OCC (Operating Characteristic Curve)** for sampling of lots. The same formula can also be applied for Conformance Characteristic curve.

CC curve calculation is based on the Poisson formula

$$P(A) = (np^{A}) (e^{-np}) / A!$$

P(A)	The probability of acceptance.
p	The fraction or percent defective like 0.01, 0.02 and so on
N	Total no. of test cases or scenarios which is available
n	Number of test cases that must be executed to check the quality of the product. This must be defined by the Customer (Internal/External) after carefully analyzing the progression of the project, the vendor reputation in the product and quality requirements as specified in Scope
A	A is the acceptance level which means the no. of defects that is acceptable in the selected lot of sample test cases

Sample date is as below

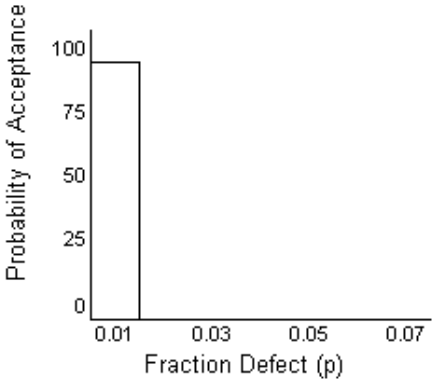
- N = 1000 Total no. of test cases
- n = 60 Sample no. of test cases
- p = .01 Fraction defect
- A = 3 Acceptance level

Np	d= 3 PA
.6	99.8
1.2	87.9
3	64.7
4.2	39.5

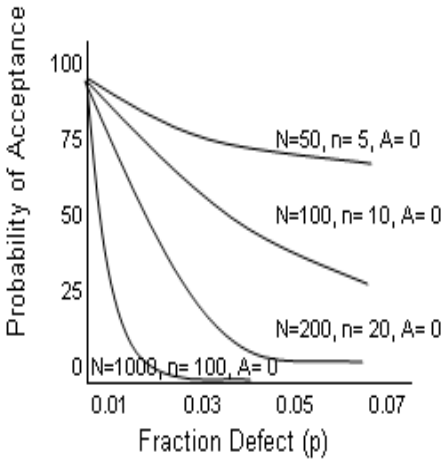
The graph is drawn by varying p (like 0.01,0.02,0.03 and so on). The probability of acceptance is derived based on the Poisson table.

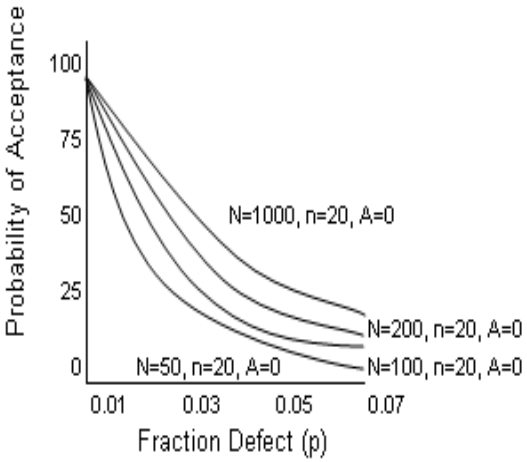
Going into the details of the Poisson formula is not the scope of this paper but to touch base on the basic concepts is important to understand sampling.

The ideal curve is as shown as below.
This is possible only with 100% sampling of the Lot which is not possible and does not lay emphasis on Costs.



Please refer the below two graphs which explain the properties of the CC Curve better





** The first graph shows the comparison of four sampling plans with 10% samples
** The second graph shows a comparison of 4 sampling plans with constant sample sizes

This emphasizes that the absolute size and not the relative size of the samples determines the protection given by the sampling plans. So when selecting the sample sizes the rule of x% of total no. of test cases must not be followed with increase of no. of test cases.

To take a decision on sample size, the charts must be tried with different sample sizes. Depending upon the Business Criticality of the Software, Project Schedule Constraints and

Quality Management plan negotiated with the vendor, the optimal sampling plan must be selected.

Generally the Quality Norms are specified by the Customer at the time of contract finalization. The acceptable "Leakage Ratio" of the test cases will be specified which can also be the basis for sample size selection.

Properties of OC Curves

- The acceptance number and sample size are most important factors.
- Decreasing the acceptance number is preferred over increasing sample size.
- The larger the sample size the steeper the curve.
- By changing the acceptance level, the shape of the curve will change. All curves permit the same fraction of sample to be nonconforming.

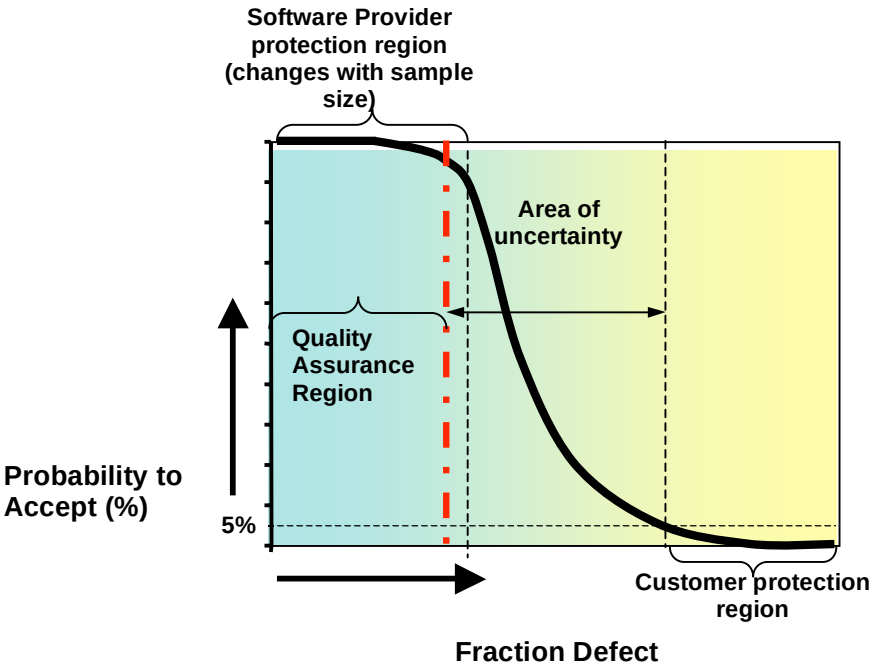


Fig 3. Conformance Characteristic Curve depicting the Software provider's risk and Customer (internal or external) risk

Bottlenecks

- The sample size selection is important to keep the risk on both parties to minimum
- Selection of test cases (samples) must be done by an expert to ensure on the business impact
- This method of testing cannot be followed for detailed testing phase
- This method can be used when the software provider (vendor) is reliable and has proven track records for quality.
- Sampling size cannot be kept constant and it varies with the customer business needs

Conclusion

The Conformance characteristic reflects the sample testing strategies and aids in selection of sampling plans which draws a balance between the Vendor risk as well as Customer risk. Vendor risk is the risk of rejection of good quality software where as Customer risk is acceptance of bad quality software. Sample testing can be used in Customer end testing or Regression testing by Business Analyst or Release Management to confirm on the quality of the Software on the first hand before proceeding with detailed testing. The cost of inspecting the software will be considerably reduced. Selection of sample size is the key to success of this strategy. Selection of test cases must be done based on the areas of business criticality due to the usage of the new software.

About the Author:

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Senthil Kumaran is a Senior Project Manager with Ramco Systems Limited, Basel, Switzerland. Ramco Systems is an India based software powerhouse delivering business solutions to its customers in different verticals. He is currently assigned to a number of large ERP implementations in Switzerland. He has a rich experience of 11+ years in Project Management, ERP implementation, Business Consultancy and Manufacturing. Prior to his current job, he was an Executive Engineer with Larsen and Toubro (LTM), a manufacturer of plastics injection-molding machinery. Senthil Kumaran is a PMP, ITIL and has a Bachelor of Technology (Production) and a Post Graduate degree of MS in Operations Management. Senthil can be contacted at email: senthil_kumaran_a@yahoo.com