Software Engineering Innovative Risk Analysis in Matrix Tool

Shankar Nayak Bhukya, Suresh Pabboju

Abstract: The purpose of the research is to propose a framework for quantitative risk analysis for more optimal solutions by analyzing risk during necessities engineering segment of SDLC. The following two cases are consider for my research proposed work

I. RISK IDENTIFICATION

Here result analysis is done considering two cases

- **Case 1**: Here the candidate solutions are directly applied to probability –Matrix tool to find out the advantages of applying Genetic algorithm to candidate solutions.
- **Case 2**: Here the genetic Algorithm is applied to Candidate solution and then its output is applied to probability–Matrix tool to find visibility of risk. The Sample values taken for Probability and Collision are shown in form of table

<table>
<thead>
<tr>
<th>Probability Category</th>
<th>Probability number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>9</td>
</tr>
<tr>
<td>High</td>
<td>7</td>
</tr>
<tr>
<td>Medium</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>Very Low</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1.1 Sample Probability Test

<table>
<thead>
<tr>
<th>Project Objective</th>
<th>Very Low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 1.2 Sample Collision Test

The probability values are decided on the basis of Den and Likelihood values as shown in below table.

<table>
<thead>
<tr>
<th>SA(T)</th>
<th>DE(N)</th>
<th>Likelihood</th>
<th>Probability</th>
<th>Probability number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>Null</td>
<td>Likely</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>Partial</td>
<td>Null</td>
<td>Occasional</td>
<td>Medium</td>
<td>5</td>
</tr>
<tr>
<td>Full</td>
<td>Partial</td>
<td>Occasional</td>
<td>Medium</td>
<td>5</td>
</tr>
<tr>
<td>Full</td>
<td>Partial</td>
<td>Occasional</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>Partial</td>
<td>Full</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
</tr>
<tr>
<td>Null</td>
<td>Partial</td>
<td>Unlikely</td>
<td>High</td>
<td>7</td>
</tr>
<tr>
<td>Partial</td>
<td>Partial</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
</tr>
<tr>
<td>Partial</td>
<td>Partial</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 1.3 Calculation of Probability

Case 1: Here Genetic Algorithm is not applied to candidate solutions.

<table>
<thead>
<tr>
<th>Candidate solutions</th>
<th>SA(T)</th>
<th>DE(N)</th>
<th>Likelihood</th>
<th>Probability number</th>
<th>Probabilit y</th>
<th>Probability number</th>
<th>Collision</th>
<th>Collision number</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Full</td>
<td>Null</td>
<td>Likely</td>
<td>Low</td>
<td>3</td>
<td>Low</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>Partial</td>
<td>Null</td>
<td>Occasional</td>
<td>Medium</td>
<td>5</td>
<td>Medium</td>
<td>5</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>Full</td>
<td>Partial</td>
<td>Occasional</td>
<td>Medium</td>
<td>5</td>
<td>Medium</td>
<td>5</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Full</td>
<td>Partial</td>
<td>Occasional</td>
<td>Low</td>
<td>3</td>
<td>Low</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Partial</td>
<td>Full</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
<td>Medium</td>
<td>5</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>S6</td>
<td>Null</td>
<td>Full</td>
<td>Unlikely</td>
<td>High</td>
<td>7</td>
<td>High</td>
<td>7</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>Partial</td>
<td>Partial</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
<td>Medium</td>
<td>5</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>S8</td>
<td>Partial</td>
<td>Partial</td>
<td>Rare</td>
<td>High</td>
<td>7</td>
<td>High</td>
<td>7</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.4 Probability and collision matrix table without using GA

Graph 1.1 Graph of Probability
Every risk is question for prospect and collision

1. Probability-Collision Matrix Tool

Risk investigation is an imperative task of all software industries herein world. In today world all organizations execute high end, Complex and expensive projects which necessity be successfully accomplishwithindecidedas well as always uncertainatmosphere. As a project leader, Team leader, Manager or as a software engineer, it is the duty of all team members to be aware of risks and have visibility of risk and this can best be done by probability collision matrix tool.

This tool helps to prioritize risk. If this tool is used effectively it helps us to focus our efforts on most important risks. It’s a qualitative risk investigation device. It is evaluates

----- Likelihood (prospect) that a finicky risk determination arises

The Risk probability collision matrix tool is stand on the principal so as to a risk has 2 main proportions. They are

1) Probability: A risk is an occurrence so as to couldarise. Its possibility of its happening is presser vassortmentwhereveras of immediately 0 percent to immediately 100 percent.

Note: it cannot be precisely 100 percent sinceafter that it would be a conviction, not a risk. And it cannot be accurately 0 percent, since it cannot be a risk.

2) Collision: A risk by its sceneryforever has a pessimistic collision. Though, the dimension of the collision fluctuates in stipulations of rate etc.

The tool tolerates us to speed possiblerrisk on these two extents. The prospect that a risk determinationarise is characterize on Y axis and the collision of the risk if it arise is represented on X axis. The essential structure of the risk Probability/collision is revealed below

----- Probable collision (Consequences) on apurpose if it occurs

How to use probability collision matrix tool

A sample version of the tool is shown below

The graph shown above does not throw much light on intensity of risk. So is the case with Risk factor formula which is

Risk score / Risk Factor = Probability * Collision

Illustration: If the risk has low prospect and is allocated a score of 1
If the collision is momentous and is dispersed an collisioncost of 9
Risk score / Risk Factor = Probability * Collision = 1 * 9 = 9

In some cases, it becomes very difficult to detect risk so we can include difficulty of Detection value also in the formula which is optional
If such risks occur then it is necessary to cope with them and move on. However it is necessary to reduce the likelihood that they will occur.

3. **Low Probability/High Collision**-Risks in the bottom right corner are of high importance. If these risks occur then contingency plans should be ready and it should take care of risk.

2. **High Probability/High Collision**-Risks towards the top right corner are of critical importance. These risks should be of top priority and must pay close attention.

Graph 1.6 Outputs without Using GA

From the tool we conclude that S6, S8 candidate solution have High Probability and High collision which is to be avoided. Here the candidate solutions obtained in Graph 1.9 are applied to probability-collision matrix tool. Here Candidate solutions are obtained without applying Genetic Algorithm and only cost attribute is used to obtain candidate solutions.

**Table 1.5** Probability and Collision matrix table Output using GA

All risks do not have same collision on software project. Some risk has more collision, while some have intermediate collision and the rest may have less collision. Also is the same case with Probability. Some risk has high probability, while some risk has intermediate probability and the rest may have less probability of occurrence. So we need to understand risk so that software engineer in the project can take note of it and avoid high collision, high probability risks first which are very dangerous. This is the reason to use 3x3 matrixes as shown in Graph 1.11. The probability and collision matrix tool helps in detection, estimation as well as prioritization of risks pursuencorporate and economical submission of propertytoward dimininsh, observe and organize the possibility and collision of adverse measures.

Graph 1.7 Graph of Probability using GA

Graph 1.8 Graph of Collision using GA

Graph 1.9 Graph of Risk Factor with GA

Graph 1.10 Output Using GA

**Analysis of Probability and collision Matrix**

From Probability Matrix tool it can be observed that no candidate solution obtained is having High probability and high Collision. We have some candidate solutions like S55,
S66, which have low probability but high collision. These candidate solutions can also be avoided since collision is high. From Graph 1.11, we can observe that that S22 have intermediate probability and intermediate collision. So we can select it and reduce the likelihood when they occur. We have some candidate solutions in the range of intermediate and low probability, and low collision. Such candidate solutions are in safe zone.

Graph 1.12 Probability – Collision Grades

The final case study obtained after genetic algorithm is shown in below Graph 6. The combination of goals of the candidate solutions obtained above can be used for success. After obtaining the results it is necessary to respond to the risk. This is done by reducing the probability of negative risk by proper planning and to increase positive risk. Risk planning can be done by using any of the following methods.

Negative Risks can be dealt with by:

1) Risk Acceptance: This step can be taken if Risk is of low collision and low probability as shown in above fig.
2) Risk Avoidance: This step can be taken if Risk is of high collision and high probability. Here Plan is changed to avoid the risk. Also using a proven approach instead of new approach. Also it is necessary to increase team communication to tackle such situations.
3) Risk Reduction: This step can be taken when we obtain result which is Intermediate collision and intermediate possibility or Low collision and high probability.
4) Risk Transfer: bestand easy way to tackle risk is to transfer risk to third parties like Insurance, using Performance Warranty. But this incurs additional budget.
5) Risk Mitigation/contingency measures: Condense the possibility and/or collision of the risk by Simplifying the processes, develop Prototype and by additional inspection.

Positive Risk can be increased by

1) Exploit: Ensureso as to positive Risk ensue and formulategreatestutilize of the prospect provided.
2) Enhance: augment the possibility and/or collision of the risk
3) Share: The opportunity is shared with a third party to make obtain additional revenue.
4) Accept: Kindly accept the opportunity when it happens but not actively pursuing it.
Summary
The output obtained by genetic Algorithm is a set of candidate solutions. Each Candidate solution is a collection of goals. First the goals are identified in Goal Risk model. In the next step the refined Goals are obtained after passing the test conducted by Extraction Tree and Approximation Algorithm model. Then the output is subjected to Genetic Algorithm. Genetic algorithm has three steps whose intention is to provide optimum candidate solutions. These candidate solutions are used to calculate probability of occurrence and collision of risk. This is illustrated in Graph1.7 and 1.8. When these two factors are multiplied then collision factor is obtained which is illustrated in graph1.9.
The calculation of risk factor is illustrated in table 1.5. The collision factor is not providing sufficient information for us to detect risk. So to have more visibility and clarity about risk we use probability collision matrix tool. This tool clearly exposes risk. This tool does not provide place for risk to hide. The tool is systematic and structured and it divides the risk into many types. They are
1) High possibility and High collision risk
2) Intermediate Probability and Intermediate collision risk.
3) Low probability and low collision risk.
It clearly highlight risk as shown in graph1.10. To analyze the risk we use 3x3 Matrix as shown in graph1.12. This matrix helps in decision making process.

REFERENCES


15. **Shahzad Anwer, Naveed Ikram**, —Goal Oriented Requirement Engineering: A Critical Study of Techniques— XIII Asia pacific software engineering conference (APSEC’06) IEEE.

16. **John Mylopoulos**, key note talk on —Goal-Oriented Requirements Engineering, 14th IEEE Requirements Engineering Conference Minneapolis, September 15, 2006