**A survey on the effectiveness of methods for evaluating the maintainability of SOFL specifications**

1. What is your current occupation? [Single-choice item]

|  |  |  |
| --- | --- | --- |
| **Option** | **Subtotal** | **Proportion** |
| Developer/Maintainer | 4 | 20% |
| SOFL Expert | 1 | 5% |
| Student | 5 | 25% |
| Teacher | 6 | 30% |
| Product/Operations professional | 3 | 15% |
| Software Engineer | 1 | 5% |
| Valid responses (n) | 20 |  |

**TASK 1: Quality Evaluation of Maintainability Metrics**

2. Please rate the following aspects of the Lines of Expressions (LOE) metric [Matrix of Likert-type items]

**Mean (1–5): 4.27**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 1(5.00%) | 7(35.00%) | 12(65.00%) | 4.55 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 0(0%) | 15(75.00%) | 5(25.00%) | 4.25 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 4(20.00%) | 12(60.00%) | 4(20.00%) | 4 |
| Subtotal | 0(0%) | 0(0%) | 5(8.33%) | 34(56.67%) | 21(35.00%) | 4.27 |

3. Please rate the following aspects of the Number of Processes (NOP) metric [Matrix of Likert-type items]

**Mean (1–5): 4.38**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 0(0%) | 6(30.00%) | 14(70.00%) | 4.70 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 3(15.00%) | 12(60.00%) | 5(25.00%) | 4.10 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 1(5.00%) | 11(55.00%) | 8(40.00%) | 4.35 |
| Subtotal | 0(0%) | 0(0%) | 4(6.67%) | 29(48.33%) | 27(45.00%) | 4.38 |

4. Please rate the following aspects of the Number of Control Data Flows (NOCDF) metric [Matrix of Likert-type items]

**Mean (1–5): 4.48**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 1(5.00%) | 9(45.00%) | 10(50.00%) | 4.45 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 0(0%) | 8(40.00%) | 12(60.00%) | 4.60 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 0(0%) | 12(60.00%) | 8(40.00%) | 4.40 |
| Subtotal | 0(0%) | 0(0%) | 1(1.67%) | 29(48.33%) | 30(50.00%) | 4.48 |

5. Please rate the following aspects of the Cyclomatic Complexity (CC) metric [Matrix of Likert-type items]

**Mean (1–5): 4.65**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 1(5.00%) | 6(30.00%) | 13(65.00%) | 4.60 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 0(0%) | 6(30.00%) | 14(70.00%) | 4.70 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 0(0%) | 7(35.00%) | 13(65.00%) | 4.65 |
| Subtotal | 0(0%) | 0(0%) | 1(1.67%) | 19(31.67%) | 40(66.67%) | 4.65 |

6. Please rate the following aspects of the Module Halstead Volume (MHV) metric [Matrix of Likert-type items]

**Mean (1–5): 4.47**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 1(5.00%) | 1(5.00%) | 8(40.00%) | 10(50.00%) | 4.35 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 1(5.00%) | 8(40.00%) | 11(55.00%) | 4.50 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 2(10.00%) | 5(25.00%) | 13(65.00%) | 4.55 |
| Subtotal | 0(0%) | 1(1.67%) | 4(6.67%) | 21(35.00%) | 34(56.67%) | 4.47 |

7. Please rate the following aspects of the Number of Data Stores Used (NODSU) metric [Matrix of Likert-type items]

**Mean (1–5): 4.67**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 0(0%) | 6(30.00%) | 14(70.00%) | 4.70 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 0(0%) | 0(0%) | 8(40.00%) | 12(60.00%) | 4.60 |
| This metric is theoretically and practically justifiable | 0(0%) | 0(0%) | 0(0%) | 6(30.00%) | 14(70.00%) | 4.70 |
| Subtotal | 0(0%) | 0(0%) | 0(0%) | 20(33.33%) | 40(66.67%) | 4.67 |

8. Please rate the following aspects of the Extensiveness of Comments (EOC) metric [Matrix of Likert-type items]

**Mean (1–5): 4.37**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 1(5.00%) | 7(35.00%) | 12(60.00%) | 4.55 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 1(5.00%) | 1(5.00%) | 7(35.00%) | 11(55.00%) | 4.40 |
| This metric is theoretically and practically justifiable | 0(0%) | 1(5.00%) | 3(5.00%) | 8(40.00%) | 8(40.00%) | 4.15 |
| Subtotal | 0(0%) | 2(3.34%) | 5(8.34%) | 22(36.67%) | 31(51.67%) | 4.37 |

9. Please rate the following aspects of the Extensiveness of Blank Lines (EOBL) metric [Matrix of Likert-type items]

**Mean (1–5): 4.25**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The definition of this metric is clear and easy to understand | 0(0%) | 0(0%) | 3(15.00%) | 4(20.00%) | 13(65.00%) | 4.50 |
| This metric effectively captures an important aspect of maintainability | 0(0%) | 1(5.00%) | 4(20.00%) | 7(35.00%) | 8(40.00%) | 4.10 |
| This metric is theoretically and practically justifiable | 0(0%) | 1(5.00%) | 4(20.00%) | 6(30.00%) | 9(45.00%) | 4.15 |
| Subtotal | 0(0%) | 2(3.33%) | 11(18.33%) | 17(28.33%) | 30(50.00%) | 4.25 |

10. Does the complete set of metrics collectively address the main facets of maintainability [Likert-type items]

**Mean (1–5):** 4.30

|  |  |  |
| --- | --- | --- |
| **Option** | **Subtotal** | **Proportion** |
| Strongly Disagree | 0 | 0% |
| Disagree | 0 | 0% |
| Neutral | 0 | 0% |
| Agree | 14 | 70% |
| Strongly Agree | 6 | 30% |
| Valid responses (n) | 20 |  |

**TASK 2: Validation of the rating result**

11. Case1-Random Scenarios [Single-choice item]

|  |  |
| --- | --- |
| **Option** | **Subtotal** |
| SYSTEM\_ATM | 2 |
| SYSTEM\_COURSE\_REGISTRATION | 2 |
| NOTIFICATION\_MANAGEMENT | 2 |
| SYSTEM\_HOSPITAL\_REGISTRATION | 2 |
| Manage\_Patient\_Registration\_Decom | 2 |
| Manage\_Doctor\_Schedule\_Decom | 2 |
| Manage\_Registration\_Decom | 2 |
| Manage\_Current\_Account\_Decom | 2 |
| Manage\_Savings\_Account\_Decom | 2 |
| Manage\_Transfer\_Decom | 2 |
| Valid responses (n) | 20 |

12. Case 1 — Please indicate your level of agreement with the following statements [Matrix of Likert-type items]

**Mean (1–5): 4.33**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The tool-generated overall maintainability rating accurately reflects the maintainability of this module | 0(0%) | 0(0%) | 1(5.00%) | 15(75.00%) | 4(20.00%) | 4.15 |
| The LOE score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 12(60.00%) | 7(35.00%) | 4.30 |
| The NOP score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 12(60.00%) | 8(40.00%) | 4.40 |
| The NOCDF score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 12(60.00%) | 7(35.00%) | 4.30 |
| The CC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 12(60.00%) | 7(35.00%) | 4.30 |
| The MHV score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 12(60.00%) | 6(30.00%) | 4.20 |
| The NODSU score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 7(35.00%) | 11(55.00%) | 4.45 |
| The EOC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 5(25.00%) | 13(65.00%) | 4.55 |
| The EOBL score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 4(20.00%) | 6(30.00%) | 10(50.00%) | 4.30 |
| Subtotal | 0(0%) | 0(0%) | 14(7.78%) | 93(51.67%) | 73(40.56%) | 4.33 |

13. Case2-Random Scenarios [Single-choice item]

|  |  |
| --- | --- |
| **Option** | **Subtotal** |
| SYSTEM\_PUBLIC\_TRANSPORT\_TICKETING | 2 |
| Manage\_User\_Accounts\_Decom | 2 |
| Manage\_Routes\_and\_Timetables\_Decom | 2 |
| Manage\_Ticket\_Operations\_Decom | 2 |
| Manage\_Payment\_Decom | 2 |
| Manage\_System\_Maintenance\_Decom | 2 |
| SYSTEM\_STOCK\_TRADING | 2 |
| Manage\_User\_Registration\_Decom | 2 |
| Manage\_Account\_Decom | 2 |
| Manage\_Foreign\_Currency\_Account | 2 |
| Valid responses (n) | 20 |

14. Case 2 — Please indicate your level of agreement with the following statements [Matrix of Likert-type items]

**Mean (1–5): 4.35**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The tool-generated overall maintainability rating accurately reflects the maintainability of this module | 0(0%) | 0(0%) | 1(5.00%) | 13(65.00%) | 6(30.00%) | 4.25 |
| The LOE score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 9(45.00%) | 11(55.00%) | 4.55 |
| The NOP score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 11(55.00%) | 8(40.00%) | 4.35 |
| The NOCDF score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 15(75.00%) | 5(25.00%) | 4.25 |
| The CC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 14(70.00%) | 6(30.00%) | 4.30 |
| The MHV score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 11(55.00%) | 7(35.00%) | 4.25 |
| The NODSU score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 8(40.00%) | 11(55.00%) | 4.50 |
| The EOC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 6(30.00%) | 12(60.00%) | 4.50 |
| The EOBL score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 3(15.00%) | 10(50.00%) | 7(35.00%) | 4.20 |
| Subtotal | 0(0%) | 0(0%) | 10(5.56%) | 97(53.89%) | 73(40.56%) | 4.35 |

15. Case3-Random Scenarios [Single-choice item]

|  |  |
| --- | --- |
| **Option** | **Subtotal** |
| Query\_Market\_Decom | 2 |
| Manage\_Trading\_Decom | 2 |
| Perform\_Settlement\_Decom | 2 |
| Monitor\_Risk\_Decom | 2 |
| SYSTEM\_VENDING\_MACHINE | 2 |
| Manage\_Item\_Inventory\_Decom | 2 |
| Handle\_User\_Interaction\_Decom | 2 |
| Record\_Transaction\_Decom | 2 |
| Monitor\_System\_Status\_Decom | 2 |
| Change\_Password\_Decom | 2 |
| Valid responses (n) | 20 |

16. Case 3 — Please indicate your level of agreement with the following statements [Matrix of Likert-type items]

**Mean (1–5): 4.41**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Question \ Option | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| The tool-generated overall maintainability rating accurately reflects the maintainability of this module | 0(0%) | 0(0%) | 1(5.00%) | 8(40.00%) | 11(55.00%) | 4.50 |
| The LOE score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 13(65.00%) | 7(35.00%) | 4.35 |
| The NOP score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 12(60.00%) | 7(35.00%) | 4.30 |
| The NOCDF score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 7(35.00%) | 13(65.00%) | 4.65 |
| The CC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 13(65.00%) | 7(35.00%) | 4.35 |
| The MHV score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 0(0%) | 12(60.00%) | 8(40.00%) | 4.40 |
| The NODSU score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 1(5.00%) | 9(45.00%) | 10(50.00%) | 4.45 |
| The EOC score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 2(10.00%) | 10(50.00%) | 8(40.00%) | 4.30 |
| The EOBL score produced by the tool is appropriate for this module | 0(0%) | 0(0%) | 3(15.00%) | 6(30.00%) | 11(55.00%) | 4.40 |
| Subtotal | 0(0%) | 0(0%) | 8(4.44%) | 90(50.00%) | 82(45.56%) | 4.41 |

**TASK 3: Metric Importance Ranking**

17. Please rank the following metrics by their importance for maintainability assessment, from 1 (most important) to 8 (least important) [Ranking item]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Option | Mean | NO.1 | NO.2 | NO.3 | NO.4 | NO.5 | NO.6 | NO.7 | NO.8 |
| Number of Control Data Flows (NOCDF) | 5.75 | 3(15.00%) | 5(25.00%) | 5(25.00%) | 1(5.00%) | 3(15.00%) | 3(15.00%) | 0(0%) | 0(0%) |
| Module Halstead Volume (MHV) | 5.6 | 6(30.00%) | 2(10.00%) | 3(15.00%) | 3(15.00%) | 0(0%) | 5(25.00%) | 1(5.00%) | 0(0%) |
| Number of Processes (NOP) | 5.45 | 2(10.00%) | 6(30.00%) | 4(20.00%) | 2(10.00%) | 2(10.00%) | 2(10.00%) | 1(5.00%) | 1(5.00%) |
| Lines of Expressions (LOE) | 5.35 | 5(25.00%) | 3(15.00%) | 1(5.00%) | 3(15.00%) | 4(20.00%) | 1(5.00%) | 3(15.00%) | 0(0%) |
| Cyclomatic Complexity (CC) | 5 | 3(15.00%) | 2(10.00%) | 5(25.00%) | 3(15.00%) | 1(5.00%) | 2(10.00%) | 3(15.00%) | 1(5.00%) |
| Number of Data Stores Used (NODSU) | 4.25 | 0(0%) | 1(5.00%) | 2(10.00%) | 5(25.00%) | 8(40.00%) | 2(10.00%) | 1(5.00%) | 1(5.00%) |
| Extensiveness of Comments (EOC) | 3 | 1(5.00%) | 1(5.00%) | 0(0%) | 2(10.00%) | 1(5.00%) | 3(15.00%) | 10(50.00%) | 2(10.00%) |
| Extensiveness of Blank Lines (EOBL) | 1.6 | 0(0%) | 0(0%) | 0(0%) | 1(5.00%) | 1(5.00%) | 2(10.00%) | 1(5.00%) | 15(75.00%) |