Spreadsheet Guardian: An Approach to Protecting Semantic Correctness throughout the Evolution of Spreadsheets (Journal-First Abstract)\textsuperscript{1}

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Abstract—We developed an approach that protects users from using faulty spreadsheets in collaborative settings. Results from an empirical evaluation with 71 spreadsheet users indicate that the approach is both helpful and easy to learn and apply.

I. MOTIVATION

Spreadsheets are powerful tools which play a business-critical role in many organizations and are often produced and maintained by end-users. However, many bad decisions taken due to faulty spreadsheets show that these tools need serious quality assurance. An open question until to date has been how spreadsheet correctness could be ensured during the maintenance of spreadsheets in collaborative settings, as such settings are pretty common.

II. SPREADSHEET GUARDIAN

We developed a conceptually simple approach named Spreadsheet Guardian which separates the specification of spreadsheet test rules from their execution. The basic idea is that end-users define their own “protective” test rules which are able to detect semantic anomalies. As these test rules are continuously executed in the background, collaborating spreadsheet users are warned when introducing faults during maintenance. Therefore, even if only few users specify such test rules, all other collaborating users can profit from them.

III. EVALUATION

To evaluate Spreadsheet Guardian, we implemented a tool named Spreadsheet Inspection Framework (SIF) that integrates seamlessly into Microsoft Excel. SIF implements two testing techniques that are representative for Spreadsheet Guardian. We picked one of them (the so-called “test scenarios”) for the evaluation of our approach and formulated two evaluation goals:

• Goal 1: Analyze spreadsheet users learning Spreadsheet Guardian and creating test scenarios using SIF, for the purpose of evaluating the effectiveness of spreadsheet users specifying test scenarios, with respect to the amount of correctly created test scenarios, the time required by users to specify the test scenarios and the perceived complexity of the maintenance tasks.
• Goal 2: Analyze spreadsheet users maintaining pristine spreadsheets versus spreadsheets protected by Spreadsheet Guardian using SIF, for the purpose of comparing the effectiveness of the created test scenarios, with respect to the actual correctness of the spreadsheets.

We accordingly added hypotheses for testing the feasibility of creating new test scenarios, the complexity of using SIF and the correctness of the results. We evaluated our hypotheses in three experiments (E1, E2 and E3). Our population comprised 29 typical spreadsheet end-users (in E1 and E2) and 42 undergraduate computer science students (in E3). For the main tasks after a basic training, we subjected the participants to an unfamiliar existing spreadsheet that was initially produced correctly by a typical spreadsheet user but seeded with three typical spreadsheet faults by us. We asked the participants to perform correct and adaptive maintenance activities.

IV. RESULTS AND CONCLUSION

For analyzing the results, we tested the spreadsheets modified by the users for regressions and operational capabilities of their modifications. The results indicate that Spreadsheet Guardian is easy to learn and to apply. Furthermore, after finishing maintenance, participants with spreadsheets “protected” by Spreadsheet Guardian are more realistic about the correctness of their spreadsheets than participants who employ only “classic”, non-interactive test rules based on static analysis techniques. Hence, we believe Spreadsheet Guardian can be of use for business-critical spreadsheets.

REFERENCES

\textsuperscript{1} The full version of this work was accepted as journal article \cite{1}