Appendix 2E

Part 2

Validity of the Electronic Implementation of the Counting Rules – Referenda

THE POLICY INSTITUTE, TRINITY COLLEGE DUBLIN

Mr. Lorcan Coyle, *Department of Computer Science, TCD*
Mr. Donal Doyle, *Department of Computer Science, TCD*

Table of Contents

Summary

This report is dedicated to verifying that the counting software in the Integrated Election Software (IES) developed by NEDAP/Powervote is a faithful implementation of the Irish system of counting for Referenda. This was done by running test referenda with predefined numbers of votes and checking that the IES obtained the expected results. **The IES achieved the expected result in every tested referendum. Our results support the view that the counting software in the IES developed by NEDAP/Powervote is a faithful implementation of the Irish system for counting referenda.** However, an exhaustive search of every possible scenario (i.e. every possible combination of votes) was not feasible due to the very large number of possible permutations.

Recommendations

- As the software is changed, new "builds" are issued. Our tests are only valid in the context of the software build that we have tested. The build we were issued with and tested was build 1.31. If the Commission feels that the level of testing that we have performed is appropriate, then this level of testing should be performed on any subsequent builds used in actual referenda.

Volume Testing and Interesting Count Situations

There are only three possible outcomes of a referendum; (a) the majority vote in favour of amending the constitution, (b) the majority vote against amending the constitution, (c) there is a tie, with equal numbers of votes for and against. We have performed a total of 14,011 volume tests with random datasets. These datasets contain between 848 and 60,920 votes and are comprised of a random number of yes and no votes as well as a number of "null" votes. To test marginal election scenarios, sixty manual datasets were generated. These datasets covered situations where a referendum was decided by a single vote (e.g. 1,000 in favour, 999 against). They also covered situations where the number of votes in favour was equal to the number of votes against. These datasets contained between 1,999 votes and 60,000 valid votes. We also ran two large referenda with datasets of 1,000,000 votes and 4,000,001 votes respectively.

In total, 14,073 referenda datasets were created. The performance of the IES counting implementation was confirmed to yield the correct result in every one of these datasets. It should be noted that an exhaustive search of every possible scenario (i.e. every possible combination of votes) was not feasible due to the very large number of possible permutations.