

ABSTRACT

A System for Measuring Program Complexity. (August 1976)

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At this stage in software research, few validated tools exist for an objective evaluation of a program or for comparisons between programs. There are no generally applicable or empirically validated categorizations for computer programming. Furthermore, there are no generally accepted, comprehensive, and validated measures of computer program complexity or difficulty. There is a great void of data relevant to software, whether it be with regard to programs' error/change histories, their usability, complexity, or any other program quality.

The purpose of this research is the development of techniques for measuring a program's complexity. This consists of the development of a system which would serve not only as a static analyzer for analyzing a program in terms of its relevant complexity characteristics, but also as a vehicle for actually collecting statistics on each complexity characteristic as it was evidenced in a program. The program statistics collected are analyzed and then utilized in various measures of program complexity.

A great number of subjective opinions have been put forth on the topic of program complexity. These opinions have proposed a wide range of program characteristics as factors relevant to

complexity. Unfortunately, there is little objective validation to reinforce these proposed characteristics as valid in measuring complexity. Objective data collection and program analysis is needed not only to validate these opinions on complexity characteristics but also to show which of the proposed characteristics appear often enough in programs to even be relevant.

Development of complexity measures has been undertaken in two phases. The implementation phase involved setting up a static analysis data collection scheme for analyzing both COBOL and FORTRAN program characteristics deemed relevant to program complexity. Here the opinions which have been put forth by authors about complexity provide a reasonable set of program characteristics to use in this static analysis system.

The second phase of development involved utilization of the data provided by the data collection system in various types of analyses. The purpose of this phase is to refine the data collected into a set of valid, discriminating complexity characteristics. These complexity characteristics are in turn used to reevaluate sample programs via a complexity ranking scheme. The complexity characteristics are also the basis of discussion for other techniques for complexity measurement.