Chapter 11
Assessment of Software Quality:
A Fuzzy Multi-Criteria Approach

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ABSTRACT
Software Quality Assurance consists of monitoring the software engineering processes and ensuring the highest quality. But, the software quality attributes that we deal with are not explicit in the outset and cannot be easily measured. The same attribute has multiple significance and importance in multiple contexts. The user, the developer and the manager of a software product may have different stands regarding the significance of a quality attribute. A software quality engineer, while measuring the total software quality should provide appropriate weight to each of the decision makers. This chapter proposes a fuzzy multi-criteria approach to measure the total software quality and to identify the best alternative from a set of software products.

INTRODUCTION
Software engineering is the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software (Pierre Bourque and Robert Dupuis, 2004). Computerized systems now pervade every aspect of our daily life, increasing the importance on the quality of the software that run them. As the hardware systems became more sophisticated, the software became more complex and new programming paradigms were introduced. The development and use of software is becoming very important in today’s life of rapid technological advancement. It becomes even more important when critical decisions are made by software driven systems (M. Lehman, 1996).

Therefore, as we become more dependent on software based systems, there is a need to produce high quality software which requires a systematic approach for quantification of quality of the software developed. Software quality is generally defined as “the degree to which a system or its components, or the processes involved in the system meets speci-
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fied requirements”. It can also be expressed as “the degree to which a system, its components, or process meets customer or user based expectations.” (Sivamuni Kalaimagal and Rengaramanjam Srinivasan, 2008). Quality, in general, is the totality of features and characteristics of a product or a service that bears on its ability to satisfy the given needs (Arun Sharma, Rajesh Kumar and P. S. Grover, 2008). According to Ljerka Beus Dukic and Jorgen Boegh (2003), software quality evaluation is defined as “the systematic examination of the software capability to fulfill specified quality requirements.” A software quality model is defined as, “a set of characteristics and sub characteristics, as well as the relationships between them that provide the basis for specifying quality requirements and evaluating quality.” To fulfill the expectations of user, good software should deal various quality attributes, the quantification of which is a challenging and complex prospect.

Many investigators have classified various software quality attributes depending on the important viewpoints of a software product (Luigi Buglione and Alian Abran, 1999) and (Praveen Ranjan Srivastava and Krishan Kumar, 2009) these can be as follows:

- Attributes with Manager’s Perspective
- Attributes with User’s Perspective
- Attributes with Developer’s Perspective

These attributes can play important role while integrating the effect of each one of them to evaluate the best software quality among the given alternatives. All such important attributes for choosing the best alternative have to be considered which should not only deal with the uncertainty associated with specifying various attributes but also discuss different criteria. This can be dealt by applying the concept of fuzzy multi-criteria approach because the method is suitable for making decision under fuzzy environment. To deal with uncertainty in the form of fuzziness of the selection process of good software, the importance weights of various criteria and the ratings of qualitative criteria are to be considered as linguistic variables. Fuzzy logic allows linguistic values such as good, poor and bad to take numerical values and thus enabling us to include such values in numerical calculations. In this chapter an application of fuzzy multi-criteria approach has been introduced to assess the software quality parameters by identifying the various types of software attributes.

BACKGROUND

The concept of software quality is more complex than what common people tend to believe. However, it is very important both for common user and IT professionals (Cote, M., A. Suryn and W. Georgiadou, 2006). If we look at the definition of quality in a dictionary, it is usual to find something like the following: set of characteristics that allows us to rank things as better as or worse than other similar ones. In many cases, dictionaries mention the idea of excellence together with this type of definitions.

Software Quality refers to the abilities related properties of software products which meet users’ needs. According to its standards, the software quality evaluation is the software development process throughout the software quality and continuous measurement, revealing the current state, estimating the follow-up trend of software quality and providing precisely control of it (FuLi Jin, Guisheng Yin and Dekun Yang, 2008). Software quality can be evaluated quantitatively to assess precisely and efficiently so that it can provide an objective and impartial scientific basis (Souheil Khaddaj and G Horgan, 2004).

Software Quality Attributes are the benchmarks that describe system’s expected behavior within the environment for which it was built. Software Quality Attributes provide visibility to management that the software products and processes in the project life cycle conform to the specified requirements and established plans (San-
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