Abstract

The role of software in our day-to-day life has been increased since the early seventies. Software is being used in diverse areas for various applications. The impact of software failures can have a broad range of consequences starting from minor inconvenience to the loss of life. As a result, software reliability has become a common concern for both developers and users. Software reliability is an important area of research which has grown tremendously in recent years and many software reliability models have been developed. However various assumptions made in these models are not realistic and most of the metrics of software development life cycle (SDLC) can not be measured precisely. This necessitates the requirement of more practical models for software reliability estimation and prediction. Therefore, this research work proposes some models using fuzzy set theory approach that are relevant and applicable for software reliability modeling and prediction.

In the early phases of SDLC as failure data is not available, software defects have to be predicted based on software metrics. Software metrics are associated with uncertainty and can be assessed in linguistic terms in the early phase of SDLC. Traditional models on early software defects prediction do not consider metrics that are relevant from reliability point of view. Therefore, a model using fuzzy set theory approach and considering reliability relevant metrics is proposed in this thesis. Research in the area of software reliability indicates that testing phase is an important part of SDLC which consumes nearly 50% of total software development cost. Therefore, two models are proposed to forecast the time-between-failures of software during testing phase using fuzzy time series approach. Apart from these models, a model to predict testing-effort using two-factor first-order fuzzy time series approach is also proposed. Further, a model for defects prediction of multi-release software is proposed. In this model, applicability of fuzzy time series approach is explored. Software project manager can minimize the mismatch in project costing and development schedule by applying these models. All the models proposed in the thesis are validated using multiple case studies.

Keywords: software reliability, time between failures, testing-effort, early software defects prediction, fuzzy time series, fuzzy logic, software metrics.