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Fundamentals of Software Engineering Third Edition

软件工程基础（第3版）

Rajib Mall 著

清华大学出版社

大学计算机教育国外著名教材系列（影印版）

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出 版 说 明

进入21世纪，世界各国的经济、科技以及综合国力的竞争将更加激烈。竞争的中心无疑是对人才的竞争。谁拥有大量高素质的人才，谁就能在竞争中取得优势。高等教育，作为培养高素质人才的事业，必然受到高度重视。目前我国高等教育的教材更新较慢，为了加快教材的更新频率，教育部正在大力促进我国高校采用国外原版教材。

清华大学出版社从1996年开始，与国外著名出版公司合作，影印出版了“大学计算机教育丛书（影印版）”等一系列引进图书，受到国内读者的欢迎和支持。跨入21世纪，我们本着为我国高等教育教材建设服务的初衷，在已有的基础上，进一步扩大选题内容，改变图书开本尺寸，一如既往地请有关专家挑选适用于我国高等本科及研究生计算机教育的国外经典教材或著名教材，组成本套“大学计算机教育国外著名教材系列（影印版）”，以飨读者。深切期盼读者及时将使用本系列教材的效果和意见反馈给我们。更希望国内专家、教授积极向我们推荐国外计算机教育的优秀教材，以利我们把“大学计算机教育国外著名教材系列（影印版）”做得更好，更适合高校师生的需要。

清华大学出版社

PREFACE

The third edition of this book was necessary to trace on the rapid advancements taking place in the field of software engineering. The techniques and practices discussed, are revamped according to the current trends since the first edition was written.

This book has taken its shape while teaching the subject of **Software Engineering** to the undergraduate and postgraduate students at IIT, Kharagpur over the last one-and-a-half decades. The book treats all important topics of software engineering, including the recent advancements made in a coherent framework. At the same time, the book deals with the topics from the perspective of the practising engineers. A large portion of the text is based on my own practical experience gained while working on software development projects in several organizations.

Designed to serve as a textbook for one semester course in software engineering for the undergraduate students, this book can be used as a reference book for postgraduate students as well. As the topics on Halstead's software science, Software reuse and formal specification covers the topics taught at the postgraduate level.

The book is also intended to the students who are familiar with at least one high level programming and one low level programming language. The students expected are to possess basic ideas about operating systems, systems programming, compiler writing, and computer architecture issues. Experience in writing large-sized programs would be very helpful in grasping some of the important concepts discussed in this book.

The emphasis of this book is to illustrate the important concepts through small examples rather than a single large running example. The former approach has been opted as this would help to illustrate several subtle and important concepts through appropriate small examples, as illustrating these concepts through a single running example becomes a difficult task.

The layout of the chapters has been guided by the sequence of activities undertaken during the life of a software product. However, since the project management activity is spread over all phases, it was considered necessary to discuss these as early in the book as possible. Software project management has been discussed in Chapter 3. However, while teaching this book, one should teach the project management topic after Chapter 11, as teachers would be able to give the design assignments to the students early, and they would get sufficient time to complete them.

In the text, I have taken the liberty to use he/his to actually mean both the genders. This has been done only to increase the readability of the writing rather than with intent of any bias.

The PowerPoint slides to teach the book as well as the solutions manual can be obtained either from the publisher or by sending an e-mail to rajib@cse.iitkgp.ernet.in

We welcome readers to send their suggestions or queries.

RAJIB MALL

PREFACE TO THE FIRST EDITION

This book is designed as a textbook on software engineering for undergraduate students in computer science. Software engineering is a fast developing field. While teaching the subject at the Indian Institute of Technology Kharagpur, I felt the need for organizing a textbook that gives a coherent account of all the state-of-the-art topics and at the same time presents these topics from the viewpoint of practising engineers. A portion of the text is, therefore, based on my own practical experience, gained while working on software development projects in several industries.

The book starts with a comprehensive introduction to software engineering, including some important life cycle models. Chapter 2 presents and discusses techniques and concepts of software project management. This chapter encompasses all phases of software development that are considered crucial to the success of software projects. Chapter 3 focuses on requirements analysis and specification. In this chapter, different approaches to formal requirements specification and essential features of algebraic specifications as a formal specification technique are explored. Chapter 4 highlights some important facets of software design. In Chapter 5, the methodology of Structured Analysis/Structured Design (SA/SD) in relation to traditional function-oriented design. Chapter 7 brings out some basic aspects, techniques and methods pertaining to user interface design. Significant progress has been made in this field and it is important for students to know the various issues involved in a good user interface design. Chapter 8 discusses coding and unit testing techniques. Integration and system testing techniques are elaborately described in Chapter 9. These are the main quality control activities. Chapter 10 is, therefore, exclusively devoted to software quality assurance aspects, ISO 9000 and software reliability models, as these are considered necessary to expose students to basic quality concepts as part of a software engineering course. Finally, in Chapter 11, the student has been introduced to general concepts to CASE tools, without going into specifics of any particular CASE tool.

The students using this textbook should be proficient at least in one high level and low level programming language each. They should also possess basic knowledge of operating systems, systems programming, compiler writing, and computer architecture.

The emphasis in this book is to illustrate the important concepts through several small examples rather than a single large running example. The book also contains many exercises

at the end of each chapter aimed at reinforcing the knowledge of principles and techniques of software engineering.

I do hope fervently that the students will find this text both stimulating and useful.

Acknowledgements

Many persons have contributed to make this book a reality. I would especially like to express my appreciation to Prof. L.M. Patnaik for his unstinted support and encouragement. I would also like to thank Prof. Sunil Sarangi, Dean (CEP) for his guidance throughout the preparation of the manuscript. Thanks are also due to Prof. Ajit Pal, the present Head of the Department, and all my colleagues at the Computer Science and Engineering Department of IIT Kharagpur for their helpful comments and suggestions. I express my special thanks to Prof. P.K.J. Mahapatra of IEM Department for his help during the final preparation of the manuscript.

I acknowledge the help and cooperation received from all the staff members of the Computer Science and Engineering Department of IIT Kharagpur.

I would like to acknowledge the financial assistance provided by IIT Kharagpur for the preparation of the manuscript and I wish to thank the numerous B.Tech and M.Tech students whose enthusiastic participation in classroom discussions helped me to present many ideas and concepts, as discussed in this book, with greater clarity.

Finally, I wish to express my sincere thanks to all my family members for their moral support. In particular, I thank my parents, Sanjib, Kanika Bhabhi, Sudip, Shivani, Sonali and Amitabha, my parents-in-law and GUGLOO. I am grateful to my wife Prabina for her constant encouragement.

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