TURING 图灵原版计算机科学系列

国际软件测试认证委员会（ISTQB）指定教材

Software Testing Foundations

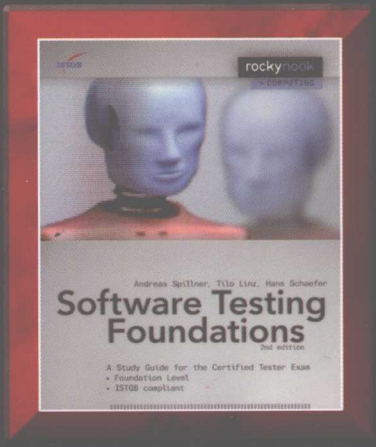
A Study Guide for the Certified Tester Exam

Second Edition

软件测试基础教程

（英文版·第2版）

[德] Andreas Spillner
[德] Tilo Linz 著
[挪] Hans Schaefer



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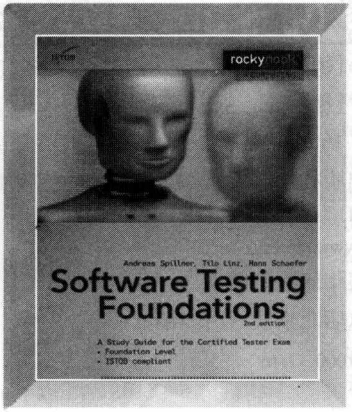

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内 容 提 要

本书是国际软件测试认证委员会（ISTQB）认证考试的指定教材，也是软件学院相关专业软件测试课程的理想教材。书中从软件测试的基础、软件生存周期中的测试、静态测试、测试设计技术、测试管理测试工具等几个方面介绍了软件和系统测试的基本技术、工具和概念。

本书适合作为本科院校软件学院相关专业软件测试课程的教材，也是软件测试领域技术人员的理想参考书。

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软件测试基础教程（英文版·第 2 版）

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［挪］Hans Schaefer
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版权声明

Foreword to the First Edition by Rex Black

I've been in the software and systems engineering business for over twenty years, with most of that time spent as a tester. In the 1980s, when I shifted my career emphasis from programming and system administration to testing, the resources were pretty limited. There were a few books by testing pioneers such as Boris Beizer, Bill Hetzel, Glenford Myers, and Bill Perry. Some of these books were – and remain – good resources. Someone new to the field could cover the entire software and systems testing library in a few months of reading.

Not any more. Now we have dozens and dozens of books out there on testing. You can read a book on testing specific kinds of applications, like Web applications and embedded applications. You can read a book on testing in formal settings and informal settings. You can even read a book or two on test management.

However, every professional needs to start somewhere. Every profession needs its foundation. The profession of software and systems testing needs books that provide the basic techniques, tools, and concepts. This is one such book.

This book will provide you with a solid practical foundation for your work and study of testing. Software and system testing suffers from a serious gap between best practices and common practices. If you're someone who is making a living from doing testing but haven't gotten around to reading a book, why not start with this one?

The authors wrote this book using the International Software Test Qualification Board's Foundation Level Syllabus as an outline. So, if you're pursuing test certification, I recommend this book. You can get certified according to the Foundation Level Syllabus by taking an exam offered through a recognized National Board. Such National Boards include the American Testing Board, the Indian Test Board, and the Israeli Test Certification Board, to name three such boards that I serve on.

This book would also make a fine textbook for a college course. If you're a professor looking for a good testing textbook, both you and your students may find this book a good choice.

This book should prove especially useful to you if you work on inhouse system development. The discussion on the role, techniques, and importance of requirements specification and acceptance testing in such environments is excellent. Of course, we don't always find ourselves working in organizations that have the overall system lifecycle process maturity that underpins this book. However, assuming that the testing process is part of a larger set of mature, well-managed development, maintenance, and deployment processes is a smart way to keep the book from spiraling into a complex discussion on how testing can adapt to dysfunctional organizations.

One problem we face in the testing profession is the lack of a universally-accepted glossary. That leads to a lot of discussion and confusion. The authors deal with that by providing definitions for their terms, based on the International Software Testing Qualification Board's glossary. I found a lot that I liked in this book. It provides a good description of what software and systems testing is. It explains not just the best practices and techniques, also the whys and hows of these techniques.

If you've read my books, *Critical Testing Processes* and *Managing the Testing Process*, you know that I like case studies and examples. If you've taken my training courses, you've worked through exercises based on real-world examples. This book uses a well-described, practical, true-to-life running case study to illustrate the key points. That helps bring the material to life and make it clear.

I also liked the survey of the commonly-used and commonly-useful black box and white box techniques. The authors also provide good brief discussions of some of the more unusual – but sometimes useful – techniques, too. If you're an analyst or test manager, this should help you understand the essential techniques of test design.

There's also a good survey of test automation tools and techniques. The authors give a balanced perspective that neither bashes nor boosts the tools. With so much hype and confusion surrounding this topic – and, sadly, so many failed attempts at test automation – the authors' dispassionate approach, with plenty of cautionary notes, is refreshing.

Finally, it's nice to see a test book that includes a broad, helpful discussion of test management. Other than my own two books, this topic hasn't

gotten much attention. If you're a tester or QA analyst who needs to understand the management perspective, this book should help.

As you can see, this book introduces many topics in the field of software and system testing. In spite of that, this is a relatively short book, which makes it more approachable for busy test professionals. As a writer, I know it's hard to write books that are both comprehensive and brief. The authors have struck a good balance in the level of detail they provide, focusing on the needs of the target audience. This book will provide a solid foundation for you when you read more advanced books on specific topics like test management, test design, test automation, or testing particular kinds of applications.

Bulverde, Texas, June 2004
Rex Black, President of the ISTQB

Foreword

In the foreword to the German first edition of *Software Testing Foundations*, we asked if more books on software testing were needed. Since both the first and second German editions quickly sold out, we consider the answer to our question to be a resounding "Yes!". The German second edition was translated to English and this English edition also sold out surprisingly fast.

The current syllabus

There has only been one internationally recognized syllabus published since 2005 for the ISTQB® Certified Tester, Foundation Level, and the two existing compatible syllabi by the Information Systems Examinations Board (ISEB) [URL: ISEB] and the German Testing Board (GTB) have been combined and updated.

This second English edition of *Software Testing Foundations* conforms to the International Software Testing Qualifications Board Foundation Level Syllabus (ISTQB) [URL: ISTQB], which was published in July 2005. The book includes additions to the syllabus with respect to the two earlier versions.

What is new in the new ISTQB Syllabus?

Found in the syllabus, and therefore also in this second English edition, is some new content (such as the test first approach and risk-based testing), and you will find that the formulation of learning objectives is the basis for a new learning dimension. Explicit learning objectives help the reader to remain oriented. These learning objectives also clarify the knowledge and the depth of knowledge that is expected from an ISTQB Certified Tester, Foundation Level. This means, for example, that at the lowest level of the learning objectives the glossary definitions of all marked key terms of the syllabus are relevant for the examination.

"The terms are no longer defined in the new ISTQB Foundation Level Syllabus, but can be found in the ISTQB Glossary of Testing Terms [URL: ISTQB] and its national equivalents. The new ISTQB Foundation Level Syllabus, on the other hand, provides a detailed explanation of Best Practices of Software Testing, not relying on outside sources such as national standards. Analogous to the Advanced Level, the content relevant for the

examination (i.e., test management) has now been structured in the same way for the Foundation Level. Thus, the Foundation Level creates the basis for the additional knowledge required for the Advanced Level" (Horst Pohlmann, German Testing Board, Working Party Foundation Level).

Certification

The education and certification for the Certified Tester have been very well received worldwide. At the end of 2006, there are already more than 40,000 certified testers (i.e., those who passed the exams organized worldwide by several national testing boards) [URL: ISTQB]. Approximately Eighty percent of the examined people passed the exam and received the certificate. The official exam questions are currently being updated so they match the new ISTQB Syllabus. New examinations are now run only based on the most current syllabus. Several companies have been accredited to hold training seminars for the Certified Tester examination. Thus, qualified training is available in Europe, the USA, and India.

ISTQB members

Currently, the following countries have national testing boards in the ISTQB: Australia/New Zealand, Austria, Bangladesh, Brazil, Canada, Chinese, Denmark, England, Finland, France, Germany, India, Israel, Japan, Korea, Netherlands/Belgium, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, the United States, and the Ukraine. There are also testing boards for Latin America and South East Europe.

In response to the international interest in software testing and Certified Tester education, we also published a Dutch edition of *Software Testing Foundations* in 2004. Translations into Polish and Romanian are currently under way. At the 2nd level, there are currently two schemes and two syllabi: ASQF/iSQI Advanced Level (developed by the German Testing Board) and ISEB Practitioner Level (developed by the UK Board). Both are recognized by ISTQB as professional qualifications for testers, as they have gained a respect in the testing community over many years. ISTQB intends to have these two 2nd level schemes integrated into a single unified 2nd level "ISTQB Advanced Level" qualification, which should supersede both existing schemes. Seminars for advanced topics (i.e., test management, test methods) are already being offered and these seminars are well attended. We are currently busy writing the literature to match this syllabus. The German book "Praxiswissen Softwaretest – Testmanagement" was recently published and covers parts of the syllabus for these topics. In spring 2007 there will also be an English edition of the book »Software Testing Practice – Test Management«. Books about »Test Methods« and the topics for the yet to be defined Expert Level shall follow.

The next qualification level

Use at universities and colleges

We are pleased to note that this book has been adopted at universities and colleges, and lectures with attached examinations are being offered at

the technical universities of Munich and Darmstadt, the University of Dortmund, the universities of applied science in Cologne and Bremen, as well as the University of Iceland in Reykjavik, and the University of Graz, Austria. Students of these classes were able to take the exam for the Certified Tester, Foundation Level.

Thank you notes

We want to thank our readers for their helpful comments, which have contributed to corrections and clarifications in the first and second German editions of this book. We would like to extend a further thank you to our colleagues in the GTB and ISTQB, without whose great work there would be no Certified Tester scheme. We especially want to thank Horst Pohlmann for his excellent contributions when composing the syllabi, examination questions, and the Certified Tester glossary.

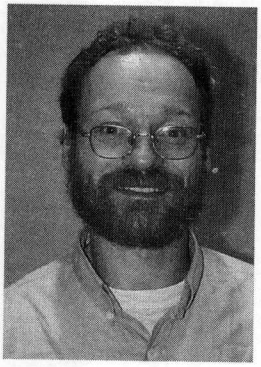
We want to cordially thank Martin Pol for his translation of the book to Dutch. Rex Black has also given us many valuable comments, as well as his foreword for the first English edition.

Andreas Spillner, Tilo Linz and Hans Schaefer
Bremen, Möhrendorf, and Valestrandsfossen,
December 2006

About the Authors

Andreas Spillner is a professor of Computer Science in the Department of Electrical Engineering and Computer Science at Bremen University of Applied Sciences. For more than 10 years, he was president of the German Special Interest Group in Software Testing, Analysis, and Verification of the German Society for Informatics. He is a member of the German Testing Board. His work emphasis is on software, quality assurance, testing, and object-oriented system development.

Tilo Linz is CEO of imbus AG, a leading service company for software testing in Germany. He is president of the German Testing Board and was president of the ISTQB from 2002 to 2005. His work emphasis is on consulting and coaching projects on software quality management, and optimizing software development and testing processes.



Hans Schaefer is an independent consultant in software testing in Norway. He is president of the Norwegian Testing Board. He has been consulting and teaching software testing methods since 1984. He organizes the Norwegian Special Interest Group in Software Testing for Western Norway. His work emphasis is on consulting, teaching, and coaching test process improvement and test design techniques, as well as reviews.

Contents

1 Introduction

Software has found an enormous dissemination in the past years. There are few machines or facilities left today that are not controlled by software or at least include software. In automobiles, for example, from the engine to the transmission and up to the brakes, more and more functions are controlled by microprocessors and their software. Thus, software is crucial to the functionality of devices and industry. Likewise, the smooth operation of an enterprise or organization depends largely on the reliability of the software systems used for supporting the business processes or particular tasks. The speed at which an insurance company is able to introduce a new product, or even a new rate, most likely depends on how quickly the IT systems can be adjusted or extended.

High dependence on the correct functioning of the software

Within both sectors (embedded and commercial software systems), the quality of software has become the most important factor in determining the success of products or enterprises.

Many enterprises have recognized this dependence on software and strive for improved quality of their software systems and software engineering (or development) processes. One way to achieve this goal is systematic evaluation and testing of the developed software. In some cases, appropriate testing procedures have found their way into the daily practice of software development. However, in many sectors, there remains a significant need to become educated in regard to evaluation and testing procedures.

Basic knowledge for structured evaluation and testing

With this book, we offer basic knowledge that helps to achieve structured and systematic evaluation and testing. Implementation of these evaluation and testing procedures should contribute to an improved quality of the software being developed. This book is written in such a way that it does not presume previous knowledge of software quality assurance. It is designed as a textbook and is meant for self-study. A single, continuous case example is included which will help explain every shown topic and its practical solution.

We want to appeal to the software testers in software and industry enterprises who strive for a well-founded, basic knowledge of the principles behind software testing. We also address programmers and developers who are already practicing testing tasks or will do so in the future. The book will help project managers and team leaders to improve the effectiveness and efficiency of software tests. Even those in related disciplines close to IT jobs, as well as other employees who are involved in the process of acceptance, introduction, and further development of IT applications, will find this book helpful for their daily tasks.

Evaluation and testing procedures have a high cost in practice (expenditures in this sector are estimated to be 25 % to 50 % of the software development time and cost [Koomen 99]). Yet, there are few universities, colleges, or vocational schools in the sector of computer science that offer courses that intensively teach this topic. This book is of value to both students and teachers, as it provides the material for a basic course.

Lifelong learning is indispensable, especially in the IT industry, therefore many companies offer further education to their employees. The general recognition of a course certificate is, however, only possible if the contents of the course and the examination are defined and followed up by an independent body.

Certification program for software testers

In 1998, the *Information Systems Examinations Board* [URL: ISEB] of the *British Computer Society* [URL: BCS] [URL: ISEB] started such a certification scheme.

International initiative

Similar to the British example, other countries took up these activities and established country specific *Testing Boards* in order to make it possible to run training and examination in the language of the respective country. These national boards cooperate in the *International Software Testing Qualifications Board* [URL: ISTQB].

The current structure of the ISTQB is shown in figure 1-1.