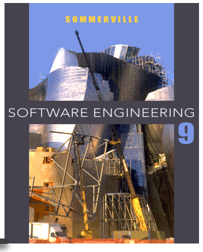
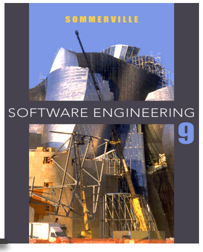


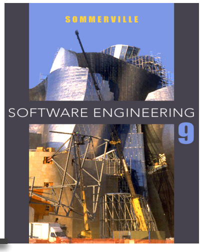
Chapter 1- Introduction

Topics covered



- Professional software development
  - What is meant by software engineering.
- Software engineering ethics
  - A brief introduction to ethical issues that affect software engineering.
- Case studies
  - An introduction to three examples that are used in later chapters in the book.

Importance of software engineering



- We can’t run the modern world without software.

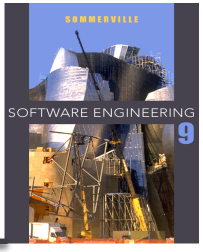
  Examples:1. Industrial manufacturing and distribution is completely computerized.
  2. Financial system : ATM Banking, Online purchase etc.
  3. Entertainment including the music industry, computer games, and film and television, is software intensive.
  Therefore, software engineering is essential for the functioning of national and international societies.

- Software systems are abstract and intangible not constrained by property of materials and not governed by physical laws.

- Quickly become complex and difficult to understand and expensive to change.

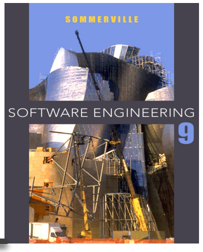
- There are many different types of software systems, from simple embedded systems to complex worldwide information systems. It is pointless to look for universal notations, methods, or techniques for software engineering because different types of software require different approaches.

Software engineering



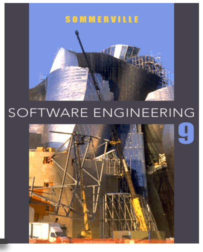
- The economies of ALL developed nations are dependent on software.
- More and more systems are software controlled.
- Software engineering is concerned with theories, methods and tools for professional software development.
- Expenditure on software represents a significant fraction of GDP in all developed countries.

Professional Software Development



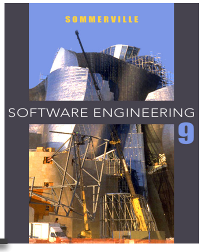
- Lot of People write programs. Example: People in Business write spreadsheet programs to simplify their jobs. Scientist and engineers write program to process their experimental data.
- Vast majority of the software development is an Professional activity where software is developed for specific purpose.
- A professionally developed software system is more than single program. It contains system documentation, user documentation, websites.

Software products



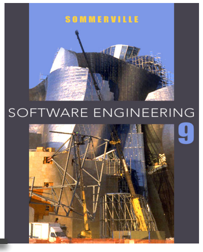
- Generic products
  - Stand-alone systems that are marketed and sold to any customer who wishes to buy them.
  - Examples – PC software such as graphics programs, project management tools; CAD software; software for specific markets such as appointments systems for dentists.
- Customized products
  - Software that is commissioned by a specific customer to meet their own needs.
  - Examples – embedded control systems, air traffic control software, traffic monitoring systems.

Product specification



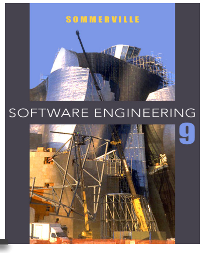
- Generic products
  - The specification of what the software should do is owned by the software developer and decisions on software change are made by the developer.
- Customized products
  - The specification of what the software should do is owned by the customer for the software and they make decisions on software changes that are required.

Frequently asked questions about software engineering



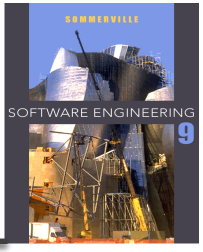
Question	Answer
What is software?	Computer programs and associated documentation. Software products may be developed for a particular customer or may be developed for a general market.
What are the attributes of good software?	Good software should deliver the required functionality and performance to the user and should be maintainable, dependable and usable.
What is software engineering?	Software engineering is an engineering discipline that is concerned with all aspects of software production.
What are the fundamental software engineering activities?	Software specification, software development, software validation and software evolution.
What is the difference between software engineering and computer science?	Computer science focuses on theory and fundamentals; software engineering is concerned with the practicalities of developing and delivering useful software.
What is the difference between software engineering and system engineering?	System engineering is concerned with all aspects of computer-based systems development including hardware, software and process engineering. Software engineering is part of this more general process.

Essential attributes of good software



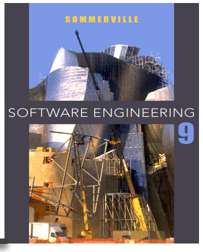
Product characteristic	Description
Maintainability	Software should be written in such a way so that it can evolve to meet the changing needs of customers. This is a critical attribute because software change is an inevitable requirement of a changing business environment.
Dependability and security	Software dependability includes a range of characteristics including reliability, security and safety. Dependable software should not cause physical or economic damage in the event of system failure. Malicious users should not be able to access or damage the system.
Efficiency	Software should not make wasteful use of system resources such as memory and processor cycles. Efficiency therefore includes responsiveness, processing time, memory utilisation, etc.
Acceptability	Software must be acceptable to the type of users for which it is designed. This means that it must be understandable, usable and compatible with other systems that they use.

Software engineering



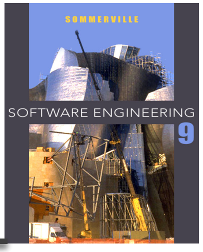
- Software engineering is an engineering discipline that is concerned with all aspects of software production from the early stages of system specification through to maintaining the system after it has gone into use.
- Engineering discipline
  - Using appropriate theories and methods to solve problems bearing in mind organizational and financial constraints.
- All aspects of software production
  - Not just technical process of development. Also project management and the development of tools, methods etc. to support software production.

Software process activities



- Software specification, where customers and engineers define the software that is to be produced and the constraints on its operation.
- Software development, where the software is designed and programmed.
- Software validation, where the software is checked to ensure that it is what the customer requires.
- Software evolution, where the software is modified to reflect changing customer and market requirements.

General issues that affect most software



Heterogeneity

- Increasingly, systems are required to operate as distributed systems across networks that include different types of computer and mobile devices.

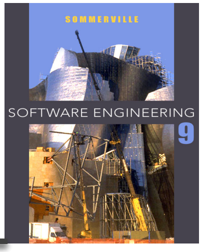
Business and social change

- Business and society are changing incredibly quickly as emerging economies develop and new technologies become available. They need to be able to change their existing software and to rapidly develop new software.

Security and trust

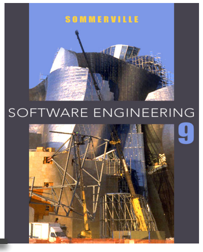
- As software is intertwined with all aspects of our lives, it is essential that we can trust that software.

Key points



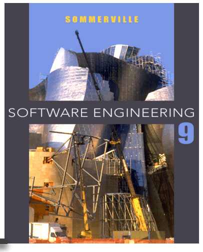
- Software engineering is an engineering discipline that is concerned with all aspects of software production.
- Essential software product attributes are maintainability, dependability and security, efficiency and acceptability.
- The high-level activities of specification, development, validation and evolution are part of all software processes.
- The fundamental notions of software engineering are universally applicable to all types of system development.

Key points



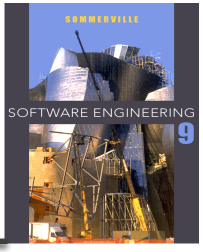
- There are many different types of system and each requires appropriate software engineering tools and techniques for their development.
- The fundamental ideas of software engineering are applicable to all types of software system.

Software engineering ethics



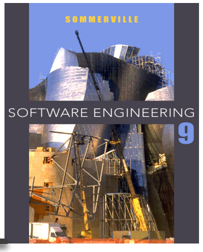
- Software engineering involves wider responsibilities than simply the application of technical skills.
- Software engineers must behave in an honest and ethically responsible way if they are to be respected as professionals.
- Ethical behaviour is more than simply upholding the law but involves following a set of principles that are morally correct.

Issues of professional responsibility



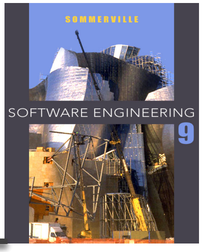
- Confidentiality
  - Engineers should normally respect the confidentiality of their employers or clients irrespective of whether or not a formal confidentiality agreement has been signed.
- Competence
  - Engineers should not misrepresent their level of competence. They should not knowingly accept work which is outwith their competence.

Issues of professional responsibility



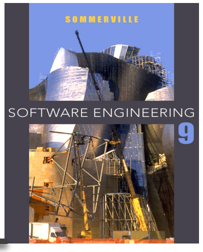
- Intellectual property rights
  - Engineers should be aware of local laws governing the use of intellectual property such as patents, copyright, etc. They should be careful to ensure that the intellectual property of employers and clients is protected.
- Computer misuse
  - Software engineers should not use their technical skills to misuse other people’s computers. Computer misuse ranges from relatively trivial (game playing on an employer’s machine, say) to extremely serious (dissemination of viruses).

ACM/IEEE Code of Ethics



- The professional societies in the US have cooperated to produce a code of ethical practice.
- Members of these organisations sign up to the code of practice when they join.
- The Code contains eight Principles related to the behaviour of and decisions made by professional software engineers, including practitioners, educators, managers, supervisors and policy makers, as well as trainees and students of the profession.

The ACM/IEEE Code of Ethics



Software Engineering Code of Ethics and Professional Practice

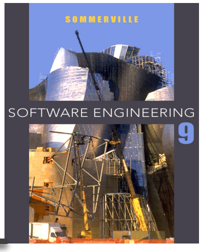
ACM/IEEE-CS Joint Task Force on Software Engineering Ethics and Professional Practices

PREAMBLE

The short version of the code summarizes aspirations at a high level of the abstraction; the clauses that are included in the full version give examples and details of how these aspirations change the way we act as software engineering professionals. Without the aspirations, the details can become legalistic and tedious; without the details, the aspirations can become high sounding but empty; together, the aspirations and the details form a cohesive code.

Software engineers shall commit themselves to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety and welfare of the public, software engineers shall adhere to the following Eight Principles:

Ethical principles



1. PUBLIC - Software engineers shall act consistently with the public interest.

2. CLIENT AND EMPLOYER - Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest.

3. PRODUCT - Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.

4. JUDGMENT - Software engineers shall maintain integrity and independence in their professional judgment.

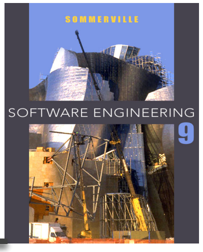
5. MANAGEMENT - Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.

6. PROFESSION - Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.

7. COLLEAGUES - Software engineers shall be fair to and supportive of their colleagues.

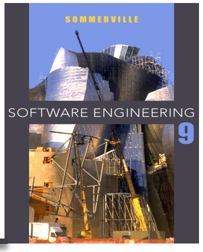
8. SELF - Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

Case studies



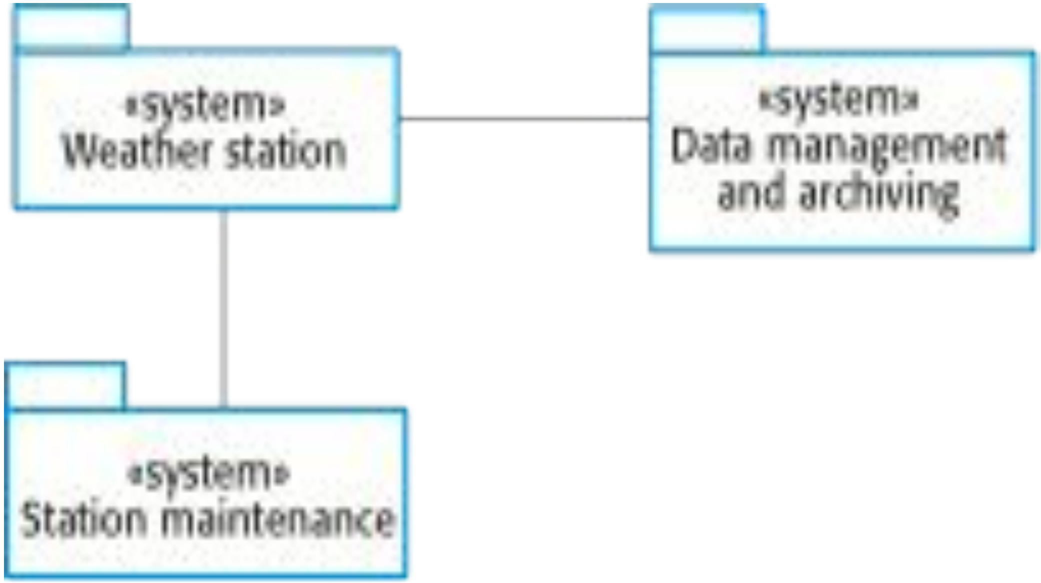
- A personal insulin pump
  - An embedded system in an insulin pump used by diabetics to maintain blood glucose control.
- A mental health case patient management system
  - A system used to maintain records of people receiving care for mental health problems.
- A wilderness weather station
  - A data collection system that collects data about weather conditions in remote areas.

Wilderness weather station

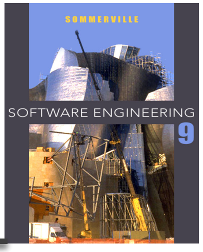


- The government of a country with large areas of wilderness decides to deploy several hundred weather stations in remote areas.
- Weather stations collect data from a set of instruments that measure temperature and pressure, sunshine, rainfall, wind speed and wind direction.
  - The weather station includes a number of instruments that measure weather parameters such as the wind speed and direction, the ground and air temperatures, the barometric pressure and the rainfall over a 24-hour period. Each of these instruments is controlled by a software system that takes parameter readings periodically and manages the data collected from the instruments.

The weather station’s environment

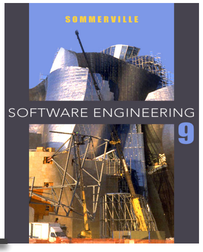


Weather information system



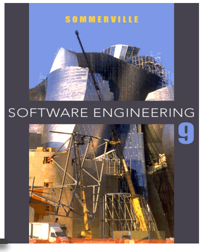
- The weather station system
  - This is responsible for collecting weather data, carrying out some initial data processing and transmitting it to the data management system.
- The data management a system and archiving
  - This system collects the data from all of the wilderness weather stations, carries out data processing and analysis and archives the data.
- The station maintenance system
  - This system can communicate by satellite with all wilderness weather stations to monitor the health of these systems and provide reports of problems.

Key points



- Software engineers have responsibilities to the engineering profession and society. They should not simply be concerned with technical issues.
- Professional societies publish codes of conduct which set out the standards of behaviour expected of their members.
- Three case studies are used in the book:
  - An embedded insulin pump control system
  - A system for mental health care patient management
  - A wilderness weather station

Course structure and organization



- *Add your own material here about how you will be running the course*