

Software Engineering

Introduction

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University of Lodz

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- 5 tasks, 1 question about theory of software engineering, 4 questions that require to write a code to answer
- Lab computers, Internet off, materials can be saved to the laboratory computer in advance
- No new questions
- Lecture notes and links to handbooks are provided

- For most platforms, you can download the required installation files from <https://www.python.org/downloads/> and install them using the appropriate platform-specific method
- You can use cloud resource Colab, which is an online Jupyter Notebook environment from Google: <https://colab.research.google.com/>. It is strongly recommended because the resource simplifies the presentation of your projects in the class
- Jupyter Notebook for your personal computer is recommended within Anaconda (<https://anaconda.org/>)

- Management: team building, the efficiency of the projects
- Software: (presumably efficient) coding
- Algorithms
- Elementary mathematics (mostly, probability and statistics) only to use library functions

- processing of numerical data that includes the computation of relevant statistics (`pandas` , `numpy` , `scikit-learn`)
- parsing of web-pages (`BeautifulSoup`)
- visualization of numerical data (`matplotlib` , `seaborn` , `plotly`)
- backend with a (telegram) bot (`pytelegrambotapi`)
- testing (`unittest` + test as you go)

- Roger S. Pressman Software engineering: a practitioner's approach
- Lecture notes (will be shared through `github`)
- Allen B. Downey, Think Stats Probability and Statistics for Programmers <https://greenteapress.com/thinkstats/>
codes:
<https://greenteapress.com/thinkstats/thinkstats.code.zip>
data: <https://greenteapress.com/thinkstats/nsfg.html>
- Jake VanderPlas, Python data science handbook,
`github` with everything:
<https://github.com/jakevdp/PythonDataScienceHandbook>
handbook only:
<https://jakevdp.github.io/PythonDataScienceHandbook/>

Introducing myself

- Professor Sasha (Alexander) Shapoval
- Researcher with background in mathematics and computer science
- Fields of interests: complex systems, data analysis, prediction of extremes, mathematical economics
- Papers in international refereed journals including *Scientific Reports*, *Physica D*, *Astrophysical Journal Communications* in *Nonlinear Science and Numerical Simulation*, *Journal of Mathematical Economics*
- Research grants
- Cooperation with industry as an expert in projects

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- Use office hours for questions
- Use messengers to cooperate, e. g., telegram
- In exceptional cases, online cooperation with me is possible

Value one's time

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Following the book focused on management

Roger S. Pressman, Software engineering: a practitioner's approach

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Fritz Bauer (1969)

the establishment and use of sound engineering principles in order to obtain economically sound software that is reliable and works efficiently on real machines

- The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software
- The study of approaches as in the previous item

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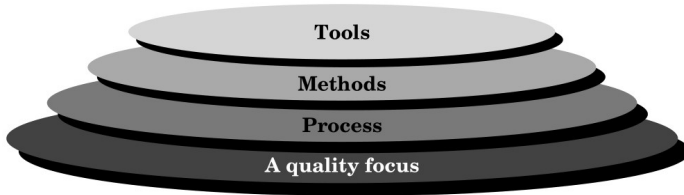
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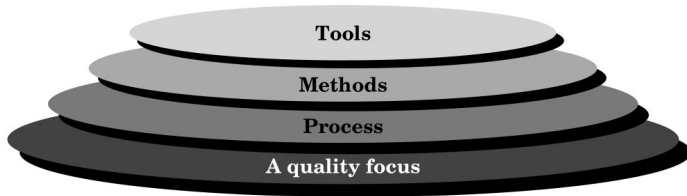
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Components of Software Engineering



Components of Software Engineering



Components of Software Engineering

- What are these components in the creation of USOS-system of the University of Lodz
- of Visual Studio Code?
- in the definition of a class in C++?

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- development phase: how it can be done
- support phase: correction of errors

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- During definition, the software engineer attempts to identify what information is to be processed, what function and performance are desired, what system behavior can be expected, what interfaces are to be established, what design constraints exist, and what validation criteria are required to define a successful system.
- The key requirements of the system and the software are identified. Although the methods applied during the definition phase will vary depending on the software engineering paradigm (or combination of paradigms) that is applied, three major tasks will occur in some form: system or information engineering, software project planning, and requirements analysis.

during development a software engineer attempts to define how data are to be structured, how function is to be implemented within a software architecture, how procedural details are to be implemented, how interfaces are to be characterized, how the design will be translated into a programming language (or nonprocedural language), and how testing will be performed. The methods applied during the development phase will vary, but three specific technical tasks should always occur: software design, code generation, and software testing.

The support phase

focuses on change associated with error correction, adaptations required as the software's environment evolves, and changes due to enhancements brought about by changing customer requirements. The support phase reapplies the steps of the definition and development phases but does so in the context of existing software

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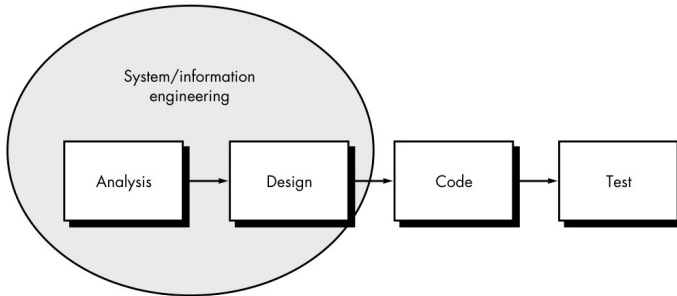
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What do you expect from the developers of Windows?
To what extent your expectations are met?

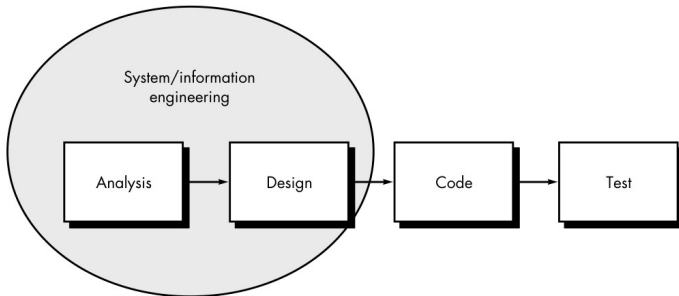
Classic lifecycle or waterfall model

Scheme



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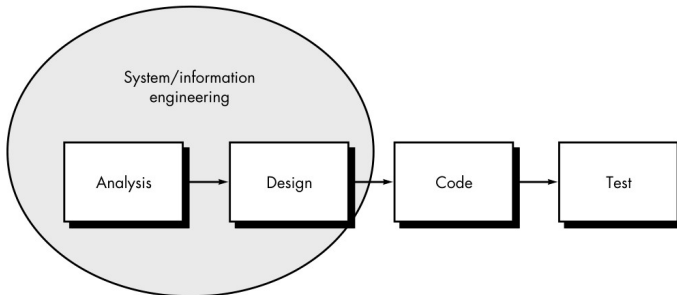
Scheme



Is this scheme applicable to Windows?

Classic lifecycle or waterfall model

Scheme



Is this scheme applicable to Windows?

Rather not as the processes go in parallel and are repeated many times

Is this scheme applicable to simple drawing project?

Rather, yes because of its simplicity

The requirements gathering process is intensified and focused specifically on software. To understand the nature of the program(s) to be built, the software engineer must understand the information domain for the software, as well as required function, behavior, performance, and interface. Requirements for both the system and the software are documented and reviewed with the customer.

Software design is actually a multi-step process that focuses on four distinct attributes of a program: data structure, software architecture, interface representations, and procedural (algorithmic) detail. The design process translates requirements into a representation of the software that can be assessed for quality before coding begins. Like requirements, the design is documented and becomes part of the software configuration

The design must be translated into a machine-readable form. The code generation step performs this task. If design is performed in a detailed manner, code generation can be accomplished mechanistically.

Once code has been generated, program testing begins. The testing process focuses on the logical internals of the software, ensuring that all statements have been tested, and on the functional externals; that is, conducting tests to uncover errors and ensure that defined input will produce actual results that agree with required results.

Software will undoubtedly undergo change after it is delivered to the customer (a possible exception is embedded software). Change will occur because

- errors have been encountered,
- the software must be adapted to accommodate changes in its external environment (e.g., a change required because of a new operating system or peripheral device)
- the customer requires functional or performance enhancements

Software support/maintenance reapplies each of the preceding phases to an existing program rather than a new one.

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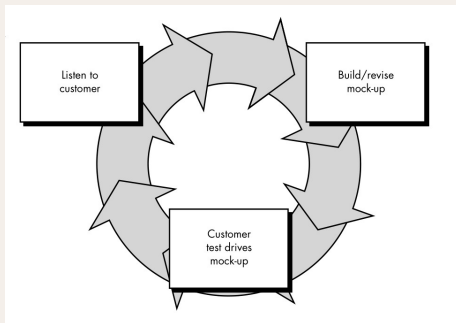
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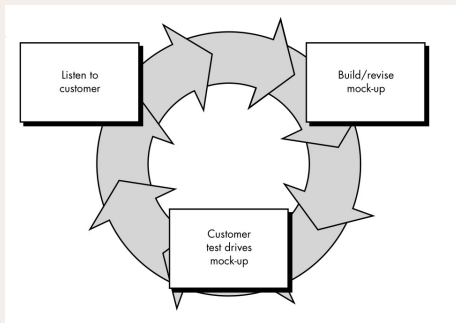
Hint: use AI to solve small issues

Prototyping model: Scheme



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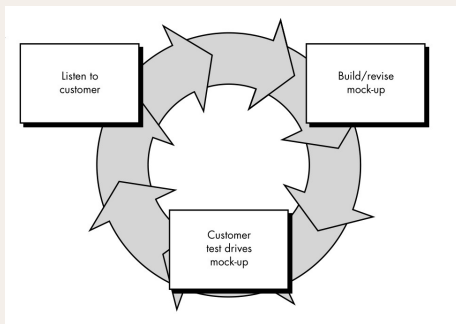
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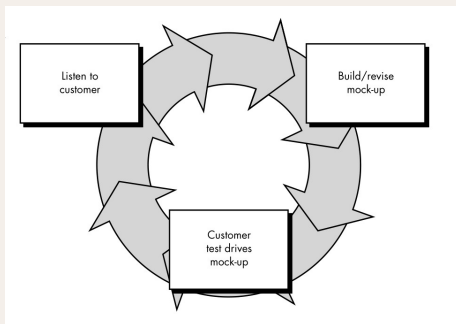


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Is this scheme applicable to such open source projects as C or Python language themselves and their environments?

Likely, yes, but who receives profits from the project and how?

- requirements gathering: obtained from customers
- Then the prototype is evaluated by the customer/user and used to refine requirements for the software to be developed.

- Rapid application development
- Evolutionary software process models
 - spiral model
 - Concurrent Development Model
- Formal methods model
- Fourth generation techniques

Fourth generation techniques

The term fourth generation techniques (4GT) encompasses a broad array of software tools that have one thing in common: each enables the software engineer to specify some characteristic of software at a high level. The tool then automatically generates source code based on the developer's specification. There is little debate that the higher the level at which software can be specified to a machine, the faster a program can be built. The 4GT paradigm for software engineering focuses on the ability to specify software using specialized language forms or a graphic notation that describes the problem to be solved in terms that the customer can understand.

Fourth generation techniques

Currently, a software development environment that supports the 4GT paradigm includes some or all of the following tools:

- nonprocedural languages for database query
- report generation, data manipulation, screen interaction and definition, code generation
- high-level graphics capability;
- spreadsheet capability, and automated generation of HTML and similar languages used for Web-site creation using advanced software tools.

Initially, many of the tools noted previously were available only for very specific application domains, but today 4GT environments have been extended to address most software application categories.

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- What are the requirements to the exam?
- What is the attitude to cheating?
- What are the components of software engineering. Explain with examples

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