INF5180: Software Product- and Process Improvement in Systems Development

Part 00:

Course Information and Introduction

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PPP in Software Development

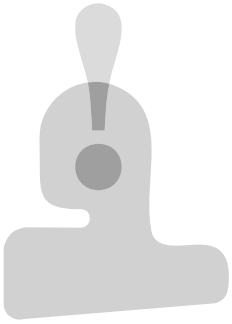
- What are the crucial ***Three Ps*** in a Software Project?

– P…?

– P…?

– P…?

PPP in Software Development

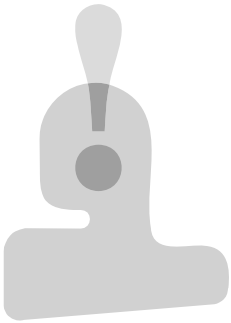


- What are the crucial ***Three Ps*** in a Software Project?
  - Products (→ What?)
  - People (→ Who?)
  - Processes (→ How?)

Software Products

- What are Typical Products in a Software Project?

Software Products



- What are Typical Products in a Software Project?
  - End Products
    - Software Code (source code and object code)
    - Installation and User manual
    - Release/Service Documentation
    - …
  - Work Products
    - Requirements Specifications / Analysis Documents
    - Design Documents
    - Test and Review Documents
    - Project Plans and Reports
    - …

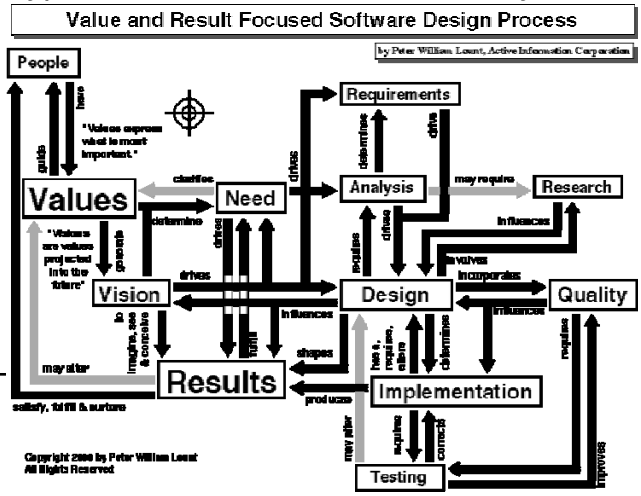
Software Processes

- What are Typical Processes in a Software Project?

Software Processes

- What are Typical Processes in a Software Project?

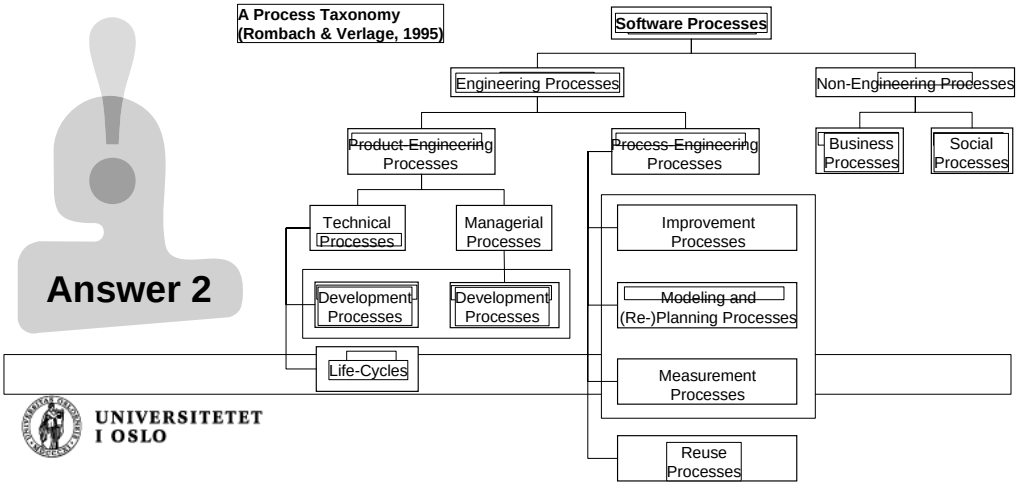
Answer 1



Software Processes

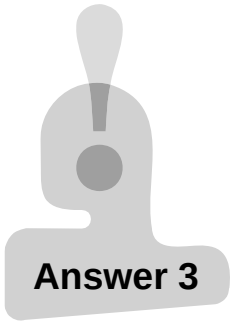
- What are Typical Processes in a Software Project?

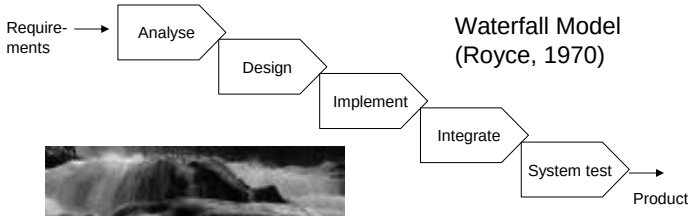
Answer 2



Software Processes

- What are Typical Processes in a Software Project?

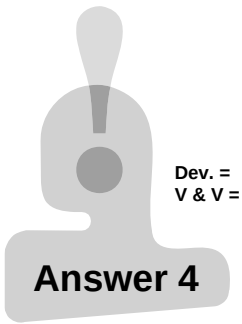




Waterfall Model
(Royce, 1970)

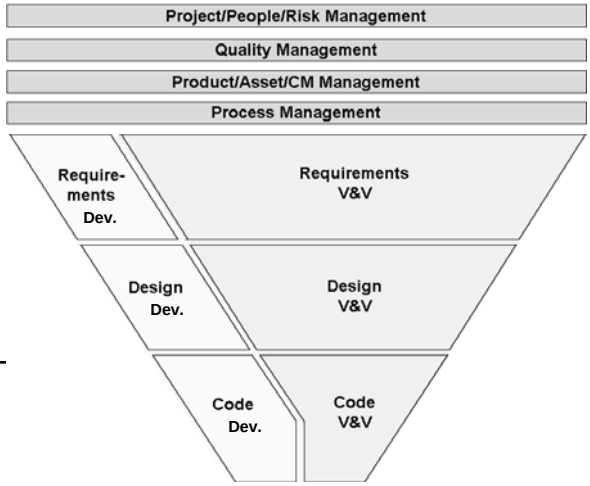
Software Processes

- What are Typical Processes in a Software Project?



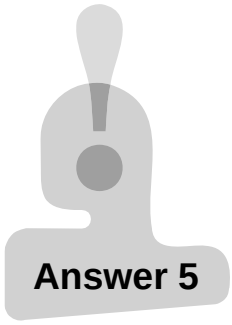
V-Model

Dev. = Development
V & V = Verification & Validation

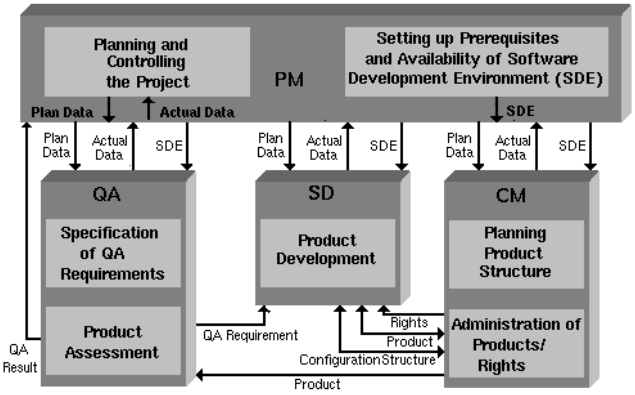


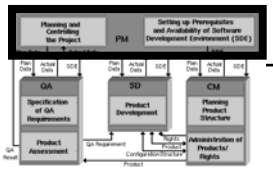
Software Processes

- What are Typical Processes in a Software Project?



German Government V-Model XT for the Planning and Management of IT Development Projects (2006)

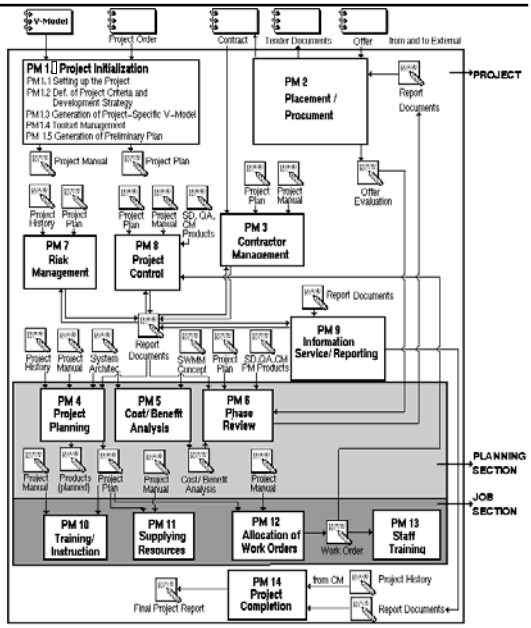




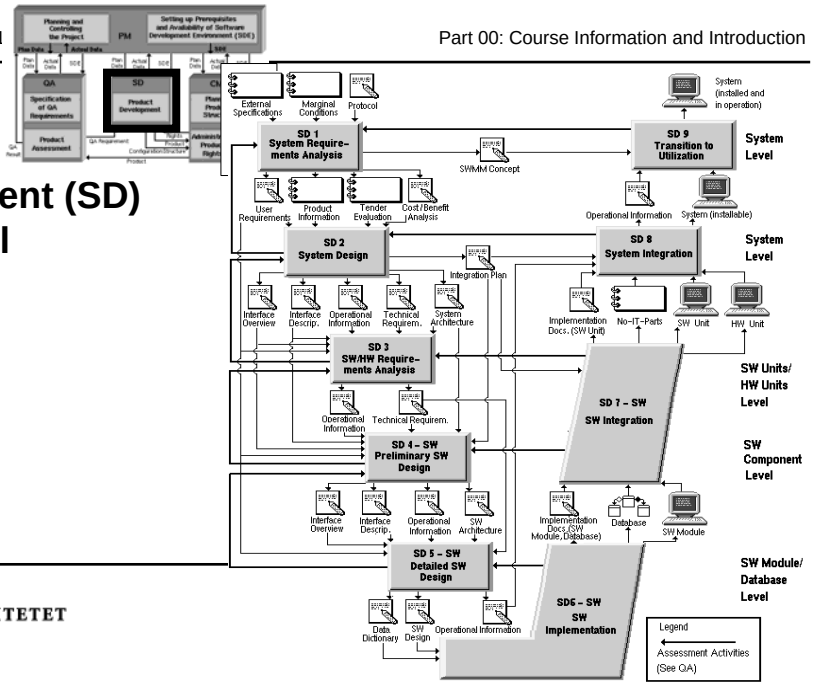
V-Model: Project Management (PM) Sub-Model

Activity Types:

- Management-related
  - Initialization/Finalization
  - Periodically Required
- Placement/Procurement-related
- Planning-related
- Resource-related



V-Model: System Development (SD) Sub-Model



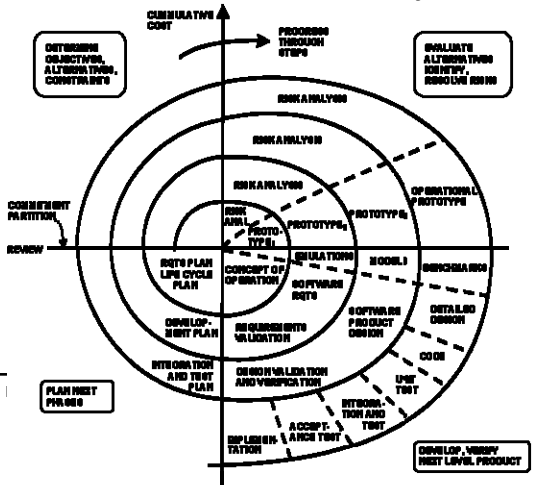
Software Processes

- What are Typical Processes in a Software Project?

(Spiral Model by B. Boehm, 1988)

Focus on risks

Answer 6



Software Processes

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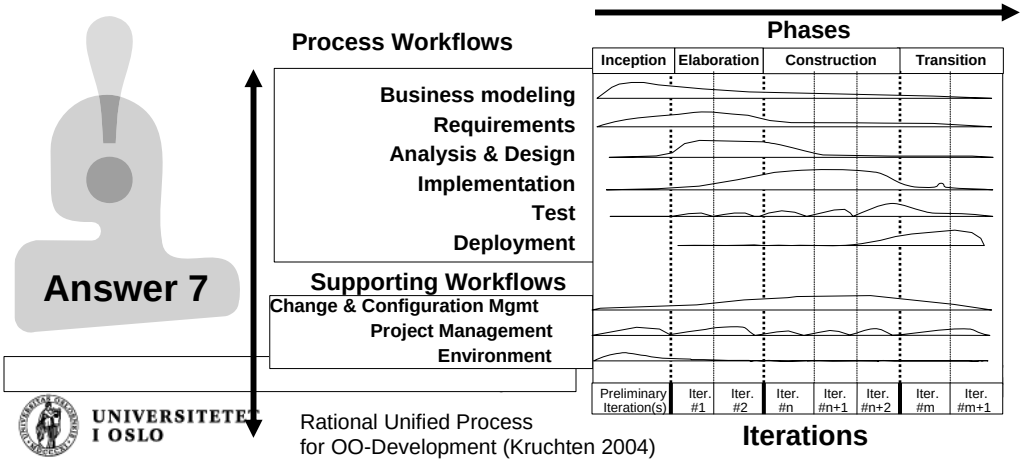

Answer 7

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Rational Unified Process
for OO-Development (Kruchten 2004)

Software Processes

- What are Typical Process

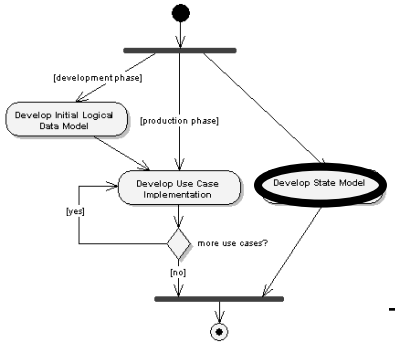
Model-Driven

System analysis produces a 3-dimensional logical technology free model of everything that the system will do. This model serves as a starting point for the System Architecture Stage and the Detailed Design Stage. System analysis revolves around developing use case implementations for each use case in the increment. This involves producing a high level sequence diagram for each flow in each use case and linking them together to follow the flow of the use case.

If this is the first or only increment then an initial logical data model should be produced first using class diagrams. The logical data model is then updated as part of each use case implementation.

The state model consists of one statechart for each object with state dependent behaviour and can be developed and updated at any part of the stage.

It is preferable that this model should be produced by those with a sound knowledge of the problem domain under the guidance of system developers rather than just by system developers themselves. It is a role that would suit analyst/programmers.

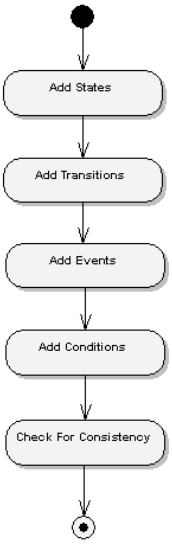


A state model is made up of statecharts: one for each class that has state dependent behaviour. Most will be children of classes in the logical data model and will model the life history of the entity.

In order to prevent developing an activity diagram, which is the logical inverse of a statechart, the statechart should be developed in the order: states, transitions, events and conditions. Actions are not necessary for the analysis as these appear in the relevant sequence diagrams. Activities should be avoided.

Statecharts provide a place to put certain kinds of business rule and a check of the completeness of the functional requirements in the use case model.

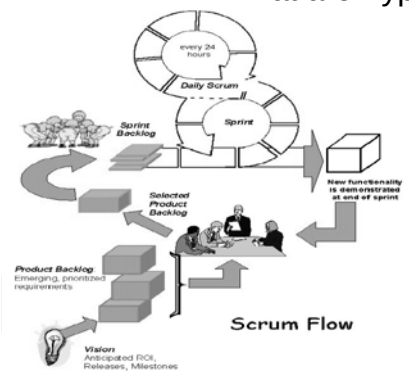
Statecharts can also be created during business modelling as children of business data entities.

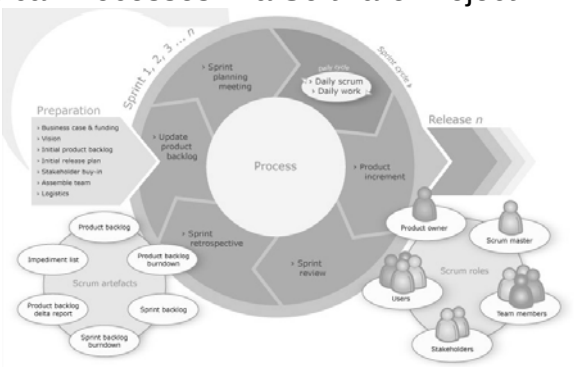


http://www.cragsystems.co.uk/development_process/

Software Processes

- What are Typical Processes in a Software Project?





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http://www.scrumforteamsystem.com/processguidance/v1/Scrum/Scrum.html

... So what about People?

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Product vs. Process vs. People Improvement

- Product Improvement
  - We are talking here about one or more attributes of the products that will be improved. Such attributes typically include
    - Quality-related attributes
    - Examples: Functionality, Reliability, Maintainability … (→ ISO 9126)
  - But it may also reflect such things as
    - Shorter time-to-market
    - Lower development cost
- Process Improvement
  - Development Process = mechanism that yields the end product
    - Engineering processes
    - Management processes
  - The development process is crucial for the product:
    - If the products are to be improved, improving the process is a pre-requisite.
- People Improvement
  - Experience & Training

Overview of Lectures (Dates are fixed / Contents are tentative)

1. **Introduction into Process Improvement**
2. **Processes and Process Modeling**
3. **Research Methods**
4. **Problem Solving and Improvement – by Individuals**
5. **Problem Solving and Improvement – by Groups**
6. ***Student Presentations***
7. **Measurement-based Improvement**
8. **Goal-oriented Measurement**
9. **Learning from Expierence**
10. **Process Assessment**
11. **Process Assessment (cont'd)**
12. **Process Improvement Frameworks**

One lecture will be devoted to review and – if possible – a presentation from industry.

NB: In most lectures up to 45 minutes will be devoted to guidance and discussion with regard to your project paper

Topics

Introduction into Process Improvement
- Important concepts: process, product, structure and quality.
- The SPO-model will be introduced as analysis instrument.
- Process improvement history (i.e., “Scientific management” and Deming’s work).

Processes and Process Modeling
- Types of processes
- Descriptive and prescriptive process modeling
- Criteria that help select an appropriate process

Research Methods
- Classification and description of frequently used research methods within studies of system development along the axes of “generality”, “objectivity” and “philosophical viewpoint”.
- Evaluation of suitability in relation to the goal. Description of different effects which can influence the results, e.g., “theory-loaded observation”.
- Use of statistics in process improvement work. Argumentation.

Topics (cont’d)

Problem Solving and Improvement – by Individuals
- System development can be regarded as problem solving. Models for problem solving and how the problem solving process is supported by models, methods, processes.
- Learning. Culture and value in a system development organization in relation to process improvement.

Problem Solving and Improvement – by Groups
- Teamwork. Relationship between trust and collaboration.
- Productivity in groups. Groups as decision makers.

Measurement-based Improvement
- Why Measurement?
- Measurement-based improvement: definitions, basics and pre-requisites

Goal-Oriented Measurement
- Why having a clear goal?
- The Goal/Question/Metric (GQM) model.

Topics (cont'd)

Learning from Experience

- The role of experience in continuous improvement work.
- Experience Factory (EF), Quality Improvement Paradigm (QIP).

Process Assessment

- The Capability Maturity Model Integration (SEI-CMMI).

Process Improvement Frameworks

- ISO-standards, CMM-families, TQM, EFQM, etc.

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Course Objectives

This course will enable you to contribute to a (your?) company's improvement efforts by:

- Giving insight into challenges that software development organizations are facing
- Conveying basic knowledge contributing to efficient, effective and sustained improvement in software development
- Focusing on both *methods for systematic process improvement* and *specific research & analysis techniques* which help achieve improvement
- Using exercises to practice/apply various process improvement methods and techniques
- Having stimulating and informative discussions on improvement work and related subjects

Answer-based learning — INF5180 — Problem/Question-based learning

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Literature (Syllabus)

- *PROFES - User Manual*, 1999. Profes Consortium.
  - NB: An electronic copy of this book will be made available to course participants.
- Dybå, Dingsøyr, Moe: *Praktisk Prosessforbedring*, 2002. Fagbokforlaget. ISBN: ISBN 8276749143.
- Additionally, the lecture slides are part of the syllabus.
- **NB**: In order to achieve a good project paper & oral exam, self-learning is essential!

Other Useful Literature (Syllabus Support)

- Luke Hohmann: *Journey of the Software Professional*, 1997. Prentice Hall. ISBN: ISBN 0-13-236613-4.
- Chrissis, Konrad, Shrum : *CMMI - Guidelines for Process Integration and Product Improvement.* 2003. ISBN: 0-321-15496-7.
- F. Shull, J. Singer and D. I. K. Sjøberg: Advanced Topics in Empirical Software Engineering, Springer-Verlag London (ISBN: 13:978-1-84800-043-8), 2008.
- D. R. Forsyth: Group Dynamics (4th ed.). Pacific Grove, CA: Brooks/Cole, 2006.
- B. Boehm and R. Turner: Balancing Agility and Discipline: A Guide for the Perplexed. Addison-Wesley Longman Publishing Co., Inc, 2003.
- K. Schwaber: Agile Project Management with Scrum. Microsoft Press, 2004.
- A. Cockburn: Agile Software Development. Boston: Addison-Wesley, 2001. (2nd edition appeared in 2006)
- A. Endres and D. Rombach: A Handbook of Software and Systems Engineering – *Empirical Observations, Laws and Theories*, Addison-Wesley, 2003.
- P. M. Senge: The Fifth Discipline. The Art and Practice of the Learning Organization. Currency Doubleday, New York, 1990.

Evaluation, Marking, and Grades

Two parts:

1) Assignment: Project Report (~20 pages) – 80% of the grade [16 marks]
   - Criteria:
     - Readability and clarity [2 marks]
     - Language and formality (title, captions, referencing, etc.) [2 marks]
     - Structure and flow of argument [4 marks]
     - Contents: completeness, consistency, realisms (→ could it be implemented?) [8 marks]
   - Note: There will be a mandatory short presentation and draft outline/draft required (3-5 pages); failing to do the oral presentation or to submit the outline/draft in time will automatically generate a penalty of 2 marks! Not submitting the outline at all will generate a penalty of 4 marks!
2) Oral exam (approximately 15 minutes): will be based on your answers to questions about the course and about your project (report) – 20% of the grade [4 marks]
   - Clarity and conciseness [1 mark]
   - Relevance (→ is the answer to the point?) [1 mark]
   - Correctness and completeness [2 marks]

Project Assignment (1)

Task:

- Prepare a (realistic) software process improvement plan for a software/systems development organization

Project Assignment (2)

General information:

- No group submissions, but informal collaboration between students is ok.
- Some lecture time will be devoted to reflection about the project paper.
- The system/software development organization and its requirements may be real or fictitious. In any case, suggested improvement actions must clearly be related to the business problems and goals.
  - It is recommended to contact a software development organization in order to find a real-world problem/challenge/issue. *Note: It is not necessary to mention the organization's name.*
- If you happen to find (or even be involved in) a real-world improvement project, you should not make yourself completely dependent on the reality, because a real-world project might have a longer time-frame than our course.
- In order to be able to develop your improvement plan, you might need to study some materials before they are presented in a lecture. Therefore, in order to find good solutions (improvement actions) it is recommended to study available material ahead of teaching.

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Project Assignment (3)

Mandatory! (-1 marks each if not delivered in time)

Deliverables:

- Feb 11: Brief presentation of organization and its probem(s)/need(s)
- April 15: First draft report (3-5 pages)
  - Brief characterisation of the organization
  - Brief description of the organisation'a problem(s) and/or goals of the improvement project
  - Initial structure of the improvement plan (What? – When? – Who?)

  NB: Lecturer will comment within a week.
- May 13: Final submission (maximum 20 pages) containing:
  - Part 1: Description of the problem and goals of the improvement project (max 3-5 pages).
  - Part 2: Improvement plan (5-7 pages): detailed description of measures that will be taken (What and How? – When? – Who?)
  - Part 3: Underlying rationale of the key elements of the improvement plan (7-10 pages).

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Project Assignment (4)

Evaluation criteria:

- Consistency between stated problem and improvement plan.
- Thoroughness of argumentation in the reasoning about the improvement plan.
- How realistic/executable is the improvement plan?
- Use of syllabus material and other references.
- Structure and readability. Conciseness!
- Formality (language, grammar, correct referencing, etc.)
  - Formatting rules: font: 11pt Arial (tables might use smaller font, but not less than 8 pt); line spacing: single spaced; top/bottom/left/right margins approx. 2 cm; provide page numbers
  - Provide table and figure captions; proper referencing

Project Assignment (5)

Examples of problems and goals:

- *Customers find too many defects* – Improve software quality.
- *Inaccurate planning / estimates* – Improve planning methods/models.
- *New technologies or standards make their way into the market (e.g., Java, .net, SOA, model-driven development/testing)* – Mitigate risks associated with introducing the new technology.
- *Software is hard to maintain / difficult to evolve* – Improve software architecture.
- *Increasing competition* – Speed-up development, issue releases more frequently.
- *Customer are dissatisfied with deliveries* – Stronger customer participation and more flexible process.
- *"Old-fashioned", heavy development process* – Modernize development processes, methods, and tools.
- *Little diffusion of competence, low motivation* – Improve training and enhance involvement of people.

FIND A REALISTIC APPROACH TO SOLVING A REALISTIC PROBLEM.

MAKE USE Of YOUR IMAGINATION (but choose "probable" problems/goals/solutions).