



**Mid-Semester Examination (R) – Software Engineering and Management
(SS G562)**

First Semester: 2023-24

Dr. Tanmaya Mahapatra

Department of Computer Science and Information Systems

Name and ID: _____

Important Information:

- Write your name and ID on the question paper.
- Please check the completeness of the exam booklet (**4 double-sided pages**)
- Use only **blue** or **black** pen to answer the questions; Pencils, green and red pens are not allowed!
- You are only allowed to answer the questions using the provided exam sheets.
- Working time is **90 minutes** for **4 questions** of **35 points!**
- On any attempt to **cheat**: the exam will be assessed with a **0** and you would be barred from the makeup exam too!
- Permitted writing aids: calculator & printed handout — **partially open book exam!**

1. **Software Development Methodologies**

Question 1: 7½ pts

In this task, you have to discuss the strengths and weaknesses of *model-driven development*, *software product lines*, & *agile development* based on a couple of stereotypical case studies. For each of the following case studies, you should thus decide which development methodology you would adopt and justify your choice. In case you propose to adopt a model-driven development approach, you should furthermore discuss the concrete type of model that you would use here and reason about the relationship between model and deployed system. In case you propose to implement a software product line, you should discuss what would be the stable platform, what would be the variability points, and at which point would you expect the break-even point.

- (a) Imagine you recently joined Pied Piper, a young start-up specialising in developing highly sophisticated data compression algorithms and approaches. Having already successfully deployed its patented compression algorithm for desktop and server environments, Pied Piper wants to take the next step and conquer the mobile system market. To this end, the CEO, Richard Hendricks, asked you to develop a new concept to align the desktop- and mobile application development efforts. In particular, Richards is fond of reusing as much of the code and development artefacts as possible to ensure an early market penetration. However, during a brief chat with the lead architect of the desktop development team during lunch, you got to know that most of the desktop platform codebase was written in the obscure Erlang programming language – being not aware of any mobile implementation of the Erlang runtime environment you are now a bit concerned that the amount of achievable reuse probably would not be too high.

[2½]

- (b) You work for the Populus Vehiculum (PV) Corporation, one of the world's biggest automobile manufacturers. Your division is in charge of the control code of their diesel engines. This code determines how much fuel is injected and at what temperatures it is burned. A super-national body has agreed to impose stricter emission standards, and your team is tasked with writing the control code for the next generations of engines. Independent auditors will review the code, which must be certified according to the new regulations. To cut costs, there will only be three different types of engines. As this is an entirely new setup of engines, they will be in use for quite some time. So ease of maintenance and understandability is imperative. [2½]
- (c) *Mockia*, a rising star in the highly competitive smartphone market, recently introduced their new flagship smartphone, the *MeiOlaiiddl*. The *MeiOlaiiddl* is the first smartphone that allows almost full customization of the hardware configuration – the user can order a highly customized smartphone online by simply filling in a questionnaire about his usage profile. *Mockai* then promises to configure and ship a customized smartphone that perfectly fits the customer's needs within three working days. Although the new concepts already found wide reception and pre-orders by far exceed the immediate production capabilities, the CTO of Mockia during the last internal developer conference raised concerns about the flexibility of their current development approach. The entire software stack of Mockia's current smartphone portfolio is custom-built; reuse is done opportunistically. Looking at the enormous mass of configuration possibilities, the currently practised development approach can no longer keep up with the high number of pre-orders. The user can choose between 3 different camera modules, 4 CPU models, six persistent memory modules, and 2 GPS chips. A closer look at the pre-order data revealed that more than 92% of the customers pre-ordered a configuration that included the cheapest CPU and the second-smallest memory module. The remaining parts were arbitrarily combined with no apparent pattern in customer preferences. Hopelessly lost in technical details, the CTO of Mockia hired you, an experienced software development consultant, to propose a new development concept to better cope with the high number of configurations and make the software development more efficient. You know from old smartphone development projects that developing a new controller software for a CPU takes about 6 PM, for a memory module 2 PM, for a camera module 4 PM, and a GPS chip 2 PM. From your experience, you know that writing a solid platform that apriori is designed for reuse typically yields three times the usual development effort of the respective components. [2½]

2. Software Process Models

Question 2: 12½ pts

- (a) Classical Waterfall model are generally considered impractical and cannot be used in real- world projects. Why? Justify using an example. [1]
- (b) Does the deep class hierarchy a characteristic of any good Object-Oriented Design? Justify your answer. [1]
- (c) You are asked to develop an accounting system for BITS Pilani that replaces the existing system. Suggest the most appropriate software process model that might be used as a basis for managing the system development. Give proper justification. Zero marks will be awarded with no justification of the answer. [1]
- (d) Does the concept of pair programming suppress the principle of refactoring? Give justification. [1]
- (e) Can you achieve an effective modular design through functional independence of the modules? [1]

- (f) Compare the spiral model and prototyping model with respect to their risk handling capability. [2]
- (g) Explain the major differences and similarities between the rapid application development model and evolutionary model of software development. [2]
- (h) The three common ways by which a software development organization can be structured are functional format, project format, and matrix format. Identify and explain the advantages and disadvantages of each format. [2]
- (i) Identify and explain two factors contributing to the present software crisis. Can we mitigate the impacts of the software crisis? Answer either Yes or No. Also, justify reasoning behind your choice. [1½]

3. Software Project Management Techniques

Question 3: 10 pts

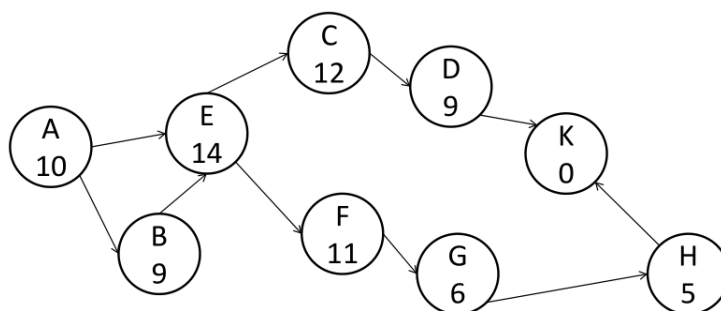


Figure 1: Figure for Question 3b

- (a) Suppose an organization plans to use COCOMO for effort estimation, but it wants to use only three cost drivers—product complexity, programmer capability, and development schedule. In this situation, from the initial estimate, by how much can the final estimate vary? [2½]
- (b) Consider the activity network (Figure 1). Compute earliest start time, latest start time, earliest finish time, latest finish time, slack time. Using these parameters, identify the critical path. [2½]
- (c) As a project manager, you are asked to build a software ‘S’ involving implementation of a well-understood application of small size. Following information is available to you regarding the various attributes of the software: [5]
- No. of user inputs: 5, No. of inputs with Simple category: 3 and Average category: 2
 - No. of user outputs: 2, No. of outputs with Simple category: 2
 - No. of user inquiries: 0
 - No. of files: 1, Simple category
 - No. of external interfaces: 1, Average category
1. Given that out of fourteen effort influencing factors, five factors have the value of 3, 4, 2, 4 and 4 respectively and remaining factors have no influence; Calculate the value of function point metric (FP) for ‘S’.
 2. Consider that the software need to be implemented in C++ language and lines of code in C++ is 127 LOC/FP. Then, estimate the time (T) and effort (E) involved in development using basic COCOMO model.
 3. Consider a scenario where the delivery-date of the software needs to be preponed. Due to this requirement, if the software has to be developed in $0.90 \cdot T$ unit of time, then what will be the value of needed efforts?

4. Earned Value Analysis**Question 4: 5 pts**

- (a) You are the project manager of a project to build fancy animal-houses. You are to build two animal-houses a month for 12 months. Each birdhouse is planned to cost \$100. Your project is scheduled to last for 12 months. It is the beginning of month 10. You have built 24 animal-houses and your CPI is .9091. [5]
1. How is the project performing? [0.5 point]
 2. What is the actual cost of the project right now? [0.5 point]
 3. Assuming that the COST variance experienced so far in the project will continue, how much more money will it take to complete the project? [0.5 point]
 4. If the variance experienced so far were to stop, what is the project's estimate at completion? [0.5 point]
 5. What is the project's TCPI using the project's budget at completion? [0.5 point]
 6. Senior management wants to know the percentage of the project that is complete. What should you report? [0.5 point]
 7. Imagine if instead of 10 months and costing \$2200, the project was in month three and costing \$4000. What formula might you use for BAC? [2 points]

(Don't let fear get the better of you. All the best!)