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Sample Exam Questions

Faculty of Information Technology

EXAM CODES:

FIT5136

TITLE OF PAPER:

Software Engineering - PAPER 1

Sample Exam Questions

Question 1

After graduation, three IT students decided to start a software company called SmartComputing. You had just been hired as a software engineer by the founders.

On your first day in the new job you asked the Chief Technology Officer (CTO) about SmartComputing's software engineering process. She replied:

We follow the Unified Process to make sure we develop the right product in the right way. The process consists of five distinct workflows. We complete all the tasks and confirm all the documentations in each workflow before we move on to the next workflow.

The first workflow is the Requirements Workflow, where we brainstorm ideas about features that our customers will love to have.

The next workflow is the Analysis Workflow. This involves analysing the problem domain more deeply and describing the requirements in the kind of exacting detail that developers need. Typically, in this workflow we will produce conceptual class diagrams, detailed use case scenarios, interaction diagrams and statecharts.

Once the Analysis Workflow is completed, we begin the Design Workflow, where we refine the conceptual class diagram into something more concrete, producing a detailed class diagram.

The next workflow of the process is the Implementation Workflow. In this workflow, we write the code to implement the detailed class diagram produced in the previous workflow.

Finally, we will have the Test Workflow, where we test our program to ensure that the system works correctly.

Based on what you have learned in FIT5136, **analyse and critique** the company's software engineering process described above by the CTO.

Question 2

You then asked the CTO about the latest project the company is undertaking. She mentioned that the project is to develop an on-line learning platform called Poodle 2 system for the university.

The first task you, as the software engineer, are assigned for Poodle 2 is the analysis of the functionality of adding students to the system:

An administrator is able to add a student enrolled in a unit. An administrator can also list the students added in the last 24 hours and also delete a student if it was added by mistake.

- (a) Draw a **UML use case diagram** for this functionality.
- (b) On the next page is a detailed description of the normal scenario for the “Add Student” use case, with no exception conditions. Write *three* exception conditions, including reasonable actions to be taken.

Sample Exam Questions

Question 2 (cont.)

Use Case Name	Add Student	
Scenario	Add a student identified by id	
Trigger	An administrator selects the Add Student functionality	
Brief description	An administrator user wishes to add a student to a unit. The student is identified by his/her id and the unit is identified by its unit code.	
Actors	Administrator	
Related use cases	List added students, remove the incorrectly added student	
Preconditions	The user performing the action must be an administrator, and the user object to be added must be a student enrolled in the unit.	
Postconditions	The student is added to the unit	
Flow of events	Actor	System
	<ol style="list-style-type: none">1. Administrator selects "Add Student" option to initiate the add action.2. Administrator enters his/her id and password.3. Administrator searches for the student to be added by entering the student id4. Administrator searches for the unit by entering the unit code5. Administrator adds the student object to the unit returned by the system.6. Administrator confirms the add action.	<ol style="list-style-type: none">1.1 System asks the user to re-enter his/her id and password to confirm the administrator identity.2.1 System confirms that the user is an administrator2.2 System displays the "Add Student" page.3.1 System returns the student object that matches the student id.4.1 System returns the unit that matches the unit code.5.1 System asks the administrator to confirm the add action.6.1 System performs the add action, and returns a confirmation message to the administrator.
Exception conditions		

Question 3

The CTO provides more description about the Poodle 2 project below:

The university that we graduated from has a very bad on-line learning platform called Poodle. We were asked to improve and extend the current system. I think we were successful in getting the project because three of us were former students and we had used their system before. Based on my experience, I can confirm that the system is really bad and definitely needs improvements. We call this project Poodle 2.

Every user of Poodle 2 is identified by an id and a name. To use the system, every user will need a password to log in. In Poodle 2, administrators can create units. Each unit is identified by a unit code and a unit name. Teaching staff can create contents in units they teach and each teaching staff can teach up to four units. Students have access to the contents as long as they are enrolled in the unit. Every student can enrol in up to four units. An administrator can add a student to the unit if the student is officially enrolled in the unit. An administrator can also delete a student from the unit if the student is no longer enrolled.

Students are allowed to comment on units and contents in Poodle 2. Comments on a unit and comments on its contents can only be created and viewed by students currently enrolled in the unit and staff teaching the unit. Users given authorisation can post replies to a comment. A lecturer of a unit or an administrator can remove a comment if the comment is deemed inappropriate, irrelevant or not useful in general.

Based on the CTO's description of the Poodle 2 project and the use case scenario in Question 2, you are tasked to produce an initial class diagram for the project.

(a) Perform noun extractions and build a dictionary of abstractions for the system. Use it to decide on your candidate classes by assessing each abstraction and considering whether it:

- lies outside the problem boundary and may therefore be ignored,
- is a candidate entity class, or
- is likely to be a simple attribute of a class.

(b) Develop an **initial UML class diagram** for the system, with the relevant classes and attributes resulting from your dictionary of abstractions. Concentrate on modelling the problem domain rather than any boundary or control classes. Make sure you:

- include appropriate attributes for the classes
- describe the relationship between classes using generalization, association, aggregation and composition (as appropriate)
- indicate the multiplicity (cardinality) of the relationships properly.
- DO NOT include responsibilities or operations. You do not have all the information at this point to do so.

Question 4

Based on the initial class diagram you have produced for Question 3 and the use case scenario in Question 2, produce a **sequence diagram** to show the messages exchanged between objects needed to carry out the Add Student use case scenario.

Question 5

After some discussions inside the company, it was decided that the commenting feature should be enhanced to make it more useful. An informal description of the new feature was documented below.

“A user can *create* comments about any content in Poodle 2. The comment is publicly visible by default. However, the author of the comment can subsequently make the comment visible only to a group of users.

A comment can be *reported* by a user if she deems it to be inappropriate, irrelevant or not useful. Once reported, a comment can be *deleted* by a member of the teaching staff or a system administrator. An accidentally deleted comment can be subsequently restored by a member of the teaching staff or an administrator.

A comment can also be *promoted* by a member of the teaching staff if it is deemed to be highly informative, relevant or useful. A promoted comment cannot be reported, nor can it be deleted.

However, if the content itself is deleted, all comments associated with this content will be permanently deleted.”

Develop a **UML statechart diagram** as a precise representation of the above informal specification of the enhanced commenting feature. When there is ambiguity in the informal specification, clarify it by stating your assumptions explicitly (separately from the statechart diagram).

Question 6

Having completed a few features with tight schedules, your talent had finally been recognised by the founders of SmartComputing with good recommendations from your team leader.

One week before the project deadline, the Chief Technical Officer (CTO) called your team leader into her office and showed him a piece of functionality implemented in the latest version of a competitor’s software, Noodle. The CTO said, “This is a feature we must have! Please ask the team to implement it by the end of the week so that we can demo the feature to the university.”

You were asked by your team leader to start designing it. After thinking for a couple of hours, you came to the conclusion that Poodle 2 was so different from Noodle that this feature simply didn’t make sense for Poodle 2. Moreover, it was not only difficult to implement, it would also make the system less reliable. You went back to the team leader to discuss these issues with him. The team leader then had a meeting with the CTO and explained your concerns to her.

After hearing the team leader’s explanation, the CTO was still adamant about including the feature in Poodle 2. To convince the team leader that it was easy to implement, she showed him the source code of Noodle, which is free and open-source, and asked him to “just copy their code then you’re done!” The team leader went ahead, followed her suggestions and completed the implementation on time for the demo.

What are the ethical and professional issues that arise with the behaviour of the CTO and the team leader in this situation? How would you evaluate their behaviours? In your answer, you must refer to the applicable parts of the Software Engineering code of ethics.

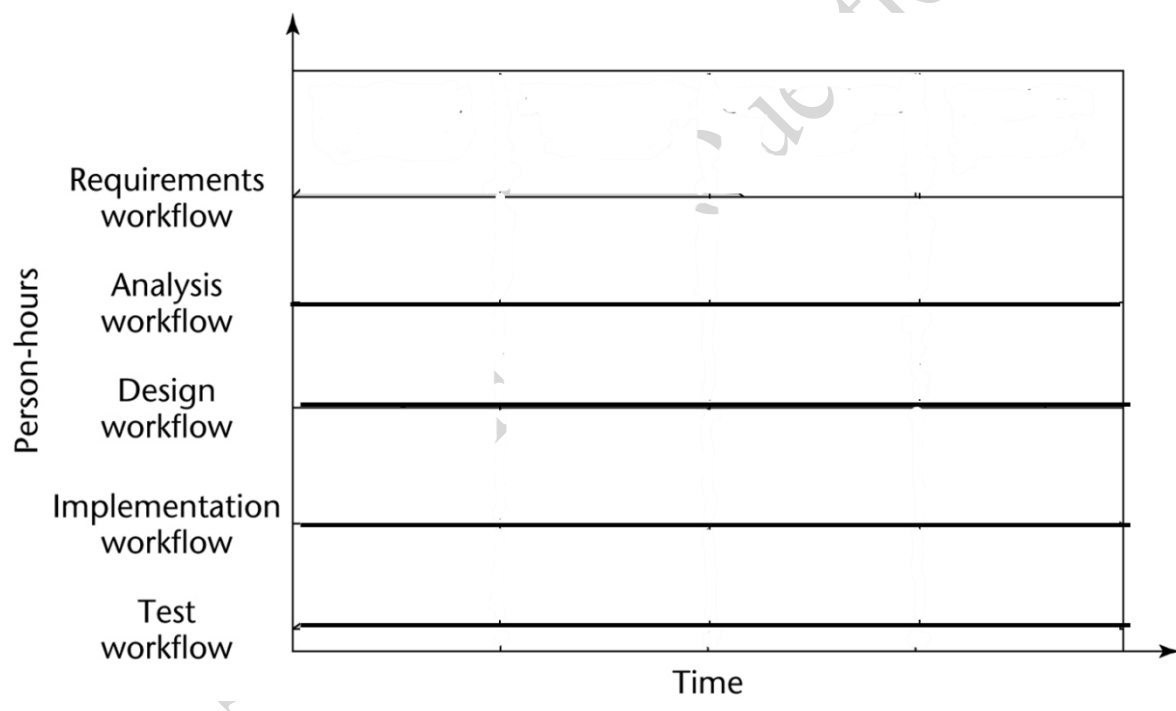
Question 7

The SmartSolutions software company had a contract with a transportation company, TransCo, to add a new component to their existing scheduling tool. The new component was to be a smart reasoning component for recommending routes to drivers. After the first version was delivered, TransCo decided that the new component would have to contain more features to allow maximum flexibility for users (“event 1”).

After incorporating these and the second version was delivered, SmartSolutions found out that the company producing the constraint solver library that it was using had gone broke, so it needed to change the design to use a different library (“event 2”).

Then SmartSolutions realized its own analysts had misunderstood one of TransCo’s requirements, so they had to re-do some of the analysis (“event 3”).

Below is an “empty” depiction of the Unified Process. Extend the figure to represent (roughly) the relative effort given to the different workflows during this project. Indicate on the x (time) axis roughly when “event 1”, “event 2” and “event 3” occurred.



Question 8

Suppose that you are a software engineer working on a car simulation system. You are given the pseudocode for the drive method in the Driver class.

```

Class CarSim:Driver
  Instance variables
  name: String
  instructions: Array of Strings
  car: Car

  begin method drive(instructions: Array of Strings)
    // "s" – start car, "x" – stop car, "a" – accelerate, "b" – brake;
    // "l" – turn left, "r" – turn right, "i" – continue forward
    Local variables
    instruction: String

    foreach instruction in instructions
      if (instruction == "s")
        if (car.getStatus() != "stopped")
          Display message "Car is already started!"
        else
          if (startCar())
            Display message "Brrrrrr! Car started"
          else
            Display message "Hmm, the car won't start."
          end if
        end if
      else if (instruction == "x")
        if (car.getStatus() == "stopped")
          Display message "Car is already stopped!"
        else
          if (car.getSpeed() > 0)
            Display message "Don't turn off the engine while driving!"
          else
            if (stopCar())
              Display message "Car stopped"
            else
              Display message "Hmm the engine won't turn off."
            end if
          end if
        end if
      else if (instruction == "a")
        if (car.getStatus() != "stopped" and accelerate())
          Display message "You are now moving at car.getSpeed()"
        else
          Display message "Couldn't accelerate, is something wrong?"
        end if
      else if (instruction == "b")
        if (car.getStatus() != "stopped" and brake())
          Display message "You are now moving at car.getSpeed()"
        else
          Display message "Couldn't brake! Is something wrong?"
        end if
      else if (instruction == "l")
        if (car.getStatus() != "stopped" and turnLeft())
          Display message "You are now heading car.getHeading()"
        else
          Display message "Couldn't turn left"
        end if
      else if (instruction == "r")
        if (car.getStatus() != "stopped" and turnRight())
          Display message "You are now heading car.getHeading()"
        else
          Display message "Couldn't turn right"
        end if
      else if (car.getStatus() != "stopped" and instruction == "i")
        if (car.move())
          Display message "You continue heading car.getHeading()"
        else
          Display message "Couldn't continue"
        end if
        Display message "Invalid instruction"
      end if
    end foreach instruction
  end method drive
end

```


Question 8 (cont.)

Write a set of 10 test cases for **glass box unit testing** of the drive() method.

Test No and brief description	instructions	Car status	Car speed	Expected output/behaviour
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Question 9

You are a software engineer working on an online shopping application. Web customers can browse items, but has to register the first time they make a purchase. When making a purchase, the customer can go back at any time and view the items in their shopping basket. When they proceed to the “checkout” phase, the system allows them the option of paying by credit card (which means the system has to connect to a credit payment service), or by PayPal. A separate database system will store all the customer registration information.

Below are 3 of the requirements, written in English. Each of these is not well-written (well-written requirements should be precise, unambiguous, complete and consistent.) For each

- (i) indicate whether this is a functional or non-functional requirement (1 mark)
 - (ii) re-write the requirement (2 marks)
-
- (a) “When customers register they have to provide a password, which must be a ‘strong’ one.”
 - (b) “The shopping website has to work on all the main web browsers.”
 - (c) “Customers will be able to search for items”

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