**CS 3365 Software Engineering I**

**Final Exam – Take-home**

**Due Date: 11:59 pm, Friday, 12/06/2019**

**NO Late Submission Will Be Accepted!**

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1. What is the most important difference between generic software product development and custom software development? What might this mean in practice for users of generic software products? (5 points)

For 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. But for 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.

1. What are the four important attributes that all good professional software should have? Suggest four other attributes that may sometimes be significant. (5 points)

The four most important characteristics of professional software are:

* Acceptability
* Dependability
* Security, Efficiency
* Maintainability

Other four attributes:

* Scalable – It can offer stable service no matter how many users are using it.
* Upgrade – It can easily update after delivered to the user.
* Multiple platform – Users can access the service via different platforms.
* Reusable – It can easily be adjustment to meet similar request for other users.

1. Explain how the principles in the Agile Manifesto lead to the accelerated development and deployment of software. (5 points)
2. *Individual and interactions over processes and tools*.

This principle suggests that the team members should focus on the development of the software rather than formal communication and process assurance, so the avoidance of communication and process can accelerate software development.

1. *Working software over comprehensive documentation*.

This contributes to accelerated development by letting the developer focus on developing rather than documentation.

1. *Customer collaboration over contract negotiation*.

The agile development suggests that customer should be closely involved throughout the development process, so it cut the time to negotiate what's in the contract and what's not.

1. *Responding to change over following a plan*.

Agile developers should embrace the change rather than following a plan, all these based on skillful developers, and it accelerates the whole process by avoiding start over if the previous plan is not matched with customer's new demands.

1. Extreme programming expresses user requirements as stories, with each story written on a card. Discuss the advantages (at least 3) and disadvantages (at least 3) of this approach to requirements description. (10 points)

The advantages are:

* It’s easy to understand the requirements.
* Customer can easily choose the stories for inclusion in the next release.
* The whole task is breaking down into implementation tasks, after the user stories are done.

The disadvantages are:

* The requirements on cards are functional requirements not non-functional requirements.
* Those requirements are part of the whole task, so it confuse the developing cost, such as testing.
* The user stories are too concise to describe the detail of the requirements.

1. Because of the close relationship between non-functional system characteristics and software architecture, the choice of architectural style and structure should depend on the non-functional requirements of the system. Please list 5 of those non-functional requirements and briefly explain each of them. (5 points)

Performance – localize critical operations and minimize communications. Use large rather than fine-grain components.

Security – Use a layered architecture with critical assets in the inner layers. Minimize the number of copies of the data and, wherever possible. Each component only knows as much as it needs to, to do its job (least privilege).

Safety – localize safety-critical features in a small number of sub-systems.

Availability – include redundant components and mechanisms for fault tolerance.

Maintainability – use fine-grain, replaceable components. Producers of data should be separated from consumers. Shared data structures should be avoided.

1. Explain why design conflicts might arise when designing an architecture for which both availability and security requirements are the most important non-functional requirements. (5 points)

Having a system that has both availability and security requirements are the most important non-functional requirements is a design conflict because availability for the systems means navigating through the system for the user should be easy. But the system that has strong security would make a passage between component and data accesses restricted, which would defeat the purpose of availability.

1. Explain the advantages of the layered architecture pattern. Name one disadvantage of the traditional layered architecture pattern. (5 points)

Advantages:

* By organizing code into layers, common low-level functionality can be reused throughout the application (DRY principle)
* With a layered architecture, applications can enforce restrictions on which layers can communicate with other layers. This helps to achieve encapsulation
* Layers and encapsulation make it much easier to replace functionality within the application
* Layers can also make it easier to swap out implementations for testing purpose

Disadvantages: Dependencies run from the top layer to the bottom layer, which makes it difficult to test each layer.

1. Explain the responsibilities of MVC components in Web applications. (10 points)

* Model Responsibilities
  + The Model in an MVC application represents the state of the application and any business logic or operations that should be performed by it
* View Responsibilities
  + Presents content through the user interface
  + Should contain minimal logic and any logic should relate to presenting content (use ViewModel if complex logic is needed to present the content)
* Controller Responsibilities
  + Handles user interaction
  + Responds to user input and interaction
  + Is the initial entry point
  + Is responsible for selecting which model types to work with and which view to render

1. Explain the advantages and the disadvantage(s) of the client-server architecture pattern. (5 points)

Advantages:

* The most important advantage of the client-server model is that it is a distributed architecture in which servers can be distributed across a network.
* It is easy to add a new server and integrate it with the rest of the system or to upgrade servers transparently without affecting other parts of the system.

Disadvantages:

* Each service is a single point of failure and so is susceptible to denial-of-service attacks or server failure.
* Performance is dependent on the network as well as the system

1. Explain why testing can only detect the presence of errors, not their absence. (5 points)

The idea behind this concept is that a programmer could write the test units with errors in mind, but simply overlook a whole set of errors. Thus, it's up to the programmer to create tests that both fully validate and verify the quality of the program.

1. You are asked to build a web application called QuizApp and below are the requirements from the customer:

* QuizApp shall display a list of available quizzes to all users (registered and non-registered)
* All users (registered and non-registered) shall be able to choose and take a quiz
* All users (registered and non-registered) shall be able to view the result after taking a quiz
* Registered users shall be able to view the results of the quizzes they took in the past
* QuizApp shall allow a user to register an account
* QuizApp shall allow a user to login

Your tasks:

1. Draw a use case diagram that covers all the requirements above (10 points)
2. Draw class diagrams that includes at least Quiz, Question, and Answer classes (10 points)
3. Draw an activity diagram for a user taking a Quiz (10 points)
4. Draw a sequence diagram for a user taking a Quiz (10 points)

Note: you must use tools, such as draw.io, Visio, etc., to draw the diagrams then export/save them as pictures to be inserted into your homework. Screenshots of the diagrams will NOT be accepted.

Use case diagram:

A close up of text on a white background

Description automatically generated

Class diagrams:

A screenshot of a cell phone

Description automatically generated

Activity diagram:

A close up of a map

Description automatically generated

Sequence diagram:

A screenshot of a social media post

Description automatically generated