Exercises for Lecture 1
Software Engineering with Components

Question 1

Which of the following statements are true? (At least one of the statements is true.)

    A. A module, *X*, is said to be dependent on another module, *Y*, if a change in *X* may necessitate a change in *Y*.

    B. A module, *X*, is said to be dependent on another module, *Y*, if a change in *Y* may necessitate a change in *X*.

    C. A module, *X*, is said to be a client of another module, *Y*, if *X* provides services to *Y*.

    D. A module, *X*, is said to be a client of another module, *Y*, if *X* uses services provided by *Y*.

Question 2

Which of the following statements are true? (At least one of the statements is true.)

    A. A module's public interface is a superset of its private interface.

    B. A module's public interface is a subset of its private interface.

    C. The interface of a module encapsulates the module and hides implementational details that users don't need to know about.

    D. A module encapsulates its interface and exposes only those parts of its functionality that users need to be aware of.

Question 3

"In order to be considered 'high quality', a software system must be…"
Which **one** of the following is the best completion of the previous sentence?

    A. useful, powerful and reliable.

    B. fast, affordable and usable.

    C. reliable, flexible and affordable.

    D. available, flexible and efficient.

Question 4

Which of the following was **not** a factor in the failure of Taurus?

    A. They tried to do too much in one go.

B. Decisions were made by a small committee of powerful individuals without consulting all the stake-holders.
C. They chose to use an expensive new system instead of modifying an existing one.
D. Work was carried out by two competing consultancy firms.

Question 5

Which of the following statements are false?

A. A module A is dependent on another module B if a change in A might necessitate a change in B.
B. A module A is dependent on another module B if a change in B might necessitate a change in A.
C. If A depends on B, then A is a client of B.
D. If A depends on B, then A provides services to B.

Question 6

With reference to the Ariane 5 disaster, which **one** of the following statements is true?

A. They used an expensive new system instead of modifying an existing one.
B. The software was insufficiently flexible and not designed to be future-proof.
C. Software was reused without properly testing it in its new context.
D. The failure was caused by software trying to convert a 16-bit integer value for a vertical velocity component into a 64-bit floating-point value.

Question 7

According to the Standish Group CHAOS report (1994) which **one** of the following was the biggest cause of software project failure?

A. The use of programming languages that do not properly support object-oriented design.
B. Failures in requirements capture.
C. Failure to reuse existing software ("re-inventing the wheel").
D. Insufficient testing.

Question 8

Which **three** of the following adjectives describe the modules in a good software system?

    A. reusable
    B. cohesive
    C. replaceable
    D. abstract

Question 9

Which **one** of the following is **not**, in general, a benefit of encapsulation and modularity?

    A. Less for developers to learn.
    B. Easier to debug.
    C. Easier to reuse code.
    D. Makes code shorter.

Question 10

Which **one** of the following best describes the cause of the Ariane 5 disaster?

    A. The project was managed by a committee consisting of members with conflicting interests.
    B. The goals of the project were too ambitious.
    C. Software was reused in a new context without adequate testing.
    D. Software interlocks did not prevent the machine from being placed in a dangerous configuration.

Question 11

Explain why increasing the number of skilled programmers working on a software development project may not decrease the amount of time that the project takes to complete. What else must be done to ensure that the increase in the number of workers results in faster completion?

Question 12

Briefly explain what the terms *modularity* and *encapsulation* mean. What benefits do these principles bring when applied to software design?

Question 13

Briefly describe a large-scale software project that failed disastrously, Highlight the main factors that contributed to the failure of the project and suggest how these might have been avoided. Write no more than 300 words.

Question 14

Briefly define the meanings of the following terms when used in the context of software engineering.

- a. modularity
- b. encapsulation
- c. coupling
- d. interface
- e. abstraction

Question 15

Which **one** of the following was **not** a conclusion of the 1994 Standish CHAOS report?

- a. 31% of software engineering projects are cancelled.
- b. 53% of projects cost over twice their original estimates.
- c. Failures in requirements capture were the biggest cause of software project failure.
- d. Failure to analyse retrospectively why a project failed means that the same mistakes are made over and over again.

Question 16

Which **one** of the following properties is **not** one that is characteristic of a module that is a good abstraction?

- a. low cohesion
- b. low coupling
- c. an appropriate level of information hiding
- d. simulates well the behavior and structure of an identifiable "thing"

Question 17

Which one of the following was the main cause of failure in the Ariane 5 project?
    A. Software inflexible and difficult to maintain.
    B. Software re-used without thoroughly testing its operation in the new context.
    C. Chose to build an expensive new system instead of modifying an existing one.
    D. Software interlocks did not prevent a dangerous configuration.

Question 18

Which one of the following was one of the main problems in the Taurus project?
    A. Software inflexible and difficult to maintain.
    B. Software re-used without thoroughly testing its operation in the new context.
    C. Chose to build an expensive new system instead of modifying an existing one.
    D. Software interlocks did not prevent a dangerous configuration.

Question 19

a. Brooks (1975) has suggested that the time taken to complete a software project does not necessarily decrease if more people are working on the project. Explain why this is so. (4 marks)
b. Explain the meaning of the following three terms:
        i. *encapsulation* (2 marks)
        ii. *modularity* (2 marks)
        iii. *context dependencies* (2 marks)

Question 20

a. In software engineering, it is generally accepted that a good software system should be *useful*, *usable*, *reliable*, *flexible*, *affordable* and *available*. Briefly explain the meaning of each of these italicised terms. [5 marks]
b. Explain what is meant by the terms *spaghetti code*, *modularity* and *encapsulation*. What is the main problem caused by spaghetti code and how can modularity and encapsulation help to prevent it? [5 marks]

Question 21

a. Briefly explain why Fred Brooks considered the concept of the "man-month" to be "mythical". [4 marks]

b. Which one of the following is **not** typically an advantage of software written using the object-oriented paradigm:

1. Code is shorter.
2. Code is more modular
3. Code is encapsulated.
4. Code is easier to re-use.

[1 mark]

c. "A good software system is constructed from cohesive, loosely-coupled components." Briefly explain what this means. [3 marks]

Question 22

a. The amount of work required to carried out a project is typically measured in *person-months*. A person-month is the quantity of work that can be carried out by 1 person in 1 month. This measure of quantity of work assumes that the time taken to complete a project is inversely proportional to the number of people working on the project.

   i. If you double the number of members on a team, then, in the worst case, how much does this increase the amount of time that the team-members spend communicating with each other? Explain your answer. [2 marks]

   ii. If doubling the number of people had no effect on the amount of communication necessary between team members and each team member was equally effective, how much less time would each team-member have to spend on the project as a result? [1 mark] How much less time would the whole project take to run? [1 mark]

   iii. In light of your answers to parts (i) and (ii), do you think that increasing the number of workers on a team always decreases the time that a project takes to complete? Explain your answer. [2 marks]

Question 23

Which of the following statements are true? (At least one of the statements is true.)

   A. Module A is dependent on module B if a change in A may necessitate a change in B.
   B. Module A is dependent on module B if a change in B may necessitate a change in A.
   C. Module A is a client of module B if B provides services to A.
   D. Module B is a client of module A if B provides services to A.