

Q46. Among UML 2.x (including 2.0 and later versions) diagrams, which of the following is the most appropriate diagram that gives a graphic overview of the actors involved in a system, the different functions those actors need to perform, and how these different functions interact?

- a) Activity diagram
- b) Communication diagram
- c) Interaction overview diagram
- d) Use case diagram

Q47. Which of the following is an appropriate explanation of encapsulation in object orientation?

- a) Abstraction and grouping of several objects that have common properties
- b) Bundling of data and the procedures operating on the data as a single object and concealment of their implementation inside the object
- c) Creation of a base class by extracting the properties that are common among classes
- d) Inheritance of the properties of a base class by a subclass

Q48. Which of the following is a technique that embeds logical expressions that hold true for the relations or conditions between variables at specific points in the execution of a program and verifies the validity of the program?

- a) Assertion check
- b) Code trace
- c) Snapshot dump
- d) Test coverage analysis

Q49. Which of the following is an appropriate test type that is conducted to ensure that the interfaces and linkages between different software parts work properly?

- a) Acceptance test
- b) Functional test
- c) Integration test
- d) Performance test

Q50. Which of the following is a software development model that repeats the development processes from requirements analysis to implementation?

- a) Prototyping model
- b) Relational model
- c) Spiral model
- c) Waterfall model

Q51. The software reengineering process can be divided into four sub-processes: program modularization, program structure improvement, reverse engineering, and source code translation. Which of the following is a process that focuses on functional analysis and information extraction?

- a) Program modularization
- b) Program structure improvement
- c) Reverse engineering
- d) Source code translation

Q45. Which of the following UML diagrams is used to represent the user interactions with the system and the functions of the system?

- a) Activity diagram
- b) Class diagram
- c) Sequence diagram
- d) Use case diagram

Q46. Which of the following is an appropriate description of an acceptance test?

- a) It is conducted by developers to verify response time and other performance items.
- b) It is conducted by testers to ensure that the interfaces and linkages between different software parts work properly.
- c) It is conducted by the project manager to verify whether users' functional requirements are met or not.
- d) It is conducted by users to confirm that the software is complete and meets the business needs that prompted the software to be developed.

Q47. In the development process, which of the following is an activity that should be performed in software architectural design?

- a) Analyzing the requirements in incremental steps by arranging them in the form of a chart
- b) Describing the specifications so that the program is clarified on a line-by-line basis
- c) Obtaining the opinion of the customer and deciding the specifications
- d) Transforming the requirements for the software into a design that describes its top-level structure and identifies the software components

Q48. Which of the following is an appropriate description concerning test data for black box testing?

- a) Test data is created based on branch coverage.
- b) Test data is created based on condition coverage.
- c) Test data is created based on external specifications.
- d) Test data is created based on program structures.

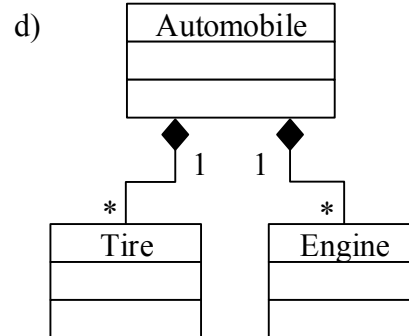
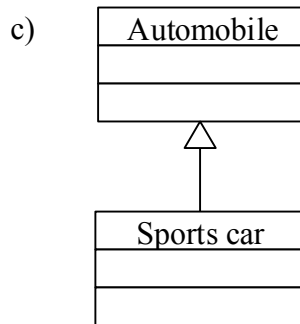
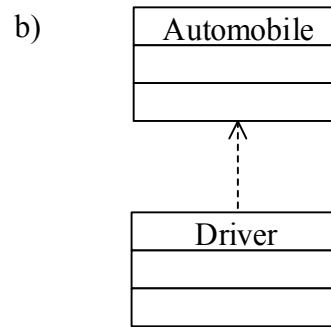
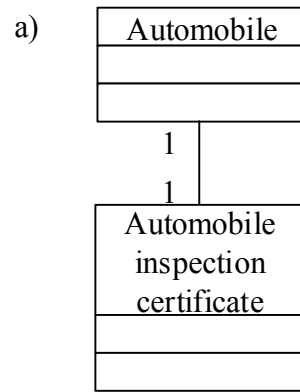
Q49. In an agile software development project, when can the customer review the first piece of working software?

- a) After the completion of the first epic
- b) After the completion of the first few releases
- c) After the completion of the first iteration
- d) After the completion of the whole project

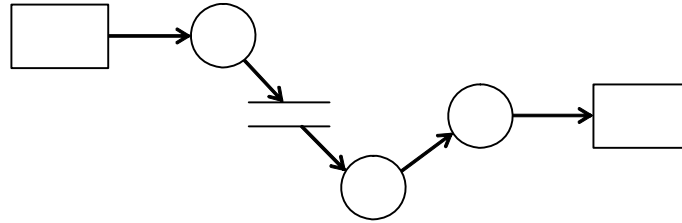
Q50. According to the Capability Maturity Model Integration, which of the following is the final and highest level of maturity?

- a) Auditable
- b) Custom
- c) Optimizing
- d) Quantitatively Managed

Q45. Which of the following is the UML class diagram that shows a generalization relation?



Q46. The figure below shows an example of a DFD that uses one of the DFD notations and represents a flow of data in a system. Texts in the figure are not shown. Which of the following is represented by the circle “O” in the DFD notation used in the example?



- a) Activity
- b) Data flow
- c) Data store
- d) Process

Q47. Which of the following is an appropriate relationship between classes and instances in object orientation?

- a) An instance defines the specifications of a class.
- b) An instance is created based on the definition of a class.
- c) Multiple classes correspond to a single instance.
- d) Only one (1) instance exists for a single class.

Q48. Which of the following is the weakest module coupling?

- a) To implement as many functions as possible with a single module
- b) To pass arguments that control another module's logic when the module is called
- c) To pass only required data items as arguments between two (2) modules
- d) To use a global area to share data items with other modules

Q49. Which of the following tests verifies the interfaces between two (2) modules or subsystems?

- a) Acceptance test b) Integration test c) Operational test d) Unit test

Q50. Which of the following is an appropriate explanation of a comprehensive patent cross-license?

- a) An agreement to share the necessary costs for patent registration is concluded.
- b) The source code is published free of charge on the Internet or other places, and anyone may improve and redistribute the software.
- c) The use of patent rights is mutually licensed among companies in the specified fields of technologies or products.
- d) To ensure that a company's patent rights are not violated, the right to stop a counterpart's manufacturing is exercised.

Q44. When a packet-filtering firewall is to be installed at the point of connection between a company's internal network and the Internet, and PCs on the internal network are to be allowed to access port 80 of a web server on the Internet, which of the following is an appropriate combination of rules of filters for allowing traffic?

a)

Source	Destination	Source port number	Destination port number
PC	Web server	80	1024 or higher
Web server	PC	80	1024 or higher

b)

Source	Destination	Source port number	Destination port number
PC	Web server	80	1024 or higher
Web server	PC	1024 or higher	80

c)

Source	Destination	Source port number	Destination port number
PC	Web server	1024 or higher	80
Web server	PC	80	1024 or higher

d)

Source	Destination	Source port number	Destination port number
PC	Web server	1024 or higher	80
Web server	PC	1024 or higher	80

Q45. Which of the following UML diagrams shows the exchange of messages among objects, message transmission, and object lifelines in a time series?

- a) Activity diagram
- b) Communication diagram
- c) Sequence diagram
- d) State-machine diagram

Q46. Which of the following is an appropriate relation between a class and an instance in object-oriented programming?

- a) An instance defines the specifications of a class.
- b) An instance is created based on the definition for a class.
- c) Multiple classes correspond to one (1) instance.
- d) Only one (1) instance exists for one (1) class.

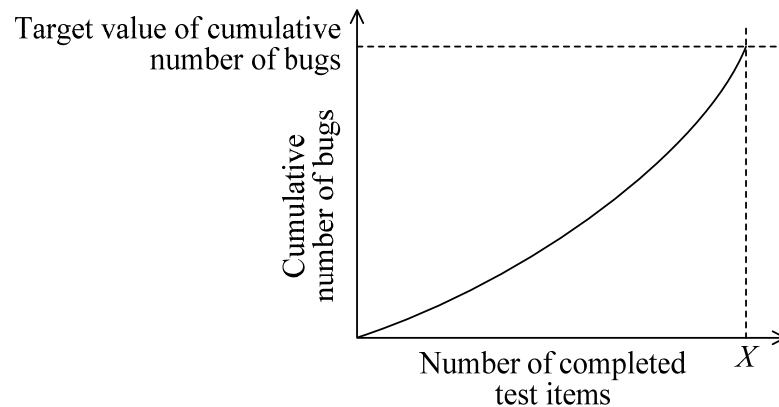
Q47. Which of the following is the type of module coupling that has the weakest degree of coupling in which the exchange of information between modules is performed only using parameters?

- a) Common coupling
- b) Control coupling
- c) Data coupling
- d) Content coupling

Q48. In the development process, which of the following is an activity that should be performed for software architectural design?

- a) Analyzing the requirements in incremental steps by expressing them in the form of a diagram, etc.
- b) Describing the specifications so that the program is clarified on a line-by-line basis
- c) Obtaining the opinion of the customer and determining the specifications
- d) Transforming the requirements for the software item into an architecture that describes its top-level structure and identifies its software components

Q49. The figure below shows that the cumulative number of bugs reached the target value, when the number of completed test items was X. Which of the following is an appropriate explanation of the situation shown in this figure?



- a) It indicates that a large number of bugs may still remain internally.
- b) It indicates that desk-checking and simulation were performed satisfactorily prior to testing.
- c) It indicates that the probability of occurrence of bugs after shipping is low, because the target cumulative number of bugs was reached.
- d) It indicates that the testing process was completed successfully.

Q51. According to the 6th edition of the PMBOK Guide, which of the following is an activity for the planning process group in project resource management?

- a) Acquire resources
- b) Control resources
- c) Develop project team
- d) Estimate activity resources

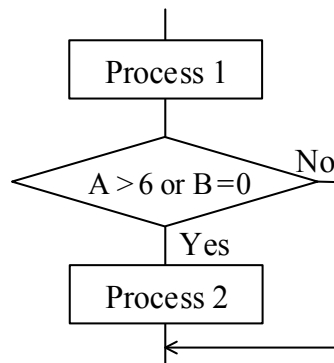
Q8. In object-oriented programming, which of the following is an explanation of overriding that achieves polymorphism?

- a) A feature that allows a class to provide a specific implementation of a method that is already provided by one of its superclasses
- b) Creating a class through abstraction by collecting common properties of multiple classes
- c) Defining multiple methods in a class that have the same name but differ either in the number of arguments, argument types, or argument order
- d) Hiding the internal contracts and structures of an object from its external specification

Q47. Among the design techniques that are used in system development, which of the following is an explanation of a decision table?

- a) It represents a combination of conditions and the corresponding operations.
- b) It represents entities by a rectangle and their relationship through connecting lines.
- c) It represents the flow of controls, such as a process or selection, by linear lines or arrows.
- d) It represents the flow of data between an external interface, processes, and data store.

Q48. Test data about the part of a program shown in the flowchart below is specified by decision condition coverage (branch coverage). When this test data is changed to being specified by multiple-condition coverage, which of the following is the appropriate test data to be added? Here, the part enclosed by parentheses () represents the set of test data.



- Test data by decision condition coverage (branch coverage)
(A = 4, B = 1), (A = 5, B = 0)
- a) (A = 3, B = 0), (A = 7, B = 2)
- b) (A = 3, B = 2), (A = 8, B = 0)
- c) (A = 4, B = 0), (A = 8, B = 0)
- d) (A = 7, B = 0), (A = 8, B = 2)

Q49. Among the different types of software tests, which of the following is a test that is performed with the purpose of checking whether or not a location that must not be affected by changes made for software maintenance is affected?

- a) Integration test
- b) Operational test
- c) Regression test
- d) System test

Q50. Which of the following is an explanation of reverse engineering of software?

- a) The entire software is reconstructed after analyzing and understanding the existing software.
- b) The existing software is analyzed, and its specification and structure are clarified.
- c) The internal structure of software is changed without changing the behavior seen from the outside.
- d) The source code is created automatically from the design information using a development support tool.

Q9. In object-oriented programming, which of the following is an explanation of overriding that achieves polymorphism?

- a) A feature that allows a class to provide a specific implementation of a method that is already provided by one of its super classes
- b) Creating a class through abstraction by collecting common properties of multiple classes
- c) Defining multiple methods in a class that have the same name, but differ in terms of the number of arguments, argument types, or argument order
- d) Hiding internal contracts and structures of an object from its external specification

Q47. In object orientation, which of the following is the name of being able to use the attributes and functions of a class in a subclass of that class?

- a) Encapsulation
- b) Inheritance
- c) Override
- d) Polymorphism

Q48. In the development process, which of the following is an activity that should be performed in software architecture design?

- a) Converting the requirements for a software item into an architecture that represents the top-level structure and identifies software components
- b) Refining a program so that the processing of each coded line is clarified
- c) Seeking comments from the customer and determining a specification
- d) Summarizing the requirements in the form of diagrams and tables, and refining and analyzing them in stages

Q49. Which of the following is the testing technique that uses the different unique combination of input conditions to check whether the corresponding result is delivered based on the design rules as specified for the system?

- a) Boundary value analysis
- b) Decision table testing
- c) Equivalence partitioning
- d) Robustness testing

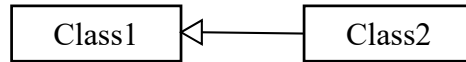
Q50. Which of the following is an appropriate test to ensure that the interfaces and linkages between different parts of software work properly?

- a) Functional test
- b) Integration test
- c) Performance test
- d) Unit test

Q51. Among eXtreme Programming (XP) practices, which of the following is adopted to improve program quality in program development through smooth communication between programmers by exchanging their roles and checking each other's work?

- a) Coding standard
- b) Pair programming
- c) Planning game
- d) Test-driven development

Q46. In the UML class diagram, which of the following represents the relationship between the classes as shown in the figure below?



- a) Aggregation b) Association c) Composition d) Generalization

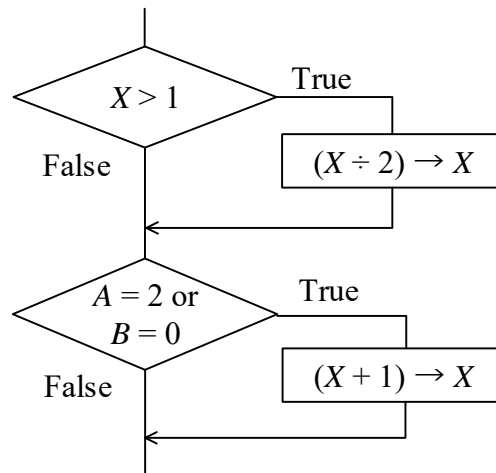
Q47. Which of the following is an explanation of encapsulation in object orientation?

- a) Abstraction and sorting of several objects that have the same nature
- b) Combination of the data and procedures that operate the data into a single object, and their concealment from outside the object
- c) Extraction of the nature shared between classes and creation of a base class
- d) Inheritance of the nature of a base class by a subclass

Q48. Which of the following can generally be called a subclass of an “automobile” based on the concept of object orientation?

- a) Engine
- b) Manufacturing number
- c) Tire
- d) Truck

Q49. In the flowchart below, what is the minimum number of test cases that satisfies the decision condition coverage (branch coverage)?



a) 1

b) 2

c) 3

d) 4

Q50. Among the software development activities, which of the following corresponds to refactoring, which is also emphasized in agile development?

- a) To improve the maintainability of a software, the internal structure of a program is changed without any change in the external specifications.
- b) To improve the quality of a software, two (2) programmers cooperate with each other and perform coding of one (1) program.
- c) To obtain feedback from the users, a prototype of the software to be provided is created at an early stage.
- d) To promptly develop a software to be operated, test cases are set in advance, and then the program is coded.

Q62. When an UML is used for business modeling, which of the following is the diagram that can represent a workflow such as the execution sequence of the business processes and branching based on conditions?

- a) Activity diagram
- b) Class diagram
- c) Component diagram
- d) Object diagram

Q47. Which of the following is a module strength for the collection of multiple sequential functions, with internal passing of data?

- a) Communicational strength
- b) Functional strength
- c) Informational strength
- d) Procedural strength

Q48. Which of the following is the appropriate combination of Class and Object in Object Oriented Programming?

	Class	Object
a)	A class can be termed as a group of objects with similar behavior and similar attributes.	An object is a particular instance of a class.
b)	A class can be termed as a group of objects with similar behavior and similar attributes.	An object is the blueprint of the class.
c)	A class contains the real values of its attributes.	An object has the definition and behavior of a class.
d)	A class is an instance of a particular object.	An object can be defined as a template that describes the behavior that the class of its type support.

Q49. Which of the following is an appropriate description concerning the black box test?

- a) Even if the program to be tested contains redundant code, such code cannot be detected.
- b) If the number of branch instructions and modules increases, the test data volume increases rapidly.
- c) In consideration of the internal structure of the program, it is verified whether or not the necessary part is executed.
- d) The coverage rate of instructions and branches is used as criteria for the creation of test data.

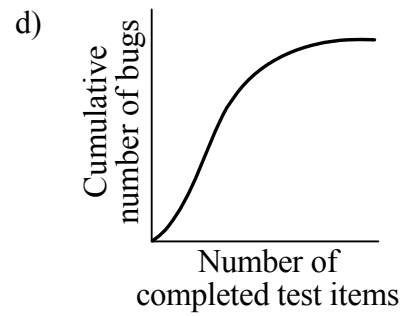
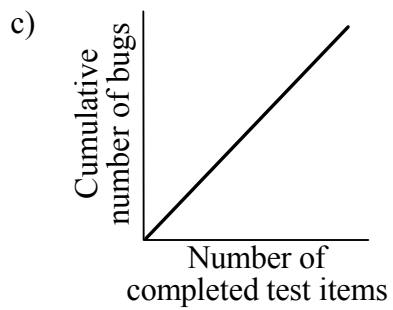
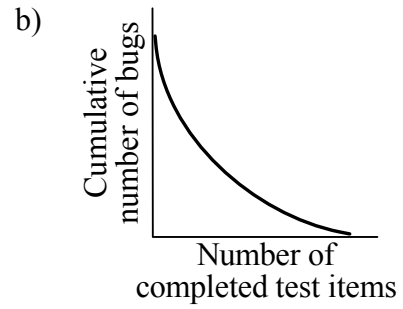
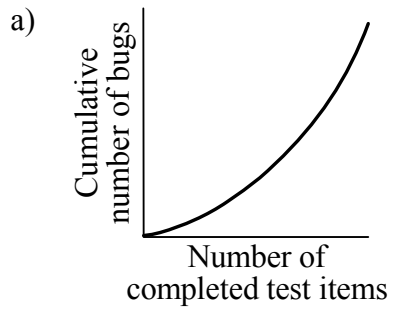
Q50. Which of the following is an appropriate testing type to ensure that the interfaces and linkages between different parts of programs work properly?

- a) Acceptance test
- b) Integration test
- c) Qualification test
- d) Unit test

Q51. Which of the following is an explanation of reverse engineering of software?

- a) The entire software is reconstructed after analyzing and understanding the existing software.
- b) The existing software is analyzed, and its specification and structure are clarified.
- c) The internal structure of software is changed without changing the behavior seen from the outside.
- d) The source code is generated automatically from the design information by using a development support tool.

Q55. In order to determine the quality condition in a test process, it is necessary to analyze and evaluate the relationship between the number of completed test items and the cumulative number of bugs. Which of the following is the graph that indicates that the quality is becoming stable?



Q66. Which of the following is the activity that translates the information gathered during analysis activities into a document as a set of requirements?

- a) Feasibility study
- b) Requirement analysis
- c) Requirement definition
- d) Requirement specification

Q46. Which of the following must be approved by the customer when the external design of a system is completed?

- a) Physical database specification
- b) Program flowchart
- c) Screen layout
- d) System development plan

Q47. Which of the following is the appropriate combination of the basic concept of object orientation?

- a) Abstraction, encapsulation, inheritance, class
- b) Embodiment, structuring, continuation, class
- c) Normalization, encapsulation, division, class
- d) Virtualization, structuring, projection, class

Q48. In order to increase module independence, the level of module coupling must be low. Which of the following methods of exchanging information between modules has the lowest level of module coupling?

- a) Control parameters are passed as arguments in order to control the execution order of modules.
- b) Only data items that are required for input and output are passed as arguments between modules.
- c) Relevant module reference data that is defined in a common area.
- d) Required data is declared externally and shared.

Q49. The integration test for software composed of modules arranged in a hierarchical structure is performed from a high-level module. In such a case, which of the following is a test module that is used as a substitute for a low-level module?

- a) Driver
- b) Emulator
- c) Simulator
- d) Stub

Q50. Which of the following is the method that uses a modeling tool to create a design document described with E-R diagrams or other representations from the definition information in an active database?

- a) Concurrent engineering
- b) Forward engineering
- c) Reverse engineering
- d) Social engineering

Q45. Which of the following is the most appropriate description of polymorphism in object oriented design?

- a) It allows developers to define classes incrementally by reusing classes defined previously as the basis for new classes.
- b) It allows the analyst to focus on the important dimensions while ignoring nonessential dimensions.
- c) It combines the processes and data into a single object.
- d) It is the provision of a single interface to entities of different types.

Q46. In the development process, which of the following is an activity that should be performed in software architectural design?

- a) Analyzing the requests in incremental steps by arranging them in the form of a chart
- b) Describing the specifications so that the program is clarified on a line-by-line basis
- c) Obtaining the opinion of the customer and deciding the specifications
- d) Transforming the requirements for the software item into an architecture that describes its top-level structure and identifies the software components

Q47. Which of the following is the most appropriate description of stack-trace in relation to debugging a program?

- a) A trace of call stack methods/functions/subroutines
- b) Stacking/gathering the traces left by other programs
- c) The traces left in memory from a stack data structure
- d) Tracing stack data structure for appropriate contents

Q48. Which of the following is an appropriate description concerning a state transition test in a system integration test?

- a) A method for black box tests that does not focus on a system's internal state.
- b) A method that checks whether a system behaves according to the designed combinations of events and internal states.
- c) A method that is suitable for tests of calculations and processing systems whose internal state does not change depending on the occurrence of an event.
- d) A method that uses a data flow diagram and a decision table to analyze the internal state of a system.

Q49. Which of the following is a method for analyzing a source and object codes, and extract program specifications and design information?

- a) Reengineering
- b) Refactoring
- c) Restructuring
- d) Reverse engineering

Q50. According to the ISO/IEC 12207 (Systems and software engineering – Software life cycle processes (SLCP)), the Software Implementation Process has the following lower-level processes:

- 1) Construction Process
- 2) Requirements Analysis Process
- 3) Architectural and Detailed Design Process
- 4) Integration and Testing process

Which of the following is an appropriate order for the Software Implementation Process?

- | | |
|----------------------|----------------------|
| a) 1) → 2) → 3) → 4) | b) 2) → 3) → 1) → 4) |
| c) 2) → 3) → 4) → 1) | d) 3) → 4) → 2) → 1) |

Q47. Which of the following are components of a UML2.x (including 2.0 and later versions) state diagram?

- a) Message and Activity
- b) Message and Transition
- c) State and Message
- d) State and Transition

Q48. As shown in the list below, there are three types of coupling. Which of the following is the most appropriate combination of the type of coupling?

Coupling A: One module passes an element of control to the other module.

Coupling B: One module passes the data structure as a parameter to the other module.

Coupling C: Two modules have access to the same global data.

	Coupling A	Coupling B	Coupling C
a)	Content coupling	Data coupling	Common coupling
b)	Content coupling	Stamp coupling	External coupling
c)	Control coupling	Data coupling	External coupling
d)	Control coupling	Stamp coupling	Common coupling

Q49. Which of the following is an appropriate description concerning test data for the black box testing?

- a) Test data is created based on branch coverage.
- b) Test data is created based on condition coverage.
- c) Test data is created based on external specification.
- d) Test data is created based on program structure.

Q50. When a software component is tested, which of the following is an appropriate combinations of X and Y ?

X : It calls the software component to be tested.

Y : It is called from the software component to be tested.

	X	Y
a)	component	unit
b)	driver	stub
c)	stub	driver
d)	unit	component

Q51. According to the Capability Maturity Model Integration, which is the final stage and has the highest level of maturity?

- a) Auditable b) Custom c) Optimized d) Quantitative

Q63. Which of the following is a usage scenario for the adoption of UML as a technique for visualizing business processes?

- a) Diagrams are shown by using a data-oriented approach where objects are handled as entities, their attributes, and the relationships among the entities.
- b) To represent processes by using data flows, sources and sinks of data, data stores, and data processes are connected with arrows that indicate data flow.
- c) To represent processes from multiple viewpoints, some purpose-specific modeling methods are used, and each model is depicted by using standardized notation rules for object modeling.
- d) To thoroughly represent the functions of a process, the events that occur in response to a single request are described by using the conditional branch format.

Q46. Which of the following is the most appropriate explanation of the deployment diagram defined in UML 2.x (including 2.0 and later versions)?

- a) It addresses the dynamic view of the system. In other words, it is drawn for a single class to show the lifetime behavior of a single object.
- b) It describes the types of objects in the system and the various kinds of static relationships that exist among them.
- c) It shows a static view of the run-time configuration of processing nodes, such as servers and clients, as well as the components that run on these nodes.
- d) It shows the organizations and dependencies among a set of pieces that are independently purchasable and upgradeable, and addresses the static implementation view of the system.

Q47. In software development for small projects, which of the following is an appropriate explanation of test driven development (TDD)?

- a) All functionalities are identified at the start of the project. Code and test cases are developed together and functionalities are developed simultaneously.
- b) Continuous testing is implemented during the coding process using automated testing. The process eliminates the requirement for system testing
- c) Development is done in increments of functionality where test cases are executed and the code is developed to pass the test cases before moving to the next increment.
- d) Test cases are executed at the end for each stage of the development process where all code must first pass the test case before proceeding to the next stage.

Q48. There is a program module that is executed only when the value of integer x is $25 \leq x < 50$. When this module is tested using the boundary value analysis, which of the following is an appropriate combination of values to be tested?

- | | |
|-------------------|-------------------|
| a) 24, 25, 49, 50 | b) 24, 25, 50, 51 |
| c) 25, 26, 49, 50 | d) 25, 26, 50, 51 |

Q49. Which of the following is an appropriate category of system maintenance performed for the purpose of modifying the system to cope with changes in the software environment (e.g. DBMS, Operating system)?

- a) Adaptive maintenance
- b) Corrective maintenance
- c) Perfective maintenance
- d) Preventive maintenance

Q50. Which of the following is an appropriate order of six phases used in every SDLC (Software Development Life Cycle) model?

- a) Requirements Analysis → Design → Programming → Deployment → Testing → Maintenance
- b) Requirements Analysis → Design → Programming → Testing → Deployment → Maintenance
- c) Requirements Analysis → Design → Programming → Testing → Maintenance → Deployment
- d) Requirements Analysis → Programming → Testing → Design → Maintenance → Deployment

Q55. In order to check whether a system works normally, users in the system user department and operators in the system operations department jointly conduct operational testing prior to full operation. Which of the following is an appropriate description of the users should prioritize during testing?

- a) Testing whether all application programs work according to the specifications
- b) Testing whether online, batch, and other processing is performed according to the operational procedures
- c) Testing whether the performance objective is achieved
- d) Testing whether the system operates according to predetermined business procedures

Q56. When data in the business operations department is entered in a data sheet by the information system department, which of the following is an appropriate task executed by the information system department?

- a) In order to prevent unauthorized use or leakage of confidential information, data sheets are disposed of immediately after the completion of data entry.
- b) The data sheets are retained in the information system department until the due date for processing, and confirmation including a check of the number of sheets received is performed for all sheets collectively just before the due date.
- c) To enable the business operations department to check the processing results of each data sheet, the processing results list is sent to the business operations department.
- d) When the data sheet contains an error, and only when the error is obvious, the data sheet is corrected and an entry is made based on the judgment of only the person in charge of data entry.

Q49. According to ISO/IEC 25010 (Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models), which of the following is an appropriate quality characteristic that means the degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions?

- a) Functional suitability
- b) Performance efficiency
- c) Reliability
- d) Usability

Q50. In unit testing, which of the following activities is part of “white box testing”?

- a) Boundary value analysis
- b) Condition testing
- c) Equivalence partitioning
- d) Orthogonal array testing

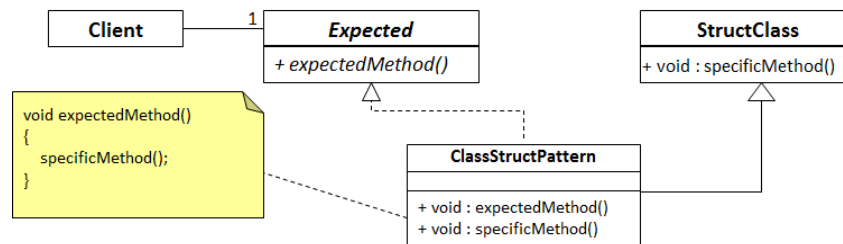
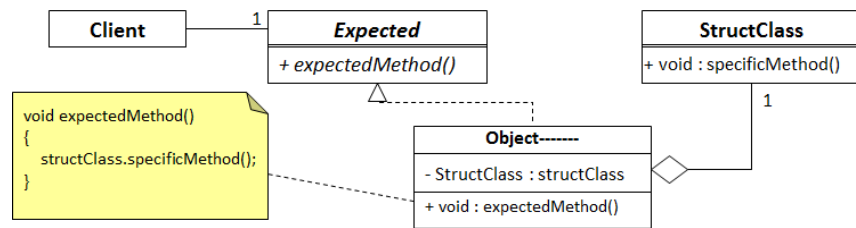
Q51. Which of the following is a mechanism that allows several subclasses of a common parent class to override the same method with different behaviors?

- a) Aggregation
- b) Composition
- c) Inheritance
- d) Polymorphism

Q52. The integration test for a software that is composed of a set of modules arranged in a hierarchical structure is performed from a low-level module. In such a case, which of the following is a test module used as a substitute for a higher level module?

- a) Driver b) Emulator c) Simulator d) Stub

Q53. Which of the following is a structural design pattern that allows classes with incompatible interfaces to work together and that can be implemented in either form in the two diagrams below?



- a) Adapter b) Factory c) Iterator d) Singleton

Q54. Which of the following is a term for the process of generating a Unified Modeling Language (UML) class diagram from a program?

- a) Backtracking
- b) Forward engineering
- c) Re-engineering
- d) Reverse engineering

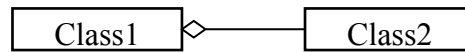
Q46. Which of the following is the most suitable system for a design using a state transition diagram?

- a) A greenhouse control system, which keeps the environment in a greenhouse optimum based on the information of the installed sensors
- b) A water bill accounting system, which calculates charges from the data of water meters
- c) An inventory-taking system, which counts the inventory assets at the end of each month and at book closing
- d) An operations measurement system for system resources, which measures the operational status of the system resources, and generates a report

Q47. Among UML 2.x, (including 2.0 and later versions) diagrams, which of the following is the most appropriate diagram that can give a graphic overview of the actors involved in a system, different functions needed by those actors and how these different functions are interacted?

- a) Activity diagram
- b) Communication diagram
- c) Interaction Overview diagram
- d) Use Case diagram

Q48. Which of the following is an appropriate explanation about the following UML class diagram?



- a) An instance of Class1 associated with has an instance of Class2.
- b) An instance of Class2 is a logical part of an instance of Class1.
- c) An instance of Class2 is a physical part of an instance of Class1.
- d) An instance of Class2 is like an instance of Class1. Class2 inherits from Class1.

Q49. Which of the following is an appropriate description of how to design test cases for a black box test?

- a) Test cases are designed according to the program's functional specifications and interface specifications.
- b) Test cases are designed on the basis of the procedure and internal structure of the program.
- c) Test cases are designed so that each of the decision conditions in the program can evaluate both TRUE and FALSE at least once.
- d) Test cases are designed with reference to program specifications or the source list, after the program specifications are finalized or the coding is completed.

Q50. Which of the following is the purpose of a stress test?

- a) To compare performance with other computers by measuring the execution time of a standard program
- b) To confirm the operation at the limits of processing capability that is required for a system
- c) To confirm that there are no unintended effects on the program functions that have no relation to correction or change in the program
- d) To evaluate the usability of a system by having actual users use the system

Q51. Which of the following is the process of changing a software system in such a way that it does not alter the external behavior of the code yet improves its internal structure?

- a) Reengineering
- b) Refactoring
- c) Restructuring
- d) Reverse engineering

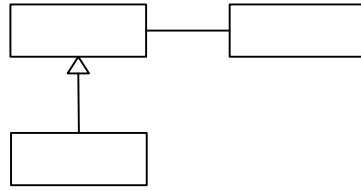
Q52. Which of the following is an explanation of the spiral model in system development?

- a) In this model, cycles are divided up into smaller, more easily managed iterations called build. Each iteration passes through the requirements, design, implementation and testing phases.
- b) In this model, each phase must be completed in its entirety before the next phase begins. At the end of each phase, a review takes place to determine if the project is on the right path and whether to continue the project or not.
- c) This model has four phases: Planning, Risk Analysis, Engineering and Evaluation. A software project repeatedly passes through these phases in iterations.
- d) This model is a sequential execution of processes. Each phase must be completed before the next phase begins. Testing is emphasized in this model and the testing procedures are developed early in the life cycle before any coding is done, during each of the phases preceding implementation.

Q22. Which of the following is classified as a function of a static test tool?

- a) Calculating the coverage from the paths executed by the test
- b) Detecting an error in a program by analyzing the source code
- c) Generating a driver or a stub necessary for the module to be tested
- d) Generating the data for testing a specific path of the program

Q48. In the UML diagram shown below, which of the following is described in the blank ?



- a) Aggregation name
- b) Association name
- c) Class name
- d) Use case name

Q49. In object-oriented development, it is possible to make settings such that the user is not affected even if the internal structure of an object is changed. Thus, it is possible to create a situation where the user of an object is not necessarily aware of the internal structure of the object. Which of the following is the term that represents the concept of implementing such development?

- a) Classification
- b) Encapsulation
- c) Modularization
- d) Structuration

Q50. In software development, which of the following is an appropriate explanation of a test that uses stubs?

- a) During the execution of a program, the contents of a variable or register are displayed as required, and the test is continued after the contents are modified if necessary.
- b) Each time a specific instruction is executed, the contents of registers and main memory are dumped to check whether the process is executed correctly.
- c) When a top-down test is performed, a dummy lower-level module that is called by the upper-level module is prepared to stand in for an unfinished portion of the program.
- d) When a unit test for a module is performed, a dummy higher-level module that calls the module is prepared to check whether the operation is executed correctly.

Q51. Which of the following is an appropriate explanation of the state transition diagram that is used for requirements analysis and design in system development?

- a) The flow of data between processes is described by using four symbols: data flow, process, data store, and external entity.
- b) The functions of a system are described from a top-level overview down to details in a stepwise manner.
- c) The overall structure of a program is represented in the form of a hierarchical structure.
- d) The triggers that change the state, such as the passage of time and the change in control signal, and the operations performed as a result are described.

Q52. Among the software development activities, which of the following is an explanation of refactoring?

- a) In order to improve the maintainability of a program, its internal structure is modified without any change of the external specifications.
- b) In order to improve the quality of a program, two programmers cooperate with each other and perform the coding of a single program.
- c) In order to obtain feedback from users, the prototype of a program to be provided is created at an early stage.
- d) In order to promptly develop a program to be operated, test cases are set in advance, and then the program is coded.

Q46. The diagrams used in UML 2.x (including 2.0 and later versions) are categorized into two types of diagrams: structure diagrams and behavior diagrams. Structure diagrams show the static structure of the objects in a system. Behavior diagrams show the dynamic behavior of the objects in a system. Which of the following is an appropriate combination of diagrams that belong to each category?

	Structure diagram	Behavior diagram
a)	Class diagram Component diagram	Sequence diagram Use case diagram
b)	Component diagram Object diagram	Communication diagram Deployment diagram
c)	Deployment diagram Object diagram	Activity diagram Component diagram
d)	Object diagram Use case diagram	Sequence diagram State machine diagram

Q47. According to the ISO/IEC 25010 standard, the quality properties of a software product or system are categorized into eight characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Which of the following is the appropriate explanation of “performance efficiency”?

- a) Degree to which a product or system can be used by specified users to achieve specified goals in a specified context of use
- b) Degree to which a product or system provides capabilities relative to the amount of resources used under stated conditions
- c) Degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions
- d) Degree to which a system, product, or component performs specified functions under specified conditions for a specified period of time

Q48. Which of the following is an appropriate deliverable that must be approved when the external design of a system is completed?

- a) Physical database specification
- b) Program flowchart plan
- c) Screen layout
- d) System development

Q49. In terms of the test coverage of a program module, which of the following is an appropriate explanation of the relationship between path coverage, branch coverage, and statement coverage?

- a) 100% branch coverage implies 100% path coverage but not statement coverage.
- b) 100% path coverage implies 100% statement coverage but not branch coverage.
- c) 100% path coverage implies both 100% branch coverage and statement coverage.
- d) 100% statement coverage implies 100% branch coverage but not path coverage.

Q50. When an integration test is performed by using the top-down approach, which of the following is particularly necessary?

- a) Debugger
- b) Driver
- c) Emulator
- d) Stub

Q49. Among the diagrams used in UML 2.x, which of the following is the diagram that can represent the interactions based on messages sent or received between objects?

- a) Component diagram
- b) Sequence diagram
- c) State machine diagram
- d) Use case diagram

Q50. When a system is developed by using object-oriented approach, which of the following is the effect of encapsulation?

- a) A new class is derived as a child class, so the child class can use any necessary attributes of its parent class.
- b) An increase in the types of objects receiving messages does not affect the objects sending messages, because each object responds to the same message in a different way.
- c) In addition to existing types, user-defined types can be used, so the specification of a program can be extended according to the problem area.
- d) When the internal data structure or the implementation of a method for an object is changed, other objects are not susceptible to the change.

Q51. Which of the following is an appropriate description concerning the black box test?

- a) Even if the program to be tested contains redundant code, such kind of code cannot be detected.
- b) In consideration of the internal structure of the program, it is verified whether or not the necessary path is executed.
- c) The amount of test data increases rapidly with an increase in the number of branch instructions or modules.
- d) The coverage rates of instructions and branches are used as criteria for creating test data.

Q52. Which of the following is the appropriate category of system maintenance that is performed for the purpose of adding new features to an existing system or enhancing existing features?

- a) Adaptive maintenance
- b) Corrective maintenance
- c) Perfective maintenance
- d) Preventive maintenance

Q53. Which of the following is an appropriate explanation of Agile software development methodology?

- a) A model in which the system is developed by enlarging the scale of the development functions while repeating a series of development processes over and over and by minimizing various risks such as a development cost increase
- b) A model in which trial software is created in an early stage of development in order to determine user interfaces and system performance such as responsiveness, and to reduce the risk of rework caused by specification changes in subsequent stages
- c) A model that encompasses a group of adaptive, iterative, and incremental development methods, such as XP and Scrum, and focuses on collaboration and responding to changes in the shortest period of time in a sustainable manner
- d) A model that prescribes a series of development phases in which development process flows downwards without going back to an earlier phase once it is completed, and each phase has its distinct set of deliverables used for the succeeding phase

Q54. Which of the following is the order that activities *A* through *F* are performed in a system development process using a waterfall model?

[Description of activities]

A: Investigating and analyzing current problems, and defining requirements for the target system

B: Dividing functions required for the system into programs, and clarifying the flow of processing

C: Designing detailed procedures, and writing code

D: Performing tests

E: Designing the internal structure of each program

F: Defining functions needed as the system on the basis of the system requirements specifications

a) *A, B, F, C, E, D*

b) *A, F, B, E, C, D*

c) *A, F, B, E, D, C*

d) *A, F, E, B, C, D*

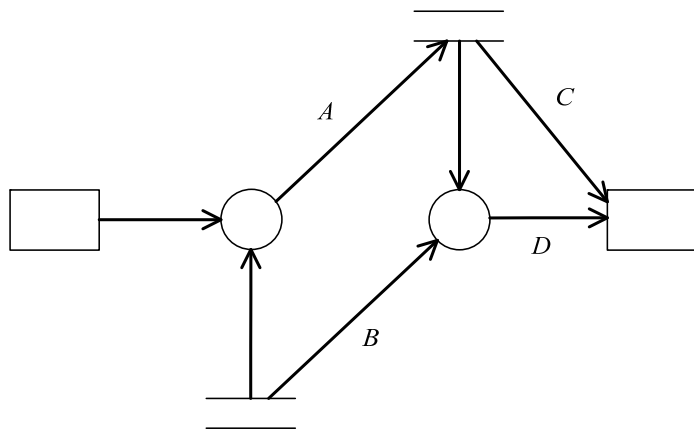
Q55. In the development process, which of the following is an activity that should be performed in software architecture design?

- a) Analyzing the requirements on a step-by-step-basis by using the form of a chart
- b) Deciding how to implement the software requirements that are already defined
- c) Deciding the specifications according to the baseline of customer opinions
- d) Describing the specifications so that the program is clarified on a line-by-line basis

Q47. In a UML class diagram, which of the following is a direct relationship between one object in a class and another object in another class and is graphically represented as a solid line with or without an arrow?

- a) Association b) Dependency c) Inheritance d) Realization

Q48. Which of the following is an **invalid** data flow in the DFD shown below?



a) *A*

b) *B*

c) *C*

d) *D*

Q49. Which of the following is an appropriate description concerning test data for a white box test?

- a) Test data is created on the basis of external specifications.
- b) Test data is created on the basis of internal structures.
- c) Test data is created on the basis of the relationships between input and output.
- d) Test data is created using equivalence partitioning.

Q50. When the quality of a software product is evaluated using the ISO/IEC 25000 series of standards, which of the following is an appropriate quality characteristic that means the capability of the software product to maintain a specified level of performance when it is used under specified conditions?

- a) Functional suitability
- b) Maintainability
- c) Performance efficiency
- d) Reliability

Q51. Which of the following is a type of integration test in which all the related program modules are combined and tested at once regardless of the hierarchical structure after the unit test for each module is completed?

- a) Big bang test
- b) Bottom-up test
- c) Sandwich test
- d) Top-down test

Q52. Among the maintenance activities of a system, which of the following is an appropriate description of adaptive maintenance?

- a) Existing issues or defects are identified and corrected on an as-needed basis.
- b) New features are added to an existing system, or existing features are improved.
- c) Periodic monitoring or inspection is performed to prevent service interruptions.
- d) The system is modified to cope with changes in the external environments.

Q53. Which of the following is an explanation of reverse engineering of software?

- a) The existing software is analyzed, and its specification and internal structure are clarified.
- b) The internal structure of software is changed without changing the behavior seen from the outside.
- c) The new software is developed on the basis of the in-depth analysis of the existing software.
- d) The source code is automatically generated from the design information by using a CASE tool.

Q57. Which of the following is an appropriate inspection item that should be included in an operational test?

- a) Ensuring that the algorithm used in each software item is reasonably acceptable
- b) Ensuring that the consistency of the interfaces between software units is maintained
- c) Ensuring that the specifications are met for each software unit
- d) Ensuring that the system satisfies the requirements from the user's viewpoint

Q46. Which of the following is an appropriate description concerning a use case diagram in UML?

- a) It is used to describe the sequence of states that an object goes through in response to external events.
- b) It is used to model the functional, informational, behavioral, and organizational workflow perspectives.
- c) It is used to represent mutual actions by means of messages sent and received between objects.
- d) It is used to show what system functions are performed for which actor, from the user's perspective.

Q47. During system development, a domain model is often created as part of the business modeling activities. Among the diagrams in UML, which of the following is the diagram that contains the implementation view of the entities in the domain model?

- a) Class diagram
- b) Communication diagram
- c) Object diagram
- d) Use case diagram

Q48. In UML, the state machine diagram (previously called statechart diagram) is used for describing the state machine model of a target system. Which of the following is an appropriate description of the state machine diagram?

- a) It shows how data flows in the system through a sequence of processes.
- b) It shows how the system responds to internal and external events.
- c) It shows relationships among objects in the system at a point in time.
- d) It shows the flow of events from one activity to another.

Q49. In the course of object oriented design, which of the following can be regarded as a subclass of the base class “automobile”?

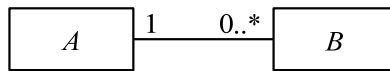
- a) Engine
- b) Serial number
- c) Tire
- d) Truck

Q50. The integration test for software that is composed of a set of modules arranged in a hierarchical structure is performed from a high-level module. In such a case, which of the following is a test module that is used as a substitute for the low-level module?

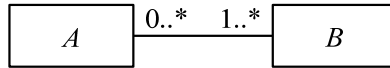
- a) Driver
- b) Emulator
- c) Simulator
- d) Stub

Q51. When the data model conforms to the notation described below, which of the following is an appropriate description concerning the interpretation of the E-R diagram shown below?

[Notation]

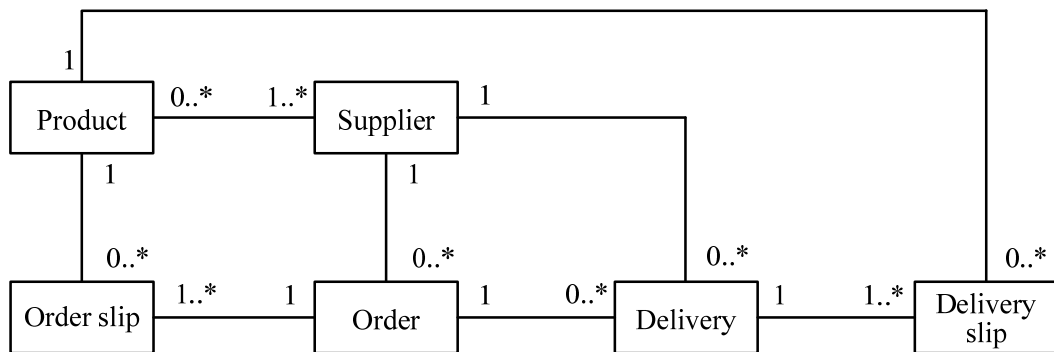


One data item of entity A corresponds to n ($n \geq 0$) data items of entity B , and one data item of entity B corresponds to one data item of entity A .



One data item of entity A corresponds to n ($n \geq 1$) data items of entity B , and one data item of entity B corresponds to m ($m \geq 0$) data items of entity A .

[E-R diagram]



- A single order is not made from multiple suppliers.
- Multiple products are not ordered with a single order.
- Order slips correspond to delivery slips on a one-to-one basis.
- The identical product is purchased from a single supplier.

Q52. Which of the following is the software development process model that aims to achieve a high degree of completion of a system by dividing the system into some subsystems and repeating the development cycle for each subsystem in consideration of minimizing the risk in each cycle?

- a) Evolutional model
- b) Incremental model
- c) Spiral model
- d) Waterfall model

Q53. Which of the following is the most appropriate description concerning maintenance management that is to be planned for the development environment of an embedded system used during the development of a product?

- a) It is necessary that the development environment leased from a rental company be always maintained under the responsibility of the rental company.
- b) It is necessary to maintain the development environment by updating it to reflect the latest status, even if it is not frequently used.
- c) It is necessary to maintain the development environment such as through periodic operational checks regardless of usage frequency.
- d) It is not necessary to maintain the development environment after the commercialization of the product because the environment is not used again.

Q27. Which of the following is categorized as a function of a static testing tool?

- a) It analyzes source code and detects errors in the program.
- b) It calculates the test coverage from the paths that are executed by the test.
- c) It generates the data for testing the specific path in a program.
- d) It generates the drivers or stubs necessary for a module to be tested.

Q48. Which of the following provides a standard set of graphical notations or diagrams for specifying, visualizing, designing, and documenting object-oriented systems?

- a) DFD b) DML c) UML d) XML

Q49. Which of the following can be represented in an E-R diagram?

- a) The relationship between data and processes
- b) The relationship between entities
- c) The relationship between entity types and instances
- d) The relationship between processes

Q50. Which of the following is a type of software test that is performed in order to ensure that changes made for software maintenance do not affect any other unintended parts of the software?

- a) Integration test
- b) Operational test
- c) Regression test
- d) System test

Q51. In a UML class diagram, which of the following is a relationship in which objects from the “whole” class control the lifetime of objects from the “part” class and which is graphically represented as a solid line with a filled diamond next to the class playing the “whole” role?

- a) Aggregation b) Composition c) Inheritance d) Realization

Q52. When software components written in a low-level programming language are used to perform time-critical arithmetic operations on a very large amount of data, which of the following is expected to be improved among the eight software product quality characteristics defined in the ISO/IEC 25000 series of standards?

- | | |
|---------------------------|----------------|
| a) Functional suitability | b) Operability |
| c) Performance efficiency | d) Reliability |

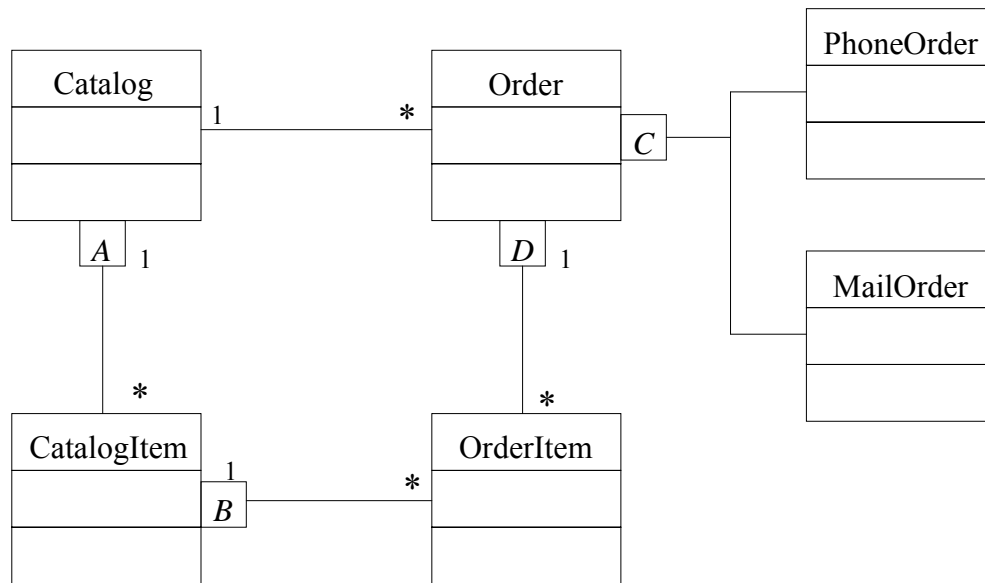
Q53. Which of the following is a characteristic of object orientation?

- a) Encapsulation can increase interdependency between objects.
- b) Inheritance can localize the changes necessary to expand or modify a model.
- c) Operations on an object for abstraction must be specified in advance.
- d) When a class is changed, all higher-level classes must also be changed.

Q54. In software development, which of the following is the method that is used to test the functions of modules in accordance with specifications without respect to their internal structures?

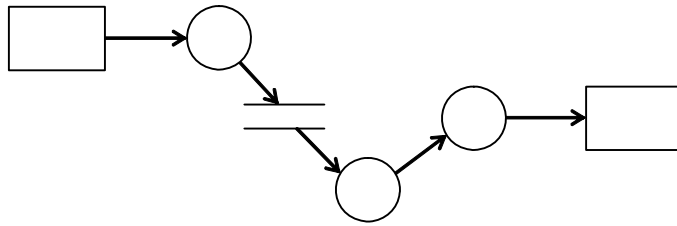
- a) Black box test
- b) Regression test
- c) Top-down test
- d) White box test

Q47. The class diagram below shows part of an ordering system used for mail order and teleshopping. Which of the following is the most appropriate combination of relations that should be inserted into blanks *A* through *D* in order to complete the diagram?



	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
a)	(Aggregation)	(Navigability)	(Generalization)	(Composition)
b)	(Composition)	(Generalization)	(Navigability)	(Aggregation)
c)	(Generalization)	(Composition)	(Aggregation)	(Navigability)
d)	(Navigability)	(Aggregation)	(Composition)	(Generalization)

Q48. The figure below shows an example of a DFD used in structured analysis. What does the symbol “ ” represent in the figure?



- | | |
|--------------------|---------------|
| a) Data flow | b) Data store |
| c) External entity | d) Process |

Q49. Which of the following is a diagram that is used for modeling the event-driven or discrete behavior of an object in UML 2.x (i.e., UML 2.0 or later)?

- a) Activity diagram
- b) Object diagram
- c) Sequence diagram
- d) State machine diagram

Q50. From internal and external viewpoints concerning software product development and maintenance, which of the following is an appropriate quality characteristic that includes several sub-characteristics such as maturity, fault tolerance, recoverability, and availability?

- | | |
|---------------------------|--------------------|
| a) Functional suitability | b) Maintainability |
| c) Portability | d) Reliability |

Q51. Which of the following is a type of integration test that has the characteristics listed below?

[Characteristics]

- All of the related program modules are combined and tested at once.
- Neither drivers nor stubs are required.
- It is useful for small programs, but not for commercial development projects.

- | | |
|------------------|-------------------|
| a) Big bang test | b) Bottom-up test |
| c) Sandwich test | d) Top-down test |

Q52. Which of the following is a typical method that is contained in agile software development?

- a) Dynamic programming
- b) Extreme programming
- c) Server-side programming
- d) Web programming

Q23. Which of the following is the appropriate CASE tool that is prepared especially for the software development phases including program design, programming, and testing?

- a) Component CASE tool
- b) Integrated CASE tool
- c) Lower CASE tool
- d) Upper CASE tool

Q48. Which of the following is a diagram used in UML2.0 for the purpose of depicting the interactions between the system, external systems, and users, or graphically describing who uses the system and in what ways the user expects to interact with the system?

- a) Component diagram
- b) Deployment diagram
- c) Sequence diagram
- d) Use case diagram

Q49. Which of the following is the most appropriate statement concerning the use of frameworks in software development?

- a) Compiled programs written with the use of a framework can run on different platforms without modification and re-compilation.
- b) Frameworks can shorten the development period for software projects by taking advantage of the work and experience of others.
- c) Programs using frameworks are generally faster because frameworks are typically optimized for performance and efficiency.
- d) Use of frameworks eliminates programming errors by promoting reuse of design and algorithms and allowing programmers to focus on application logic.

Q50. In software development, which of the following is the most appropriate primary purpose of performing a system test?

- a) To verify the functionality and operability of the deliverables principally on developer's own responsibility in the production environment
- b) To verify the functionality of each software component on programmer's own responsibility
- c) To verify the functionality of multiple software components as well as the interfaces between the components
- d) To verify the operational readiness and determine whether the software is acceptable to end users

Q51. In object-oriented design, which of the following is a way to form new classes using classes that have already been defined and to take over data structures and procedures of the pre-existing classes referred to as base classes?

- a) Delegation b) Encapsulation c) Inheritance d) Polymorphism

Q52. Which of the following is an activity to be performed in software architecture design within the development process?

- a) Clarifying the details of the processing executed by each line of the program
- b) Determining how to implement software requirements already defined
- c) Finalizing specifications based on customer opinions
- d) Organizing the requirements in charts to analyze them in step-by-step detail

Q53. In a software test phase, when a bug control chart is used to evaluate test progress and software quality, which of the following is the most appropriate perspective to consider?

- a) If the cumulative total number of completed test items, the cumulative total number of bugs, and the number of unresolved bugs all remain unchanged, it is necessary to check if the software has a bug that is hard to resolve.
- b) If the test items are processed as scheduled and there are not so many unresolved bugs, software quality is considered to be high even when the cumulative total number of bugs does not increase.
- c) The schedule is delayed because of more bugs than expected during the first half of the test phase, and then is reviewed on the assumption that the test phase is completed with a delay of a few days.
- d) The test completion date can be almost exactly predicted from the changes in the cumulative total number of bugs and the number of unfinished test items, regardless of the number of unresolved bugs.

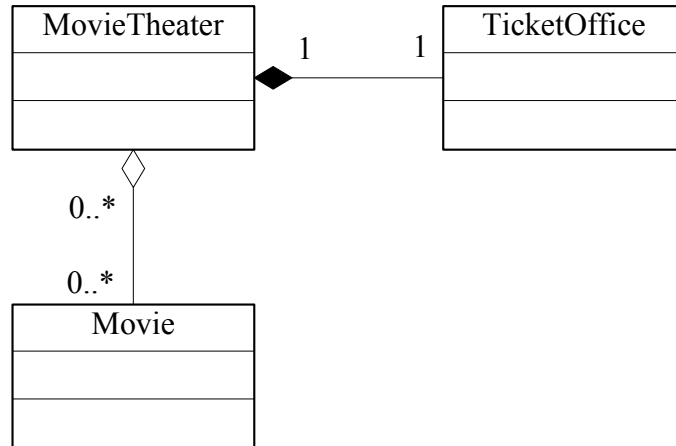
Q54. Which of the following is a technique that analyzes software or hardware and creates a design document, such as an E-R diagram based on the definition information of database system in the production environment?

- a) Concurrent engineering
- b) Forward engineering
- c) Reverse engineering
- d) Social engineering

Q46. Among UML diagrams, which of the following is the most appropriate diagram that can describe more easily dynamic behaviors of business process and events triggering the process, and can also represent various workflow routing types such as sequential routing, join, split, iteration, and parallel routing?

- a) Activity diagram
- b) Communication diagram
- c) Sequence diagram
- d) State machine diagram

Q47. Which of the following is the appropriate relationship between “MovieTheater” and “TicketOffice” shown in the class diagram below?



- a) Aggregation
- b) Association
- c) Composition
- d) Generalization

Q48. Which of the following is the technique that is used to redesign or reorganize an existing body of program code without changing its externally observable behavior?

- a) Reengineering
- b) Refactoring
- c) Restructuring
- d) Reverse engineering

Q49. There is a program module that is executed only when the value of an integer variable x is within the range of 50 through 100 ($50 \leq x \leq 100$). When this module is tested using the boundary value analysis, which of the following is the appropriate combination of the values to be tested?

- a) 49, 50, 99, 100
- b) 49, 50, 100, 101
- c) 50, 51, 99, 100
- d) 50, 51, 100, 101

Q50. The test phase of software development can be divided into four stages: unit test, integration test, system test, and operational test. When the descriptions *A* through *D* shown below are applied to the four stages, which of the following is the appropriate combination of each stage and its description?

A: The test is done by developers in order to confirm the overall system functions.

B: The test is done, mainly to check interface between modules or components.

C: The test is done on a module or component basis.

D: The test is done under the production environment, and users take a key role in testing.

	Unit test	Integration test	System test	Operational test
a)	<i>B</i>	<i>C</i>	<i>A</i>	<i>D</i>
b)	<i>B</i>	<i>C</i>	<i>D</i>	<i>A</i>
c)	<i>C</i>	<i>B</i>	<i>A</i>	<i>D</i>
d)	<i>C</i>	<i>B</i>	<i>D</i>	<i>A</i>

Q51. Which of the following is an appropriate activity to be performed in the first phase of system development?

- a) Analyzing the current business operations and organizing system requirements
- b) Designing the internal structure of each program
- c) Designing the user interface
- d) Dividing subsystems into programs and designing the details of each program

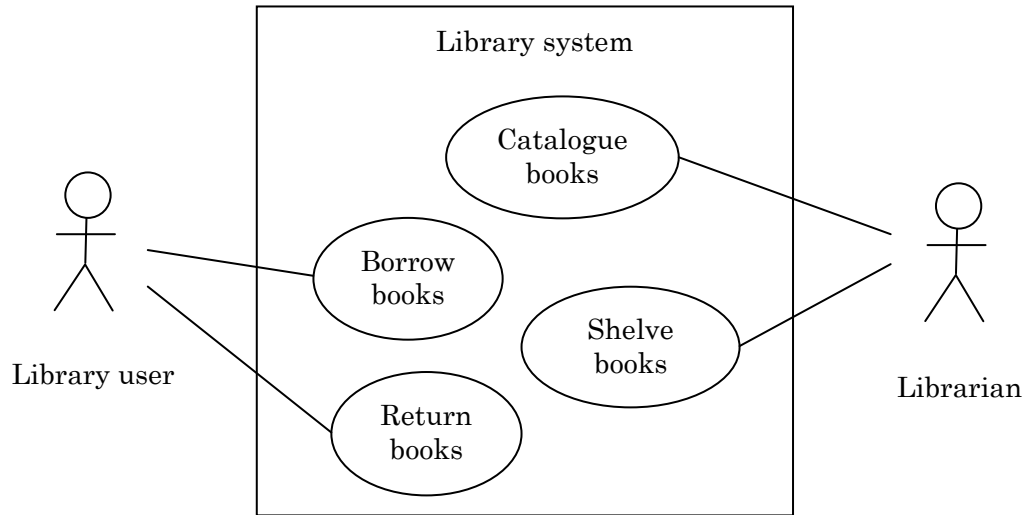
Q52. Which of the following is an explanation of the waterfall model in system development?

- a) Instead of building complicated software from scratch, the development starts by repeating analysis, design, implementation, and testing of simple parts, and gradually expands its scale.
- b) Instead of building everything at once, the system is developed in incremental steps on the top of the basic system architecture according to the priority of each function.
- c) Development makes progress by creating a prototype and receiving feedback on user requests.
- d) The development process is divided into some phases, such as design, implementation, and test. Once a phase is completed, its deliverables are used for conducting the next phase.

Q53. Which of the following is the most appropriate description concerning maintenance and management activities that are performed in a development environment for embedded systems used during the development of a product?

- a) It is desirable to maintain and manage the development environment by updating it to the latest environment, even if it is not frequently used.
- b) It is desirable to maintain and manage the development environment such as through periodic operational checks regardless of usage frequency.
- c) It is not necessary to maintain the development environment after the commercialization of the product because the environment is not used again.
- d) The development environment leased from a rental company is always maintained under the responsibility of the rental company.

Q47. The diagram shown below depicts who can use the system and in what ways the users (or external systems) expect to interact with the system. What is this type of diagram called?



- a) Activity diagram
- b) Data flow diagram
- c) Entity relationship diagram
- d) Use case diagram

Q48. Which of the following is an appropriate description concerning object-oriented design?

- a) “Aggregation” is the feature that allows values of different data types to be handled using a uniform interface.
- b) “Encapsulation” is the technique to integrate data and operational procedures as an object and hide implementation details from the outside.
- c) “Inheritance” is the property of an object where data or methods in the subclass can be used in the super class.
- d) “Method” sent to an object is the only means of performing its specific functions.

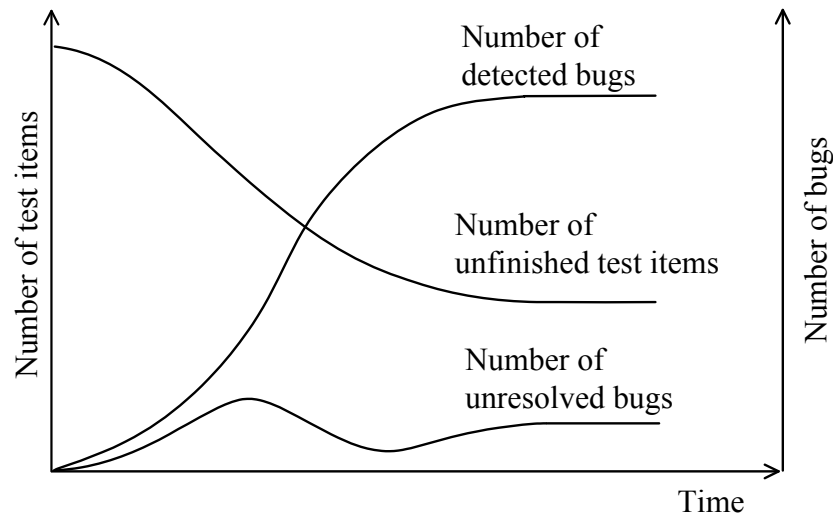
Q49. Which of the following is an appropriate combination of the fundamental object-oriented concepts?

- a) Abstraction, encapsulation, inheritance, class
- b) Materialization, structuring, continuity, class
- c) Normalization, encapsulation, division, class
- d) Virtualization, structuring, projection, class

Q50. In software development, it is a good practice to develop highly independent modules. When module independence depends primarily on two measures, module strength (or cohesion) and module coupling, which of the following is the appropriate combination of good programming practices?

	Module strength	Module coupling
a)	High	High
b)	High	Low
c)	Low	High
d)	Low	Low

Q51. As shown in the figure below, all the lines show signs of leveling off in the control chart of a program test. Which of the following can be inferred from this condition?



- a) Numerous bugs have occurred, and the number of completed test items has stopped rising.
- b) The bug occurrence and test item completion rates match, and there are no more unresolved bugs.
- c) The number of completed test items has risen, and bugs have stopped occurring.
- d) The process is facing some bugs that are difficult to resolve, and subsequent tests are not proceeding.

Q52. Which of the following is the test that is performed to ensure that the components and modules of a system can communicate with one another in accordance with the functional specifications and design?

- a) Integration test
- b) Operational test
- c) System test
- d) Unit test

Q53. Which of the following is the software development process model that incorporates the best features of both the classic lifecycle and the prototyping approaches, by beginning each repeated development cycle with extensive risk analysis throughout the entire software development life cycle for large-scale applications?

- a) Evolution model
- b) Growth model
- c) Spiral model
- d) Waterfall model

Q54. Which of the following is an appropriate description concerning the maturity level in the staged representation of CMMI?

- a) At the “defined” level, processes are statistically measured and controlled.
- b) At the “initial” level, processes are characterized for projects and are often reactive.
- c) At the “managed” level, processes are documented and followed.
- d) At the “quantitatively managed” level, processes are continually improved.

Q49. Which of the following systems is the most suitable for a design using a state transition diagram?

- a) A greenhouse control system, which keeps the optimum environment in a greenhouse based on the information of the installed sensors
- b) A water bill accounting system, which calculates charges from the data of water meters
- c) An inventory-taking system, which counts the inventory assets at the end of each month and at book closing
- d) An operations measurement system for system resources, which measures the operational status of the system resources, and generates a report

Q50. Which of the following appropriately describes “efficiency” that is one of six software quality characteristics defined in ISO/IEC 9126-1?

- a) The capability of the software product to be modified: Modifications may include corrections, improvements, or adaptation of the software to changes in environment, and in requirements and functional specifications.
- b) The capability of the software product to be transferred from one environment to another
- c) The capability of the software product to be understood, learned, used, and attractive to the user, when used under specified conditions
- d) The capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions

Q51. Which of the following is an example of the relationship between the base class and the subclass in object orientation?

- a) “Car” and “engine”
- b) “Company” and “employee”
- c) “Figure” and “triangle”
- d) “Human” and “head”

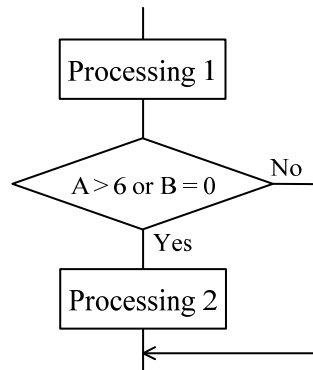
Q52. Which of the following is the appropriate purpose of regression test?

- a) To verify and assess the acceptability of the system performance under varying workloads
- b) To verify that the system can work with the actual data and operational procedures in actual environments
- c) To verify that the system operates in a stable manner for a long period of unscheduled maintenance, repair, or adjustment
- d) To verify the functionality of the upgraded system against a baseline system to ensure that any existing system capabilities have not been adversely impacted

Q53. Which of the following is the appropriate description concerning standardization in programming?

- a) Defining programming conventions is effective for preventing errors that programmers tend to make.
- b) It is effective for clarifying the standard execution time of a program to promote the creation of efficient programs.
- c) Its original purpose is not to limit an individual programming style, but to easily achieve the effect of optimization provided by a compiler.
- d) Its purpose is to define rules about common items that are independent of programming languages.

Q54. The test data about the part of a program shown in the flowchart is specified by “decision condition coverage” (branch coverage). If this test data is specified by “multiple condition coverage,” which of the following is the appropriate data to add? Here, the part enclosed in parentheses indicates the pair of test data elements.



The test data used by “decision condition coverage” (branch coverage):

(A=4, B=1), (A=5, B=0)

- a) (A=3, B=0), (A=7, B=2)
- b) (A=3, B=2), (A=8, B=0)
- c) (A=4, B=0), (A=8, B=0)
- d) (A=7, B=0), (A=8, B=2)

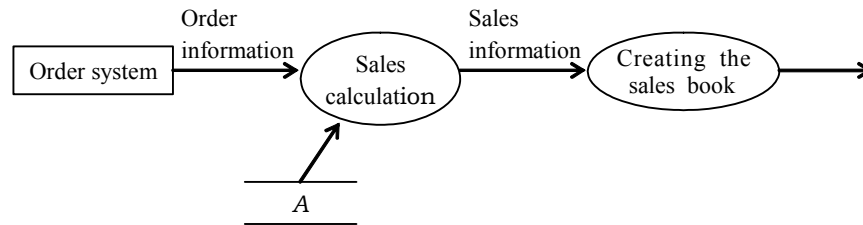
Q56. Which of the following is the model that can be used to guide process improvement and to assess the capability level and the maturity level of a project, a division, or an entire organization?

- a) CMMI b) MBNQA c) SLA d) SLCP

Q41. Which of the following is the activity performed during the external design phase in system development?

- a) Logical data design
- b) Physical data design
- c) Requirements analysis
- d) Structured program design

Q42. In the DFD for a sales management system shown below, which of the following is appropriate for item *A*?



- a) Order file
- b) Records of money received
- c) Sales file
- d) Unit price list

Q43. Which of the following is the appropriate description of the relationship between a class and an instance in the object-oriented approach?

- a) An instance defines the specification for a class.
- b) An instance is generated based on the definition of a class.
- c) Multiple classes correspond to one instance.
- d) Only one instance exists for one class.

Q44. Module coupling needs to be weakened in order to increase module independence. Which of the following has the weakest level of module coupling among methods of information transfers between modules?

- a) A control parameter is passed as an argument to control the execution sequence of modules.
- b) Data defined in a common area is referenced by related modules.
- c) Only data items are passed as arguments between modules.
- d) The required data is externally declared and shared.

Q45. Which of the following is the appropriate point to notice at the time of creating the test data for a white box test?

- a) The boundary values for each equivalent class obtained with the application of equivalence partitioning
- b) The functions of the program
- c) The internal structures, such as the algorithm, for the program
- d) The relationships between the input and output of the program

Q46. Which of the following is the appropriate purpose of design review?

- a) To find specification defects and design errors at an early stage, and reduce the person hours for rework
- b) To improve the design quality to more precisely estimate the development scale
- c) To prevent errors in the design phase, simplify the test, and improve development efficiency
- d) To review the development schedule and make it feasible

Q47. When the cost associated with information systems can be broken down into the initial cost and the running cost, which of the following is included in the initial cost?

- a) Amortization cost for equipment and facilities
- b) Development cost of application software
- c) Personnel cost associated with operations
- d) Rental or lease cost of equipment

Q37. Which of the following is an appropriate explanation of data mining?

- a) A database storage method for accumulating large volumes of chronological data such as sales performance and actual manufacturing results
- b) A parallel access method for searching large volumes of data at high speed
- c) A technique for creating departmental databases in accordance with the purpose of use
- d) A technique that uses statistical and mathematical methods to analyze large volumes of data in order to discover rules and causal relationships

Q38. Which of the following software development models is an appropriate description of the spiral model?

- a) A trial product is made at an early stage to finalize a user interface and to confirm usability, performance, and functionality so that reworks resulting from specification changes can be prevented in subsequent stages.
- b) It is a model in which a large-scale system is developed by enlarging its scale of functions through the repetition of the development cycles of design, implementation, and testing on each independent subsystem.
- c) It is a model in which a system is divided into several independent subsystems. Each subsystem is concurrently developed and released stepwise, enabling the system operations to be confirmed from the initial release even if not all of the functions are readily available.
- d) It prescribes a series of development phases in which development process flows downwards without going back to an earlier phase once it is completed, and each phase has its distinct set of deliverables used for the succeeding phase.

Q39. Which of the following tasks is performed in the external design phase of the waterfall model?

- a) Code design
- b) Detailed input/output design
- c) Module partitioning
- d) Physical file design

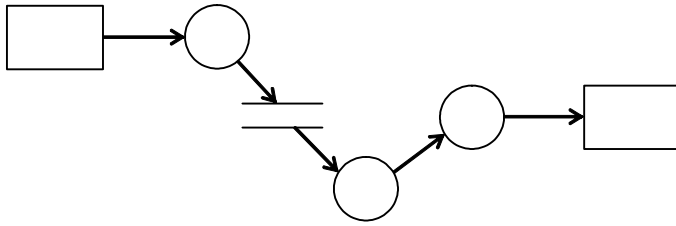
Q40. Which of the following is the most appropriate description concerning software reuse?

- a) Incentives such as commendation systems for promotion of reusing components are initially not very effective but are more effective over time.
- b) More person-hours are required for development of reusable components than for regular software development of the same scale.
- c) Reusing smaller components is more effective in reducing the development person-hours per unit than reusing larger components.
- d) The rate of person-hour reduction by reusing components is inversely proportional to the size of components.

Q41. A certain program module directly refers to the content of another module. It executes a single unique function, and some concept, data structure, or resource is hidden within the single module. From a standpoint of module independence, which of the following combinations appropriately shows the “module strength” and “module coupling” of this module?

	Module strength	Module coupling
a)	High	High
b)	High	Low
c)	Low	High
d)	Low	Low

Q42. The figure below shows an example of a DFD used in structured analysis. What does the symbol “○” in the figure represent?



- a) Activity b) Data flow c) Data store d) Process

Q43. Which of the following is an explanation of encapsulation in the object-oriented paradigm?

- a) A subclass inherits attributes from a specific base class.
- b) Attributes common to classes are extracted to create a base class.
- c) Data and its related operational procedures are hidden inside objects.
- d) Multiple objects with the same attributes are abstracted and classified.

Q44. Which of the following combinations is described in a UML class diagram?

- a) Activation, lifeline, object
- b) Attribute, operation, role name
- c) Final state, initial state, transition
- d) Link, message flow, object

Q45. Which of the following is an appropriate execution sequence in the test phase of the waterfall model?

- a) System test → Integration test → Unit test → Operational test
- b) System test → Unit test → Operational test → Integration test
- c) Unit test → Integration test → System test → Operational test
- d) Unit test → System test → Integration test → Operational test

Q46. In a narrow sense, which of the following is the most appropriate description concerning the function of a tracer that can be used for debugging purposes?

- a) It can capture the contents of designated memory each time a specific instruction is executed.
- b) It can dump the memory contents when an error occurs during the execution of a program.
- c) It can output the contents of magnetic tape files or hard disk files.
- d) It can record program flow, such as the sequence and results of execution of the program instructions.

Q38. CASE tools can be classified on the basis of the applicable development processes and phases. Which of the following classifications includes support functions for requirements analysis?

- a) Downstream
- b) Maintenance
- c) Testing
- d) Upstream

Q39. Which of the following is the method which analyzes the source or object code to retrieve information concerning program specifications and design?

- a) Reengineering
- b) Refactoring
- c) Restructuring
- d) Reverse engineering

Q40. Based on the concept of object orientation, which of the following can be commonly regarded as a subclass of the class “automobile”?

- a) Engine
- b) Serial number
- c) Tire
- d) Truck

Q41. Which of the following should be done in the internal design phase of software development processes?

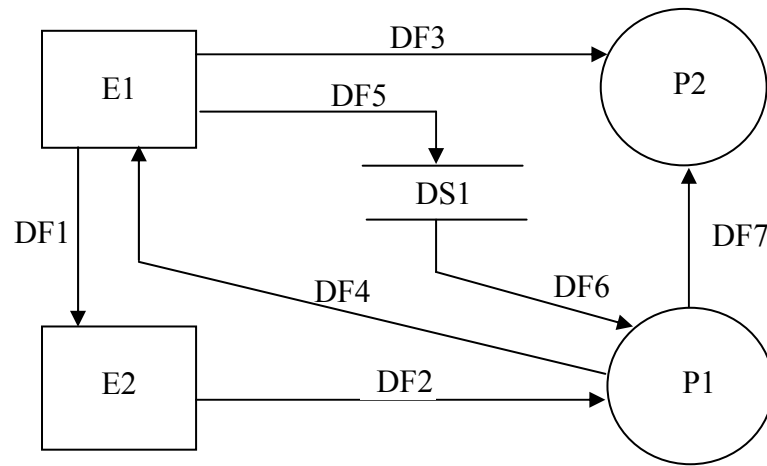
- a) Designing interfaces between subsystems
- b) Designing logical data structure
- c) Designing physical data structure
- d) Designing screen layouts

Q43. Which of the following is the appropriate sequence for drawing up a DFD model that is used to develop a new system based on the current system?

1. Current logical model
2. Current physical model
3. New logical model
4. New physical model

- a) $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$
- b) $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$
- c) $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$
- d) $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$

Q44. In DFD illustrated below, DF_i is used for data flow *i*, P_j for process *j*, E_k for source or destination of data *k*, and DS_l for data storage *l*. There are three errors (rule violations) in this DFD. One is in P₂; that is, P₂ must have at least one output data flow. The other two are in data flows. Which of the following combinations includes two rule violations, one for each data flow?



- a) DF1 and DF2
- b) DF1 and DF5
- c) DF2 and DF3
- d) DF3 and DF4

Q45. Which of the following is the appropriate characteristic of object-oriented models?

- a) A program consists of operational expressions in nested structure, commands expressing functions (operation symbols), and data. “Command execution” corresponds to “calculation (evaluation) of operational expressions or function values.”
- b) Control of computation is passed from command to command in order. Data is delivered between commands indirectly by referencing memory through the “variables.” Definitions of commands and data are separated.
- c) Data is hidden from the outside and indirectly handled by procedures called methods. A program is a collection of data and methods.
- d) The order of computation is determined by data flow, not by control flow. Commands can be executed when all the input data becomes available.

Q46. Which of the following is the test to verify interfaces both between modules and between subsystems?

- a) Integration test
- b) Operational test
- c) System test
- d) Unit test

Q47. A certain program contains the complex decision shown below:

“Condition 1” OR (“Condition 2” AND “Condition 3”)

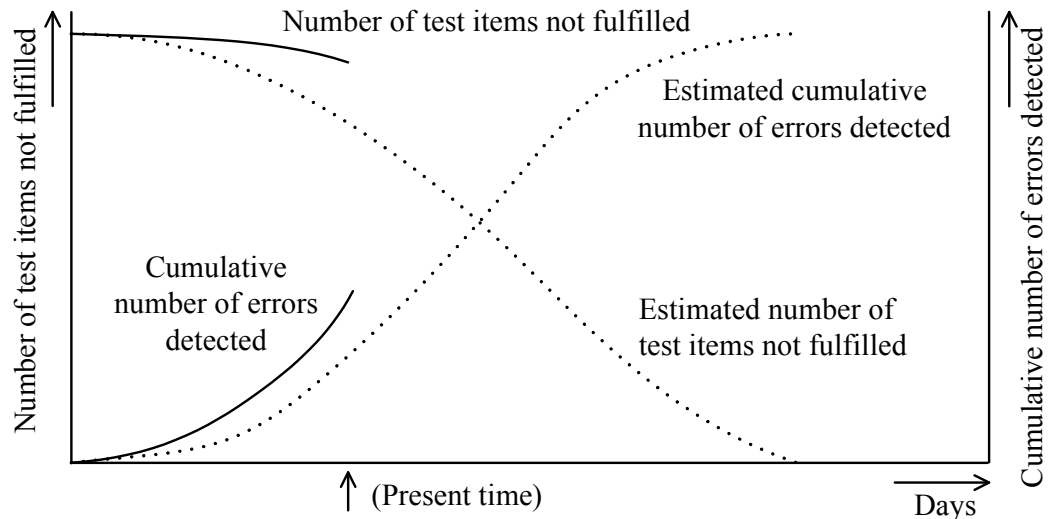
When testing based on decision-condition coverage (branch coverage), which of the following is appropriate for an additional test item?

[Test items completed]

- (1) “Condition 1” is true, “Condition 2” is false, and “Condition 3” is false.
- (2) “Condition 1” is false, “Condition 2” is true, and “Condition 3” is true.

	Condition 1	Condition 2	Condition 3
a)	false	false	true
b)	true	false	true
c)	true	true	false
d)	true	true	true

Q48. Which of the following is the appropriate interpretation of the testing-process quality control graph shown below and follow-on actions to be taken?



- Detection of errors is ahead of the pace of fulfilling the test items. The test is thus efficiently conducted. At this time there is no concern, but progress management is necessary to cope with errors in order not to leave them unresolved over a protracted period of time.
- Fulfillment of test items is fast, and detection of errors is also more advanced than expected. The test is still in the first half, so it is advisable to continue testing and see what happens.
- Fulfillment of test items is slow, so some measures should be discussed concerning the insufficiency of the testing environment and the lack of development staff members before it is too late. There is no problem with the quality, as errors are detected more often than expected.
- The resulting quality is generally rather poor, so it is necessary to take strong measures against places in which errors occur frequently; the quality status of the preceding process should be reviewed and do it over again if necessary.

Q52. In software maintenance, which of the following tests is performed to ensure that fixes or modifications do not affect other, unchanged parts of the software?

- a) Endurance test
- b) Exception handling test
- c) Performance test
- d) Regression test

Q71. Which of the following is UML standardized by OMG?

- a) Description language of an interface for using objects from other programs
- b) Manipulation language for relational databases, which defines tables and handles data
- c) Mark-up language to describe meanings and structure of a file or data
- d) Modeling language used in software development using object orientation

Q37. Which of the following is an appropriate description concerning the spiral model?

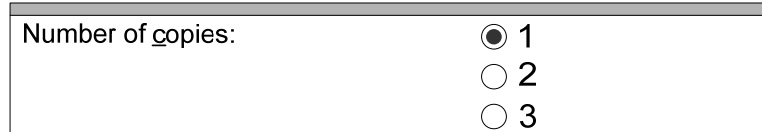
- a) A prototype is created for each phase of the waterfall model and the specifications are checked, in order to eliminate the difficulty of checking the specifications required by documents.
- b) System development proceeds in the order of process flow, so going back upstream results in a significant loss of efficiency.
- c) Systems are developed in a short time by involving users, performing development in small groups and utilizing development tools.
- d) The design and implementation of an application is performed for a unit of component, and then this process is repeated successively for every component.

Q38. In the GUI design of visual panels, how to input the data of “Number of copies” is under review. If there are both keyboard and mouse available as input devices, which of the following options is the best choice that can be acceptable to a wide range of users? Here, the value of “Number of copies” can range from 1 up to the maximum number of copies.

a) [Drop-down list]

A GUI design for a drop-down list. It consists of a rectangular box with a light gray border. Inside the box, on the left, is the text "Number of copies:". To the right of this text is a smaller rectangular box containing the number "1". To the right of the "1" is a small square button with a downward-pointing arrow.

b) [Radio button]

A GUI design for radio buttons. It consists of a rectangular box with a light gray border. Inside the box, on the left, is the text "Number of copies:". To the right of this text are three radio buttons arranged vertically. The first radio button is selected (filled with a black dot) and is followed by the number "1". The second radio button is followed by the number "2". The third radio button is followed by the number "3".

c) [Spin box]

A GUI design for a spin box. It consists of a rectangular box with a light gray border. Inside the box, on the left, is the text "Number of copies:". To the right of this text is a smaller rectangular box containing the number "1". To the right of the "1" is a small square button with up and down arrows.

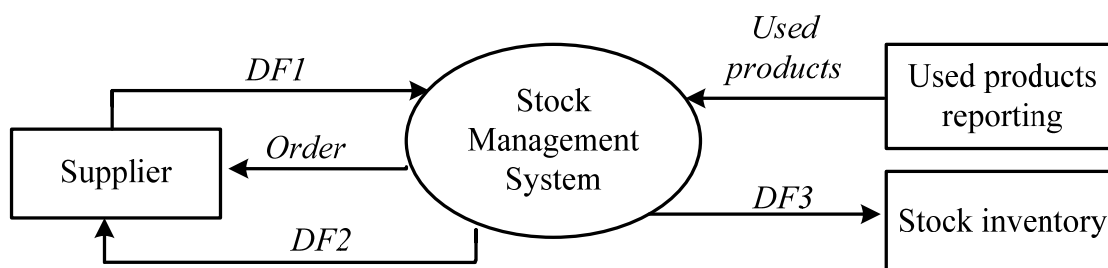
d) [Text input field]

A GUI design for a text input field. It consists of a rectangular box with a light gray border. Inside the box, on the left, is the text "Number of copies:". To the right of this text is a rectangular box containing the number "1".

Q39. Which of the following characteristics can be found in well-designed modules with a high degree of independence?

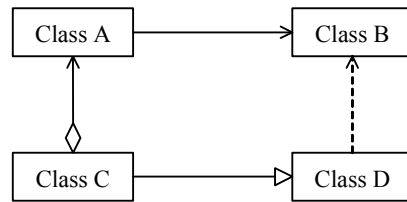
- a) High coupling and high cohesion
- b) High coupling and low cohesion
- c) Low coupling and high cohesion
- d) Low coupling and low cohesion

Q40. In the context diagram illustrated below, which of the following combinations appropriately describes data flows *DF1*, *DF2*, and *DF3*?



	<i>DF1</i>	<i>DF2</i>	<i>DF3</i>
a	Delivery invoice	In-stock inventory	Payment bill
b	Delivery invoice	Payment bill	In-stock inventory
c	In-stock inventory	Payment bill	Delivery invoice
d	Payment bill	Delivery invoice	In-stock inventory

Q41. Which classes are in the relationship of aggregation in the UML class diagram shown below?



- a) Class A and Class B
- b) Class A and Class C
- c) Class B and Class D
- d) Class C and Class D

Q42. In object orientation, the term “open (white box) reuse” refers to the reusing of base-class data and functions by creating subclasses for the base class. Which of the following is the appropriate description concerning the reuse technology in object orientation of this method?

- a) Changes in the base class do not affect the subclasses.
- b) Only differences between the data and functions defined by the base class and those of subclasses can be stated in subclasses, so development is highly efficient.
- c) Since the data defined in the base class is protected, programs with a high degree of safety can be developed.
- d) The base class can be used to develop multiple applications, but its subclasses cannot be re-used.

Q43. Which of the following is the method in which the designer and a group of involved personnel review the design documents at the completion of each design for the purpose of early detection of design errors?

- a) Desktop debugging
- b) Parallel simulation
- c) Top-down testing
- d) Walk-through

Q45. Which of the following appropriately explains a tracer as one of the dynamic debugging tools?

- a) At an abnormal end of the program, it outputs the contents of the memory and registers.
- b) Every time it executes code for debugging, which is embedded in the program, it outputs the contents of the memory and registers.
- c) It creates a pseudo-environment necessary for the execution of the program.
- d) It outputs the contents of the memory and registers in order to monitor the results of the program execution in chronological order.

Q47. Which of the following is the appropriate combination of basic concepts of object-oriented approach?

- a) Abstraction, encapsulation, inheritance, and class
- b) Instantiation, Structuralization, sequence, and class
- c) Normalization, encapsulation, division, and class
- d) Virtualization, Structuralization, projection, and class

Q48. Which of the following is the appropriate characteristic of “data oriented design” as compared with “process oriented design?”

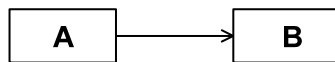
- a) Data modeling is performed prior to the modeling of business operations.
- b) Data oriented design is effective for building a specific business application system in a short period of time.
- c) It is possible to consider data as shared resources and to manage it in a unified manner.
- d) It is possible to create data structures combined with business processes.

Q49. Which of the following is the appropriate program that supports dynamic processing in a Web environment and runs only on a Web server?

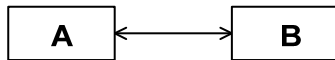
- | | |
|-----------------|---------------|
| a) Java applet | b) JavaScript |
| c) Java servlet | d) VBScript |

Q50. When the data model is represented to conform to the notational convention shown below, which of the following statements appropriately interprets the designated E-R diagram?

[Notational convention]

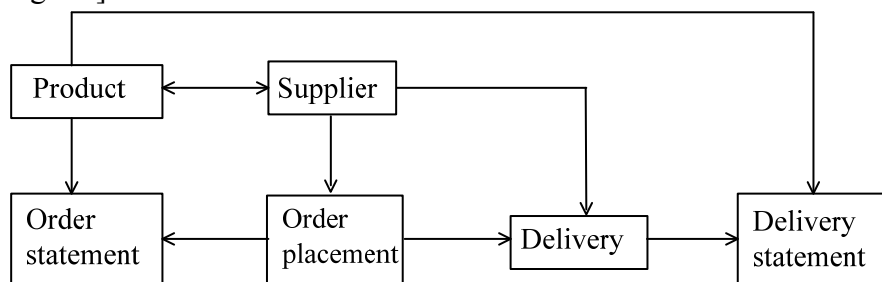


One of the data in entity **A** corresponds to “ n ” ($n \geq 0$) pieces of the data in entity **B**, and one of the data in entity **B** corresponds to one of the data in entity **A**.



One of the data in entity **A** corresponds to “ n ” ($n \geq 0$) pieces of the data in entity **B**, and one of the data in entity **B** corresponds to “ m ” ($m \geq 0$) pieces of the data in entity **A**.

[E-R diagram]



- A single product is supplied by a single supplier.
- It does not occur that a single order placement is given for multiple types of products.
- It does not occur that a single order placement is given to multiple suppliers.
- Order statements and delivery statements have a one-to-one correspondence.

Q51. Which of the following design tasks is performed from the standpoint of the system developer, based on the deliverables of external design and in consideration of the implementation method and processing efficiency?

- a) Code design
- b) Functional decomposition and structured design
- c) Logical data design
- d) Screen flow design

Q52. Which of the following is the appropriate sequence of DB application development activities?

- a) Conceptual design → Database planning → Data conversion → Physical design
- b) Conceptual design → Database planning → Physical design → Data conversion
- c) Database planning → Conceptual design → Physical design → Data conversion
- d) Database planning → Physical design → Conceptual design → Data conversion

Q53. Which of the following is the appropriate statement concerning how to illustrate data flows (arrows) in DFD?

- a) Each data store must be connected to another data store with at least one data flow.
- b) Each data store must have at least one data flow in and one data flow out.
- c) Each external entity must be connected to another external entity with at least one data flow.
- d) Each process must have at least one data flow in and one data flow out.

Q54. Which of the following is the appropriate description concerning the functions of “driver” or “stub” used in the module test?

- a) “Driver” calls the module to be tested while passing arguments to it.
- b) “Driver” is a module that is called from the module to be tested.
- c) “Stub” displays and prints the value returned by the module to be tested.
- d) “Stub” is a module that calls the module to be tested.

Q55. Which of the following is the appropriate description concerning black box testing?

- a) Attention is focused on the internal structures of programs, and verification is made as to whether necessary portions are executed.
- b) Even if any redundant code exists in a tested program, it cannot be detected.
- c) If branch instructions and modules increase in number, the amount of test data also leaps upward.
- d) The test case coverage is used as criteria for preparing test data.

Q58. Which of the following appropriately describes the purpose of using a check digit?

- a) To detect an error of the inputted code value
- b) To detect an error of the number of inputted code digits
- c) To detect an error that alphabetic characters and/or symbols are mixed in data inputted into the numerical item
- d) To detect an error that the inputted data value is out of the predefined range

Q45. Which of the following is an appropriate description concerning a tracer that is used as a debugging tool?

- a) It outputs history information such as execution sequences and execution results of program instructions.
- b) It outputs the contents of a specified memory each time a specific instruction in a program is executed.
- c) It outputs the contents of magnetic tape files and hard disk files.
- d) It outputs the contents of the relevant memory when an error occurs during the execution of a program.

Q46. Which of the following is an appropriate description in regard to a waterfall model?

- a) System development proceeds in the order of process flow, so going back upstream results in a significant loss of efficiency.
- b) Systems are developed in a short time by involving users, performing development in small groups and utilizing development tools.
- c) The design and implementation of an application is performed for a unit of component, and then this process is repeated successively for every component.
- d) Working prototypes are created to verify and evaluate requirements specifications at an early stage.

Q47. Which of the following is an appropriate description concerning object-oriented design?

- a) A class always has at least one instance.
- b) A class can inherit attributes and methods from its base class.
- c) An object is a template for a class.
- d) Encapsulation refers to the creation of a library of classes.

Q48. Which of the following is a UML diagram that can be used to describe interactions among a number of objects in terms of an exchange of messages?

- | | |
|---------------------|---------------------|
| a) Activity diagram | b) Class diagram |
| c) Sequence diagram | d) Use case diagram |

Q49. A systems design is represented using several diagrams. When a system analyst wants to confirm the design information such as the relationships among functions and the interface among modules in a hierarchical manner, which of the following is the most appropriate diagram that should be inspected by the analyst?

- a) Data flow diagram
- b) Entity-relationship diagram
- c) State transition diagram
- d) Structured chart

Q50. In the module design of software, which of the following is the appropriate technique for improving reliability and maintainability?

- a) Module cohesion is increased, and module coupling is strengthened.
- b) Module cohesion is increased, and module coupling is weakened.
- c) Module cohesion is reduced, and module coupling is strengthened.
- d) Module cohesion is reduced, and module coupling is weakened.

Q52. Which of the following is an appropriate statement in regard to a module unit test?

- a) Generally, test cases are created and executed by dedicated testing staff, not programmers who have done the coding.
- b) The module design documents have already been verified. If a problem is found in the test results, an error exists in the test case or the module.
- c) The module interface falls outside the scope of the unit test because the module interface cannot be tested using a single module.
- d) Verification should be performed, in principle, using test cases which cover all the logic paths at least once while reviewing the module design documents.

Q53. Which of the following is an appropriate statement in regard to program testing?

- a) In the program testing, it is necessary to check not only whether the program works as intended but also whether there are any unintended operations.
- b) The black box method is used for the test of internal structure, and the white box method is used for the test of external specifications.
- c) The number of errors remaining in a program is unrelated to the number of errors already found.
- d) The objective of program testing is to verify its completeness, and the test should be planned under the assumption that all errors can be detected.

Q54. Which of the following software test methods is performed to verify whether changes made for software maintenance are not affecting other portions of the software?

- a) Integration test
- b) Operation test
- c) Regression test
- d) System test

Q57. From multiple types of slips, data in items specified for each type is inputted. Which of the following is the appropriate initial process to be executed in the program to confirm that all the required data is inputted?

- a) A comparison is made between the number of items specified for each slip type and the number of items inputted.
- b) Inputted data is checked against master files to confirm that the contents of inputted items are correct.
- c) It is confirmed that the contents of inputted items are in agreement with the data formats specified for the slip type.
- d) The slip type code is used to inspect the data formats of inputted items.

- Q58.** When the system development division and the operations division are separately organized, which of the following is an appropriate method for ensuring that the transition from development to operation proceeds smoothly and efficiently?
- a) After completion of the operation test, the development division explains the system specifications and operation methods to the operations division.
 - b) In order to improve the efficiency of the operation test, the operation test should be performed only by the operations division without the participation or assistance of the development division.
 - c) The development division conducts the operation test, prepares the operation manual, and then hands over the system to the operations division.
 - d) The operations division participates actively in system development to provide assistance from the viewpoint of operability.

Q59. Which of the following is an appropriate statement in regard to operation of a distributed system?

- a) A dedicated administrator is assigned in the same manner as in a centralized system to manage common resources such as databases.
- b) An administrator is not assigned at each site; instead, the users involved in operation are thoroughly educated, and operation is left to the users.
- c) The extent of user responsibilities is made clear, and each user is able to manage the network configuration.
- d) The information resources are distributed, so a malicious network intrusion is not likely to happen, and the workload of security management is relatively low.

Q53. When 50% of the undefined specifications are defined each time a prototype is created, how many prototypes should be created to define over 90% of the specifications that are undefined at the start of prototyping?

- a) 1 b) 2 c) 3 d) 4

Q55. The number of remaining bugs in software is estimated by bug-embedding method. The number of captured bugs by testing is 48. The number of bugs found by testing is 16 out of 22 embedded bugs. How many bugs are estimated to be still hidden? Here, the number of the embedded bugs found in the test is proportional to the number of the bugs found in the software.

- a) 6 b) 10 c) 18 d) 22

Q47. An automated ticketing system for motorists is installed for a highway with a minimum speed limit of 60 kph (kilometers per hour) and a maximum speed limit of 100 kph. When the system is tested based on “equivalence partitioning” as a black box, which of the following is an appropriate set of speed values in kph?

- | | |
|-----------------------------|----------------|
| a) 0, 59, 60, 100, 101, 150 | b) 40, 80, 120 |
| c) 59, 60, 100, 101 | d) 60, 100 |

Q49. How much is the approximate expected value in dollars, for the first-year correction cost of an application program under the following conditions?

[Conditions]

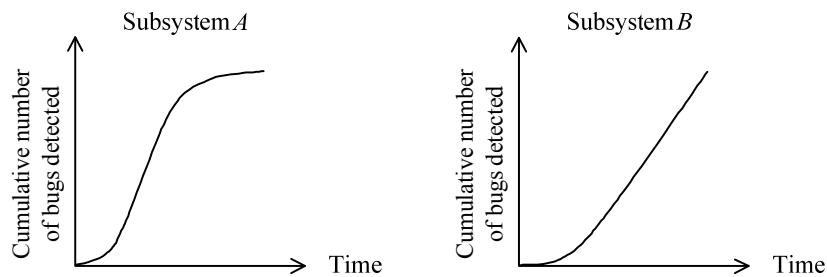
- (1) Program size: 2,000 Ksteps
- (2) Potential program error rate: 0.04 errors / Ksteps
- (3) Annual discovery rate of potential errors: 20 % / year
- (4) Classification of errors
 - Error with major impact: 20 %
 - Error with minor impact: 80 %
- (5) Correction cost per error
 - Error with major impact: 20,000 dollars
 - Error with minor impact: 5,000 dollars
- (6) Only errors with major impact are corrected.

- a) 64,000 b) 128,000 c) 160,000 d) 640,000

Q44. A certain system is being developed separately as Subsystems A and B . Each subsystem test has just been completed. The test data up to this point is shown in the table below. Here, the number of standard test items for this system is 10 items/Ksteps.

Subsystem name	Development size	Number of test items	Number of unresolved bugs
A	30 Ksteps	300	0
B	20 Ksteps	200	0

The following graphs show the numbers of bugs detected so far.



When Subsystems A and B have the same level of difficulty, which of the following appropriately evaluates the current status?

- About the same number of bugs has been detected in both of the subsystems, so both can be considered practically identical in quality.
- In both subsystems, the number of unresolved bugs is 0, so both can be considered fully tested.
- Neither of the subsystems has stable quality, so both can be considered to be tested additionally.
- The number of bugs detected by the test is reaching the saturation level in Subsystem A compared to Subsystem B , so Subsystem A can be considered superior in quality.

Q59. How many magnetic tapes are required to create and manage backup copies of server files under the following conditions?

[Processing conditions]

- (1) A full backup copy is made at the beginning (on the first day) of each month. One magnetic tape is required per full backup.
- (2) An incremental backup copy is made each day between the day following the day when a full backup copy is made and the day when the next full backup copy is made. An incremental backup copy is added to a separate magnetic tape dedicated to incremental backups. All the incremental backup copies made during a one-month period can be recorded on a single magnetic tape.
- (3) It is guaranteed that any file can always be restored to the state of any specified day with respect to any data for any day not earlier than this day six months ago. Here, if this day of the month did not exist six months ago, it is guaranteed that any file can be restored to the state of any specified day with respect to any data for any day not earlier than the last day six months ago. (For example, if the current day is October 31, it is guaranteed that any file can be restored to the state of any specified day with respect to any data for any day not earlier than April 30.)

a) 12

b) 13

c) 14

d) 15

Q44. There are two methods to execute byte-code programs written in Java. In the first method, an interpreter is used to execute byte-code. In the second method, native code generated by a compiler is executed. In the second method, how many lines of byte-code are at least required, in order to achieve shorter processing time (including compiling time) than the first method, under the conditions below?

[Conditions]

- (1) The execution time is proportional to the number of lines in the program.
- (2) If a program consisting of 100 lines of byte-code is executed using an interpreter, it takes 0.2 seconds. If the same program is executed after compiling, it takes 0.003 seconds.
- (3) It takes 0.1 seconds to compile 100 lines.
- (4) In case of the method using a compiler, an overhead of 0.15 seconds is always required for file input/output, compiler startup, and so on, regardless of the number of lines in the program.
- (5) Other miscellaneous time such as time for downloading the program file may be ignored.

a) 50

b) 75

c) 125

d) 155