# Which of the following is the correct value of the quadruple of hexadecimal fraction 0.FEDC? | 3.FB70

# In a floating-point number format, which of the following is the correct operation for adjusting the radix point and the exponent so that the most significant digit of the mantissa can be a non-zero value?| Normalize

# The decimal value “-72” is stored in an 8-bit register using 2’s complement. If the data in the register is logically shifted two bits to the right, which of the following is the correct result that is represented in decimal? | 46

# By definition of the IEEE754 standard, 32-bit floating point numbers are represented as follows, S (1 bit) E (8 bits) M (23 bits) | 7F800000

# In the Venn Diagrams labeled 1 to 3, which of the following is the result of Boolean “OR” operations for all three to be combined? Here, “? ” is used for “logical AND,” “+” for “logical OR,” and “ A ” for the “logical NOT” of A. Each set corresponding to x, y, or z is depicted by a circle | x.y-.z- + x-+y

# When you flip a coin four times, what is the probability that it will come up heads exactly twice? | 0.375

# There are two important operations on a stack: PUSH and POP. PUSH adds the new data to the top of the stack leaving previous data below, and POP removes and returns the current top data of the stack. | x =1 ; y = 7

# Reverse Polish Notation (RPN) is used to represent arithmetic expressions without using brackets to define priorities for evaluation of operators.For example, 3.(a+b) becomes 3ab+x in RPN | Stack

# Which of the following is an appropriate description concerning the list and/or array structures | The list structure allows any data to be inserted or deleted simply by modifying pointers.But, after the data was deleted, the cells that contained the data remain as garbage in memory.

# The table below shows a state transition table that checks the input character string. This check starts from the initial state A, and it fails if the state changes to E during the input of the character string.| 12.2

# There are two jugs; one is a 4-liter (4L) jug and the other is a 3-liter (3L) jug. Which of the following is the correct sequence to obtain exactly 2 liters of water in the 4L jug under the conditions shown below? | (0,0)->(0,3)->(3,0)->(3,3)->(4,2)->(0,2)->(2,0)

# Which of the following is the correct result produced by executing the program shown below? Here, the parameter “x” is called by value, and the parameter “y” is called by reference. Main Program | a = 7, b = 3

# The “prime number division remainder” method is a well-known hashing algorithm. In this method, a key value is divided by a number N, and the remainder which is also called a hash value is used directly as an index into the hash table. | 3

# In a certain computer, a bubble sort of an array of 200 data elements takes the same time as a quick sort of the array. In case of an array of 40,000 data elements, how many times faster is a quick sort than a bubble sort? | 100

# Integers are stored in the 1st to N-th elements of an array A (N >1).The flowchart below shows the process to check which element of the array contains the same value as X. Which of the following correctly describes the execution result of this process? | If the same value as X exists in two places of the array, the 1st and N-th elements, k is set to 1.

# Which of the following is a re-writable, erasable memory, using electrical signals, which is widely used for various devices such as digital cameras and digital music players and can maintain the data even after the power is turned off? | Flash memory

# The figure shows an RS flip-flop using two NOR gates. Which of the following is the correct truth table for the flip-flop? Here, “unchanged” shown in the table means the outputs maintain a previous state, and “unstable” means the outputs are in an unstable state | 0 0 unchanged/0 1 0 1

# Which of the following is the correct combination of various addressing modes? Here, X 1 is an address which is stored in a program counter.X 2 is an address part of an instruction which is addressed by X 1 | X 3 = X 2 X 3 = (X 2 ) X 3 = X 1 +X 2 X 3 = X 2 +X 4

# A computer is designed to enable pipeline control so that each instruction can be completed in five cycles. How many cycles are needed to execute 20 instructions? Here, all instructions can be executed without being stopped halfway | 24

# Which of the following is an appropriate statement in regard to interrupts?A priority is individually assigned to the cause of an interrupt in preparation for the occurrence of multiple interrupts.

# Which of the following is an appropriate description concerning cache memory? | In one method, when executing a write instruction, data is written to both cache memory and main memory. In the other method, data is written only to a block in cache, and the modified block is written back into main memory only when it is replaced.

# There are two systems A and B whose access times of cache and main memory are shown in the table. When a certain program runs on these systems, the cache hit ratio and the effective access time are the same on both systems. Cache memory 15 10 / Main memory 50 70| 0.8

# Which of the following is an appropriate description of memory interleaving? Dividing main memory into several banks and speeding up access to sequential addresses in memory

# There is a hard disk drive with specifications shown below. When a record of 15 Kbytes is processed, which of the following is the average access time in milliseconds? Here, the record is stored in one track| 37.5

# The sequence of virtual page numbers shown below is encountered in the course of execution of programs on a computer with virtual memory. |33

# What is an advantage of DVD-RAM in comparison with DVD-RW and DVD+RW? More durable rewritable disc

# Which of the following is the appropriate combination of 4 color inks or toners for a full-color printer? | Cyan, Magenta, Yellow, and Black

# Which of the following is the most appropriate index indicating the performance of a laser printer? | Number of dots per inch (2.54 cm) and number of pages that can be printed per minute

# Computer font is an element in the user interface. Which of the following is the most appropriate explanation concerning the font? | A set of glyphs and associated information such as code points

# The figure shows the basic configuration of a computer. Which of the following is the correct combination of A, B, and C to be inserted in the figure? | Control unit Memory ALU

# Which of the following is an input device classified as a pointing device and can be used for graphical input in a CAD system? | Tablet

# Which of the following is a display, with low-voltage operation and low-power consumption, which does not need backlighting because it emits light when voltage is applied? |OLED

# Which of the following is an appropriate description concerning the role of a shell in an OS? | It interprets the commands entered by the user and instructs the OS to execute the corresponding functions.

# Which of the following terms refers to the function that adjusts all address dependent locations within a program to correspond to the load position when the program is loaded into main memory prior to its execution? | Relocation

# The table shows the priorities of five tasks A to E.When each task is independently executed, the processing sequences and times associated with CPU and I/O devices are also shown in the table. Which of the tasks B to E should be combined together with task A assigned a “high” priority so that there may be no idle time of CPU from starting of execution of the combined tasks to endin of both tasks?| D Low CPU (3) -> I/O (2) ->CPU (3)-> I/O (1)-> CPU (4)

# In a search system, when search was first performed under condition A, there were 5,000 search results. When further narrowed down with condition B, 30% of these search results remained.If search first performed under condition B produces 10,000 search results, what percentage will remain when these are further narrowed down with condition A? |15

# Which of the following functions can reduce the network load by placing a frequently-used instruction set on the server in advance, when accessing a database in a client/server system| Stored procedure function

# Which of the following is a system where one computer is in standby mode when the other computer is functioning normally? | Duplex system

# There is a CPU whose clock cycle time is 0.01 microsecond. The table below shows a program’s instruction mix executed on the CPU. What is the approximate MIPS value for the processor| 18.02

# Which of the following is an appropriate statement with regard to system performance evaluation, when selecting a new computer system? The data required for evaluation can be acquired by running programs which are frequently used or time critical

# A company uses 1,000 PCs. The mean failure in 20 days is to be restricted to 2 PCs.How many hours of MTBF are at least required for these PCs? Here, the mean usage time of the PCs is assumed to be 8 hours per day. |80,000

# Which of the following statements concerning programming languages appropriately describes Java? | It enables the creation of applets and other programs that run in web browsers.The applets can be run on any environment where virtual machines are implemented.

# 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. | 155

# Which of the following is an appropriate description concerning a tracer that is used as a debugging tool? | It outputs history information such as execution sequences and execution results of program instructions.

# Which of the following is an appropriate description in regard to a waterfall model? | System development proceeds in the order of process flow, so going back upstream results in a significant loss of efficiency.

# Which of the following is an appropriate description concerning object-oriented design? | A class can inherit attributes and methods from its base class.

# 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? | Sequence diagram

# 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? | Structured chart

# In the module design of software, which of the following is the appropriate technique for improving reliability and maintainability? | Module cohesion is increased, and module coupling is weakened.

# The entity-relationship diagrams A and B shows the relationships between three entities in a school: teacher, class, and classroom.Which of the following is an appropriate interpretation concerning the diagrams | In A, a teacher is responsible for one class only. In B, a teacher may be responsible for one or more classes.

# Which of the following is an appropriate statement in regard to a module unit test? | The module interface falls outside the scope of the unit test because the module interface cannot be tested using a single module.

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

# 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? | Regression test

# A check digit for a 4-digit number X 1 X 2 X 3 X 4 can be calculated as follows: mod((X 1.4+X 2 .3+X 3 .2+X 4 .1), 10) When the check digit for the 4-digit number “7X 2 42” is equal to 6, which of the following is the correct number to be put in X 2 ? Here, mod (a,b) returns the remainder after “a” is divided by “b.” | 6

# An implementation plan for a system development project was drawn up, and the critical path was determined. Which of the following tasks can be identified by the critical path? | Tasks directly connected with the delay of the entire project

# 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 comparison is made between the number of items specified for each slip type and the number of items inputted.

# 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? | The operations division participates actively in system development to provide assistance from the viewpoint of operability.

# Which of the following is an appropriate statement in regard to operation of a distributed system | A dedicated administrator is assigned in the same manner as in a centralized system to manage common resources such as databases.

# In the OSI 7-layer model, which of the following layers converts data from the upper layer into many tiny pieces called segments for transmission across the network? | Transport Layer

# Which of the following is the appropriate protocol that can deliver data from sender to receiver, correctly and in order? | TCP

# Which of the following protocols is used in a TCP/IP network to provide a virtual terminal function that enables remote login to a host for remote operation? |TELNET

# When constructing a network with a TCP/IP environment, IP address management becomes cumbersome and complicated as the number of clients becomes larger. Which of the following protocols is able to increase the efficiency of IP address management by assigning IP addresses dynamically according to requests from clients? | DHCP

# Which of the following is an appropriate statement in regard to the transmission operation of nodes connected to a LAN in the CSMA/CD method? |Each node checks whether the carrier is busy and can transmit only if the carrier is not busy. When collision is detected, transmission is tried again after a random time has elapsed.

# A message consists of 200 characters.If we can transmit 200 messages on average before a 1-bit error occurs, what is the bit error rate of the transmission line? Here, 1 character equals to 2 bytes while 1 byte equals to 8 bits. |1/640000

# Which of the following appropriately describes a schema in a relational database management system? | It is a set of data definitions such as the data properties, format, relationship with other data, etc.

# Which of the following appropriately describes a domain (defined area), a term used for relational databases? | It is a set of values that attributes can hold.

# Which of the following operations extracts specific columns from tables in a relational database? | Projection

# Which of the following is the correct decimal fraction equal to hexadecimal fraction 0.248? | 73/512

# When a transaction fails, which of the following should be performed in order to abort it and to rebuild the previous state of the database? |Rollback

# There is an OS that can set access privileges to read, update, and create subordinate files in a directory. These three types of access privileges can be set to “enabled” or “disabled” using 1 bit. If these three bits are set by an octal (base-8) number expressed by numerals 0 to 7, which of the following is an appropriate description, taking into account the trial results below?| When 4 is set, only create is enabled.

# Which of the following is an appropriate description of the virus pattern file that is used in virus protection measures for computers?| It is a file that records the signature code of known viruses and is used to detect viruses by the virus protection software.

# Against what kind of attacks does SSL (Secure Socket Layer) protect users on the Internet? | Tapping and exploitation of data

# Which of the following is an appropriate statement regarding elements of information security defined in ISO/IEC 17799:2005? | Integrity is safe-guarding the accuracy and completeness of information and processing methods.

# Which of the following is an appropriate description concerning CRM (Customer Relationship Management)? | It is an approach for increasing customer satisfaction and ultimately revenues by sharing information and raising the service levels, not only in the sales division but in all customer related channels within a company.

# The figures show the break-even point for two companies A and B. Which of the following is an appropriate statement with regard to the profit/loss analysis of Companies A and B? | Company A has low variable costs per unit of product, so when sales exceed the break-even point, Company A's profits are larger than Company B.

# Which of the following is an appropriate statement concerning a radar chart? | The degree of attainment of the benchmarking goal is plotted on the radial axis which corresponds to each item. All such plotted points are connected by a line, thereby making a comparison of overall balance.

# The figure below shows plots of the relationship between values of a certain factor x, in the product manufacturing process, and values of quality characteristics y. Which of the following is an appropriate description concerning this figure? | The coefficient of correlation between x and y is negative.

# In order to shorten the cumulative duration of activities on the critical path by one day, which of the following is the appropriate action to be taken? | To shorten the activity I by one day

# Three products A, B, and C are produced from raw materials at plant X. The production time per unit volume of each product, the required quantity of raw materials, and the profit amounts are shown in the table below. The maximum production hours per month at this plant total 240 hours, and the amount of raw materials that can be fed for production is 150 kg per month.| Linear programming method

# There are various types of e-commerce, depending on the transaction: B2B, B2C, C2C, m-commerce, etc. Which of the following refers to the activities associated with the selling and buying of goods and services via the Internet such as an online auction website and an online flea market? | C2C (Consumer to Consumer)

# What range of decimal numbers can be represented with an 11-bit two's-complement number | -1024 to 1023

# Which of the following decimal fractions becomes a finite fraction in an octal representation? | 0.5

# When a certain natural number x is expressed as a 2n-digit binary number “1010...10” consisting of 1 and 0 arranged alternately, which of the following equations can be formulated in terms of the number x? | x + x/2 = 2^2n - 1

# An integer m is stored in a register as a binary value. If this value is shifted to the left by three bits and m is added to the shifted value, how many times as large as m is the resulting number? Here, no overflow occurs. | 9

# Which of the following is the reason why a large number of computers use “complement representation” to simplify arithmetic circuits? | Subtraction can be processed by addition.

# Which of the following is the appropriate statement concerning Newton’s method that is known as an algorithm for obtaining the approximate value of the solution to the formula ƒ(x) = 0? | An approximate value of the solution is obtained geometrically using the tangent lines of y = ƒ(x)

# There is a four-digit number N 1 N 2 N 3 C that is used for Customer Account Number (CAN). The right most digit “C” can be calculated as follows: | 9690

# Two players, X and Y play a dice game. A pair of dice is tossed. If the sum of the dice is 2, 4, or 6, X wins the game. Otherwise, Y wins. What is the probability that Y wins the game | 3/4

# There are a total of 1,900 students in a school, 553 of whom are taking a course in computer science, 667 of whom are in mathematics, and 290 of whom are in both computer science and mathematics. How many students are not taking a course in either computer science or in mathematics? | 970

# Which of the following is equivalent to the logical expression A.B+B.C.(B+C) ? Here, “• ” is the logical product, and “ + ” is the logical sum.| B.(A+C)

# There are three 7-bit character codes: 30, 3F, and 7A. When an even parity bit is added to the front of each character code, which of the following shows the correct result? Here, the character codes are expressed in hexadecimal | 30, 3F, FA

# Which of the following data structures uses the LIFO (Last In First Out) method in order to manage data? | Stack

# In a microprocessor, there are two general registers: GRi and GRj (hereinafter referred to as GRx instead of GRi or GRj). PUSH GRx is used for adding the contents of GRx to the top of a stack. POP GRx is for removing the current top data of the stack and storing it to GRx. Which of the following operations can exchange the contents of GRi and GRj? | PUSH GRi PUSH GRj POP GRi POP GRj

# Which of the following is the appropriate statement concerning data sorting methods? | The “heap sort” method builds an ordered tree from the unsorted portion of the elements, extracts the maximum or minimum value from this ordered tree, and moves it to the sorted portion. This operational sequence is then repeated to gradually shrink the unsorted portion.

# A binary tree is said to be perfect, if all its leaves are at the same depth and every internal node has two children. Which of the following is correct about the perfect binary tree? Here, n is the number of nodes, and h is the height of the perfect binary tree.| n = 2^(h + 1) - 1

# A depth-first search (DFS) visits all the vertices in a graph. When an edge to be explored next is chosen, this algorithm always chooses to go “deeper” into the graph. That is, it will pick the next adjacent unvisited vertex until reaching a vertex that has no unvisited adjacent vertices. | ABCDEF

# Which of the following equations holds well in the postfix notation (or Reverse Polish Notation)? Here, x, y, and z are variables. | x y - z + = x y z - -

# The following function f (n, k) exists: What is the value of f (4, 2)? | 6

# Which of the following logic circuits generates the same output as the logic circuit shown in the figure below?

# Which of the following leads to the von Neumann bottleneck? | Data transfer speed between CPU and main memory

# Which of the following is the highest priority process just after execution of each instruction on CPU? | Check if there are any interrupts waiting

# The instruction pipeline is a technique used in order to improve the CPU performance. Instructions are divided into stages and moved through the processor. An RISC processor has five-stage pipeline (Instruction fetch, Instruction decode, Execute, Memory access, Register write back) | 14

# There is a processor with a clock frequency of 1 GHz. When the instruction set of this processor is composed of two types of commands as shown in the table below, what is the approximate processing performance in MIPS? | 125

# Which of the following is classified as an external interrupt? | An interrupt which takes place when hardware detects malfunctions

# A CPU has four blocks of cache memory. Using the LRU (Least Recently Used) replacement algorithm, which memory blocks are stored in the cache memory after the execution of the following sequence of access to memory blocks: 1 2 3 4 5 2 5 4 1 5 2 3? | 1 5 2 3

# Which of the following appropriately describes the purpose of the cache memory used by processors? | To compensate for the difference between the main memory access speed and the processor speed

# Which of the following appropriately describes “memory interleaving” that is one of the high-speed computer technologies? | It is a method for dividing the memory into multiple independently-operating groups and accessing each group in parallel.

# How many tracks are required to store a sequentially organized data file including a total of 10,000 records on the hard disk drive under the following conditions? Here, each track can contain multiple blocks, but each block cannot be stored across multiple tracks. | 125

# The head of a hard disk drive is currently positioned at cylinder number 100, and the cylinder numbers 120, 90, 70, 80, 140, 110, and 60 are lined up in the I/O request queue. What is the total number of cylinders that the head moves under the following conditions? | 120

# Which of the following technologies is used to divide each data file into blocks at constant length and to store them across multiple hard disks that can be accessed in parallel, thereby speeding up file access? | Disk striping

# Which of the following appropriately describes a method of recording data on CD-R? | Laser beams are radiated onto an organic dye layer in a disk. As a result, a series of burned spots called pits are created on that layer, thereby recording the data.

# Which of the following is a method whereby the relevant program is read into main memory and the CPU reads out and executes it sequentially? | Stored program method

# Which of the following functions is a part of OS task management? | CPU allocation

# When variables shared among tasks are updated, an unexpected result may occur if synchronous control among tasks is not performed. When the initial value of the variable x shared among tasks is 3, the final value of x is expected to be 12 if task A executes the assignment statement “x = x + x” and if task B executes the assignment statement “x = x × x.” | a1 -> b1 -> b2 -> b3 -> b4 -> a2 -> a3 -> a4

# Which of the following has the feature whereby only minimally limited OS functions, such as memory management and process management, are supported and other OS functions, such as the file system, are implemented as server processes? | Microkernel

# Which of the following is the appropriate statement concerning client/server architecture? | It divides a series of processes into two groups by means of an inter-process communication mechanism; one group includes processes that request services, and the other consists of processes that execute the requested services.

# Which of the following is the primary purpose to use RAID? | To ensure higher reliability and/or performance

# There is an RAID5 disk array system that is composed of 10 hard disk drives, and each disk capacity is 100Gbytes. What is the approximate maximum capacity (in Gbytes) that can be used to store user data and/or programs on this system? | 900

# In some systems, the system manually or automatically determines memory blocks which are no longer referenced by a program and reorganizes the memory space so that it can be available for subsequent allocation. What is this process called? | Garbage collection

# Which of the following is the appropriate description concerning the performance evaluation of a computer system? | In the case of a system in operation, a software monitor can be used to collect and analyze statistical data, thereby permitting performance-related problems to be grasped.

# Which of the following appropriately describes a dual system? | Two systems perform the same processing, and the processed results are collated to confirm the correctness of the processing. If a fault occurs in either system, processing continues in degraded operation.

# When the operational model of a system is shown in the figure below, which of the following represents the correct combination of MTBF and MTTR of the system? Here, t i (i = 1, 2, ..., n) denotes the operating time of the system, and r i (i = 1, 2, ..., n) denotes the repair time of the system. | 1/n S i=1 n t i - 1/n S i=1 n r i

# In some circumstances, a program may be still running when it is called again by another program. Which of the following is the appropriate characteristic that should be implemented to execute this program correctly? | Reentrant

# Which of the following is the language processing program that generates, on a certain computer, object programs that can be executed on another computer that has a different instruction set? | Cross compiler

# Which of the following is the standardized document description language that prescribes methods, as an international standard, for describing the logical structures and attributes of documents using tags and facilitates the management and exchange of electronic documents? | SGML

# Which of the following is the appropriate combination of basic concepts of object-oriented approach? | Abstraction, encapsulation, inheritance, and class

# Which of the following is the appropriate characteristic of “data oriented design” as compared with “process oriented design?” | It is possible to consider data as shared resources and to manage it in a unified manner.

# Which of the following is the appropriate program that supports dynamic processing in a Web environment and runs only on a Web server? | Java servlet

# 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? | It does not occur that a single order placement is given to multiple suppliers.

# 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? | Functional decomposition and structured design

# Which of the following is the appropriate sequence of DB application development activities? | Database planning -> Conceptual design -> Physical design -> Data conversion

# Which of the following is the appropriate statement concerning how to illustrate data flows (arrows) in DFD? | Each process must have at least one data flow in and one data flow out.

# Which of the following is the appropriate description concerning the functions of “driver” or “stub” used in the module test? | “Driver” calls the module to be tested while passing arguments to it.

# Which of the following is the appropriate description concerning black box testing? | Even if any redundant code exists in a tested program, it cannot be detected.

# Which of the following appropriately describes the purpose of using WBS (Work Breakdown Structure) in software development? | To divide development work into small tasks in a top-down manner, thereby facilitating work management

# Which of the following appropriately explains the function point method, which is one of the estimation methods used in system development? | It is a method for estimating the system size by evaluating system functions quantitatively on the basis of the amount of input/output data, the number of files, etc. and by making proper adjustments based on the complexity and characteristics of the application.

# Which of the following appropriately describes the purpose of using a check digit? | To detect an error of the inputted code value

# How many magnetic tapes are required to create and manage backup copies of server files under the following conditions? | 14

# Which of the following subnet masks provides the minimum number of IP addresses available in the subnet to assign to devices that request a connection? | 255.255.255.252

# In the OSI basic reference model, which of the following layers provides a set of rules for establishing and terminating the connection between applications on computer systems? | Session layer

# Which of the following protocols is used on the transport layer of OSI basic reference model? | UDP

# Which of the following is the appropriate technology that is used to establish a private or secure network connection within a public IP network, such as the Internet, and to give the company the same capabilities at much lower cost by using the shared public infrastructure rather than a private one? | VPN

# Which of the following IP addresses can be used to connect a computer directly to the Internet? | 203.162.1.160

# Which of the following is the appropriate specifications concerning 100Base-T? | Twisted pair cable Star 100

# Which of the following is the correct table that is created by the “natural join” operation of two tables T 1 and T 2 ?| A B C D /a 1 b 1 c 1 d 1 /a 2 b 1 c 1 d 1

# Which of the following is the appropriate description of a lock that is the exclusive control of a database?| Locks come in two types: shared locks, used while reading, and exclusive locks, used during a change.

# In a database system employing incremental log with immediate updates, information in the log is used in restoring the state of the system to a previous consistent state when a crash occurs. < T 2 , C, 3000, 3500> and before < T 2 , commit>? | Roll forward T 1 and roll back T 2

# Which of the following is the appropriate SQL statement that is used to create Table A from Persons Table? | SELECT name FROM Persons WHERE country LIKE ' %Korea% ' AND gender = ' F ' OR age = 26

# Which of the following is the major impact of a Denial of Service (DoS) attack? | Degradation of service due to network traffic congestion

# Which of the following is the appropriate method that supports both private key cryptography and public key cryptography, enables users to securely exchange e-mail messages, and to secure files, disk volumes, and network connections with both privacy and strong authentication? | PGP (Pretty Good Privacy)

# Port scanning is the process of sending packets to check every port on each target system to see which ports are open and which ports are locked. Which of the following information can be identified by port scanning? | Network and application services currently available

# Which of the following appropriately explains benchmarking used in business management? | It is to make comparisons with the strongest competitors or advanced companies in order to scope out best practices for setting business goals, and to gain an understanding of products, services, and practical methods qualitatively and quantitatively.

# Which of the following appropriately describes a cause-and-effect diagram? | It systematically arranges the relation between cause and effect in a fishbone format and clarifies which causes are related to particular effects.

# Which of the following is the appropriate statement concerning how to use management science methodology? | The time-series analysis method is used to forecast product sales in the market.

# The selling price per unit of product Z is set to $250, and sales for the coming year are expected to be 500 units. If the company requires a return of 15% in the coming year on its investment of $250,000 in product Z, what is the target variable cost per unit for the coming year? Here, the fixed cost is $10,000 per annum | $155

# When the moving average method is applied to the receipt/shipment ledger shown below, how much in dollars is the closing inventory value of August? | 1,300

# In a production process of 1,000 units of product X, “material cost” incurred is $10,000, and “direct labor cost” is $20,000. “Production overhead” is 100% of direct labor cost. “Selling and distribution cost” is $10,000. How much in dollars is the unit cost of product X? | 50

# The following table shows the duration for the optimistic, most likely, and pessimistic scenarios in a program development. How many hours are required to complete all the activities on a “three point estimate” basis? | 15

# Which of the following is the appropriate combination of processing modes in banking activities? | Online Batch Online Batch

# Which of the following is equal to the hexadecimal fraction 2A.4C? | 25+23+21+2-2+2-5+2-6

# In what radix does the following equation hold? 131-45 = 53 | 7

# In fixed-point representation that expresses negative numbers by two’s complement, which range of integers can be expressed with n bits? Here, the position of the binary point is to the right of the least significant bit. | -2n–1 through 2n–1-1

# In a certain program, in order to stay in a loop, variable X must be in the range from 1 through 10 (X >= 1 AND X <= 10). In this program, which of the following is the condition of exiting the loop? Here, “AND” and “OR” are the logical product and logical sum operations respectively. In addition, comparison operators <, <=, >, and >= are less than, less than or equal to, greater than, and greater than or equal to, respectively. | X < 1 OR X > 10

# When the results of the logical operation “x # y” are shown in the table below, which of the following expressions is equivalent to the operation “x # y”? Here, “AND” is used for the logical product, “OR” is for the logical sum, and “NOT” is for the logical negation. x y x # y True True False True False False False True False False False True | (NOT x) AND (NOT y)

# Which of the following numbers is a valid ISBN? Here, ISBN means the International Standard Book Number which is used to identify books, publishers, and bookstores. It consists of exactly 10 digits, and the rightmost digit is used for a check digit. The check digit is validated by using modulo 11 as follows | 0071361286

# The state diagram shown below is a simple Mealy machine. Which of the following transitions is NOT possible in the diagram? Here, S0, S1, and S2 are states. Each edge is labeled with “j / k” where j is the input and k is the output. | S0 ? S1 ? S2 ? S1 ? S2 ? S0

# The formula shown below is represented in postfix (or reverse Polish) notation. Which of following is the resulting value of this formula? 5 1 – 3 \* 3 1 – 2 \* / | 3

# There are five different sizes of white balls and five different sizes of green balls. When these ten balls are laid out in a line so that adjacent balls can have different colors, how many arrangements of the balls can be made? | 28,800

# A coin is tossed three times. What is the probability that it lands on heads exactly one time? | 0.375

# In a certain computer system, a simple hash function called the division method is used for page-based address translation. By using this method, a pair of new logical page number “101000” and its corresponding physical page number “0010” is stored into the page table shown below. Which of the following indexes is used to place them in the table? | 110

# In the binary tree shown below, which of the following trees is created after conversion into a (max) heap? a) Dòng cu?i 2 4 1

# A singly linked list is implemented using two arrays VALUE and LINK, in which LINK(I) points to the successor of VALUE(I). When a new element that does not exist initially in the list is assigned to VALUE(J), the program fragment shown below is executed. Which of the following appropriately describes the function of this program? | VALUE(J) is inserted after VALUE(I) in the list

# When a list of 7 elements shown below is rearranged in ascending order, which of the following sorting algorithms is completed with the minimum number of element exchanges? 3 5 12 9 10 7 15 | Shell

# Which of the following represents the sequence of nodes visited in a post-order traversal of the binary tree T shown below? | U X W Q Z Y V P

# The flowchart below shows a binary search algorithm to find the index m of the array element A(m), such that the equation “A(m) = k” holds, from the array elements A(1), A(2), …, A(n) already sorted in ascending order. In case of “m = 0” at the end, there is no element such that the equation “A(m) = k” holds. Which of the following is inserted in the process box X in the flowchart? Here, the slash ( / ) indicates division that truncates all digits after the decimal point. | (x + y) / 2 ? m

# How many memory cells (or latches for holding 1 bit each) are implemented in SRAM with 24 address lines and 16 data lines? | 224 x 16

# When two input signals A and B are given in the logic circuit shown below, which of the following tables describes the correct combination of output signals W, X, Y, and Z? Here, is used for an AND gate, and for a NOT gate. | dòng cu?i 1 1 0 0 0 1

# The figure shows an RS flip-flop using two NAND gates. Which of the following is the correct truth table for the flip-flop? Here, “unchanged” shown in the table means the outputs maintain a previous state, and “unstable” means the outputs are in an unstable state. | unstable.1 0.0 1. unchanged

# Which of the following interrupts can signal to OS that a program might have gone into an infinite loop? | Timer Interrupt

# Which of the following appropriately explains the pipeline processing method of processors? | Method whereby one processor simultaneously executes multiple instructions with slight delays in time

# Which of the following appropriately describes cache memory? | Two methods exist: one is to rewrite both the cache and main memory when a write instruction is executed; the other is to rewrite only the cache memory while the main memory is not rewritten until the data is removed from the cache memory.

# In the RAID3 system shown below, three disks (Disks 0 through 2) for byte-striped data and one dedicated parity disk (Disk 3) are used as one volume. Parity byte Ap is generated by calculating the exclusive OR (XOR) of three bytes in Disks 0 through 2. For example, Ap (1-3) is calculated as follows: | XOR (Exclusive OR)

# A system manages files by allocating file storage on a block-by-block basis, where each block consists of eight 500-byte sectors. How many sectors in total are required to store two files: one with 2,000 bytes and the other with 9,000 bytes? Here, sectors for management information such as directories can be ignored. | 32

# Which of the following is an appropriate description concerning the characteristics of USB? | It has three data transfer modes: high-speed mode for external hard disks, full-speed mode for printers and scanners, and low-speed mode for keyboards and mice.

# A computer consists of units that execute five functions: input, storage, processing, control, and output. From which unit is an instruction fetched and by which unit is the instruction decoded? | Storage Control

# In a multiprogramming environment, there is a need to limit access to shared resources; that is, the current process has exclusive use of the assigned resources for some period of time. Which of the following appropriately describes the function to successfully implement this type of exclusive control? | A semaphore variable is used to indicate the status of common resource

# In virtual memory systems, serious degradation of system performance may occur due to a large number of page faults. Which of the following terms most appropriately describes this situation? | Thrashing

# Two processes A and B with the same priority are executed in a round-robin method with a time slice of 30 milliseconds on a single CPU, but they use respectively different I/O devices. When they are executed as a standalone process, their processing times and sequences are shown in the figure below. How long (in milliseconds) does it take to complete both processes? Here, the two processes are | 170

# The FIFO method is used as the page-replacing algorithm in virtual memory. There are 3 page frames available for a program in main memory, and the page numbers referred to by a program are 4 ? 3 ? 2 ?1 ? 3 ? 5 ? 2 in this order. How many times does page-in occur during execution of the program? Here, nothing is loaded into main memory in the initial state. | 5

# Which of the following is an appropriate description concerning throughput? | Spooling in which the output to the printer is temporarily stored on a hard disk drive is helpful for increasing the throughput.

# Last year, a company providing web application services needed an Internet line to service clients’ demand at that time. However, in order to increase availability, the company actually made use of two Internet lines from different vendors. This year, the demand is doubled and both lines are fully busy, so the company will install one more Internet line. Each of the Internet lines has availability of 80%. What percentage of availability will be cut down after the installation? | 7.8

# Which of the following is the system configuration with the highest availability? Here, each unit shown by a box has the same availability (less than 1), and multiple units connected in parallel are considered operating if at least one unit is operating. | A

# Which of the following is an appropriate language that can be used to develop applications running mainly on Web browsers? | JavaScript

# Which of the following appropriately describes a typical feature of ADSL? | By separating the frequency bands used by analog telephones and data communications, it allows both of these connections to be used simultaneously

# Which of the following flowcharts illustrates a “while repetition structure” in the control structure of programs? | Condition Process mui tên ngu?c lên

# Which of the following is an appropriate description concerning the spiral model? | The design and implementation of an application is performed for a unit of component, and then this process is repeated successively for every component.

# 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. | [Spin box]

# Which of the following characteristics can be found in well-designed modules with a high degree of independence? | Low coupling and high cohesion

# In the context diagram illustrated below, which of the following combinations appropriately describes data flows DF1, DF2, and DF3? b Delivery invoice Payment bill In-stock inventory

# Which classes are in the relationship of aggregation in the UML class diagram shown below? | Class A and Class C

# 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? | 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.

# 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? | Walk-through - 22

# 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. | 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.

# Which of the following appropriately explains a tracer as one of the dynamic debugging tools? | It outputs the contents of the memory and registers in order to monitor the results of the program execution in chronological order.

# There are seven activities, a through g shown in the table below. At least how many days does it take to complete these seven activities? Here, activities a and b can be performed concurrently, but the others cannot be done until their preceding activities are completed. For example, c cannot begin until a is completed. The optimistic time estimate is x in days, the most likely or normal time estimate is y, and the pessimistic time estimate is z. The expected time Te is computed using the formula (x + 4y + z)/6. Unit: day | 19.51

# Full backup and differential backup are two methods of backing up a database. Which of the following appropriately describes the differential backup method? | To recover a database, the full backup data is restored and then the differential backup data is added.

# Which of the following most appropriately describes the handling of control information in system operation management? | The system should be managed by a small group of managers. Each manager should be given an exclusive and separate account. Control information should be disclosed to the general user after its security level and other factors are considered.

# Which of the following is an appropriate description concerning countermeasures to online system failures? | The master file should be backed up not only at the completion of online service but at times corresponding to the characteristics of the system.

# Which of the following can make MTBF longer in system maintenance? | To do preventive maintenance

# When a network device is connected to the LAN with the network address of 201.12.1.64 and the subnet mask of 255.255.255.192, which of the following IP addresses should NOT be assigned to the device on the network? | 201.12.1.127

# Which of the following is the appropriate protocol that is widely used with TCP/IP networks to collect and manage information from network devices such as servers, routers, switches, and hubs? | SNMP

# Which of the following is the appropriate protocol that is used to send e-mail messages from one server to another over the Internet? | SMTP

# Which of the following operations is performed on the packet header while the data packet moves from the lower to upper layers according to the OSI basic reference model? | Header deletion

# Which of the following occurs when computer A broadcasts an ARP request to find the MAC address of computer B on the same network? | All computers in network receive the request from A, and only B replies to A with its MAC address

# Which of the following is the general-purpose markup language that allows its users to define their own tags and to facilitate the sharing of data across different information systems, particularly via the Internet? | XML

# Which of the following is the key technology that enables to connect a computer using a private IP address to the Internet? | NAT

# Which of the following provides the function of mapping between domain names and IP addresses in a TCP/IP network? | DNS

# Which of the following is an appropriate purpose of installing a firewall in a computer network? | To block and permit data traffic

# Which of the following is described graphically using an E-R diagram? | Entities and relationships between entities

# You are building a new database for a company with 10 departments. Each department contains multiple employees. In addition, each employee might work for several departments. How should you logically model the relationship between the department entity and the employee entity? | Create a new entry, create a one-to-many relationship from the employee to the new entry, and create a one-to-many relationship from the department entry to the new entry.

# Which of the following is an appropriate explanation concerning functions of keywords in SQL? | “HAVING” specifies a search condition for an aggregate or a group.

# User A issues the command as follows: UPDATE cust\_orders SET id = 200 WHERE id = 1 Then user B issues this command as follows: UPDATE cust\_orders SET id = 300 WHERE id = 1 | Ask user A to commit the transaction.

# There is a table including the data items shown below. Which of the following SQL statements can insert a new row in the “student” table? Name Null? Type STUD\_ID NOT NULL NUMBER(3) NAME NOT NULL VARCHAR2(25) ADDRESS VARCHAR2(50) GRADUATION DATE | INSERT INTO student (stud\_id, address, name, graduation) VALUES (101, ‘100 Happy Lane’, ‘Dave’, ‘2001-06-14’);

# There is a student score table shown below with basic and advanced subject codes which begin with letters B and A respectively. Which of the following SQL statements can be used to retrieve students, from the score table, whose basic subject score is 70 or more and examination date is 2007-05-04? | SELECT student\_number FROM score\_table WHERE score >=70 AND examination\_date = ‘2007-05-04’ AND subject\_code LIKE ‘B%’

# In database recovery management, which of the following appropriately explains incremental logging with deferred update? | The new value of the updated item is stored in the log

# A store intends to use public key cryptography so that it may receive orders from customers through a network without exposing the contents of the orders to third parties. Which of the following is the appropriate combination of keys used by both the store and customer? b Private key Public key

# What is the purpose of attaching a digital signature to software disclosed on the Internet? | To guarantee that the software contents have not been tampered with

# Which of the following can be realized by using the packet filtering function of a firewall? | To allow only the packets with specific TCP port numbers to pass from the Internet through to the internal network

# Which of the following is the salami technique used in computer crime? | Stealing from multiple assets little by little, to a degree that the illegal action does not come to the surface and become noticeable

# Which of the following is a method of phishing? | Someone sends e-mails to entice the recipients and to have them access fake Web sites that appear to be sites of actually existing companies etc. and steals personal information.

# Which of the following is a characteristic of the QR code? | Using three symbols for detection, the code makes it possible to recognize the rotation angle and the direction of reading.

# A data warehouse was set up, but it is hardly used. The result of a hearing suggests that the users’ skill level is lower than expected. Which of the following is an appropriate measure for improvement to promote usage? | To prepare, as standards, templates according to data extraction and analysis patterns

# Which of the following appropriately describes financial statements? | Profit and loss statement is also known as the income statement. This presents how revenues are converted to net income by reporting both revenues and expenses of the company for a given period of time.

# Which of the following is the appropriate statement according to the Pareto analysis (also known as the 80-20 rule)? | This is the idea that 80% of tasks can be completed in 20% of the disposable time. The remaining 20% of tasks will take up 80% of the time.

# The seven traditional, fundamental quality control tools consist of Check sheet, Pareto chart, Stratification, Scatter Diagram, Histogram, and Control Chart. What is the last (or 7th) one? | Cause and effect diagram

# The activities A to E shown below are planned in a system development project. What is the highest possible weekly cost (in dollars) of this project? | 1,750

# A server runs a regional web application. It services the requests coming in from all regional offices. Each request is completed in 80 milliseconds on average. A total of 10 requests per second arrive at the server on average. If the M/M/1 queuing model can be applied, how many requests are waiting for the service on average? | 4.00

# The sales volume of the next month is predicted by the data in the past. The sales volume is changed greatly from month to month, but the annual fluctuation pattern is almost the same every year. Which of the following is the most appropriate formula that can be used for calculating the sales volume of the next month? Here, Pt+1 is the sales volume predicted for the next month, St is the sales volume of the current month t, and the data is retained for three years. | Pt+1 = (St–11 + St–23 + St–35) / 3

# There are goods whose unit purchase prices are gradually rising. There was an inventory of these goods at the end of the last accounting period, and the goods were carried into and out of the warehouse several times during the current period. Which of the following valuation methods produces the lowest valuation of the inventory at the end of the current period? | Last-in first-out method

# Which of the following decimal fractions becomes a finite fraction when converted to an octal number? | 0.5

# A register stores a numerical value representing a binary number. After a positive integer x is entered in the register, the following operation is performed: “shift the register value two bits to the left and add x.” How many times as large as x is the new value of the register? Here, the shift does not cause an overflow. | 5

# Which of the following is the appropriate way to check whether or not an 8-bit unsigned binary number x is a multiple of 16? | The bit-by-bit logical product between x and the binary number 00001111 is 0.

# In the single precision of “IEEE Standard for Binary Floating-Point Arithmetic” (IEEE 754), the value “V” is represented as follows: | –28

# There are a total of N values observed. The sum S (S>0) of these values is obtained, and then the average value is calculated. Which of the following is the correct expression when the average value is rounded off to the nearest integer value? Here, “/” indicates division, and [X] is the maximum integer equal to X or less. | [S/N+0.5]

# A k-string is a character string with a length of k characters. An m-substring is an ordered sequence with a length of m characters, which consists of consecutive elements of the original k-string. An n-subsequence is also an ordered sequence with a length of n characters, which consists of elements of the original k-string, but it does not need to be consecutive. How many m-substrings and n-subsequences are respectively included in the k-string? | k-m+1,k!/n!(k-n)!

# There are 3 white balls and 3 red balls in a box. What is the probability that the two balls taken out at random from the box are one white ball and one red ball? | 3/5

# There are n locks and n keys; the keys are mixed and need to specify which key belongs to which lock. Which of the following is the maximum number of trials to find the correct key for each lock? Here, one key can open only one lock. | (n2–n)/2

# Which of the following is equivalent to the logical expression shown below? Here, “•” is used for the logical product, and “+” is for the logical sum. ((X + Y) • (X + Z)) + ((X •Y) + (X • Z)) | (X + (Y • Z)) + (X • (Y + Z))

# Which of the following Boolean expressions is equivalent to the sentence below? “The output z is true if at least two of the three inputs x1, x2, and x3 are true.” Here, “ n x ” is used for the logical negation of xn, “+” for the logical sum, “.” for the logical product, and “?” for the exclusive disjunction (or exclusive OR). | x1.x2+x2.x3+x1.x3

# There are three stacks A, B, and C where stack A contains the values 1, 2, and 3; 3 is on the top of the stack, and stacks B and C are empty. The stack command format is as follows: | 3, 2, 1

# In a certain examination, the minimum and maximum scores are 31 and 95 respectively. A one-dimensional array shown below is used to display the distribution of scores for all examinees, and each array element indicates the number of examinees whose scores are in the specified ranges. Which of the following is the most appropriate expression to calculate an array index for each score? Here, any digits after the decimal point of the resulting value are truncated to generate an integer as an index. | (Score–30)/10+1

# A k-ary tree is a tree in which every node has no more than k children. A binary tree is the special case where k=2. In a k-ary tree with n nodes and height h, which of the following is an upper bound for the number of leaves? | kh

# A recursive definition of a factorial function f(n) that calculates “n!” can be represented as follows: f(n) = (n > 1) f(n) = (n = 0) Which of the following combinations should be inserted in the boxes A and B? Here, “n” is a non-negative integer. | n \* f(n–1) , 1

# A binary search tree is created by inserting the values shown below. 7 9 11 2 8 10 5 3 After deletion of the root from the newly created tree, what does it look like? | dong dau 8 dong cuoi 3 10

# Which of the following is the sorting algorithm that divides the data elements into two groups, in which all those elements less than a particular element (called a pivot value) and all those elements greater than or equal to it are separately included, and then repeats the same operation until all elements are sorted in ascending or descending order? | Quick sort

# The figure shown below represents a logic gate and its timing chart. Which of the following is an appropriate logical function of this gate? Here, both A and B are the input signals and F is the output signal. | Exclusive-NOR

# Which of the following is an appropriate description concerning registers in processors? | A complement register generates integer complements in order to perform operations in the adder circuit.

# When a CPU can perform a multiplication in 12 nanoseconds (ns), an addition in 1 ns, and a subtraction in 1.5 ns, which of the following is the minimum CPU time, in nanoseconds, for the calculation of “a×a–b×b”? | 14.5

# Which of the following is the appropriate diagram that explains pipeline control? Here, the meanings of the capital letters in the diagrams are as follows: F: Fetching instruction D: Decoding A: Address calculation R: Reading operand E: Executing | a d f thang hang

# Which of the following is the appropriate description of CPU clock frequencies for PCs? | The instruction execution timing in a CPU varies depending on the clock frequency. The higher the frequency, the faster the instruction execution speed gets

# There is a CPU with an internal clock frequency of 700 MHz. The number of clock cycles for executing instructions and their appearance rates are shown in the table below. What is the approximate performance (measured in MIPS) of this CPU? | 50

# A processor with a 256-Mbyte address space is using the address “35E3C03” to access a 16-Mbyte memory device. What are the highest and lowest addresses in the memory map of the 16-Mbyte | FFFFFFF 0000000

# Which of the following is used in ECC memory to detect 2-bit errors and correct 1-bit errors? | Hamming code

# A system has a main memory access time of 60 nanoseconds (ns) and a cache memory access time of 10 ns. When the effective access time for accessing the main memory via the cache memory is 15 ns, what is the hit ratio of the cache memory? | 0.9

# Which of the following storage devices has the fastest access time? | CPU register

# Which of the following is widely used as a computer port for a modem connection? | Serial port

# A certain computer system runs in a multi-programming environment using a nonpreemptive “shortest job first” algorithm. In this system, four processes A, B, C, and D arrive sequentially in the process queue every 1 millisecond. The table shown below includes estimated execution time for each process; for example, process A uses CPU, I/O, and then CPU sequentially for 4, 5, and 5 milliseconds respectively. When 14 milliseconds elapse after the arrival of the first process A, which of the following processes is executed in CPU? Here, the multi-processing overhead of OS can be ignored, and both CPU and I/O operations can be executed concurrently. | C

# The figure below shows the state transition diagram of a certain process. Which of the following is the appropriate combination of States A, B, and C? | Running Ready Waiting

# Which of the following is the appropriate explanation of spooling? | Output data to a low speed device such as a printer is temporarily stored on a high speed hard disk and later sent as output to that target device.

# Which of the following is the appropriate set of major functions supported by an OS? | Data management, job management, and task management

# Which of the following is the appropriate explanation of RPC in a client/server system? | It is a method of communication between programs, where parts of the process are assigned to another computer

# In order to make a multiplexing system with an availability of at least 0.999 by using devices with an availability of 0.9, how many of these devices need linking together in parallel? | 3

# Which of the following helps improve availability? | Doubling MTBF and reducing MTTR to half

# Which of the following refers to the concept of fail-safe design? | If the system determines that the sensor which detects someone entering the work area has failed, the robot arm is stopped by force.

# Which of the following is the term that refers to collecting a large volume of data through a variety of corporate activities, organizing, integrating, and saving the data for specific purposes, and using it for decision-making support, for example? | Data warehouse

# When large-scale websites are built, application servers are often used in addition to Web servers. Which of the following is an appropriate reason for this? | System modification or expansion is made easier in comparison with Web servers alone.

# 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? | Upstream

# Which of the following is the method which analyzes the source or object code to retrieve information concerning program specifications and design? | Reverse engineering

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

# Which of the following should be done in the internal design phase of software development processes? | Designing physical data structure

# In the flowchart below, which of the following indicates the relationship between the initial values a and b that are given in m and n in the process (1) in order to carry out these processes in the order shown below? (1) ? (2) ? (3) ? (5) ? (2) ? (3) ? (4) ? (2) ? (6) Here, a and b are both positive integers. | 3a = 2b

# 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 | 2 ? 1 ? 3 ? 4

# In DFD illustrated below, DFi is used for data flow i, Pj for process j, Ek for source or destination of data k, and DSl 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? | DF1 and DF5

# Which of the following is the appropriate characteristic of object-oriented models? | Data is hidden from the outside and indirectly handled by procedures called methods. A program is a collection of data and methods.

# Which of the following is the test to verify interfaces both between modules and between subsystems? | Integration test

# 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? | false false true

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

# How much is the approximate expected value in dollars, for the first-year correction cost of an application program under the following conditions? | 64,000

# Which of the following is the most appropriate description concerning a “watch list” of system failures? | System operators also monitor processing delays, because such delays can cause system failures.

# Which of the following is an appropriate description concerning a characteristic of job scheduling in a computer system? | In a system on which interactive processing and batch processing are mixed, it is expected that the response performance of interactive processing is improved by giving a higher priority to interactive processing

# 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? | Regression test

# An IP address in IPv4 consists of two parts: the network address part and the host address part. Which of the following is the appropriate description concerning the network address and the host address? Here, n is the number of bits in the network address part, and h is the number of bits in the host address part. In addition, the special-purpose and ineffective addresses should not be counted as an effective address. | In classes A, B, and C, the maximum number of effective host addresses available to one network is defined as 2h – 2.

# Which of the following terms can be applicable to an explanation below? “The sender sends a single datagram; the routers are responsible for making copies and sending them to a group of interested receivers.” | Multicast

# Which of the following is a protocol for e-mail on the Internet that supports not only text but other data such as audio and images through message header extension? | MIME

# Which of the following is the appropriate description concerning ATM exchange? | It is an exchange device that handles a variety of data in an integrated way by partitioning data into fixed-length blocks called cells and adding a header containing destination information to each cell.

# Which of the following protocols is used for synchronizing the clocks in multiple nodes on the Internet? | NTP

# Which of the following is a mechanism that allows a Web server to store its own information about a user on the user’s own computer so that the Web server can identify users and possibly prepare customized Web pages for them? | Cookie

# Which of the following is the mechanism for interfacing a Web server with an external program in order to implement an interactive page where an application program on the server executes a request from a client and returns the resulting output to the browser? | CGI

# Which of the following data models represents data relationships in a tree structure? | Hierarchical model

# Which of the following is an appropriate explanation of a relational database? | Data is represented by two-dimensional tables.

# Which of the following is an appropriate explanation of “projection” in relational operations? | Only specified attributes are extracted from tables, and a new table is created.

# There are two tables “movie” and “movietype” as shown below. Which of the following tables is created as the result of executing the SQL statement specified below? | mName mTypeCode mCompany Beowulf AC Paramount Pictures Hitman AC 20th Century Fox

# Which of the following appropriately describes a group function of SQL? | A group function returns a single result row per group for a set of queried rows.

# Which of the following appropriately explains the SQL statements shown below? CREATE TABLE STAFF ( Name CHAR(256), Birthdate DATE, DeptID NUMBER ) CREATE TABLE MANAGER UNDER STAFF AS ( ManagedDept NUMBER ) | “SELECT \* FROM STAFF” extracts all records in the table MANAGER.

# Which of the following authentications can be realized with the information exchange between two communication actors X and Y according to the procedure below? | Y authenticates X.

# Which of the following is an advantageous effect of encrypting e-mails? | It is possible to prevent the contents of e-mails from leaking out.

# Which of the following is an appropriate action to be taken when a computer virus is found? | First, the infected computer is disconnected from the relevant network, because other computers may be infected via the network.

# Which of the following is an appropriate operations management method for user IDs and passwords? | For the purpose of preventing passwords from being abused by other people, it is so arranged that users become free to change their passwords at any time.

# When LAN analyzers are used for finding out the causes of network failures, which of the following is a point to keep in mind? | Some analyzers are capable of displaying packets that pass through networks. Therefore, it is necessary to be careful not to use them in different ways such as wiretapping.

# Which of the following is UML standardized by OMG? | Modeling language used in software development using object orientation

# Which of the following is an appropriate description concerning financial indexes? | Total capital profit ratio denotes the ratio of profits to gross capital. The larger the value of this ratio, the higher the profitability.

# A certain company is producing and selling its product X. The variable cost of the product X is 60% of its selling price, and the fixed cost of the company is $50,000 per month. When the company’s target profit for the forthcoming month is $20,000, how much sales volume (in dollars) is required to meet it? | 175,000

# A certain manufacturer plans to produce products in the two periods 1 and 2 as shown in the table below. How much is the fixed cost (in dollars) to produce the planned products during a single period? Here, the fixed cost remains unchanged for each period. Period Number of products to be produced Manufacturing cost ($) 1 1,000 5,000 2 1,500 6,000 | 3,000

# A certain retailer purchases watches from a wholesaler and sells them to customers. As shown in the transaction record table below, the retailer purchased a total of 150 watches and sold 120 watches in January. In addition, the retailer had a stock of 30 watches at the beginning of January. What is the total purchase cost (in dollars) of watches that were sold on an FIFO (First In First Out) basis in January? [Transaction record] Date (yyyy-mm-d| Transaction Quantity Unit cost ($) 2008-01-01 Beginning inventory 30 20 2008-01-10 Purchased 60 21 2008-01-16 Purchased 40 22 2008-01-25 Purchased 50 23 2008-01 Sold 120 | 2,520

# Company A and Company B can expect profits as shown in the table below when each of them implements two different strategies. Which of the following is the profit of Company A when both companies carry out the maximin strategy? In each cell of the table, the left value indicates the profit of A, and the right value indicates the profit of B. | 5

# Which is the method of solving a problem of the following type: “How can we distribute a resource subject to constraints that can be expressed by first-degree equations so as to obtain a maximum effect?” | Linear programming

# A certain company has installed an online computer for the purpose of improving its inventory control system. When the company anticipates sales of 15,000 units per year, ordering cost of $60 per order, and annual holding cost of $20 per unit, what is the optimal order quantity (in units) per order? Here, the fixed order quantity model can be applied. | 300

# There are seven activities A through G shown in the table below. Activities A and B can be performed concurrently, but the others cannot be done until their preceding activities are completed. For example, C cannot begin until A is completed. Which of the following is the critical path of these activities? Activity Preceding activity Used Time (days) A — 4 B — 5 C A 5 D A 6 E B, C 5 F D 4 G E 5 | A ? C ? E ? G

# Which of the following is the situation that is expected to be improved by the introduction of an MRP (Material Requirements Planning) system? | Information concerning materials necessary for manufacturing and their required quantities is complex, so errors can occur repeatedly in the estimated quantity of order and thereby bring about problems to production

Which of the following represents the hexadecimal fraction 3A.5C as a decimal fraction? | 3735. 64

Which of the following hexadecimal numbers, representing signed 16-bit binary numbers, results in overflow when multiplied by 4? Here, a negative number is represented in 2’s complement. | DFFF

Which of the following is the appropriate reason why the mantissa is normalized in the floating point representation? | The maximum number of significant digits can be maintained.

The function f(x) has a real-type argument and a real-type return value. The procedure using this function is shown in the steps 1 through 5. When this procedure is executed repeatedly a sufficient number of times and the value of y stops changing in the step 3, which of the following expressions holds? | f(y) = y

The student scores in a certain examination are shown in the table below. What is the standard deviation of these student scores? Here, the standard deviation d can be defined as follows: | 20

There are three different sizes of white balls and three different sizes of green balls. When these six balls are laid out in a line sothat the three white balls can be placed in adjacent positions, how many arrangements of all the balls can be made? | 144

Which of the following expressions results in a loss of trailing digits when calculated by a computer whose floating-point representation has a 23-bit mantissa? Here, the numbers in “( )2” are represented in binary. | (1.01)2×2 18 +(1.01)2×2 –5

There is a device consisting of Unit A, Unit B, and Unit C. Each unit can execute the “exclusive OR” operation in units of 4 bits. When an input bit string 1101 is given, an output bit string 0100 is obtained. In this device, if the internal key for Unit B is changed and the output bit string 1111 is generated, which of the following is the newly changed internal key for Unit B? | 1110

As shown in the truth table below, when anoutput signal is generated using three input signals A, B, and C, which of the following Boolean expressions can be applied to the output signal? Here, “?” stands for the logical product, “?” for the logical sum, and “X” for the logical negation of “X”. | A-^(BvC)

A “negative AND” operation “X NAND Y” of X and Y is defined as “NOT (X AND Y)”. Which of the following is the logical expression that represents “X OR Y” by using NAND only? | (X NAND X) NAND (Y NAND Y)

Which of the following is included as an element of a set of character strings represented by a regular expression “[A – Z] + [0 – 9]\*”? Here, the regular expression follows the rules described below. | ABCDEF

Which of the following terms is applicable to the binary tree shown below? | AVL tree

In a unidirectional list shown below, Blue is the top of the list, and its pointer indicates the next data address 110. In addition, Yellow is the end of the list, and its pointer is 0. Which of the following operations can replace Green with Red in the list? | Set the pointers of Red and Blue to 100 and 140 respectively.

In the graph shown below, which of the following is an appropriate description concerning the shortest path from the node “A” to another node? Here, the number shown beside the line indicates the distance between the two adjacent nodes. | The shortest distance from A to F is 9.

When the bubble sort algorithm is used for sorting the dataset (23, 43, 56, 12, 87, 14, 87, 15, 90, 23, 10) in descending order, how many data exchanges occur during the first pass? | 8

The flowchart below shows an algorithm in which two integers are temporarily entered into two variables x and y at the beginning, and then, after comparison of the two integers, the larger number is stored in the variable x and the smaller is in the variable y. In order to complete the algorithm, which of the following should be inserted in the process box A in the flowchart? | x + y ? x, x – y ? y, x – y ? x

Which of the following expressions shows the output Z of the combinational circuit using NAND gates as shown below? Here, “·” stands for the logical product, “+” for the logical sum, and X for the logical negation of X. | X + Y

When a certain RISC processor has a 5-stage instruction pipeline, how long (in nanoseconds) does it take to continuously execute 7 instructions excluding branch/jump instructions? Here, it takes 1.5 nanoseconds to complete each stage. In addition, any delay, such as pipeline stall and bubble, does not occur during the execution of those instructions. | 16.5

At least how many bits are required for the register identification field of a machine instruction code in order to specify one of 16 general purpose registers in the machine? | 4

Which of the following architectures in a uniprocessor requires multiple functional units that can execute two or more instructions in parallel during a clock cycle by simultaneously dispatching the instructions to the functional units? | Superscalar

Which of the following is used to hold the address of the instruction being executed or the address of the next instruction to be executed, and is automatically incremented after fetching an instruction? | Program counter

When a microprocessor works at a clock speed of 200 MHz and the average CPI (“cycles per instruction” or “clocks per instruction”) is 4, how long does it take to execute one instruction on average? | 20 nanoseconds

Which of the following is a method that serves to enhance the reliability of memory access and makes it possible to automatically correct some of data errors? | ECC

Which of the following is an appropriate description concerning RAID? | RAID 0 increases performance by using disk striping. However, the reliability is rather low because damages on even one disk cause whole data to be lost.

Which of the following USB transfer modes is mainly used for a mouse, joystick, etc.? | Interrupt transfer

When an image is read with a scanner at a resolution of 600 dpi and printed with a printer at a resolution of 300 dpi, how many times as large as the area of the original image is the area of the printed image? | 4

Which of the following input devices is classified as a pointing device and used for graphics input in a CAD system? | Tablet

Which of the following combinations of access time and hit ratio for cache memory and access time for main memory results in the shortest effective access time to main memory? | 10-80-30

The LRU method can be used as one of the methods for replacing blocks between the cache memory and the main memory. Which of the following blocks is subject to replacement by this method? | The block with the longest time since it was referenced last

As one of the virtual storage methods, virtual address space is divided into fixed-length areas. What is such a fixed-length area called? | Page

Which of the following descriptions about file storage is appropriate as the explanation of an archive? | It bundles multiple files into one file and stores it in a storage device.

There is a fault-tolerant computer system with high reliability and availability in which two CPUs perform the same processing and compare the processing results to each other. If one CPU fails, the system cuts off the failed CPU and continues processing on the other CPU. What is this system configuration called? | Dual system

Which of the following is an appropriate explanation of fault-tolerant systems? | Even in the event of a partial system failure, the system as a whole can provide necessary operational capabilities.Even in the event of a partial system failure, the system as a whole can provide necessary operational capabilities.

There are four hard disk subsystems A, B, C, and D including two or three disks with designated MTBF values as shown in the table below. Which of the following hard disk subsystems can provide the highest reliability? Here, if one of the disks fails in each subsystem, it is regarded as a failure of the entire hard disk subsystem. | C

Which of the following is the closest value as overall availability of the system composed of the four devices A to D? Here, availability of individual device is 0.9 for A and C, and 0.8 for B and D. In addition, when either of the parallel connections is operating, the corresponding parallel portion can be regarded as operating. | 0.95

Which of the following is the most appropriate description concerning the interconnection interfaces between computers and peripheral devices or between peripheral devices? | IEEE 802.11 refers to a family of specifications for wireless LAN, and includes several standards, such as IEEE 802.11a, 802.11b, and 802.11g, which define over-the-air interfaces between a wireless client and a base station or between two wireless clients.

Which of the following performs reasoning using a knowledge base? | Expert system

Which of the following is the main purpose of optimization performed by a compiler? | To reduce program execution time

Which of the following is the international standard of the document description language that defines how to describe the logical structure and makes it easy to manage and exchange electronic documents? | SGML

Which of the following software, as represented by Linux, requires the freedom to redistribute, inclusion of the source code at redistribution, and consent to modify derived software? | Open source software

Which of the following is the activity performed during the external design phase in system development? | Logical data design

In the DFD for a sales management system shown below, which of the following is appropriate for item A? | Unit price list

Which of the following is the appropriate description of the relationship between a class and an instance in the object-oriented approach? | An instance is generated based on the definition of a class.

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? | Only data items are passed as arguments between modules.

Which of the following is the appropriate point to notice at the time of creating the test data for a white box test? | The internal structures, such as the algorithm, for the program

Which of the following is the appropriate purpose of design review? | To find specification defects and design errors at an early stage, and reduce the person hours for rework

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? | Development cost of application software

In an arrow diagram shown below, how many days are needed in minimum to complete all the activities A through G? Here, in the diagram, each number shown beside the arrow indicates the number of days required to complete the activity. | 27

When the development department and the operations department of a system are organized separately, which of the following is the appropriate method for smooth and effective transfer from development to operations? | The operations department proactively participates in the system development and provides advice from the viewpoint of operations.

When there are multiple business application systems available, which of the following is the most appropriate method for access control? | Appropriate access permissions are granted for each business application system, irrespective of a user’s position and authority.

Which of the following is the most appropriate description concerning the changes in network configuration after the beginning of operations? | It is necessary to update the equipment control log, network diagram, etc. on a timely basis so that the network configuration can be changed at any time as needed.

Which of the following is an appropriate description concerning maintenance of applications? | Record the completion of maintenance in order to prevent maintenance activities from being left uncompleted.

Which of the following appropriately explains the function of the transport layer in the OSI basic reference model? | It is responsible for maintaining reliable end-to-end communications and data transfer between systems across the network, and provides a variety of functions including flow control, virtual circuit, and error checking and recovery.

Which of the following is the appropriate statement concerning the number of host addresses available to one sub-network in IPv4? | The number of host addresses available in a sub-network is determined by the number of “0” bits in the subnet mask.

Which of the following is the local broadcast address to be used by a computer with IP address 202.130.17.63 and subnet mask 255.255.255.0 if classless addressing is used? | 202.130.17.255

When a 9-Kbyte data file is transmitted using the asynchronous (or start-stop) communication protocol at a speed of 2,400 bps, what is the “overhead” (time spent on sending start, stop, and parity bits except data bits) in seconds? Here, a start bit is first sent, followed by eight data bits, no parity bit, and one stop bit, for each byte of the data file. | 7.5

When MAC (Media Access Control) frames defined by IEEE 802.3 are transmitted over Ethernet, which of the following methods is used for error detection? | CRC

Which of the following methods is used for avoiding unnecessary collisions in the IEEE 802.11 family of wireless LAN standards? | CSMA/CA

VLAN (Virtual LAN) is used to logically segment a LAN into different broadcast domains. In which of the following network devices should the function of VLAN be supported? | Switch

Which of the following is an appropriate explanation of the schema in a relational database management system? | It is a set of data definitions, such as the data attributes, data formats, and relationships with other data.

indicates that the value of attribute y is determined uniquely by the value of attribute x. Which of the following appropriately defines the relationships shown in the figure as a set of tables of the third normal form? Here, multiple attributes contained in a box x show that the value of attribute y is determined uniquely by the values of all those multiple attributes. | Table 1(a, b, c, d, e)- Table 2(b, f, g)- Table 3(b, c, h)

Which of the following is a non-updatable view? | A view including a “GROUP BY” clause in the view definition

There are two tables X and Y as shown below. Which of the following SELECT statements returns the maximum number of rows by using these two tables? | SELECT \* FROM X, Y

When a new record is inserted in the relational database table “Payment” shown below, which of the following SQL statements causes a unique constraint violation? Here, “Contract\_number” and “Contract\_date” are primary keys. | INSERT INTO Payment VALUES (1003, ‘2009-01-15’, 1000)

Which of the following files is used for writing the values before and after a database update, and storing them as a database update record? | Journal file

When secret documents are sent and received using public key cryptography, which of the following is an appropriate description of the key management? | The decryption key must be kept private, but the encryption key is public.

In the context of message authentication code, which of the following is the purpose of using message digests? | To confirm that no message has been tampered with

Which of the following is an appropriate explanation of Web beacons? | Images embedded in Web pages to gather information such as user access trends

Which of the following is an appropriate description concerning security measures for network systems? | By using a circuit-switched network with closed-area connection functions, limiting connections to particular user groups is an effective way to prevent unauthorized external access.

There are two types of attacks which an information system might face: active attack and passive attack. Which of the following is categorized as an active attack? | Falsification of data

Which of the following shows the appropriate sequence of items 1 through 3 that are required for establishing ISMS according to ISO/IEC27001:2005? | 3-2-1

The projected annual purchase amount and the actual annual transaction value of each client company are plotted on the graph. Which of the following is the appropriate description concerning the future sales policy? | A client in area A has the potential of becoming a major customer, so it is better to strengthen sales activities.

Which of the following financial statements indicates the assets, liabilities, and net assets of a company at a specific time and shows the financial condition of the company? | Balance sheet

The table shows the sales, cost, and profit for a certain product in the current period. When the sales unit price of this product is 5 dollars, at least how many should be sold to earn twice or more in profit during the next period? | 3000

Which of the following is the work sampling method? | It specifies the number of observations and observation time, and estimates working hours from the ratio of the number of observation points by actual observation based on statistical theory.

How many days in total are required in the critical path of the arrow diagram? Here, the number shown beside the arrow indicates the number of days for each activity. | 11

A certain factory has recorded the number of defective products in the past on a root cause basis. Which of the following is the graph that indicates the factors that are ranked high for defective products and their rates, based on this record? | du?ng cong lên ki?u c?u v?ng

You want to invest in one of the stocks A through D, all of which are 100 dollars at the current price. The table shows the predicted price increase of each stock when the growth of the economy is high, medium, or low. When the “maximin” principle is applied, which of the following stocks should be invested in? | A

Three products A, B, and C are processed by two machines M1 and M2. Processing must be performed in order of M1?M2 (M1 first and then M2). The table shows the time required to process each product on each machine. In this case, which of the following shows the order of processing these three products so that the time required from the start of the process to the completion of the process for all the products may be the shortest? Here, when processing of a product at M1 is completed, another product can be processed consecutively at M1. Preparation time, such as setup time, is ignored. | B-A-C

Which of the following explains a volume license agreement? | The agreement offers a master to a bulk buyer of the software, such as a company, and determines the maximum installable number of licenses beforehand.

Which of the following arithmetic expressions is correct? Here, a number is written in radix notation; that is, a decimal subscript following the number (i.e. numberradix) is used to indicate the radix. | 1101 + 4 = 17

When the binary fraction 11101.110 is subtracted from the binary fraction 101101.101, what is the correct result? | 111.111

When a certain natural number x can be represented by a 2n-digit binary number consisting of 1 and 0 arranged alternately, i.e. 1010...10, which of the following equations holds for x? | ket qua (2 mu 2n) - 1

There is an 8-bit numerical value, where a negative number is represented in two’s complement. When this value is represented in decimal, it becomes -100. When this value is regarded as an unsigned number, which of the following is the correct value in decimal? | 156

When multiple values are added arithmetically, it is recommended that the values be added sequentially, starting from the number whose absolute value is the smallest. Which of the following errors can be reduced by means of this method? | Loss of trailing digits

The figure below shows daily changes in the weather for a given district, and each value represents the probability of changes in the following day’s weather. When the weather is rainy on a given day, what is the probability that the weather is clear two days later? | 0.33

Which of the following operations does not change the lower 4 bits of an 8-bit string? | A logical product (i.e. AND) with a bit string 0F in hexadecimal

In a certain company, there are a total of 400 employees including 100 smokers. The number of male employees is 250, including 75 male smokers. What is the probability that an employee selected at random is a female nonsmoker? | 5/16

The decision table shown below is used to determine whether or not an order can be accepted in a sales order processing system. Which of the following logical expressions is equivalent to “Accept order”? Here, “NOT” is used for the logical negation, “AND” for the logical product, and “OR” for the logical sum. | (NOT X) AND (NOT Y OR Z)

Which of the following sets is equivalent to the set S-(TvR)? Here, “^” stands for a product set operation, “v” for a union set operation, and “-” for a difference set operation. | (S-T)-R

The figure below shows the state transition diagram of an automaton that accepts bit strings with even numbers of 1s. The double circle marked with “Even” represents the accepted state. Which of the following combinations should be inserted in the blank boxes labeled A and B? | 1 - 0

Which of the following is the minimum possible depth of a binary tree with 14 nodes? | 3

Which of the following appropriately describes a characteristic of linked lists? | The elements cannot be accessed directly or randomly.

There is a two-dimensional array A(m, n) with m rows and n columns, and the array in physically contiguous memory addresses is accessed such that rows are stored one after another, in row-major order. Which of the following is the correct memory address of any given element A(i, j)? Here, both m and n are greater than 0, and the indices i and j range from 1 to m and n respectively. In addition, x is the memory address of the element A(1,1). | x+n×(i–1)+(j–1)

When a list of seven elements shown below is rearranged in ascending order, which of the following sorting algorithms is completed with the minimum number of element exchanges? (15,14,13,12,11,10,9) | Selection sort

When a program (or a function) calls itself recursively, which of the following data structures is suitable for storing the data that is currently used in the program? | Stack

Which of the following logic circuits (i), (ii), and (iii) is or are equivalent to the circuit shown in Figure 1? Here, A and B are input signals and F is an output signal. | (i), (ii), and (iii)

When two D flip-flops are connected as shown below, which of the following timing charts represents this logic circuit? Here, in D flip-flop, an input signal is read in and held as an output signal only when a clock signal is changed from zero (or low) to one (or high). In other cases, no state transition occurs. | chinh giua, dai trai, ngan phai

Which of the following is a high-speed memory technology that uses flip-flop circuits? | SRAM

In a certain intrusion detection system, a detector is driven by a 4 KHz crystal clock oscillator and checks intrusion every 1,000 clock pulses. How many times per minute does the detector check intrusion in this system? | 240

Which of the following addressing modes is shown in the figure below? | Indexed addressing mode

A CPU that operates at 1 GHz is known to execute one machine-language instruction in an average time of 0.8 clocks. Approximately how many million instructions can be executed by this CPU in one second? | 1250

There is a hard disk drive that has the following specifications. | 50 Mbytes

From a point of view of better performance, improved fault tolerance, and enhanced data integrity, which of the following RAID configurations is commonly suitable for enterprise systems? | RAID 5

Which of the following is an explanation of USB? | A serial interface that connects devices in a tree topology via hubs

When an image file is transferred from a PC at hand to another PC separated by a partition without any connection cables, which of the following interfaces can be used? | Bluetooth

A color video clip is displayed in full-screen mode on a PC at 30 frames/second, with each screen comprising 300,000 pixels and 256 colors displayed at the same time. Under these conditions, which of the following is the approximate amount of data (in megabytes) that can be displayed in one minute? Here, the data is not compressed. | 540

With which of the following task scheduling methods is it highly possible for a specific task to continue to wait for the allocation of CPU resources? | The task with the shortest estimated processing time is executed first. The next task is initiated when the currently executed task is completed or suspended for some reason.

When a printing operation is performed under the conditions shown below, what is the minimum number of megabytes necessary as the total capacity of the spool file? | 1,200

Which of the following is the appropriate purpose of using semaphores? | For managing shared resources

The FIFO method is used as the page replacement algorithm in virtual memory. There are 3 page frames available in real memory, and a reference list of the virtual page numbers “1, 4, 2, 4, 1, 3” was allocated to real memory in this order as shown in the table below. The table, up through “assigning step 3”, shows the status of the real memory pages just after each of the first three page numbers “1, 4, 2” of the reference list was allocated to real memory. Which of the following should be inserted in the bold-lined box that indicates the last status of the real memory pages just after the remaining page numbers were referenced? | 3 4 2

When a certain job is executed in a computer system, 35 percent of the total processing time of the job is used for CPU and the rest is spent waiting for I/O to complete. If a newer CPU whose speed is three times faster than the current one is installed, approximately how many times faster is the new system than the current system? Here, the system environment except for the CPU remains unchanged. | 1.3

Which of the following is the system configuration with the highest availability? Here, multiple systems connected in parallel are considered operating if at least one system is operating. | Three identical systems with each availability of 80% in parallel connection

When machine tools are controlled by microcomputers, which of the following focuses on fail safe? | The system automatically stops when an abnormal operation signal is detected.

Which of the following is an appropriate explanation of availability concerning RASIS? | A computer system is maintained in such a state that it can be used whenever necessary.

When a corporate intranet is connected to the Internet, which of the following mechanisms works as a bridge to access the Internet, enables high-speed access by caching Web content, and then is used to ensure security? | Proxy

Which of the following is an appropriate explanation of data mining? | A technique that uses statistical and mathematical methods to analyze large volumes of data in order to discover rules and causal relationships

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

Which of the following tasks is performed in the external design phase of the waterfall model? | Code design

Which of the following is the most appropriate description concerning software reuse? | More person-hours are required for development of reusable components than for regular software development of the same scale.

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? | high high

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

Which of the following is an explanation of encapsulation in the object-oriented paradigm? | Data and its related operational procedures are hidden inside objects.

Which of the following combinations is described in a UML class diagram? | Attribute, operation, role name

Which of the following is an appropriate execution sequence in the test phase of the waterfall model? | Unit test - Integration test - System test - Operational test

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? | It can record program flow, such as the sequence and results of execution of the program instructions.

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? | 40, 80, 120

Which of the following is used for estimating the scale of system development with the function point method? | Number of screens

In a system environment requiring continuous availability as well as a high level of reliability, which of the following is the most appropriate term that stands for the capability to automatically switch over to a standby or redundant database, a server, or a network when the previously active one fails to operate properly? | Fail-over

A value is calculated from a given data according to specific rules, and then a check character is determined from this value and appended to the given data. This is used to check the input data. | 7

Which of the following devices is used for the purpose of protecting systems against momentary power loss and supplying just enough power for systems to shut down at the time of power outages? | UPS

The person in charge of operating a sales management system has decided to rearrange the customer master file records in cooperation with the system users in the sales department. Which of the following is an appropriate policy for rearranging the master file? | Before deleting a customer record, it is necessary to first check that the customer code is not used anywhere within the sales management system and related systems.

When the subnet mask “255.255.255.0” is used in a “class A” network, how many host addresses can be assigned to network devices? | 254

Which of the following protocols is used in mail servers on a TCP/IP network? | SMTP

Which of the following protocols is supported by the transport layer of the OSI basic reference model? | TCP

Which of the following is the network topology that is used to connect one central node or hub with point-to-point links to several other nodes? | Star

In home and office networks of Fast or Gigabit Ethernet, which of the following cables can be used as a lower cost option for connecting a client PC to the network? | UTP

Which of the following is a device that interconnects LANs at the physical layer of the OSI basic reference model? | Repeater

Which of the following is the most appropriate information used by routers in order to determine the routing paths of packets? | Destination IP address

As shown below, there are three tables Student, Instructor, and Result. Which of the following relational algebra operations can be used for deriving the table “Result” from the tables “Student” and “Instructor”? | Instructor – Student

There are three tables T1, T2, and T3 as shown below. Which of the following tables is created as the result of executing the SQL statement specified below? | 1-70 2-30

When a program accesses relational database tables by means of embedded SQL statements, which of the following SQL statements is used to define the derived table? | DECLARE CURSOR

Which of the following is an appropriate description concerning the recovery process of databases? | At the restart known as “warm start,” control goes back to the checkpoint, and the update information log is used for recovering the database.

Which of the following is an appropriate description concerning the duties of database administrators? | To design and maintain databases, monitor their operations, and recover from failures

For the purpose of finding out the number of times a Web page is accessed, an access counter is being designed. As shown in the figure, when two browsers gain access to the Web page simultaneously, Processes 1 through 4 are executed in this order on the server. When the access counter value is 100 before the two browsers access the Web page, what is the counter value at the completion of Process 4? | 101

In public key cryptography, which of the following key can be used for decrypting the data that is encrypted by using the server’s public key? | Server’s private key

Which of the following is an appropriate description of phishing? | It is a technique for fooling users into visiting a hostile or untrusted website through spam messages and divulging personal data such as accounting numbers, passwords, and other confidential information.

In an electronic transaction that employs public key cryptography, which of the following is created by the certification authority (CA), a third party independent of the parties involved in the transaction? | The electronic certificates for the public keys of the parties involved in the transaction

Which of the following is an appropriate description concerning Internet VPN security? | There is no capability for identifying individual people who are qualified to participate in the network.

Which of the following is an appropriate description concerning risk analysis? | It takes too much time and cost to handle all potential risks, so the damage costs and occurrence probabilities should be estimated in advance and priority should be given in accordance with the magnitude of risks.

Which of the following is a meta-language that includes self-defining markup symbols called tags to describe the content of a Web page or file and supports bi-directional hyperlinks with high affinity to the Internet? | XML

Which of the following is the purpose of emphasizing the importance of stakeholders in corporate management? | Improving satisfaction of interested parties such as customers, shareholders, and employees; aiming for sustainable growth

When the average cost method is used for the inventory control in the transaction record table shown below, what is the inventory value (in dollars) at the end of March? | 1,875

As shown below, a shop purchases and sells a certain type of product. | 200

Which of the following is the appropriate relationship between two variables x and y represented by the scatter diagram? | Negative correlation

Which of the following is the diagram showing results of cluster analysis? | hinh cay nhi phan nam ngang

When ABC analysis is done on the products shown in the table below, which of the following is a set of the product numbers that should be handled as management items of Group A? | 2 and 5

The figure below is the OC curve (Operating Characteristic curve) that shows the result of a sampling inspection of a certain product lot. Which of the following appropriately describes what this figure indicates? | The probability that a lot with a fraction defective greater than p2% passes the inspection is at most L2.

Which of the following is the explanation of a control chart? | Variation of data occurring in time sequence is expressed by a line graph; it is used to find an abnormal behavior, with an upper limit and a lower limit specified.

Which of the following is a characteristic of IC tags (RFIDs)? | IC tags are dirt-resistant, and the information recorded on them can be read even from outside the package.

When the equation “100n–34n=44n” holds, which of the following represents 26n? Here, each number is written in radix notation; that is, each subscript “n” indicates the radix. In addition, when there is no subscript, the radix 10 is implied. | 22

In the truth table shown below, which of the following is the correct combination of output values x1, x2, and x3? Here, “·” stands for the logical product, “+” for the logical sum, “?” for the exclusive OR, and “X ” for the logical negation of “X”. | 1 0 1

Which of the following expressions can be used to calculate the quarter number (for example, “1” for January through March) for the n-th month of the year? Here, “n” ranges from “1” for January to “12” for December, and each fractional part of the resulting values is truncated. | ((n-1) chia 3) + 1

When the resulting value of the expression “13 × 16^3+11× 16^2+9 × 16+3” is represented in binary, how many “1” bits are included in the binary value? | 10

When the simultaneous equations shown below hold for the Boolean variables w, x, y, and z, which of the following is the correct solution? Here, “+” stands for the logical sum operation, and “·” for the logical product operation. | 0 1 0 1

Tic-tac-toe, also known as noughts and crosses, is a popular game for two players, O and X, who take turns marking the spaces in a 3×3 grid. The player who succeeds in placing three respective marks in a horizontal, vertical, or diagonal row wins the game. For example, the player O wins on the tic-tac-toe board shown below. | 9!

When three cards are randomly selected at a time from a standard deck of 52 playing cards, what is the probability that all of these three cards are in the same suit (heart, diamond, spade, or club)? | 22 chia 425

When a linked list is used for queue implementation, which of the following structures provides the most efficient and effective way to perform both “insert” and “delete” operations? Here, the number of queue elements is variable, and the arrows shown in the figures represent link pointers. | hai hang chu, 4 thung chuyen tuan tu

Which of the following is an appropriate description concerning a binary search tree whose node values are 17, 6, 19, 3, 22, and 32? | No matter which value is placed at the root node, “3” cannot have a left child.

In a binary tree, | n + 1

Which of the following data structures can be referred to as a “last-in first-out” operation? | Stack

When the binary search algorithm is applied to the list of data sorted in ascending order as shown below, how many comparisons are needed to find the fact that “104” is not in the list? | 4

When the expression | sum + ((–1)^i ×x^–i) - sum

Which of the following stands for the processor architecture in which a single stream of instructions can operate on multiple pieces of data in parallel? | SIMD

Which of the following is classified as an internal interrupt? | Interrupt by divide-by-zero

When a memory chip has 8 data lines and 9 address lines, what is the maximum number of bytes that can be stored in the chip? Here, chip select signals are implemented independent of those address lines, and no parity bit is considered. | 512

Which of the following is an optical disc that uses organic dye for the recording layer of the storage media and makes the traces of burning by laser light called pits to record the data? | CD-R

Which of the following is an appropriate explanation of memory-mapped I/O? | It is a technology for assigning the registers of I/O devices to the specifically dedicated I/O address space in main memory.

Which of the following is the most appropriate explanation of grid computing? | By connecting multiple computers via a network, a high-performance system can be configured.

As shown in the figure, this configuration consists of two systems. One performs on-line processing as an active system, and the other prepares for failure of the active system as a standby system. The standby system usually performs batch processing. What is this system configuration called? | Duplex system

As shown in the figure, one server, three clients, and two printers are connected to the LAN. This system transfers the data on the server to a printer based on instructions from a client. When the availability of each device is as shown in the table, which of the following is the formula indicating the availability of this system? Here, the operation is considered normal if at least one of the three clients and one of the two printers are operating. | a (1–(1– b)^3 ) (1– (1– c)^2 )

The system operations model is shown in the figure. Which of the following is the appropriate combination of the expressions indicating MTBF and MTTR in this system? Here, “ti” represents the system operation time, and “ri” represents the system repair time (i = 1, 2, ..., n). | 1 chia n - ti va 1 chia n - ri

A certain computer system runs in a multi-programming environment using a non-preemptive “shortest job first” algorithm. In this system, four processes A, B, C, and D arrive sequentially in the process queue every 1 millisecond. The table shown below includes estimated execution time for each process; for example, process A uses CPU, I/O, and then CPU sequentially for 4, 5, and 4 milliseconds respectively. Which of the following is the third completed process? Here, the multi-processing overhead of OS can be ignored, and both CPU and I/O operations can be executed concurrently. | B

In a certain file server system, it takes 15 ms to process one transaction if the target data is available in the disk cache. If the target data is stored in the hard disk in lieu of the disk cache, additional 75 ms for disk access is required to process it. When two-thirds of the number of transactions can be processed by using the disk cache data only, how many transactions per second on average can be consecutively handled in this system? Here, no parallel operation of disk access and data processing is performed. Overhead, such as communication and OS, can be ignored. | 25

There is a virtual memory system in which the FIFO or LRU page replacement algorithm can be used as a page replacement algorithm. There are 4 page frames available in real memory, and a process makes the list of page references as follows: | 6 8

Which of the following appropriately describes the role of task management? | It controls multiprogramming and uses the CPU effectively.

Which of the following is the appropriate explanation of the hash method? | Access method that calculates the storing address of a record from its key value using a function

Which of the following groups of CASE tools is used only in a particular stage of the software development life cycle and is designed to work cooperatively with other CASE tools in an integrated and consolidated environment? | Component CASE tools

Which of the following is the appropriate explanation of DRAM? | It can represent one bit, depending on whether the capacitor is electrically charged or not. It is often used as main memory.

As shown in the floor layout below, there are three sensors S1, S2, and S3 that control a light bulb in the middle of a hallway. The sensor S1 is a light sensor that generates the output signal “0” only when sunlight (or some other external light source) is detected. | hai cai dau tu

The half adder in the diagram below adds one-digit binary numbers x and y, and produces z (the first digit of the sum) and c (carry) as output. Which of the following is the appropriate combination of elements A and B? | Exclusive logical sum - Logical product

Which of the following is an appropriate usage of a radio button that is a GUI component? | It is used to select one option from among a set of mutually exclusive options.

Which of the following is a human interface design that is intended to improve the consistency of operations? | Designing operation buttons so that they have a common display location and shape on all screens

Which of the following SQL statements corresponds to the “projection” operation of the relational algebra that can extract only the column “Continent” from the table “Country” and eliminate duplicates from the records returned? | SELECT DISTINCT Continent FROM Country

Among the ACID (Atomicity, Consistency, Isolation, Durability) properties of transactions, which of the following is the appropriate description concerning “atomicity”? | A transaction is a basic unit of processing; it must be performed in its entirety, or else it must be cancelled.

When a database on a client/server system is accessed, which of the following is the function that can reduce the network load by preparing the instruction groups beforehand that are frequently used on the server? | Stored procedure function

Which of the following is the appropriate description concerning exclusive control in a database? | When a shared lock is applied to a resource by a transaction, another shared lock can be applied to it by another transaction.

Which of the following appropriately describes a characteristic of distributed database systems in comparison to centralized database systems? | Local queries and transactions accessing data at a single site have better performance because of the smaller local databases.

Which of the following protocols can be used to temporarily assign an IP address leased from the pool to the host that asks for an address or to repeatedly assign the same IP address to the host according to the MAC address of the host? | DHCP

Which of the following can be used to interconnect multiple LANs on the network layer (layer 3) of the OSI basic reference model and to relay packets of data? | Router

When the subnet mask 255.255.255.240 is used for a server, which of the following is a valid IP address of the server? | 195.206.108.25

Which of the following is the signaling protocol that is widely used to initiate, manage, and terminate multimedia communication sessions, such as voice and video calls over the Internet? | SIP

Which of the following is a security feature that can allow network administrators to specify exactly which stations should have access to the wireless network? | MAC address filtering

Which of the following can be achieved by receiving mail text and its hash value from the sender and comparing the hash value with the one calculated from the mail text by the receiver? Here, the hash value from the sender is protected. | Detection of presence or absence of falsification

When the judgment threshold is changed in a biometric authentication system, which of the following shows the relationship between FRR (False Rejection Rate) and FAR (False Acceptance Rate)? | As FRR decreases, FAR increases.

As shown in the figure, an application on a client has access to the database on a server via a pair of database connection programs. Which of the following is the appropriate measure for preventing the data transmitted and received between the database connection programs from being wiretapped on a communication line? | Encrypting the communication between the database connection programs on the client and server sides

Which of the following sends a program incorporating fraudulent functions, such as destruction and falsification of data, for installation and execution? | Trojan horse

A Web server was invaded from the outside, and its contents were falsified. Which of the following is the appropriate sequence of subsequent activities? | 3 1 2 4

Which of the following systems is the most suitable for a design using a state transition diagram? | A greenhouse control system, which keeps the optimum environment in a greenhouse based on the information of the installed sensors

Which of the following appropriately describes “efficiency” that is one of six software quality characteristics defined in ISO/IEC 9126-1? | The capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions

Which of the following is an example of the relationship between the base class and the subclass in object orientation? | “Figure” and “triangle”

Which of the following is the appropriate purpose of regression test? | To verify the functionality of the upgraded system against a baseline system to ensure that any existing system capabilities have not been adversely impacted

Which of the following is the appropriate description concerning standardization in programming? | Defining programming conventions is effective for preventing errors that programmers tend to make.

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. | (A=7, B=0), (A=8, B=2)

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. | 18

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? | CMMI

The table below shows the series of activities for a certain project. The numbers in the table indicate the cost of each activity and how long (in weeks) it takes to complete each activity. Prior to starting each activity, the previous activities shown in the table must be completed. When the weekly cost of the project is minimized without delay of the project, what is the highest weekly cost in dollars during this project? | 750

The execution plan for the system development project is prepared, and the critical path is obtained. Which of the following is the activity that can be understood by means of the critical path? | The activity whose delay directly leads to the delay of the whole project

Which of the following appropriately describes the purpose of using WBS (Work Breakdown Structure) in software development? | To divide development work into small tasks in a top-down manner, thereby facilitating work management

Which of the following is an appropriate characteristic of a Gantt chart used in progress control? | It can compare the planned schedule and actual results.

When the four roles, change control administrator, configuration administrator, maintenance administrator, and maintenance staff are defined in software maintenance organizations, which of the following persons should be primarily responsible for providing mechanisms for identifying, controlling, and tracking versions of software components? | Configuration administrator

The membership registration process in company A issues IDs in the format defined below. The table shows the transition of the number of issued IDs at the end of each fiscal year. On the assumption that this tendency continues in years to come, when are the IDs in this format expected to be exhausted? | Fiscal year 2012

Which of the following is the primary objective of conducting a system migration test? | To confirm the procedures for switching from an existing system to a new system as well as problems accompanied with this switching, from the viewpoints of security and efficiency

Among the functions provided by client management tools, which of the following is the most effective function for confirming that no software unrelated to the business operations is installed? | Inventory collection

Which of the following is the purpose of periodically reorganizing a database in operation? | Additions, updates, and deletions performed repeatedly on a database generate storage areas that cannot be reused, and therefore the database volume increases and the processing speed decreases. For this reason, such areas are reorganized to prevent performance degradation.

Which of the following is an appropriate description concerning the role of a system auditor? | It is to assure the full preparation and operations regarding the control of the information system or to give advice on them, from a professional standpoint independent from the audit target.

When IT controls are classified into the two categories of preventive control and detective control, which of the following falls into the category of detective control for discovering data entry errors or unauthorized actions? | Matching the output list of data entry results with the data entry sheets

Which of the following is an explanation of EA (Enterprise Architecture)? | It is a technique to review respective business operations and information systems from the perspective of overall optimization through analysis of four key architectures—business, data, application, and technology.

The diagram below shows the procedure for business improvement in six steps. When activities “a)” through “d)” are to be inserted into the blank boxes A through D, which of the following is the activity inserted in the blank box C? | Develop improvement plan

A scoring model is a method for quantifying qualitative evaluation items. Based on the four-level scoring model and evaluation items shown in the table below, which of the following indicates the goal achievement level of the entire system in percentage? | 36

Which of the following is a document that asks to provide the information necessary for the preparation of a document that asks for proposals? | RFI

Which of the following is an advantage of M&A? | A company can establish a new business in a short period of time by acquiring skills and know-how that it does not have.

Which of the following describes the characteristics of niche strategy in the context of competitive strategy? | Specializing in a market segment where other companies cannot enter easily to achieve higher profitability

Which of the following is not an appropriate usage for embedded systems? | A host system for managing train ticket reservations

Which of the following is “B to C” in electronic commerce? | Virtual mall

In an arrow diagram shown below, at least how many days are needed to complete all the activities A through J? Here, in the diagram, each number shown beside the arrow indicates the number of days required for the activity. | 11

When the fixed order quantity model can be used for controlling inventory under the following conditions, what is the Economic Order Quantity (EOQ)? Here, EOQ is the optimal order quantity that theoretically minimizes the total of the cost of ordering and holding inventory. The demand is constant, and does not vary over time. | 1000

The sales staff at Company A wants to depart from Company A, visit customer companies B, C, and D once, respectively, and return to Company A. The table shows time required to move from one company to another. How long is the shortest time (in minutes) required for the visit? | 110

Which of the following appropriately explains “patent right” according to the WTO’s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)? | It is a right to exclusively utilize a new invention suitable for industrial use, which is granted upon application to and examination by the competent authority.

Which of the following is the appropriate description concerning the CSV data format? | It separates character and numeric data by a comma and data records by line feeds. Character data may be enclosed in quotation marks.

#There is an 8-bit register where integers are represented in binary by using 2’s complement for negative numbers. When the decimal integer “–24” is stored in the register and then arithmetically shifted 2 bits right, what is the resulting value in decimal? Here, the leftmost bit of the register is used as a sign bit | –6

#When a single-bit “half adder” circuit is used for simply adding two input signals x 1 and x 2 , which of the following is the appropriate combination of logical expressions for two output signals s (sum) and c (carry)? Here, “ ? ” stands for the logical OR operation and “? ” for the logical AND operation. | (x1+x2).\_(x1.x2) - x1.x2

#Which of the following prefix expressions is equivalent to the infix expression “(A + B) \* C – (D – E)”? | – \* + A B C – D E

#The syntax rules of the field identifier “field ID” are represented in BNF notation as shown below. When each ID is defined as an arbitrary sequence of letters and/or digits, which of the following should be inserted into the blank A?| <letter>|<digit>|<ID><letter>|<ID><digit>

#As shown in the figure below, there is a binary tree which is created in accordance with a specific rule that the value of a parent node is greater than that of a child element.| D

#When a set of values “5, 4, 3, 2, 8, 6, 0, 1, 9, and 7” is inserted in this order to create a binary search tree, which of the following represents the sequence of node values visited in the post-order traversal of the binary search tree? | 1 0 2 3 4 7 6 9 8 5

#At this point, three values 6, 8, and 15 are stored in the queue. The start and end pointers indicate the location of the first and last data values respectively. After the series of operations described below is performed| 5 0

#When the series of operations below is performed on an empty stack, which of the following is the data remaining on the stack? Here, “push x” is the operation to save data x to the stack, and “pop” is used to retrieve data from the stack. | 1 and 3

#Extract an element one by one from an unsorted dataset, and insert it into a max heap until all the elements are extracted and inserted. | 2

# The Fibonacci sequence (0, 1, 1, 2, 3, 5, 8, 13, 21, 34, …) can be defined recursively as follows: | 15

#In a certain CPU, a floating point adder unit uses a total of 40 percent of the execution time. If the floating point adder unit is replaced with a new unit whose speed is ten times faster than the original unit,| 1.56

#There is a CPU with a clock frequency of 1 GHz. When the instructions consist of two types as shown in the table below, what is the performance in MIPS of the CPU?| 125

#When a color image is stored in video memory at a tonal resolution of 24 bits per pixel, approximately how many megabytes (MB) are required to display the image on the screen with a resolution of 1024? 768 pixels?| 2.4

#How many memory cells (or latches for holding 1 bit each) are implemented in SRAM with 24 address lines and 16 data lines?| 2^24x16

#There is a hard disk drive that has the specifications shown in the table below. When a record of 10,000 bytes is read out from this disk, approximately how long (in milliseconds) does it take to access the disk and to complete the data transfer?| 42

#Which of the following is the appropriate purpose of defragmentation of hard disks? | To access disk files faster and more efficiently

# Which of the following is an appropriate explanation of TCO? |Total cost required throughout the life cycle of a system

# In the RAID3 system shown below, three disks (Disks 0 through 2) for byte-striped data and one dedicated parity disk (Disk 3) are used as one volume. Parity byte A p is generated by calculating the “exclusive OR”|Exclusive OR

# Backup sites, which are used during system downtime, are classified into three types: warm, cold, and hot sites. In general, which of the following is the list arranged in order from shortest to longest recovery time?|Hot site, warm site, cold site

# Which of the following is the appropriate explanation of throughput? |It is the number of jobs processed per unit time. Spooling helps to improve throughput.

# In an online transaction system environment, which of the following represents the interval of time from the time the system completes receipt of an input to the time the system begins to return its resulting output?|Response time

# Which of the following is the most appropriate set of major functions supported by an OS?|Data management, job management, and task management

# Multiple directories having the names “A” and “B” are managed in the structure shown below.|\B\A

# Which of the following is an appropriate explanation of the spooling function?|The overall processing power of a system is enhanced by performing data transfer between the main storage and low-speed input/output devices via auxiliary storage devices.

# There are some methods of getting backup files for the purpose of recovering files and managing generations. Which of the following is an appropriate description concerning those methods or procedures?|A differential backup contains all files changed after the last full backup, while an incremental backup saves all files changed after the last full, differential, or incremental backup.

# The figure below shows a logic circuit representing a full adder. When 1, 0, and 1 are entered into x, y, and z respectively, which of the following is the appropriate combination of the output values of c (carry) and s (sum)?| 1 0

# Which of the following is an appropriate explanation of SoC (System on a Chip)?|A semiconductor chip in which all required functions (systems) are integrated in the same manufacturing process

# Which of the following is a user interface that enables frequently-used operations to be performed efficiently?|Shortcut key

# Which of the following is the data model that was originally introduced for the purpose of conceptual modeling and is often used for logical modeling and physical modeling as well as conceptual modeling?|E-R model

# The figure below shows the relationships among data items used in a certain parts management system. When the system is implemented as a relational database|Parts table - Part\_name Color Cost Supplier\_name/ Supplier table -Supplier\_name Supplier\_address Supplier\_phone

# As shown below, there are two relational database tables Movie and Actor. Which of the following SQL statements should be used for retrieving a list of movie titles, released years, and directors, from all the movies that include “Action” or “Comedy” as a genre and “Cooper” as an actor’s name?|SELECT Movie\_title, Released\_year, Director FROM Movie, Actor WHERE Name = 'Cooper ' AND (Genre = 'Action ' OR Genre = 'Comedy ') AND Title = Movie\_title

# As shown below, there are four relational database tables Product, Supplier, Sale, and Employee that are used for a database system in a retail store. Here, the solid and dotted lines indicate the primary and foreign keys, respectively.|10,000

# As shown in the table below, there are five transactions T 1 through T 5 that are performed simultaneously in parallel, in any order. Which of the following is the combination of transactions that has the possibility of a deadlock? Here, only one transaction can have an exclusive lock at a time.|T 2 , T 3 , and T 5

# Which of the following explains the database rollback process? |The “undo journal” is used to restore the data to the status immediately before the start of the transaction.

# Which of the following information in IP header is used for routing the IP packets across networks?|Destination address field

# Which of the following network topologies is commonly used, especially in Fast or Gigabit Ethernet, for connecting network devices via a centralized unit such as a hub or a switch?|Star

# What is the minimum number of communication cables that are needed to connect six network devices in a full mesh topology? Here, at least one communication cable is required to connect two network devices.| 15

# Which of the following is the IP network addressing and routing scheme whereby data is routed to the “nearest” or “best” destination as viewed by the routing topology?|Anycast

# Which of the following protocols can be used to access e-mail messages that are stored on a remote, and possibly shared, mail server, and thereby are manipulated from a desktop computer at home, a workstation at the office, and a notebook computer while traveling, without the need to transfer messages back and forth between these computers?|IMAP

# When a message is sent to Person A from Person B using public key cryptography, which of the following keys should be used for encrypting the message?|A’s public key

# Which of the following is the function of S/MIME used for e-mails? | Encrypting e-mails and attaching a signature

# Which of the following can be achieved by using SSL/TLS? |Communication between clients and servers is encrypted.

# Which of the following refers to online scams where thieves attempt to entice e-mail recipients into clicking on a link that takes them to a bogus website, and the website may prompt the recipient to provide personal information such as social security number, bank account number,|Phishing

# A government website accepts passport applications using HTTP forms to collect information. Users provide complete personal information in the forms to help expedite processing of face-to-face transactions, and payments are done offline.| Sniffing traffic for identity theft

# Which of the following explains the pattern matching method that is used by antivirus software?|Viruses are detected by comparison with the signature codes of known viruses.

# 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?| Use case diagram

# Which of the following is an appropriate description concerning object-oriented design?|“Encapsulation” is the technique to integrate data and operational procedures as an object and hide implementation details from the outside.

# Which of the following is an appropriate combination of the fundamental object-oriented concepts?|Abstraction, encapsulation, inheritance, class

# 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?|High Low

# 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?|The process is facing some bugs that are difficult to resolve, and subsequent tests are not proceeding.

# 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?|Integration test

# 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?|Spiral model

# Which of the following is an appropriate description concerning the maturity level in the staged representation of CMMI?|At the “managed” level, processes are documented and followed.

# Which of the following is the project management tool whereby the project activities and their relationships can be graphically represented, and the project manager can understand how the various activities flow towards completion in order of time?|Network diagram

# A painter has 20 houses and 4 shops to paint. In comparison with the shop, the house usually takes half the time to paint. The painter has finished painting 10 houses in 3 days. If the painter continues to work at the same pace, how many days does it take to complete the remaining work|5.4

# Which of the following is the appropriate element that is used to calculate slack time in the PERT (Program Evaluation and Review Technique)?| The earliest of the latest start times of the successor activities

# Which of the following is the method used for estimating the scales or person-months in system development where the five basic components—external input, external output, internal logical file, external interface file,|Function point method

# Which of the following is the risk response which accepts the cost of damages because risk impact is assumed to be small when the risk becomes exposed?| Risk retention

# Which of the following is an appropriate characteristic of the single-step (so-called “big bang”) migration method?| Problems during migration to the new system have serious impacts.

# From a viewpoint of reliability of systems, which of the following is the appropriate timing for measuring the availability of a system?|When the problems found immediately after the start of system operations have been resolved and the system is becoming stable

# When a company is notified of the necessity of upgrading the version for the server OS on which a database system and business application are running, which of the following is an appropriate decision on whether or not to upgrade the OS?| The company checks if the database system runs without problem in the new OS environment, and then checks the operation of the business application. If there is no problem, the company upgrades the OS.

# Which of the following is an effective measure to protect information systems from overvoltage caused by lightning?|Connecting communication cables to computers via SPD (Surge Protection Device)

# Which of the following is an appropriate responsibility of a system auditor for problems found during an audit?|Reporting the problems found to the audit requester

# Which of the following is an explanation of ERP? |It is the technique and concept for improvement in management efficiency by planning and controlling the company-wide management resources in an effective and integrated way.

# Which of the following is an explanation of BPR?|Redesigning the business processes from a customer perspective, by making full use of information technology to radically change the characteristics and structure of the company

# Which of the following is the service provided by ASPs? |Services to provide a variety of functions of a general-purpose application system to multiple customers over a network

# Which of the following is an activity concerning a model of business operations developed during the overall planning of information systems?|Associating business processes with data classes

# Which of the following is an explanation of SOA? |It is an architectural style or method to implement software functions corresponding to each activity in business operations as services, and to build the entire system by combining these services.

# Which of the following is an explanation of digital divide? |It refers to economic or social disparities caused by differences in capabilities or opportunities to use PCs and telecommunications.

# Which of the following describes characteristics of the growth stage of the product life cycle?|The market begins to understand the value of the product. The company needs to expand its product lines and distribution channels. During this stage, sales increase but more investment is required.

# Which of the following is a mechanism used in electronic commerce to exchange data between companies? | EDI

# Which of the following is the most appropriate position that is primarily responsible for centralized oversight of enterprise IT strategic planning?| CIO (Chief Information Officer)

# When the relationship between the value “x” of a certain factor in manufacturing a product and the value “y” of a quality characteristic for the product is plotted in a chart, which of the following charts has the positive correlation coefficient between x and y?| huong' ra 45 do

# When ABC analysis is used to categorize product items in the table below, which of the following is the combination of the product numbers for the items that are categorized into the group “A”?| 2 and 5

# When the relationship between the list price and expected demand of a product can be expressed by a linear expression, which of the following is the appropriate value to be inserted in the blank A?|45,000

# Which of the following is an appropriate description concerning financial indicators?|The total capital profit ratio is the ratio of profit to gross capital. As the value is larger, profitability is higher.

#The table below shows records of purchase and withdrawal for a component. When the first-in first-out method is applied, which of the following is the unit price of the withdrawal on April 10? | 110

# Which of the following is a law that protects coded expressions of programs rather than ideas or algorithms in programs?| Copyright law

# Which of the following sets of standards should be applied for the purpose of developing the new products that are expected to be employed by government agencies of countries who are members of the WTO?|ISO standards

# Which of the following is equivalent to the result of the arithmetic expression “ 816 A6753 ? ”? Here, each number is written in radix notation; that is, the radix is represented by a subscript following the number. | 32510

# Which of the following is equivalent to the logical expression “not ( B A? or CD ? )”? Here, A, B, C, and D are variables, and the resulting values of “ B A? ” and “CD ? ” can be either 1 for true or 0 for false. | A>B and C>=D

# Which of the following is a logical equation that is equivalent to the logic circuit shown below? Here, the “•” is the logical product, “+” is the logical sum, and X is the negation of X. | (A.B tat ca ngang).(C ngang + D ngang)

# An empty tank can be filled with water in 20 minutes by using Pipe A or in 30 minutes by Pipe B, and the tank filled with water can be emptied of water in 40 minutes by using Pipe C. When the three pipes A, B, and C work together, approximately how long (in minutes) does it take to fill the empty tank with water? | 17.1

# Among network topologies represented using graphs, which of the following can be regarded as a spanning tree? | khong co duong cong

# There is a two-dimensional array A with ten rows and ten columns. Each element in the array is two bytes long and is stored sequentially in memory in the customary “horizontal row first and vertical column second” order. When the first element A(1,1) is stored in memory address 500 that is represented in hexadecimal, what is the memory address of A(3,5) in hexadecimal? | 530

# A leap year in the Gregorian calendar includes an extra day at the end of February. Any year that is divisible by 4 and does not end in 00 is a leap year. Years ending in 00 are leap years only if they are divisible by 400. How many leap years are there between 1895 and 2011 in the Gregorian calendar? | 28

# There are two one-dimensional arrays A and B of size m and n respectively. Each array contains unique integer values sorted in ascending order. As shown in a sample figure below, these two arrays are merged into a single one-dimensional array C. Which of the following is the appropriate order of the computational complexity of this merge algorithm? | O(m+n)

# Which of the following is the expression that represents the result “x” obtained by the series of three-address instructions below? Here, in a three-address instruction, an instruction using three operands “c = a op b” is represented as “op (a, b, |”. “op” represents an operator. In the expression that represents the result “x”, priority decreases in order of \*, /, +, and ?. / (c, d, w1) + (b, w1, w2) / (e, f, w3) ? (w3, g, w4) \* (w2, w4, x) | (b+c/|.(e/f-g)

# Which of the following is the characteristic of pipeline control? | The processing of each instruction is divided into multiple stages in the processor, and thus multiple instructions are executed in parallel.

# Which of the following is a method of creating a program that can use the instruction cache effectively? | The frequently executed parts of the program are put together.

# In a virtual storage computer system with cache memory, main memory, and disk storage, it takes 2 nanoseconds, 10 nanoseconds, and 10 milliseconds, on average, to access data available in the cache, main memory, and disk storage, respectively. When the cache hit ratio and the main memory hit ratio (after a cache miss) are 0.95 and 0.99 respectively, which of the following is the approximate average time in microseconds to access the necessary data? | 5.0

# When the size of a still image is ,200 60011, ? pixels and each pixel has a 256-level gray scale ranging from 0 to 255, approximately how many megabytes are needed at least to store five such still images? | 10

# Which of the following is a self-luminous display that is classified as a kind of light-emitting diode technology? | OLED display

# Which of the following is an appropriate characteristic of a client/server system? | The server provides functions as services for the client and performs the intended application in cooperation with the client.

# In a client/server system, which of the following is the most appropriate advantage of using “stored procedures” that are available to all clients and do not need to be replicated in each client? | Data traffic between client and server can be reduced.

# Which of the following is the appropriate RAID configuration that provides disk striping at the block level rather than byte level and reserves one disk for parity information? | RAID4

# In an on-line real-time system, there occur transactions at a frequency of 20 times per second. Each of the transactions is completed after it performs the CPU processing once and the hard disk I/O processing four times. The I/O processing time of a hard disk drive is 40 milliseconds per each I/O, and the CPU processing time is negligibly small. When each hard disk drive is accessed evenly, at least how many hard disk drives are required for this transaction processing? | 4

# In memory pool management for real-time systems that use memory resources of various sizes, which of the following is an appropriate characteristic of the fixed-length method in comparison with the variable-length method? | Memory efficiency is low, and processing speed to allocate or release memory is fast and constant.

# Which of the following is the method of improving the throughput of the entire system by transferring data from main memory to a low-speed output device via a high-speed auxiliary storage device? | Spooling

# Which of the following is an appropriate description concerning the use of an application on a computer with virtual memory? | Insufficient main memory causes excessive page faults during running the application and reduces the system throughput

# A certain computer system runs in a multi-programming environment using a non-preemptive algorithm. In this system, two processes A and B are stored in the process queue, and A has a higher priority than B. The table below shows estimated execution time for each process; for example, process A uses CPU, I/O, and then CPU sequentially for 30, 60, and 30 milliseconds respectively. Which of the following is the estimated time in milliseconds to complete both A and B? Here, the multi-processing overhead of OS is negligibly small. In addition, both CPU and I/O operations can be executed | 135

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

# Which of the following is a language processor that can be used to create a program suited to the processing objectives, based on necessary conditions, such as input, process, and output, specified by parameters? | Generator

# Which of the following is the appropriate logic circuit with two inputs and one output where the output X is 0 only when the two inputs A and B are both 1s? | OR circuit

# On a seven-segment LED lighting circuit as illustrated below, when 6D in hexadecimal is written out to the output port, which of the following is displayed? Here, P7 is the MSB (Most Significant Bit), and P0 is the LSB (Least Significant Bit). When 1 is written to a port, the corresponding LED segment is turned on. | 5

# Which of the following is an appropriate explanation of flash memory? | Data is written or erased electrically and erased either all at once or in blocks.

# When a GUI screen is designed for both users who are familiar with keyboard operation and users who are not, which of the following is an appropriate consideration to implement a user interface with good usability? | Both mouse and keyboard interfaces should be provided for as many operations as possible, in order to increase operational flexibility

# Which of the following is the image processing technique that is used for pasting a two-dimensional image such as a pattern or design onto the surface of a modeled object? | Texture mapping

# Which of the following is a concept that is included in both E-R and Enhanced E-R diagrams? | Cardinality

# When the SELECT statement is executed to join two tables T1 and T2 as shown below, which of the following tables is created? | U V X Y Z aa 1 3 4 7 aa 1 2 5 8 bb 2 3 4 7

# Which of the following is the appropriate SQL command that can be used to undo any changes made to the database since the last commit? | Rollback

# Which of the following is the primary purpose of locking a resource in database management systems? | To maintain data integrity

# There is a database that manages user information (user database). From a viewpoint of security management, which of the following is the appropriate access privilege granted to an application program that searches the user database and displays the results? Here, the functions of privileges are described below. | Read privilege

# Which of the following is an appropriate set of characteristics of a data warehouse in comparison with traditional databases? | Integrated, subject-oriented, non-volatile, and time-variant

# Which of the following is the broadcast MAC address that is used by multiple protocols, such as ARP (Address Resolution Protocol) and RIP (Routing Information Protocol), in order to transmit data to all of the hosts on the local subnet? | FF-FF-FF-FF-FF-FF

# In an IPv4 environment, when the subnet mask “255.255.255.224” is used for a class C network, how many IP addresses including reserved or ineffective addresses can be assigned to subnets and hosts per subnet respectively? Number of IP addresses Subnet Host | 8 32

# Which of the following is the appropriate layer of the OSI basic reference model that provides RPC (Remote Procedure Call) support, maintains the integrity of the connection between nodes, and controls data exchange? | Session layer

# Which of the following is a connectionless protocol that offers speed and low overhead as its primary advantage in the transport layer of the OSI basic reference model? | UDP

# Which of the following is a protocol used by the ping command in order to verify that the communication link between source and destination is working in the TCP/IP network environment? | ICMP

# Which of the following is an appropriate combination of information that a DHCP server dynamically provides for a client host to participate in the TCP/IP network? | IP address, subnet mask, default gateway address, and DNS server address

# Which of the following is the appropriate combination that is defined as a socket address in TCP/IP network environments? | IP address and port number

# A message with a digital signature is received via e-mail. Which of the following can be checked by verifying the digital signature of the received message? | The message has not been falsified.

# When Mr. A sends his confidential message to Mr. B by using public key cryptography as shown in the figure below, which of the following is the appropriate key K used for encryption? | Mr. B’s public key

# Which of the following is a technique of social engineering that obtains sensitive or confidential data by searching for residual data left in a computer after job execution or by examining discarded or stolen media such as printed papers, tapes, and discs? | Scavenging

# Which of the following is a collection of infected computers that have been compromised without their owners realizing it and are being remotely controlled by attackers, in order to typically send spam or attack other computers? | Botnet

# A packet filtering-type firewall is installed at the connection point between an in-house network and the Internet. When the firewall makes possible access to the Web server (port number 80) on the Internet from a PC on the in-house network, which of the following is the appropriate combination that is permitted by the packet filtering rules? |Outgoing packet PC Web server 1024 or more 80 Response packet Web server PC 80 1024 or more

# 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? | Use case diagram

# Which of the following is the most appropriate statement concerning the use of frameworks in software development? | Frameworks can shorten the development period for software projects by taking advantage of the work and experience of others.

# In software development, which of the following is the most appropriate primary purpose of performing a system test? | To verify the functionality and operability of the deliverables principally on developer’s own responsibility in the production environment

# 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? | Inheritance

# Which of the following is an activity to be performed in software architecture design within the development process? | Determining how to implement software requirements already defined

# 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? | 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.

# 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? | Reverse engineering

# When a certain project includes activities A through H as shown in the arrow diagram below, which of the following is the earliest start date of avtivity H? Here, the number shown beside an arrow indicates the number of days required for each activity, and the project starts on day zero (0). | 7

# Which of the following is the term that refers to a detailed breakdown of a project into a hierarchy of activities as shown in the figure below? | WBS

# It takes 36 days for Mr. A to complete a certain task, and 18 days for Mr. B to complete the same task. When Mr. A performs the task together with Mr. B, approximately how many days does it take to complete the task? Here, the task can be divided and performed in parallel, and both Mr. A and Mr. B can achieve an average working efficiency of 90 % every day during the cooperative task. | 14

# When the number of programs composing the system and the number of person-days required for coding per program are as shown in the table below, what is the minimum number of staff members required to develop the system in 95 days? Here, in addition to coding, the activities of design and testing are also necessary to develop the system, and those activities require eight times as many person-days as coding. Number of programs Number of person-days required for coding per program Input processing 20 1 Output processing 10 3 Calculation processing 5 9 | 9

# According to ISO/IEC 20000-1:2011 (Information technology – Service management – Part 1: Service management system requirements), which of the following refers to an unplanned interruption to a service, a reduction in the quality of a service, or an event that has not yet impacted the service to the customer? | Incident

# An IT service is provided under the conditions described below. In order to meet the SLA, the maximum allowable downtime should be less than how many hours during the service hours per month? Here, the number of business days in a month is 30. [Conditions of the SLA] - Service hours: 7 a.m. to 9 p.m. (i.e. 14 hours per day) on each business day - Availability: 99.5% or more | 2

# Company A issues an ID in the format shown below in the member registration processing. The table below shows the transition of the number of IDs issued by the end of each fiscal year. When this trend is assumed to continue in the future, in which fiscal year is Company A expected to run out of IDs in this format? Here, the IDs of resigned members are managed as vacant numbers and are not reused. | Fiscal year 2013

# When a hearing is conducted during a system audit, which of the following is the appropriate action to be taken by a system auditor? | When a problematic matter is found as a result of the hearing, backup data is collected and on-site investigations are conducted.

# Which of the following is pertinent to an audit finding in an audit of a user acceptance test? | The test is conducted by the information systems department without involving users, and the test results are approved by the person in charge of the department.

# From the viewpoint of internal controls, which of the following is a framework that can secure data integrity by means of a check and balance system in the organization? | The information systems department remains independent of the user departments that enter data, in order to ensure that the user departments can maintain the precision and accuracy of data.

# Which of the following is an appropriate explanation of SOA? | It is a design approach to architecture that builds software applications as reusable services and utilizes those services in a network such as the Internet in order to achieve a high level of productivity.

# Which of the following is an appropriate explanation of SCM (Supply Chain Management)? | It is a business process for managing the series of business operations linking purchase, production, sale, and distribution from the viewpoint of total optimization among companies in order to reduce delivery lead time and stock.

# Which of the following is the most appropriate explanation of system integration? | Necessary tasks related to an information system, such as planning, construction, and operations, are performed all together based on an underpinning contract.

# In verification of stakeholder requirements, which of the following means the ability to keep track of the process until the implementation of a change request related to a defined requirement is completed? | Traceability

# Which of the following is applicable to the definition of “non-functional” requirements? | Creating development criteria and standards suitable for the language used in system development

# The marketing strategies are categorized into four basic types: leader, challenger, follower, and nicher. The market follower is a firm that is not a market leader and that does not attempt to be a market leader. In addition, the follower can often find the reinvention of ideas easier than the originators. Which of the following is the basic strategy of the follower as a competitive position? | Imitation strategy for quickly responding to market opportunities

# The product life cycle is a concept based on the idea that all products pass through four stages: introduction, growth, maturity, and decline. Which of the following is the characteristic of the maturity stage in the product life cycle? | As demand increases, product differentiation and market segmentation become evident. Competition between competitors increases, and addition of new models and reduction of costs become important.

# Which of the following is a type of information system that helps companies change or otherwise alter their business strategy and structure and thus create a competitive advantage? | SIS

# Which of the following is an appropriate explanation of CRM? | It is a method for improving business performance by sharing information between all customer channels within a company and by increasing customer satisfaction.

# Which of the following is the characteristic of the cell production system where production is grouped into cells with each cell taking responsibility for the production of each product? | A single worker or a group of several workers completely assembles each product from start to finish.

# Which of the following is an appropriate explanation of XBRL? | It is a data description language developed for financial information exchange and reporting, based on XML (eXtensible Markup Language).

# Which of the following is the organizational structure that is given the authority and responsibility as an intrapreneur who performs a project as a semi-independent business unit and takes full responsibility for the outcome of the project? | In-house venture organization

# Which of the following is the appropriate rule for “brainstorming” that is a method of resolving problems? | Participants should listen to free-wheeling opinions, including unique ideas.

# Which of the following is an appropriate chart that can be used for planning the work schedule and for keeping track of the progress status in a project? | Gantt chart

# Which of the following is an appropriate explanation of the Delphi method that is a qualitative and exploratory forecasting approach? | It is a technique of obtaining the most reliable consensus of opinions from a group of experts through a series of questionnaires.

# Which of the following is an international standard that defines an encoding algorithm used to compress still image data? | JPEG

# According to a survey of 100 students, there are 40 students studying English, 30 studying French, and 25 studying Spanish. In addition, 8 students are studying English and French, 6 are studying English and Spanish, 5 are studying French and Spanish, and 22 are not studying any of the three languages. Which of the following is the number of students studying all three languages? | 2

# When three subsets A, B, and C exist in the universal set S as shown in the diagram below, which of the following represents the shaded area? Here, each of A, B, and C indicates the area encompassed by the corresponding circle. XY ? stands for the union set of X and Y, XY ? for the intersection set of X and Y, Y X ? for the relative complement set of Y in X, and XY ? for the mutually exclusive set of X and Y. | (aUbU|-(a+b+|

# When the true and measured values are 1.744 and 1.720 respectively, what is the approximate relative error in percentage? | 1.4

# What is the probability of getting a sum of 8 or 9 on a pair of dice, each of which is a regular hexahedron with faces numbered 1 through 6? | 1/4

# An adjacency matrix is used for representing which vertices of a directed or undirected graph are adjacent to which other vertices. Which of the following is the appropriate matrix that can represent the directed graph below? | dong dau 0 1 0

# When the runtime complexity of an algorithm is represented by n2, which of the following is the running time for the algorithm to process one million elements? Here, n is the number of elements to be processed by this algorithm, and it takes 1 nanosecond to process only one element. | 1,000 seconds

# An expression tree is a binary tree that is used to represent a mathematical expression and generate any of the three representations (infix, prefix, and postfix notations) by using one of the three traversals (in-order, pre-order, and post-order traversals) of the binary tree. Which of the following is one of the possible expressions generated by the expression tree shown below? | (A+B\*|/((A+|\*|

# When the binary tree shown in the figure below is stored in a one-dimensional array A[i] under the following conditions, what is the array index of the node “T”? | 10

# After seven keys 15, 11, 16, 2, 17, 22, 13 are sequentially stored in an empty hash table where the chain method is used for resolving collisions, how many comparisons are needed to search for the key 22 in the table? Here, the hash table size is 5, and the hash function “xmod5” is used for the key x. In the chain method, each table entry has a linked list, and synonymous keys are stored at the tail of each linked list. | 3

# When the decision tree shown below is used for sorting three numbers a, b, and c, which of the following is the correct combination of expressions to be inserted in blanks A and B? | a < c, b< c

# Which of the following is the programming language that is interpreted and executed directly from source code or bytecode and can be used as batch control programs or embedded as part of application programs? | Script language

# When XML is compared with HTML, which of the following functions is enabled only by using XML? | Exchanging structured information

# The basic configuration of a computer, which includes five major units (or sometimes called five major functions), is shown in the figure below. Which of the following is the appropriate combination of configuration elements to be inserted in blanks A through C? | Control unit Operation unit Memory

# In a processor equipped with cache memory, there are two major types of write policies: write-back and write-through. Which of the following is an appropriate description concerning write-back cache? | Write-back is more efficient than write-through because of the reduced number of accesses to main memory.

# There are various types of USB connectors. When an external storage device is connected to a PC by using a USB cable, which of the following types of plugs should be inserted into an available USB receptacle of the PC? | USB A

# When a PC is equipped with a sound card, which of the following ports can be used for enabling the PC to communicate and synchronize with electronic musical instruments, such as synthesizers and drum machines? | MIDI

# Which of the following is an appropriate explanation of a plasma display? | It displays images by using light emitted from gas discharge.

# Which of the following is the most appropriate term to represent a pay-per-use model for enabling available, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction? | Cloud computing

# Which of the following is an appropriate explanation of a fault tolerant system? | It is a system that continues providing functions required for system operations as a whole even if a part of the system fails to operate properly.

# Among indicators of RAS used for evaluating the level of system reliability, which of the following is a measure of availability? | MTBFMTTR MTBF ?

# Air brake systems are provided for railway trains, trucks, etc. Loss of air for any reason automatically applies the brakes and brings the vehicle to a stop. Which of the following is the most appropriate term that means this capability? | Fail-safe

# In the virtual memory of a paging system, when a page that does not exist in main memory is accessed, which of the following shows the appropriate order of processes and states? Here, there is no empty page frame available in main memory. | Page fault ? Decision of the page for replacement ? Page-out ? Page-in

# Which of the following is the reason for using a real-time OS with a hard real-time control system such as engine control and hard disk control? | A mechanism that completes the processing for each event within a specified time is necessary.

# The diagram below shows the flow from program translation to execution. Which of the following is the appropriate combination of inputs and outputs to and from compiler, linker, and loader? | Object program Library module Load module

# Which of the following is an appropriate description concerning open source software defined by OSI? | When open source software is modified such as for internal use but not redistributed, the modified source code is not required to be released to the public.

# Which of the following can obtain the same output result as the logic circuit shown below? | tam giac va cong cong

# Which of the following is a basic component of a sequential circuit that has two stable states and is used in a memory cell of SRAM? | Flip-flop

# From viewpoints of not only home users but also professional or experienced users, which of the following is the most appropriate GUI component that should be used for entering date of birth (four-digit year, two-digit month, and two-digit day) in three separate fields on the screen? | Combo box

# Audio is sampled 11,000 times a second, and each sampled value is recorded as 8-bit data. How many minutes of audio at maximum can be recorded in flash memory with a capacity of 512?106 bytes? | 775

# Which of the following is the data model that is organized as a tree-like structure using a parent-child or one-to-many relationship? | Hierarchical data model

# Which of the following is the appropriate description concerning the third normal form (3NF) in a relational database? | A set of relations or tables is in 3NF if and only if it is in 2NF and every non-key attribute is mutually independent and directly dependent on the entire primary key

# Which of the following is the main purpose of using indexes in relational database tables? | To improve query performance

# Which of the following is the appropriate table that can be retrieved by performing the projection operation in order to choose the column “Product name” from the Cartesian (or direct) product of two tables T1 and T2? | Product name Radio TV set CD player

# When a transaction to the relational database is successfully completed, which of the following SQL commands can be used for making changes permanent? | Commit

# Which of the following is the most appropriate description concerning the primary role of an SQL query optimizer? | It determines the most efficient way to execute a query.

# Which of the following is an appropriate explanation concerning the function of a proxy server? | It is a centralized point of access to the Internet, and also provides an effective and efficient way to improve network performance by memory and disk caching of commonly visited web sites.

# In the OSI basic reference model, which of the following is the appropriate layer that provides end-to-end communication services for applications, and also provides convenient services such as connection-oriented or connectionless data stream support, reliability, flow control, and congestion control? | Transport layer

# Which of the following is an appropriate combination of the protocols that are used for transmitting and receiving e-mail as shown in the diagram below? | SMTP POP3 SMTP

# Which of the following describes the role of DNS in the TCP/IP network? | Linking a name, such as a domain name or a host name, with an IP address

# When the CRC (Cyclic Redundancy Check) function is implemented by calculating a generator polynomial, which of the following is used as a CRC code (sometimes simply called CR|? | Remainder

# Which of the following is an algorithm that can be used for asymmetric (or public key) cryptography? | RSA

# In e-commerce such as mail-order business, there is a risk that dealers or users are damaged by falsifying, spoofing, and repudiation at the time of sales order or purchase order. Which of the following is an appropriate security technology that can cope well with all of these three threats? | Digital signature

# Which of the following is an appropriate description concerning the PIN (Personal Identification Number) of an IC card used for user authentication? | When an IC card is sent, its PIN is not sent under the same cover. The user is notified of the PIN in another way.

# When a biometric authentication system is installed, which of the following is the most appropriate point to be considered? | Setting up the system in consideration of both the probability of incorrectly rejecting an authorized user and that of incorrectly accepting an unauthorized user

# Which of the following is an explanation of a risk transfer? | Taking financial measures such as purchasing insurance

# 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? | Activity diagram

# Which of the following is the appropriate relationship between “MovieTheater” and “TicketOffice” shown in the class diagram below? | Composition

# 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? | Refactoring

# 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?x?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? | 49,50,100,101

# 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? | C B A D

# Which of the following is an appropriate activity to be performed in the first phase of system development? | Analyzing the current business operations and organizing system requirements

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

# 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? | It is desirable to maintain and manage the development environment such as through periodic operational checks regardless of usage frequency.

# In an arrow diagram shown below, when the number of days required to completeactivity F can be reduced to one day from seven days, how many days can be reduced by the time all the activities A through F are completed? Here, in the diagram, each number shown beside the arrow indicates the number of days required to complete the activity. | 5

# The table below shows the series of activities for a certain project. The numbers in the table indicate how long (in weeks) it takes to complete each activity. Prior to starting each activity, the previous activities shown in the table must be completed. What is the total float (in weeks) of activity C? Here, the total float of an activity is the amount of time by which it may be extended or delayed without delaying completion of the project, assuming no extension or delay in any other activity. | 2

# The person-months required to develop a system were originally estimated at 150 person-months. 60 person-months have been invested so far, 30% of the total system has been completed, and the project is behind schedule. By how many person-months does the project overrun the original estimate in order to complete the development of this system, on the assumption that the same productivity is maintained in the future? | 50

# The function that starts up a computer via a LAN is called WOL (Wake on LAN). Which of the following can be performed efficiently by using this function? | Maintenance of a PC at a remote location

# Which of the following is an appropriate description concerning quality management in system development? | The sufficiency level of functions required for the system, as well as all deliverables such as documents, should be subject to quality management.

# Which of the following is the most appropriate description concerning the job roles of a database administrator and a data administrator? | Designing a database, maintaining it, monitoring operations, and recovering from failures

# Five processes and one function in ITIL v2, which are classified as service support indicating daily IT service operation methods, are summarized in the table below. Which of the following is the process to be entered in blank A in the table? | Problem management

# When security control of an information system is divided into three categories, including prevention, detection, and recovery, which of the following is applicable to recovery? | Contingency plan

# Which of the following is a situation where the independence of system auditors is maintained? | Appointing system auditors hired from an auditing company as internal auditors and having them audit internal business system development

# Among the system audit items related to master file management, which of the following is pertinent to availability? | The server storing the master file is duplicated to improve fault tolerance.

# Which of the following is an appropriate explanation of BPO? | Contracting out all business processes of a company’s specific department, such as an administrative department or call center, to an external service provider, together with the operations of a business system

# Which of the following dramatically improves a company’s performance, including cost, quality, service, speed, and so on, by fundamentally reviewing and redesigning business processes? | Reengineering

# Which of the following enables users to connect to the system of a service provider via the Internet and make online use of the necessary functions of the applications offered by the service provider as needed? | SaaS

# Which of the following is the activity that is performed in the phase of requirements definition? | Identifying the specifications of the business operations and system to be newly established and clarifying the scope of computerization

# When the effect of improvement is evaluated quantitatively, there is a method called weighted comprehensive evaluation to put together the results of evaluating multiple items and quantify those results. Among the improvement plans shown in the table below, which one should take precedence? | Plan 2

# Among the costs related to computerization, which of the following is included in the running cost? | Maintenance cost for information equipment such as servers

# When the procurement process that begins with “determination of the proposal evaluation method” is classified into selection of the supplier, procurement, issuance of the RFP (Request for Proposal), and proposal evaluation and then aligned in the appropriate order, which of the following is inserted in blank C? | Selection of the supplier

# Which of the following is the appropriate combination of the phrases to be inserted in blanks A and B shown in the PPM (Product Portfolio Management) matrix below? | Market growth rate Percentage of market share

# Which of the following is a niche strategy for business management? | Market specialization

# Which of the following is an appropriate explanation of knowledge management? | Conducting business while sharing information, skills, or understanding dispersed in the company and enhancing the problem-solving ability of the entire workforce

# Which of the following is a method where tasks are performed according to the steps (1) through (3)? | MRP

# Which of the following uses RFID? | IC tag

# Which of the following is an appropriate explanation of a divisional organization? | A share of profit responsibility is assigned to each of the organizational units formed by product, region, and so on

# A factory produces three products shown in the table below. How much is the maximum possible profit in dollars? Here, there is an upper limit of monthly demand for each product, and up to 200 hours/month of factory time can be used for the assembly process. | 33,000

# When 300 pieces of product A in the component table below are shipped, which of the following is the net requirement of component b? Here, the quantity in stock for A, a, b, and c are as shown in the stock table below. In addition, there are no other items in process, on back order, or already allocated. | 600

# Which of the following is an appropriate case where ABC analysis is applied? | It is applied in the case of identifying hot-selling products from the sales value and gross profit for each product

# Which of the following explains the characteristic of the break-even point? | The sales at the break-even point are equal to the sum of the fixed cost and variable cost.

Computer A uses the single precision of “IEEE Standard for Binary Floating-Point Arithmetic” (IEEE 754) as shown below | The range of computer A is greater than that of computer B, but the precision is smaller

When two 2-bit binary numbers “x1 x0” and “y1 y0” are added and the resulting bimary number “z2 z1 z0” is obtained, the two binary digits z0 and z2 can be represented as shown below | z = (( x ? y ) ? x ) ? y

When the decimal integer “– 24” is represented in 8-bit binary by using one’s complement and two’s complement, which of the following is the correct combination? | 11100111 & 11101000

A k-string is defined as a string of length k. An m-substring is an ordered sequence of m consecutive elements of the original string. How many m-substrings are contained in a k-string? Here, when two or more m-substrings have the same sequence of elements, they are all counted separately as different substrings. | k ? m +1

In postfix notation, also known as reverse Polish notation, which of the following is equivalent to the arithmetic expression “ ? a + b × c ÷ d ? e ”? Here, a, b, c, d, and e are all variables. | a ? bc × d ÷ +e ?

Which of the following can be accepted as <root> that is defined using the BNF notation below? Here, the symbol “?” represents an empty string. | 1001001

When characters A through E are encoded, their bit patterns and probabilities of occurrence are shown in the table below. What is the average number of bits per character? | 1.8

When a two-dimensional array A(5,5) is mapped onto computer memory (i.e. one-dimensional array) in row-major (row-directional) order or column-major (column-directional) order, how many elements occupy the same memory addresses in both cases? Here, the first element A(1,1) is mapped onto the same starting memory address in either case. | 5

What is the tree below called? | Binary search tree(5,3,7..)

When the series of stack operations below is performed on an empty stack, which of the following is the data that is read out by the last READ operation? Here, “PUSH x” is the operation to put data x in the stack, “POP” is used PUSH 2 ? READ ? PUSH 3 ? PUSH 6 ? POP ? READ ? PUSH 4 ?READ ? PUSH 7 ? PUSH 5? POP ? POP ? READ | 4

The function f (n) is recursively defined as an operation on the set of natural numbers (including 0) as shown below. What is the value of f (100)? | 5050

Which of the following is a program attribute of software that can be repeatedly called and executed without reloading after completion of the execution but cannot be called and executed by multiple programs at the same time? | Reusable

“LOAD GR, B, AD” is an instruction whereby an effective address is calculated by which of the following is the data loaded into general register GR? | 1300

Which of the following is an event that generates an external interrupt? | Completion of an I/O operation by peripheral I/O devices

Which of the following is the addressing scheme where data in main memory is referenced as shown in the figure below? | Indirect addressing(20.25)

Among the descriptions of computer system architecture, which of the following is an explanation of a tightly coupled multiprocessor system? | Multiple processors share the same main memory and are controlled by a single OS. In principle, a task in the system can be executed on any of the processors, so the throughput is increased by distributing the load in small pieces.

Which of the following is an explanation of memory interleaving? | It accelerates main memory access by dividing the main memory into multiple independent groups which are accessed concurrently.

Which of the following is an advantage of using mask ROM as program memory in an embedded system? | It enables the prevention of unauthorized rewriting of programs after shipment.

Which of the following is an appropriate description of a capacitive touch panel? | An electric field is formed on the surface of the touch panel, and the touched position is detected by capturing the change in the surface charge.

Which of the following is an appropriate description concerning a hot site prepared as a backup system? | A site is put into operation as a standby site, and its data and programs are constantly updated via the network so as to resume business operations quickly in the event of a failure.

Among the descriptions of the reliability design of a system, which of the following is an appropriate example that uses a foolproof approach rather than a fail-safe approach? | A design that checks to ensure proper operation in order to prevent an operator from making a mistake because of improper use

Which of the following is an appropriate characteristic of a thin client system? | It can reduce the risk of exposure to threats, such as viruses, by protecting the server in a system where the client has no external storage device.

When the MTBF and MTTR values for devices A and B are as shown in the table below, what is the availability of a system where A and B are connected in series? | 0.72

Which of the following is the characteristic of a dynamically relocatable program? | The program currently in the computer memory can be moved to other locations of the memory during execution time.

R1: 1, 2, 3, 2, 4, 2, 5, 2, 3, 4 R2: 1, 2, 3, 4, 2, 5, 3, 1, 2, 5 | LRU & FIFO

A byte-code program written in Java can be executed in two methods: one method for | 155

Which of the following is categorized as a function of a static testing tool? | It analyzes source code and detects errors in the program.

Which of the following is an appropriate explanation of optimization in a compiler? | Generating object codes that enhance run-time performance through the analysis of program codes

Which of the following is the logic gate that is equivalent to the logic circuit shown below? | NOR(211)

Which of the following is a logical expression that is equivalent to the logic circuit shown below? Here, “+” is the logical sum, “ • ” is the logical product, and X is the negation of X. | X = A? B

When the order data shown below is entered into the order entry system, which of the following is a check that is performed to see if the order date is on or before the business day on which the data is entered? | Logical check(Order data)

Which of the following is the image processing technique that is used for smoothing the jagged edges of curved or diagonal lines caused by poor resolution on a display screen? | Anti-aliasing

A university offers many disciplines. Many students graduate in these disciplines after clearing various courses assigned to each discipline. | The relationship between course and student is many-to-many.

When data in the “Product” table is as shown below, which of the following is an update process that reduces the number of rows in the “Profitable\_product” view created using “View definition” below? | Changing the Sales\_price of the product with a Product\_code of S001 to 130,000

Each time a student is absent from school, the date is recorded in the relational database table A as shown below. DateDiff ('2012-04-11','2012-04-10') returns “1”. | FROM A, A AS A1 WHERE A.StudentID = A1.StudentID AND

Which of the following is an appropriate purpose of using a locking mechanism in a relational database system? | To support concurrency control of the simultaneous execution of transactions

Which of the following is an appropriate explanation of data mining? | A technique for analyzing a large amount of data statistically and mathematically to discover patterns or rules

Time Division Multiplexing (TDM) is a type of digital multiplexing where two or more 4 Kbytes of data over one channel of a 512 Kbps | 0.5

In a TCP/IP network, when an IP packet of 2000 bytes is sent to the link that has an MTU (Maximum Transmission Unit) of 200 bytes, how many fragments are generated? Here, each packet has a 20-byte IP header. | 11

When a repeater hub (or simply referred to as a hub), a router, and an L2 switch (or simply referred to as a switch) are used as network devices in order to interconnect LANs based on the OSI basic reference model | Hub & Switch & Router

Which of the following is the IP address range that is reserved for Class B in traditional IPv4 addresses? | 128.0.0.0 through 191.255.255.255

Which of the following is the most appropriate description concerning the usage of NTP (Network Time Protocol)? | It works with clients connecting to a time server in order to synchronize the time of every client that is distributed on the network.

From a viewpoint of security measures, which of the following is an appropriate purpose of confirming the destination address with the sender at the time of sending e-mail? | To prevent e-mail from being sent to a wrong recipient

Which of the following is the public key cryptography algorithm that is named after the initials of its three researchers and is based on the difficulty of factorizing extremely large numbers into prime factors? | RSA

Which of the following is the most appropriate tool that is used to emulate a real hacker by looking for security holes and other weaknesses from the outside of an organization’s network? | Vulnerability scanner

Which of the following is an explanation of the pattern matching technique for antivirus software? | Viruses are detected by comparing data with a collection of known virus signatures.

Which of the following is the most appropriate mechanism that allows a Web server to temporarily store user information in a PC browser so that the Web server can check whether the PC | Cookie

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

Which of the following can be represented in an E-R diagram? | The relationship between entities

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? | Regression test

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? | Composition

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? | Performance efficiency

Which of the following is a characteristic of object orientation? | Inheritance can localize the changes necessary to expand or modify a model

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? | Black box test

The fast-tracking technique is used to shorten a project schedule. The original plan is shown in Figure 1 below. When activity E is divided into activities E1, E2, and E3 as | 1

Which of the following is the most appropriate indicator used for the progress management of a program test? | The number of test items completed

In a system development project, EVM (Earned Value Management) is used for managing its performance. Which of the following is the most appropriate status that is indicated by the fact that the value “EV–AC” is positive? | Under budget

In software development that uses the waterfall model, which of the following is an appropriate description concerning the cost of fixing errors detected during an operational test? | External design errors affect not only the program but also manuals and other documents, so those errors cost more to fix than coding errors.

Which of the following is a chart or a diagram that shows the quality of a product in order of time and is used for determining whether or not the production process is in a stable state within the control limits? | Control chart

When a declining metered rate method is applied to the total charge for usage of a computer system, the charge per unit of usage decreases as the system usage increases. Which of the following is a graph that shows this method? | cong hinh chu C 3 net

Which of the following is an appropriate description concerning application maintenance? | The completion of maintenance is recorded in order to prevent maintenance activities from being left unfinished.

Among the characteristics of the structure of a service desk organization, which of the following is a characteristic of the local service desk? | By placing the service desk close to users, intensive services are provided for users who have different languages and cultures or for VIPs by specialized service staff members.

In the stage of system design, when an audit is performed on the control for reducing the risk that user requirements are not met, which of the following is a point to be checked? | Checking if the user department participates in the review of the system design documents

When IT control is classified into preventive control and detective control, which of the following is applicable to detective control? | An output list resulting from data entry is cross-checked with the input form.

Which of the following is a deliverable of data architecture that is one of the four architectures contained in Enterprise Architecture? | E-R diagram

Which of the following enables users to connect to the system of a service provider via the Internet and make online use of the necessary functions | SaaS (Software as a Service)

When a computerization plan is made, which of the following is an item to be considered? | Clarifying the cost and investment effect of development, maintenance, and operations

Which of the following is an item to be performed in the requirements definition process of system development? | Clarifying the procedures and rules of new business operations together with the constraints, and obtaining agreement between stakeholders

Which of the following is an appropriate explanation of the benchmarking used for corporate management? | Understanding products, services, and operations of the company qualitatively and quantitatively in comparison with those of the strongest competitor or a leading company

Which of the following is an explanation of marketing mix? | company’s products are effectively sold by combining product strategy, price strategy, channel strategy, promotion strategy, and others appropriately.

Which of the following is an appropriate explanation of demographic segment that is one of the market segments? | A group of a population segmented by factors such as age, gender, family size, income, occupation, education, religion, race, generation, and nationality

Which of the following is an appropriate explanation of product innovation in the management of technology? | Developing new products or products differentiated from other companies

Which of the following is the situation where an improvement can be expected by installing an MRP (Material Requirements Planning) system? | Information about materials and quantities necessary for production is complicated, so a miscalculation of order quantity or an interruption of production often occurs.

When production is planned based on the calculation formula and table shown below, what is the value for production plan C? Here, the carry-over inventory on April 1 is equal to 400 pieces of the actual inventory on March 31. | 4,850

Which of the following is an explanation of BCP (Business Continuity Plan)? | In order to avoid risks of business interruptions or recover promptly from damages, a policy or an activity procedure is prepared in advance.

Which of the following is an organization that is formed for a certain limited period of time to solve a problem and is disbanded when the problem is solved? | Project organization

Which of the following is a two-layered chart that is composed of a bar chart showing control items arranged in descending order of frequency and a line chart showing the cumulative percentage of each item? | Pareto chart

Which of the following is a method which can be used to calculate a predicted value based on actual values of the previous time period and in which each of the actual values is equally weighted? | Moving average method

Which of the following is a financial statement that represents the assets, liabilities, and net assets of a company at a certain point in time and indicates the financial condition of the company? | Balance sheet

When a publisher’s lead editor omits a section of an author’s manuscript without obtaining the consent of the author, which of the following is infringed according to the international treaty called the Berne Convention for the Protection of Literary and Artistic Works? | Moral rights

Which of the following is the binary fraction that is equivalent to the decimal fraction 115.625? | 1110011.101

x AND (y OR z) OR y AND (x OR z) OR x AND y AND z | x AND y OR x AND z OR y AND z

How many multiplications at a minimum must be performed in order to calculate the polynomial expression “x4–2x3+5x2+x–6”? | 3

How many binary numbers can be represented using a 6-bit number that does not have two contiguous 1s? For example, “101010” does not have two contiguous 1s. | 21

When the expression (A ? 2 × (B + C) ? D × E) × F in conventional infix notation is converted to the prefix expression, which of the following represents the resulting expression? | × ? ? A × 2 + BC × DEF

When the figure below shows the process flow of a compiler that is used for procedural languages, which of the following is the appropriate combination that should be inserted into blanks A though C? | Lexical analysis Syntax analysis Semantic analysis (A-B-C-O-O)

Which of the following is an appropriate description concerning a max heap whose node values are 3, 6, 11, 17, 19, 22, and 32? | The root node value is always “32”.

Which of the following is an appropriate technique that is used for implementing a queue as a data structure? | FIFO

Bubble sort is implemented using a technique that repeatedly compares adjacent pairs of elements from left to right and swaps them if they are in the wrong order. | n(n ?1)/2

The flowchart below shows an algorithm that can be used to sort all elements of one-dimensional array X in reverse order and store them in array Y. | X(i) ? Y(n–i+1) & i +1 ? i

Which of the following is the most appropriate purpose of using DTD (Document Type Definition) with XML? | It is used to check if a well-formed XML document is valid.

When a processor performs multimedia or graphic-related application programs with the mixture of vector instructions and scalar instructions, 10% of the computation time is used for vector instructions. | 1.0526

Which of the following is most suitable for cache memory? | SRAM

Which of the following is an appropriate description concerning cache memory | A write instruction rewrites cache in two ways: one is to rewrite both cache and main memory, and the other is to rewrite only cache until the cache data is removed

Which of the following is an example of a daisy chain connection? | Industrial cameras with each having two IEEE 1394 ports are serially connected, and then one end is connected to a PC

When analog audio signals are converted into digital audio signals using the PCM method at a sampling rate of 44.1 kHz | The quantization bit width of the audio data

Which of the following is the appropriate RAID configuration that provides byte-level | RAID3

Which of the following is the configuration of distributed system where hierarchical or dependency relations exist between processors as with relationships between clients | Vertical function distribution

Which of the following is a framework or methodology of dividing the resources of a computer into multiple execution environments, by applying one or more concepts or | Virtualization

A system fails and recovers repeatedly over time, as shown in the figure below. Which of the following is the appropriate combination of the indicators or indexes that represent reliability and availability in RASIS? | T & T/(T + S )

Which of the following provides a job management function in OS that selects a program with the highest execution priority in the job queue and allocates resources | Initiator

In a certain processor, a timer interrupt is generated at a clock frequency of 60 Hz on a “per clock tick” basis. It takes 2 milliseconds (including process switching overhead) | 12

In a preemptive multitasking OS environment, when a process is preempted by another process with a higher priority, which of the following is the appropriate state where the | Ready

When four jobs A through D shown in the table below are executed on a first-come first-served basis, which of the following is the average waiting time (in minutes) in the | 0:00 & 4

CPU utilization of a computer system can be improved by using multiprogramming. If there is one process in memory, the CPU utilization is (1–p). Here, “p” is the completion during 50% of the execution time | 6.25

In a logic circuit shown below, which of the following is an appropriate combination of input signals A through C that can generate the output signal “0”? | 1 0 0

The figure shown below represents a logic gate and its timing chart. Which of the following is an appropriate logical function of this gate? Here, both A and B are the | Exclusive-NOR

Which of the following is the name of a phenomenon where multiple ON/OFF signals are generated during a few milliseconds after a push-button switch with a mechanical | Chattering

Which of the following is the specification for dividing frequently-used functions of a Java program into reusable components that can be deployed in a network on any major | JavaBeans

According to ISO 9241-11, usability is defined as the “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and | Interview method

Which of the following is an appropriate example of VR (Virtual Reality)? | Computer games and simulations make use of multimodal devices, such as a wired glove, a headgear, and an omni-directional treadmill, in order to provide very enriching and life-like experience for the user.

A publishing company produces textbooks for high school. Each book is written by an author who specializes in a subject. An editor is assigned to work with an author combination of relations that are applied to complete the E-R diagram? Here, 1 \* indicates a one-to-many relation, \* \* is a many-to-many relation. | Auther1-1Book & Auther\*-\*Editor

When the database design is divided into three phases (i.e., conceptual design, logical design, and physical design), which of the following is a part of the physical design? | Describing base relations, file organizations, and indexes used to improve query performance

When the table below is used to design a relational database for managing a video-rental shop, which of the following can be a potential candidate key? Here, (X, | (CID, VID, RDate)

In the term “ACID”, which is the basic foundation that database transactions are built upon, what does the third character “I” stand for? | Isolation

Which of the following is the UPDATE statement that can correctly update the data of the “Product” table? Here, the “Product” table is defined by the CREATE statement | UPDATE Product SET Product\_name = 'D' WHERE Product\_number = 'S003'

Which of the following is the server that can be used to intercept all messages entering and leaving the network and to effectively hide the true network addresses? | Proxy server

Which of the following is the data transmission technique that has features or characteristics shown below? | Frame relay

In the network shown below, the STP (Spanning Tree Protocol) is used on both S1 and S2 switches. When the link between two PCs A and C is established via L1, which of | Always L1

In a URL (Uniform Resource Locator) specified to access a Web page through the Internet, which of the following is the appropriate sequence of four basic parts: the | protocol, host name, directory, page

Which of the following is used for encoding and interpreting binary files, images, video, and non-ASCII character sets within an e-mail message on the Internet? | MIME

Which of the following is the protocol that is expanded and standardized based on SSL (Secure Sockets Layer) v3 but cannot interoperate with SSL? | TLS (Transport layer security protocol)

Which of the following provides a baseline of security requirements for the operations of CA (Certification Authority) and RA (Registration Authority)? | Certificate policy

Which of the following is an appropriate description concerning a digital envelope? | The sender encrypts the message by using symmetric key cryptography and then encrypts the symmetric key by using public key cryptography

There are two methods of biometric authentication: one extracts physical characteristics and the other extracts behavioral characteristics. Which of the following uses | Authentication is performed by extracting characteristics from the writing speed and pen pressure used when a signature is produced

Which of the following is a method that is used to check if an image or other digital content has been illegally copied and resold? | Digital watermark

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 | (Aggregation)(Navigability)(Generalization)(Composition)

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

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)? | State machine diagram

From internal and external viewpoints concerning software product development and maintenance, which of the following is an appropriate quality characteristic that | Reliability

Which of the following is a type of integration test that has the characteristics listed below? | Big bang test

Which of the following is a typical method that is contained in agile software development? | Extreme programming

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 | 4

Which of the following is an appropriate explanation concerning a milestone in project management? | A milestone is a major event in a project schedule that is easily identifiable by such things as the completion of a significant deliverable and the occurrence of an event.

The workload required to develop a system is estimated at 80 person-months if it is carried out by one person. When four staff members with the same productivity work | 528

When an application program has functions and characteristics shown in the table below, which of the following is the function point value of the program? Here the correction coefficient of complexity is 0.5. | 12

Which of the following is the project management knowledge area that includes the processes of creating a staffing management plan, acquiring project team, developing | Human resource management

According to ISO/IEC 20000 (Information technology – Service management), which of the following is a process that has the objective to define and control the | Configuration management

Which of the following is an appropriate description concerning data backup? | Backup processing should not overlap with ordinary business processing in order to guarantee the integrity of backed-up data.

In IT service management, which of the following is an activity that is performed as incident management? | Checking to see if a failure report from a user matches a known error

Which of the following is an appropriate description concerning the implementation structure of a system audit? | The auditor reports the results of the audit to the requester so that the requester can give instructions for improvement based on the audit report.

Which of the following is an appropriate description concerning an interview or a hearing that is conducted during a system audit? | The auditor should make an effort to get documents and records that confirm the information obtained from the department under audit during the interview.

Which of the following is an appropriate measure that management takes to guarantee the apparent independence of internal system auditors? | Placing the department of auditors under the direct control of management

The “four domains” of enterprise architecture include business architecture, technology architecture, application architecture, and one other. Which of the following is the | Data architecture

Which of the following is the purpose of BPM that is a management approach in a company or an organization? | Continuous improvement of a company’s operational processes

Which of the following is an explanation of “contact management” that is a basic function of SFA (Sales Force Automation)? | Performing effective sales activities for existing and prospective customers by managing a set of records including customer visiting days and sales results

Which of the following is an appropriate explanation of the RFI that is created when a new information system is procured? | A request is made to the vendor for helpful information by showing the details of business operations and the purpose of the computerization.

When a company’s business is divided into four categories A through D as shown in the figure below, which of the following is the characteristic of the business that is classified as category B? | It is currently generating a large inflow of cash, but it also needs continuous investment into the future.

Which of the following is the technique and concept for improving management efficiency by planning and controlling the company-wide management resources in an effective and integrated way? | ERP

The four perspectives of the BSC (Balanced Score Card) includes “financial,” “learning and growth,” “internal business process,” and one other. Which of the following is the | Customer

Which of the following is an appropriate explanation of a franchise chain in the retail industry? | A form of organization in which a head office provides to its members usage rights of its trademarks and signs, and also provides managerial training and assistance in exchange for a fixed rate of compensation

Which of the following is an appropriate characteristic of an RFID tag that is a type of IC tag and is used for locating and tracking merchandise, inventory, or other assets? | It reads information without physical contact by using electromagnetic waves.

Which of the following is an appropriate explanation of EDI? | A method for electronically exchange of business data between computers over a network, based on standard formats and protocols

Which of the following is a business organization that is divided according to the type of work performed as shown in the chart below? | Functional organization

Which of the following is an appropriate explanation of accessibility in the context of information technology? | Environment where even those who are handicapped or elderly have an easy access to information equipment and receive information services

A trucking company has two types of trucks, A-type and B-type, as shown in the table below, and the company has a contract to deliver 900 boxes at a time by using the | Conditions 90x + 70y ? 900 x + y ? 10 0 ? x ? 8, 0 ? y ? 6 Objective function 400x + 300y ? Minimize

An acceptance inspection is to be conducted on a purchased component that has a non-defective ratio of 0.9 and a defective ratio of 0.1. Four plans A though D are | C

The table below shows the income statement for a certain company. Which of the following is the amount of sales (in million dollars) at the break-even point? | 625

Among various types of license agreements for a software package, which of the following is the most appropriate explanation of a site license? | A software package can be installed on any and all computers, such as PCs, workstations, and servers, at a given location in a company or an organization.

Which of the following is the globally recognized model that is used for measuring the maturity level of software and systems development processes and providing guidance | CMMI

Which of the following is the result of calculating the arithmetic expression “B6 –7C”? Here, all numbers are represented in unsigned hexadecimal. | 3A

There are several formats for representing an integer in a computer. When a set of unsigned binary integers that are arranged in ascending order is interpreted in different | Biased (i.e., offset binary) format

The distribution of days that are required to complete a certain activity can be approximated by a standard normal distribution with a mean of 500 days and a | Between 476 and 524

There is a series of project activities to be performed by two staff members, Mr. X and Mr. Y. When each of them works alone, it can be completed by Mr. X in 3 hours and | 11:20 a.m.

The figure below shows the state transition diagram of an automaton. Which of the following is a bit string for which the automaton stops in the accepting (or final) state | 1101

Which of the following is the logical expression whose resulting value is zero (0) only when the binary values of “x1, x2, ..., xn” are all zeros (0s) or all ones (1s)? Here, “·” | ( 1) ( 2) gach tren 12 va gach tren 2

When “11” is inserted in the min-heap shown below, which of the following min-heaps is created? Here, a new node is first placed at the bottom (or last) of the tree, and then | 8,11,30,25,22,40,59,53,33,44

The figure below shows the structure of a singly-linked list. In order to insert Philadelphia between New York and Washington DC, which of the following is an | The pointers for New York and Philadelphia are set to 110 and 90 respectively.

In the binary search tree shown below, which of the following is the appropriate sequence of nodes that are visited in an in-order traversal? | D ? B ? E ? A ? C ? F

Which of the following is the appropriate description of the “selection sort” algorithm? | The element with the largest...same way.

Which of the following is a role of the program register (i.e., program counter) of the CPU? | In order to read out an instruction, it contains the address where the next instruction is stored.

When the average instruction execution time of a computer is 20 nanoseconds, what is the performance of this computer in MIPS? | 50

There is a digital video recording system installed with four security cameras. In this system, the video data from each camera is captured at 30 frames per second with a | 4.5 GB

Cache memory is usually organized at multiple levels, such as L1 for level 1 and L2 for level 2, with L1 having the smallest storage capacity but the fastest memory speed. | 3.7

The magnetic head of a hard disk drive is currently positioned at cylinder number 100, and the cylinder numbers 120, 90, 70, 80, 140, 110, and 60 are lined up in the I/O | 120

Which of the following is the most appropriate explanation of cloud computing? | It provides the resources of a computer via a network so that the user can easily receive services with high scalability and availability.

Which of the following is an essential activity for achieving a fault tolerant system? | Providing redundancy for a system configuration to minimize the effect of a component failure so that the processing can be continued without any effect on the overall system

In reliability design, which of the following is an appropriate example of fail-soft? | In a system with a cluster configuration, even when a server does not work, another server takes over applications and provides functions.

Which of the following is an appropriate description concerning MTBF and MTTR? | MTBF increases through the preventive maintenance of a system.

The diagram below shows the state transition of the tasks in a multitasking computer system. When does a task in the running state move to the ready state? | When a task with a higher priority is set to the ready state

In memory pool management of a real time system using various sizes of memory resources, which of the following is an appropriate characteristic of the fixed-length | The memory efficiency is poor, and the processing speed for allocation and deallocation is fast and constant.

When CPU processing and printing are performed for four jobs under the conditions below, how many minutes does it take to complete them from the start of the first CPU | 180

When the number of concurrently running programs is increased in a virtual storage system with the small and insufficient capacity of main memory, which of the | Thrashing

Which of the following is the language processor that translates and executes a source program written in high-level language, on a line-by-line basis? | Interpreter

For the purpose of monitoring the execution process of a program in order of time, which of the following is used as a dynamic debugging tool that records the contents of | Tracer

Which of the following is an appropriate explanation of DRAM? | It is often used as main memory, and one bit is represented depending on whether or not its capacitor is charged.

The figure below shows a logic circuit representing a full adder. When 1, 0, and 1 areentered into x, y, and z respectively, which of the following is the appropriat | 1 0

Which of the following is the logic gate that is equivalent to the logic circuit shown below? | XOR(121)

When a 60-minute monaural audio signal is digitalized using a PCM format with a sampling frequency of 44.1 kHz and a quantization bit rate of 16 bits, what is the | 320

Among the descriptions concerning three-dimensional computer graphics, which of the following is an explanation of polygon? | It is a basic element that is used for constituting a polyhedron taking the form of a closed solid or for approximating a quadric surface or a free-form surface.

As shown in the class diagram below, there is a many-to-many association between the two classes Product and Warehouse. When there is a need to know how many of each | 1 0..\* 0..\* 1

As shown below, when the SQL statement is executed on the relational database table “Staff”, which of the following tables is created? | StaffID BranchID S03 B03 S04 B03 S05 B03 S07 B08

Which of the following is the appropriate flow of execution of SQL statements? | Decomposition ? Optimization ? Code generation ? Execution

In a relational database system, which of the following is an appropriate purpose of recording changes in a database file as a journal file? | To enable recovery to be undertaken effectively in the event of a failure

Which of the following is the most appropriate description concerning the exclusive control of a DBMS? | Exclusive control is necessary for data that might be updated simultaneously by several people.

When an optical fiber cable is used for data communication, which of the following is the approximate bandwidth (in units of THz) of the light within the range of | 57

Which of the following is an appropriate description concerning interconnection devices between LANs? | The repeater extends the transmission distance by amplifying signals between the same types of segments

Among the layers of the OSI basic reference model, which of the following is the appropriate layer that is primarily responsible for the translation, encryption, and compression of data? | Presentation layer

In a TCP/IP network using IPv4 addresses, which of the following is an effective IP address that can be allocated to a network device? | 203.164.15.9/28

Which of the following is an appropriate explanation of POP3 that is used in an e-mail system? | It is a protocol used to retrieve e-mails from the mailbox of a mail server

A PKI involves two types of key pairs: signature key pairs, in which the private key is used for signing and the public key for checking; and exchange key pairs, in which the | Exchange key pair

Which of the following can be achieved by receiving an e-mail text and its hash value from the sender, and then comparing this hash value with another hash value calculated | Detecting the presence or absence of falsification in the e-mail text

Which of the following is a security measure where it is effective to confirm the destination address with the sender when an e-mail is sent? | A preventive measure against wrong transmission of e-mail

Which of the following is the purpose of using a WAF (Web Application Firewall)? | To block attacks to a vulnerability arising from a Web server and an application

As a security measure on the Internet, a type of challenge-response test called a CAPTCHA can be used to determine whether the client is a human or a computer | To protect against automated spamming

Which of the following is an appropriate description concerning a use case diagram in UML? | It is used to show what system functions are performed for which actor, from the user’s perspective.

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 | Class diagram

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 | It shows how the system responds to internal and external events.

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

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 | Stub

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 | A signle order is not made from multiple suppliers.

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 | Waterfall model

Which of the following is the most appropriate description concerning maintenance management that is to be planned for the development environment of an embedded | It is necessary to maintain the development environment such as through periodic operational checks regardless of usage frequency.

The arrow diagram shown below is created for time management of a project. Which of the following is the critical path? | B ? E ? F

What is the function point value of a program that has the functions and characteristics shown in the table below? Here, the correction coefficient of complexity is 0.75. | 18

Which of the following is a chart or a diagram that is often used in quality control to rank issues or problems in descending order of frequency? | Pareto chart

Which of the following is the most appropriate indicator that is directly helpful in managing software quality in a system development project? | Period of time required to adequately review each deliverable

According to the ISO/IEC 20000 series, which of the following has the objective that aims to minimize disruption to the business by proactive identification and analysis of | Problem management

Which of the following is a service delivery process that is defined, agreed, recorded, and managed in IT service management? | Service level management

When there are several business systems available in a company, which of the following is the most appropriate method for access control? | Irrespective of the user’s job title, the appropriate access rights are set in each business system on the basis of the user’s job role.

When an audit is performed on the reliability of programming, which of the following is the most appropriate item to be reported as a finding? | The programmer selects a subset of unit test items from all the program logic paths on a sampling basis.

When a department that outsources system development must undergo a system audit concerning “progress management” of the outsourcing partner, which of the following | Business reports received periodically from the outsourcing partner, and documents showing the verification result of the business reports

In a system audit, which of the following acts as audit evidence? | System operation records obtained by the audit team from the audited department

When an information strategy is developed, which of the following is an item that must always be made consistent with the strategy? | Medium and long-term management plans

Which of the following is an improvement index in supply chain management? | Ratio of reduction in dead stock

Which of the following is provided by an ASP (Application Service Provider)? | A service in which the functions of a general-purpose application system are provided to several customers via a network

When an information system is procured according to the procedure shown in the figure below, which of the following is to be inserted into blank B? | RFP

Which of the following is an explanation of core competence management? | Management is centered on proprietary know-how and technology that are not easy for other companies to imitate.

In the product life cycle, which of the following is the stage where the market begins to understand the value of the product, and both product lines and sales channels need to | Maturity stage

SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is a technique that is used to identify and evaluate the internal and external factors that are helpful or | HH ISW EOT

Which of the following is an appropriate form of transaction where one company (i.e., the bidder) gains a decisive share of the basic equity of another target business? | Acquisition

Product Portfolio Management (PPM) is a method for analyzing the positioning of a product within the market and reviewing the resource allocation. As shown below, | C

Which of the following is an appropriate explanation of direct telemarketing? | A type of direct marketing that involves not only selling products on the phone but also asking for donations or opinions

Which of the following is an appropriate example of the effective utilization of RFID? | Identification and control of humans or objects by using a small wireless chip

Which of the following is an appropriate explanation of IR (Investor Relations)?It is a business process...continuous basis.

Which of the following is an explanation of a CIO? | An executive who is positioned to plan and execute strategies including information management and information system control

Which of the following is a technique by which useful information and relationships are discovered and extracted from large amounts of customer and market data retained by a company? | Data mining

Which of the following is a qualitative and exploratory forecasting approach that is used for obtaining the most reliable consensus of opinions from a group of experts through a series of questionnaires? | Delphi method

The table below shows the transaction records for a certain fiscal period. When the average cost is calculated based on the periodic average method, how much is the “cost of sale | 938

The figure below shows each break-even point of Company A and Company B. Which of the following is an appropriate description concerning the benefit-risk | The variable cost ratio of Company A....Company B.

When the hexadecimal value 2A is stored in an 8-bit register and is logically | 80

When two logical variables “p” and “q” are given, which of the following | (p ? q) ? ¬(p ? q)

A chemical manufacturer has a plan to deliver 500 liters of a 24% acid solution. | 100 400

Which of the following is the graph that is represented by the adjacency matrix A shown | d) V

When F(v,w) is defined using standard predicate logic as shown below | v is an aunt of w.

Each character in a text file is encoded as a double-byte character | 1632

There is a three-dimensional array A starting with A[1, 1, 1] and ending with A[3, 5, 7] | 6816

Which of the following is an appropriate set of sorting algorithms that are based on the | Merge sort, quick sort

When a series of data shown below is searched using the binary search algorithm | 3

The flowchart below shows the algorithm that generates and prints a 4-digit decimal | i < 5, d[k] = i

Which of the following is the most appropriate characteristic of XML? | XML can define any tag in order to make it easy to exchange data between

Which of the following is the appropriate course of actions to be taken by a processor at | 2 ? 1 ? 3 ? 4

Which of the following is the appropriate combination of characteristics of SRAM in | lower faster Cache memory Flip-flops

Which of the following is an appropriate description concerning cache memory | In machines with the large time gap between access to main memory and instruction

Which of the following is an explanation of USB? | A serial interface to connect devices in a tree topology via hubs

A serial interface to connect devices in a tree topology via hubs | It consists of many tiny cells between two glass panels containing a mixture of noble

Which of the following is a technique of dividing the data of each file into blocks of a fixed size | Disk striping

Which of the following is an appropriate characteristic of a Web system that is | A business process is executed on the server side, and the client software displays the

Which of the following is an appropriate expression for calculating the server processing | Ts = Tr - Tl - Tp

A certain computer system runs in a multi-programming environment using a non | 4.0

There are cases where the unused storage space is divided into lots of small and isolated | Fragmentation

Which of the following is the virtual storage technique that can resolve external | Paging

Which of the following is an appropriate explanation of a benchmark test for computer | The relative processing power of each system is measured and evaluated by executing

Which of the following is a technique that binds the modules constituting a program at | Dynamic linking

Which of the following is an OSS tool that is provided as the IDE (Integrated Development Environment) | Eclipse

Which of the following is a sequential circuit that is capable of exhibiting either of two | Flip-flop

Which of the following is an appropriate combination of Boolean expressions that are | A?B A · B

According to ISO 9241 -210: 2010, which of the following is defined as the “extent to | Usability

Which of the following is an explanation of clipping in 3D graphics processing? | It is the process of defining a window within an image display area and removing

Which of the following is the form of normalization into which the relational database | Second normal form

In a relational database, which of the following is an appropriate purpose of defining a | To provide a constraint to maintain referential consistency between the records of

Which of the following is the unit of atomicity that a DBMS must guarantee for the | Which of the following is the unit of atomicity that a DBMS must guarantee for the

Which of the following is an appropriate explanation of data warehouse? | A subject-oriented, integrated, time-variant, and non-volatile collection of data in

Which of the following is the unit of transmission that is handled in the data link layer of | Frame

In the traditional IPv4 addressing scheme, which of the following is the private IP address | 172.16.0.0 through 172.31.255.255

In a local area network using CSMA/CD as its access method, which of the following is | Each node checks if the transmission medium is in use, and can transmit data if not in

In the OSI basic reference model, which of the following is the appropriate | Application layer

In a TCP/IP network environment, which of the following is the most appropriate | Destination IP address

Which of the following is the attack where malicious input data is given to a Web | SQL injection

Which of the following is an appropriate description of a directory traversal attack | The attacker specifies files on the server by using a path that is unexpected by an

Which of the following is the most appropriate term that refers | Privacy policy

Which of the following is the most appropriate method of determining whether to enable | The MAC address of the PC is checked, and communication is permitted only when

Which of the following is the most effective method for detecting | The hash value of each file containing the content of the Web server

In a UML class diagram, which of the following is a direct relationship | Association

Which of the following is an invalid data flow in the DFD | C

Which of the following is an appropriate description concerning test data for a white box | Test data is created on the basis of internal structures.

When the quality of a software product is evaluated using the ISO/IEC | Reliability

Which of the following is a type of integration test in which all | Big bang test

Among the maintenance activities of a system, which of the following is an appropriate | The system is modified to cope with changes in the

Which of the following is an explanation of reverse engineering of software | The existing software is analyzed, and its specification and internal

As shown in the arrow diagram below, there exists a project consisting of nine activities | 1

A chart or a diagram is created to resolve a quality problem | Pareto chart

Which of the following is an appropriate description of how to estimate person-months | In the function point method, the function points are defined and classified

Which of the following is an appropriate inspection item that should be | Ensuring that the system satisfies the requirements from the user’s viewpoint

Which of the following is a characteristic of the one-time (or big bang) | A problem during migration has a very large impact on the new

Which of the following is the primary purpose of the problem management process | To trace and eliminate the root cause of an incident, and to prevent the recurrence

An IT service is provided under the conditions described below. In order to | 2

When a version control system for source code is installed, which of the | The access control of the version control system must be set appropriately.

Which of the following is an appropriate way of selecting systems that | Systems that have a high possibility of occurrence of a problem and are significantly

Which of the following is a management approach or technique that can | BPR

Which of the following is an explanation of SaaS? | It is a service where the user can use the functions of application

It is a service where the user can use the functions of application | Maintenance cost of information equipment such as servers

Maintenance cost of information equipment such as servers | It refers to the social or economic gap that occurs depending on the level of

According to Michael Porter, who is the author of “Competitive Strategy” |Value chain analysis

Among the four stages, introduction, growth, maturity, and decline in the product life | Customers are aware of product, and as a result, sales increase. However, profits

Which of the following is an example of the strategic target and key performance | Since the target is to establish a close and continuing relationship

Which of the following is a pricing method that is based on the cost plus method? | Deciding the price by incorporating the desired margin in addition

As shown in the tables below, the 5-year investment effects of IT investment plans | A

Which of the following is a characteristic of an IC tag (i.e., RFID)? | An IC tag is resistant to dirt, and the recorded information is accessible from outside

Which of the following is the appropriate term applicable to the description below? | Long tail

Which of the following is applicable to “A” in the comparison table below that shows the | Individual production

Which of the following is the methodology that performs both production scheduling and | MRP

Which of the following is an appropriate reason for using a flash memory device as a | The program can be rewritten after the microcomputer is shipped.

The program can be rewritten after the microcomputer is shipped. | Functional organization

As shown in the table below, there are four tours provided by a tour company. | Scuba diving

In the X -R control chart that is used to determine whether a process is in control or out | When at least seven consecutive plots are above or below the center line

When a total of 400 data records are stored in contiguous memory starting from the | 1113

As shown in the table below, 100 out of 100,000 patients have a cancer | 2.418

When the word list of a dictionary is searched for an exact matching word, which of the following is the most appropriate data structure in terms of runtime computational | Hash table

There is a water tank that is equipped with a faucet to fill the tank with water and two sensors | 11,00

For the post-order traversal of a binary search tree where the left and right subtrees of the | 1100

When the procedure shown below is executed in listed order, what is stored in variable y | 2

When the selection sort algorithm is used for sorting the dataset | 4

There is a circular queue implemented with a one-dimensional array ofn elements. Insertion | F = (R+1) mod n, F = R

Which of the following is a computer architecture that enables the processor to execute | Superscalar

In a paged virtual storage system, when a TLB (Translation Lookaside Buffer) is used to | 1.195

Which of the following is the addressing mode where the operand of an instruction is used | Indirect addressing

Which of the following is an appropriate characteristic of Bluetooth | The short range (up to about 100 m) of wireless voice/data communication is defined.

Among the RAID systems, which of the following should be used in cases where maximum | RAID 0

Which of the following is an appropriate explanation concerning a fault tolerant system? | A system that is designed so that the functions

The response speed of a database server is slowed down, even though no application is | Verification of the status of data storage

The table below shows the priorities of three tasks together with the operation sequence and processing time of the CPU and I/O device | 3

Among the combinations of the storage management and the multiplicity of programs in a multiprogramming environment | Virtual storage system, Large

Which of the following is an appropriate explanation concerning a memory leak | Part of main memory occupied during application execution is not released because of a bug

In a white box test, which of the following is used to evaluate the proportion of lines of code | Test coverage analysis

When the source code based on OSS licensed under GPL is not released to the public | A company obtains, modifies, and sells OSS through the company’s own operations or

The logic circuit shown below has four input signals (C1, C2, C3, and C4) and two selector signals (S1 and S2) | 1 0

A power supply unit has a rated output power of 500 watts and an efficiency of 80% | 625

Which of the following is an appropriate description concerning flash memory | It can write data electrically and erase it electrically in units of blocks

A shop sells approximately 200 types of products. Among the input items for a new product | Product category

Which of the following is an explanation concerning the morphing technique in computer animation | In order to represent the smooth transformation in appearance from an image to another

Which of the following is an appropriate explanation concerning the data structure in a relational database | Data is represented with one or more two-dimensional tables

In a relational database, there are two conditions that must be met as a primary key constraint. One condition is that there are no duplicate key values. | The primary key value must not be null.

In order to find all rows from the “Books” table that include “UNIX” in the title | %UNIX%

Which of the following is the relational operation that corresponds to the manipulation of | Projection

When the SQL statement below is executed under the given conditions, what is the maximum number of rows that are created | 101,999

In computer networking, which of the following is the most appropriate technical term that means the variation in packet delay that causes the degradation of the QoS | Jitter

Which of the following is the network device that enables LANs to be interconnected at the | Repeater

Which of the following is a mechanism that enables a variety of information, such as still | MIME

In a TCP/IP network using IPv4 addresses, which of the following is a valid network | 210.11.190.192/26

Which of the following is the effect that is expected by duplexing a server configuration | Improvement in availability

When Mr. A sends Mr. B an e-mail with a digital signature created by using public key cryptography | Mr. A’s private Key, Mr. A’s public Key

When security attacks to a computer system are classified into three categories (i.e., reconnaissance attack, access attack, and DoS attack) | Attempting to discover and map out systems, services, or vulnerabilities

Which of the following is an appropriate explanation concerning the security attack that is classified as DNS cache poisoning | Incorrect domain information is injected into the DNS server referenced by a PC, which

Which of the following is a method for preventing an SQL injection attack | Ensuring that the input characters are not interpreted as characters that have a special

When the procedure below is performed in terms of security, which of the following can be done by recipient B | Confirming that the message is from sender A

Which of the following is the security attack that is shown in the procedure below | Phishing

Which of the following is regarded as risk sharing or risk transfer? | Distributing risk to other parties by purchasing insurance

When a packet filtering firewall controls packets in accordance with a list of rules as shown | Blocked by number 1

Which of the following is a method that is used for encrypting e-mail | S/MIME

Which of the following is the function that can be implemented with HTTPS | Server authentication with an electronic certificate

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 | Class diagram Component diagram Use case diagram

According to the ISO/IEC 25010 standard, the quality properties of a software product or system are categorized into eight characteristics | Degree to which a product or system provides capabilities relative to the amount of resources used under stated conditions

Which of the following is an appropriate deliverable that must be approved when the | Screen layout

In terms of the test coverage of a program module, which of the following is an appropriate explanation of the relationship between path coverage | 100% path coverage implies both 100% branch coverage and statement coverage.

When an integration test is performed by using the top-down approach, which of the following is particularly necessary | Stub

Which of the following is a characteristic of a project? | A project is both unique and temporary.

Which of the following is an appropriate purpose of using a WBS (Work Breakdown | To decompose all development activities into smaller steps with a manageable size

The figure below shows part of a so-called fishbone diagram. Which of the following is the | B is a cause of A.

Which of the following is an explanation concerning a Pareto chart | It is used to identify problems by sorting the classified items in descending order of

Which of the following is an appropriate policy for creating an SLA? | Setting a service level under the cost and needs of a service provider and its customers

Among the management functions for service support, which of the following has the objective that aims to restore agreed service | Incident management

Which of the following is the most appropriate description concerning a backup method for | In consideration of a possible response delay in business processing, a backup schedule

When software asset management is audited, which of the following is an appropriate point | Checking to see if evidence, such as a software license certificate, is properly filed and

Among the situations that are checked during an audit of the methods of transmitting highly confidential information to a business partner by e-mail | A password is set for an attached file containing confidential information prior to being sent to the partner by e-mail

Which of the following is an appropriate activity that is undertaken by a system auditor who | Verification of the management status of access control concerning data

Among the architectures included in the “four domains” of the enterprise architecture, which of the following is the architecture other than business architecture | Data architecture

IT investment evaluation is performed as prior evaluation, interim evaluation, or post | Setting the performance objectives based on the purpose of investment, and providing the top

Which of the following is the purpose of defining a business model at the planning stage of total optimization in an information strategy | To organize the relationships between a company’s entire business operations and their

When a computerization plan is made, which of the following is an item to be considered | Clarifying the cost and investment effect of the development, maintenance, and

Which of the following is an explanation concerning non-functional requirements definition | It clearly defines the quality requirements, technical requirements, and operational

The matrix shown below is used for PPM (Product Portfolio Management) | To evaluate the current position of a company as the basis for setting an objective and

Which of the following is an explanation concerning a franchise chain in the retail industry | A form of organization where a head office allows its members to use the trademarks

Which of the following is the primary purpose of implementing an ERP system that is used | To integrate all departments and functions across a company into a single computer

Which of the following is an appropriate explanation concerning product innovation in the | Developing a new or differentiated product that is a key to success

Among the various types of e-commerce transactions, which of the following is an | Mr. B buys a book from an online shop owned by Company A.

Which of the following is an explanation concerning EDI? | The exchange of business transaction data between computers over the Internet or other

Which of the following is an organization structure where employees report to both their | Matrix organization

Which of the following is an explanation concerning the accountability at an executive | A management executive has responsibility for explaining the content and performance

Which of the following is a case example that is suitable for ABC analysis | The hot-selling products need to be analyzed on the basis of the sales value and gross

Company T sells three types of products A, B, and C. At present, products A, B, and C are sold to 10,000, 20,000, and 80,000 | The number of new customers of product S is expected to be less than the number of

When a single-license software package is purchased in a company, which of the following is an activity that is usually | Making a backup copy of software for the limited purposes, such as the licensee’s

When the carry-over from the previous month and the quantity of inventory transactions for | 26,450

Among the descriptions concerning personal data, which of the following is not an appropriate description from the viewpoint of “OECD | Personal data should be allowed to be acquired without announcing the acquisition of

Which of the following is equivalent to the calculation result of the arithmetic expression shown below | B6

What is the approximate probability (in percentage) that at least 2 people in a group of 6 | 95.7

The figure below shows the state transition diagram of an automaton. If the automaton stops in the accepting state when an input string is terminated | An input string must contain at least one 1 and any even number of 0s following

What is the minimum number of bits required to uniquely encode upper-case alphabetic | 6

When a 200-byte message is sent at 100 Kbps by using a 10 km cable with a propagation speed of | 2.05

When a binary tree is a heap with a depth of “n”, what is the minimum number of nodes (including leaf nodes) in the heap | 2^n

When the binary search tree shown below is traversed in pre-order, in-order, and post-order, | 15, 8, 2, 10, 18, 20 .... 2, 8, 10, 15, 18, 20

When the hash function “x mod 13” for a given key x is used to store five keys 367, 25, 82, 66, and 13 | 5 2

Which of the following is the average time complexity of a randomized quick sort algorithm where the pivot is selected randomly | O(n log2 n)

Which of the following is the addressing mode where the register specified is used to point | Register indirect addressing mode

As shown in the table below, when a computer executes three types of instructions A, B | 40

Which of the following is a computer architecture where each instruction is divided into multiple stages | Pipeline

Which of the following is an appropriate explanation of memory interleaving? | Main memory is divided into multiple banks, and each bank is concurrently accessed in

Which of the following is the list that arranges A through D in order of effective access time | A, D, B, C

Which of the following is widely used as storage media for image data in digital cameras | Flash memory

When a 12-point character is displayed in bitmap on a 96-dpi display screen, how many | 16

In a client/server system using a database server, the generation of a large number of SQL | Use of stored procedure

The table below shows the number of failures per day and the average repair time (in minutes) per failure that are observed during the first 2 | 0.83

In the RAID0 and RAID1 systems using two disks, when one disk has a reliability rate of | 3.97 0.03

Which of the following is a term that shows the amount of work that is processed per unit of time by a computer system | Throughput

Which of the following is the most appropriate explanation of a dual system | It provides a duplicate system for performing the same processing, and performs a cross

Among the explanations of task scheduling methods, which of the following has the highest possibility that a specific task continues to wait for the allocation of CPU time | The processing is executed from the task with the estimated shortest processing time.

Which of the following is classified as an external interrupt | An interrupt that is caused by an interval timer when the specified time elapses

Which of the following is an appropriate explanation of the LRU | The page that has not been used for the longest time is replaced.

Which of the following is an appropriate reason for using a real-time OS in an embedded system | There is a mechanism available to respond within the limited time.

Which of the following is the logical expression that indicates the output Z of the | X Y

Which of the following is a characteristic of DRAM, in comparison with SRAM? | DRAM is suitable for a higher level of integration.

Which of the following is the case where outline fonts rather than bitmap fonts are effective and suitable for use on an output device such | Characters are enlarged using a given scale factor.

Audio is sampled and recorded at a frequency of 11,000 times per second with a resolution | 775

Which of the following is a mechanism that is used for defining the style of a Web page | CSS

Which of the following is the appropriate sequence of steps used for normalizing a relational | C B A

In a relational database, which of the following is an appropriate definition of a composite | A primary or foreign key that consists of two or

When the SQL statements shown below are executed for the “SMARK” table, which of the following is the | 0014 0016 0057

In an SQL statement, which of the following is an appropriate explanation of the percent symbol | It is a wildcard character that matches

As shown below, there are three relational database tables Table\_1, Table\_2, and Table\_3 | Difference

Which of the following is an appropriate explanation concerning the NAT function of a | Conversion between private IP addresses and global IP addresses can be performed.

Which of the following is the appropriate protocol that is used on top of UDP | RTP

Which of the following is an appropriate function of a | A received packet is forwarded only to a LAN port corresponding

In a TCP/IP network, which of the following is used to check if a computer or device is | ping

Which of the following is the most appropriate term that corresponds to the method of | Sniffing

Which of the following is a computer network attack that can be classified as a DDoS | All the computers infected by a virus send a large number

All the computers infected by a virus send a large number | Authenticity and integrity

Which of the following is the most appropriate explanation of a digital | A document that verifiably associates a public key with a particular

Which of the following is a biometric recognition technique that is used | Voice recognition

Which of the following is an appropriate description concerning social engineering? | An attacker manipulates people into providing inappropriate access

Which of the following is a technique where a system is actually attacked and an intrusion | Penetration test

Which of the following is a network segment that is isolated from | DMZ

Among the diagrams used in UML 2.x, which of the following is the diagram | Sequence diagram

When a system is developed by using object-oriented approach, which of the following is | When the internal data structure or the implementation

Which of the following is an appropriate description concerning the black box test? | Even if the program to be tested contains redundant code, such kind

Which ofthe following is the appropriate category of system maintenance that | Perfective maintenance

Which of the following is an appropriate explanation of Agile software development | A model that encompasses a group of adaptive, iterative, and incremental

A model that encompasses a group of adaptive, iterative, and incremental | A, F, B, E, C, D

In the development process, which of the following is an activity that should be performed | Deciding how to implement the software requirements that are already defined

Which of the following is an activity that is performed during the WBS creation process in | Segmenting project activities hierarchically into smaller parts or pieces

When the creation status of design documents is as described in the table below | 1100

When the new procurement of a system is undertaken on the basis of the decision tree shown | Buy

The development scale of a new system is estimated as 500 Function Points (FPs). | 66

Among the structures and characteristics of a service desk organization, which of the | By locating the service desk near the users, it is possible to provide

Four types of processes including service delivery process, relationship process | Information security management

Which of the following is an effective means of protecting an information system from the | Connecting computers and cables through a surge protection device

Among the system audit items concerning master file management | The server with dual-redundancy technology is used to store

Which of the following is a situation where the independence of a system | A system auditor is recruited from an auditing firm and placed as

A system auditor is recruited from an auditing firm and placed as | A capability to guide the development and implementation of an IT strategy in

From a viewpoint of corporate management, which of the following is an explanation | The management cycle of analysis, design, execution, and improvement is incorporated

Which of the following is an explanation of SOA (Service-Oriented Architecture)? | It is a concept that the functions of software are considered as components called

Which of the following is an explanation of SCM? | A series of business operations including purchase, production

Which of the following corresponds to an example of “non-functional” requirements | Selecting development standards based on the language used in system development

When a company’s own product is analyzed by using a SWOT | Threats of new competitors

Which of the following is the purpose of CRM? | To acquire customer loyalty and maximize customer li

Which of the following is an explanation of social media? | It provides a mechanism that promotes the connection

Which of the following is an explanation of core competence | It refers to a bundle of a company’s unique skills and technologies that are the source of

Which of the following is the procurement process that enables suppliers | Reverse auction

Which of the following is an explanation of knowledge management | Business is conducted to enhance the problem-solving ability of the entire workforce by

A restaurant is to be opened for business under the conditions shown below. | 3

Which of the following is an explanation of an affinity diagram? | It is a method by which the collected information is grouped according to the mutual

Which of the following is protected by “copyright” that is based on the WTO’s Agreement | Compiler program

When OSS released under GPL is changed and distributed, which of the following is an | All the source code of the derivative work including the modified parts must be

1. As shown in the figure below, all the lines show signs of levelling-off in the control chart of a program test.Which of the following can be inferred from this condition?| The process is facing some bugs that are difficult to resolve, and subsequent tests are not proceeding.

2. Which of the following diagram/ chart is corresponding to the following statement? It describes the overview to detail elements may be a product, data, service, or any combination thereof. It also provides the necessary framework for detailed cost estimating and control along with providing guidance for schedule development and control. |WBS

3. A repairer has 60 cars and 30 bikes need to repair. In comparison with the car, the bike usually takes half the time to fix error. The repairer has finished repairing 20 bikes in 3 days. If the repairer continues to work at the same pace, how many days does it take to complete the remaining work? |19.5

4. From a viewpoint of reliability of systems, which of the following is the appropriate timing for measuring the availability of a system?| When the problems found immediately after the start of system operations have been resolved and the system is becoming stable

5. Which of the following is an appropriate responsibility of a system auditor for problems found during an audit?| Reporting the problems found to the audit requester

6. Which of the following is an explanation of ERP? |It is the technique and concept for improvement in management efficiency by planning and controlling the company-wide management resources in an effective and integrated way.

7. In business management, which of the following is an appropriate policy for creating an SLA? |Setting a service level under the cost and needs of a service provider and its customers

8. In business management, which of the following is an explanation of SOA? |It is an architectural style or method to implement software functions corresponding to each activity in business operations as services, and to build the entire system by combining these services.

9. Which of the following is the most appropriate position that is primarily responsible for centralized oversight of enterprise IT strategic planning? |CIO (Chief Information Officer)

10. When security attacks to a computer system are classified into three categories (i.e., reconnaissance attack, access attack, and DoS attack), which of the following is classified as a reconnaissance attack?| Attempting to discover and map out systems, services, or vulnerabilities

11. The table below shows records of purchase and withdrawal for a component. When the first-in first-out (FIFO) method is applied, which of the following is the unit price of the withdrawal on April 10?| 110

12. Which of the following is a method for preventing an SQL injection attack? |Ensuring that the input characters are not interpreted as characters that have a special meaning in a inquiry or operation to the database

13. When a single-license software package is purchased in a company, which of the following is an activity that is usually permitted in conformity with the concept of the WTO’s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)?| Making a backup copy of software for the limited purposes, such as the licensee’s personal use or a temporary copy for maintenance

14. Which of the following is an explanation of EA (Enterprise Architecture)? |It is a technique to review respective business operations and information systems from the perspective of overall optimization through analysis of four key architectures—business, data, application, and technology.

15. See the figure and choose the correct answer.| Develop improvement plan

16. Which of the following is an explanation of a CIO?| An executive who is positioned to plan and execute strategies including information management and information system control

17. Which of the following is an advantage of M&amp;amp;A? |A company can establish a new business in a short period of time by acquiring skills and know-how that it does not have.

18. How many elements are considered to build of cost of an I.T. project based-on Functional Point method?| 5

19. What does WBS chart stand for?|;Work Breakdown

20. When the procedure below is performed in terms of security, which of the following can be done by recipient B, in addition to the detection of message falsification? |Confirming that the message is from sender A

21. There is an organization with the following characteristics: +All processes are continually improved based on a quantitative understanding of the common causes of variation inherent in processes.+They focuses on continually improving process performance through both incremental and innovative technological improvements.+ Quantitative process-improvement objectives for the organization are established, continually revised to reflect changing business objectives, and used as criteria in managing process improvement. Which CMMI level they are archived?| Level 5

22. In CMMI, what is the correct name of the highest level?| Optimizing

23. In business management, what is CORRECT about the break-even point?| In accounting, the break-even point refers to the revenues needed to cover a company&amp;apos;s total amount of fixed and variable expenses during a specified period of time. The revenues could be stated in dollars (or other currencies), in units, hours of services provided, etc.

24. Which of the following has the objective that aims to minimize disruption to the business by proactive identification and analysis of the cause of incidents and by managing problems to closure?| Problem management

25. Given a PERT chart (see figure) drawn to show the development of a system. Which tasks are on the critical path of the PERT chart above?| A,B,D,F,I

26. The person working on task C tells the project manager he can&amp;apos;t start work until one day after the scheduled starting date. What impact would this have on the completion date of the project?| Task C finishing one day late would have no impact on the completion date of the project because it has one day of slack it could use

27. The project manager decides to reduce the time needed for tasks D and F by one day each. How effective will this reduction be in achieving his aim of maintaining the original finish time for the project?| Path A,B,C,E,I is now the longest at 13 days so it becomes the new critical path.

28. In E-Commerce context, what does EDI stand for?| Electronic Data Interchange

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

30. DNS is a hierarchical distributed naming system for computers, services, or any resource connected to the Internet or a private network. It associates various information with domain names assigned to each of the participating entities. Most prominently, it translates easily memorized domain names to the numerical IP addresses needed for the purpose of locating computer services and devices worldwide. The DNS is an essential component of the functionality of the Internet|Domain Name System

31. The expression shown below is represented in postfix (or reverse Polish) notation. Which of following is the resulting value of this expression? |18

32. N?u m?t m?ng công vi?c du?c th?c hi?n du?i các di?u ki?n sau, th?i gian ng?n nh?t, tính theo gi?, c?n d? hoàn thành vi?c x? lý là bao nhiêu?|5

33. From a viewpoint of reliability of systems, which of the following is the appropriate timing for measuring the availability of a system?| When the problems found immediately after the start of system operations have been resolved and the system is becoming stable

34. See the figure and choose the correct answer.| Develop improvement plan

35. Which of the following is an explanation of a CIO?| An executive who is positioned to plan and execute strategies including information management and information system control

36. Which of the following sets of standards should be applied for the purpose of developing the new products that are expected to be employed by government agencies of countries who are members of the WTO?| ISO standards

37. Which of the following is a mechanism used in electronic commerce to exchange data between companies?| EDI

38. In network context, HDLC protocol is belong to which layer in OSI model?| Layer 2 – Datalink

39. When a product or a system is developed, which of the following is the most appropriate test that is performed to check the extent to which it can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use?| Usability test

40. Which of the following application protocols must support UDP as its transport layer protocol?| DNS

41. Which one of the following methods allowed for smart card authentication and more secure encryption technology?|AES

42. The administrator captures network packets and discovers that hundreds of ICMP packets have been sent to the host. However, it is not a particularly busy time of the day. What type of attack is likely being executed against your network?| Denial of service

43. An application user uses untrusted data in his application without validating or escaping the raw input data provided by the user. In his code block he has a code block like below |XSS Injection

44. Which of the following technologies is the most suitable to divide the whole company network into the networks by department?| VLAN

45. Statement A: ACID stands for Atomicity, Consistency, Interprocess, Durability.Statement B: The C (consistency) property ensures that any transaction will bring the database from one valid state to another. Any data written to the database must be valid according to all defined rules, including constraints, cascades, triggers, and any combination thereof. Which of the following choice is CORRECT? |Statement A is FALSE, and Statement B is TRUE.

46. In a relational database system, which of the following is an appropriate purpose of recording changes in a database file as a journal file?| To enable recovery to be undertaken effectively in the event of a failure

47. Which of the following is the appropriate sequence of DB application development activities?| Database planning,Conceptual design, Physical design,Data conversion

48. Which of the following contents are CORRECT features of self-join?| The using of table aliases is not necessary.

49. Given the following RESULT table. Which of the following SQL statement is CORRECT to find out customers that are located in the same region?| SELECT DISTINCT c1.ContactName, c1.Address, c1.City, c1.Region FROM Customers AS c1, Customers AS c2 WHERE c1.Region = c2.Region AND c1.ContactName &amp;lt;&amp;gt; c2.ContactName ORDER BY c1.Region, c1.ContactName

50. 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?| A single order is not made from multiple suppliers.

51. See figure and choose the right answer:| In A, a teacher is responsible for one class only. In B, a teacher may be responsible for one.

52. Which of the following is INCORRECT syntax for change the structure of a table?| ALTER TABLE table\_name CHANGE COLUMN column\_name.

53. Given CUSTOMERS table. Which of the following statement is CORRECT to add new column named EMAIL into existing CUSTOMERS table?| ALTER TABLE CUSTOMERS ADD EMAIL varchar(100)

54. Thao tác nào du?c dùng d? ph?c h?i co s? d? li?u b?ng cách s? d?ng các t?p d? phòng và nh?t ký khi phuong ti?n luu tr? co s? d? li?u b? h?ng (h?ng t?p d? li?u chính - master data file)?| Roll-forward.

55. M?t tr?c tr?c h? th?ng xu?t hi?n trong khi x? lý m?t giao d?ch cho m?t co s? d? li?u dang du?c c?p nh?t. Thao tác nào khôi ph?c l?i co s? d? li?u v? tr?ng thái ngay tru?c khi xu?t hi?n tr?c tr?c này? Hãy ch?n câu tr? l?i dúng t? nhóm câu tr? l?i du?i dây.| Cu?n ngu?c (roll-back)

56. Gi? s? m?i quan h? có tính ch?t sau:(1) M?i thu?c tính c?a quan h? là atomic (t?c là, m?i c?t ch? ch?a giá tr? don và m?i dòng ch?a cùng các c?t dó). (2) M?i thu?c tính không khóa trong quan h? là hoàn toàn ph? thu?c hàm theo khóa chính. V?y quan h? thu?c d?ng chu?n (NF) nào sau dây?| D?ng chu?n 2 (2NF)

57. Pha´t biê?u na`o sau dây la` du´ng la` du´ng vê` phuong pha´p sao luu du~ liê?u?| Nê´u qui tri`nh nghiê?p vu? va` qui tri`nh sao luu duo?c thu?c hiê?n dô`ng tho`i, viê?c sao luu co´ thê? không duo?c thu?c hiê?n du´ng. Do vâ?y, sao luu pha?i duo?c lâ?p li?ch biê?u dê? không chô`ng che´o vo´i ca´c qui tri`nh nghiê?p vu?.

58. Pha´t biê?u na`o sau dây mô ta? du´ng vê` ti`nh tra?ng khoa´ chê´t (deadlock) trong hê? qua?n tri? CSDL?| No´ co´ nghi~a ra`ng hai giao di?ch cu`ng yêu câ`u mô?t ta`i nguyên, khóa lâ~n nhau, duo?c da?t va`o tra?ng tha´i cho`, dê? treo viê?c thu?c hiê?n tu`ng giao di?ch.

59. Cho m?t co s? d? li?u v?i các b?ng sau. Câu l?nh SQL nào sau dây có th? du?c dùng d? bi?t sinh viên nào trong l?p ‘Class 10A’ có di?m v? ch? d? ‘Mathematics’ l?n h?n hay b?ng 8?| SELECT name\_student FROM mark, student, subject, class WHERE mark.id\_student = student.id\_studentAND mark.id\_subject = subject.id\_subjectAND class.id\_class = student.id\_classAND name\_class = ‘Class 10A’AND name\_subject = ‘Mathematics’AND mark

60. In Network context, what does HDLC stand for?| Hint: typing only result in upper-case first letter of each word. |High level data link control

61. In Network context, which of the following protocol is using to send email?| SMTP

62. There are two statements: Statement A: Router is network device works on Layer 3 of OSI model. Statement B: TCP/IP version 6 using 64 bits to addressing.| Statement A is TRUE, and Statement B is FALSE.

63. Among the layers of the OSI basic reference model, which of the following is the appropriate layer that is primarily responsible for the translation, encryption, and compression of data?| Presentation layer

64. Which of the following subnet masks provides the minimum number of IP addresses available in the subnet to assign to devices that request a connection?| 255.255.255.252

65. Which of the following is an appropriate description concerning interconnection devices between LANs?| The repeater extends the transmission distance by amplifying signals between the same types of segments

66. In a TCP/IP network using IPv4 addresses, which of the following is an effective IP address that can be allocated to a network device?| 203.164.15.9

67. Which of the following is a security measure where it is effective to confirm the destination address with the sender when an e-mail is sent|A preventive measure against wrong transmission of e-mail

68. Which of the following is the appropriate technology that is used to establish a private or secure network connection within a public IP network, such as the Internet, and to give the company the same capabilities at much lower cost by using the shared public infrastructure rather than a private one?| VPN

69. Which of the following IP addresses can be used to connect a computer directly to the Internet? |203.162.1.160

70. In a certain CPU, a floating point adder unit uses a total of 40 percent of the execution time. If the floating point adder unit is replaced with a new unit whose speed is ten times (10x) faster than the original unit, approximately how many times faster is the new CPU than the original one? Here, there is no modification in the instruction set of the new CPU. |1.56

71. View the picture and choose right answer.|125

72. In system performance context, what does TAT stand for?| Turn-Around Time

73. In an online transaction system environment, which of the following represents the interval of time from the time the system completes receipt of an input to the time the system begins to return its resulting output?|Response

74. Which of the following is the most appropriate set of major functions supported by an OS? |Data management, job management, and task management

75. There are some methods of getting &lt;b&gt;backup files &lt;/b&gt;for the purpose of recovering files and managing generations. Which of the following is an appropriate description concerning those methods or procedures?| A differential backup contains all files changed after the last full backup, while an incremental backup saves all files changed after the last full, differential, or incremental backup.

76. See the picture and choose the right answer.|B

77. A system has a main memory access time of 60 nanoseconds (ns) and a cache memory access time of 10 ns. When the effective access time for accessing the main memory via the cache memory is 15 ns, what is the hit ratio of the cache memory?|0.9

78. In order to make a multiplexing system with an availability of at least 99.9% by using devices with an availability of 90%.How many minimum of these devices need linking together in parallel? |3

79. Which of the following helps improve availability of whole computer system? | Doubling MTBF and reducing MTTR to half .

80. When a streamer is used at a data transfer rate of 500 KB/sec, how many minutes are needed to back up 1 GB of data?|33

81. Which of the following is an appropriate characteristic of RAID |The availability of data is increased by simultaneously writing the same data into two or more hard disks.

82. Among RASIS, which of the following is an explanation of availability? |Maintaining a computer system so that it is ready for use at any time

83. Which of the following is an appropriate description concerning the hardware maintenance of a system? |Scheduled maintenance is performed for the hardware device that has failed before.

84. In a customer service system&lt;/b&gt;, which of the following is a theory that is used to analyze the number of windows and the service hours according to the arrival status of customers? |Queueing theory

85. In reliability, we used RASIS to evaluate the stable of system.| Security (Prevention of invalid access)

86. Convert the following binary number into decimal number.| 157.625

87. Convert the following decimal number into binary number.| 1011.100(0011)

88. Given the following diagram describes the addressing method (see figure). What is the name of that method?| Indexed addressing method

89. Given the following diagram describes the addressing method (see figure). What is the name of that method?| Base addressing method

90. Give a system with 3 units A, B, C with their availabilities are 0.95, 0.9 and 0.8 (see figure). What is the availability of whole system?|0.796

91. Which of the following is a characteristic of DRAM, in comparison with SRAM? |DRAM is suitable for a higher level of integration.

92. Which of the following is classified as an external interrupt? |An interrupt that is caused by an interval timer when the specified time elapses

93. Which of the following is an appropriate explanation of the LRU method that is used as a page replacement algorithm? |The page that has not been used for the longest time is replaced.

94. Which of the following is an appropriate reason for using a real-time OS in an embedded system? |There is a mechanism available to respond within the limited time.

95. Which of the following contents is/ are characteristics of real-time control?| Once a processing request is made and the result is immediately reported to the requester. It is also applied in online transaction processing systems.

96. The figure below shows daily changes in the weather for a given district, and each value represents the probability of changes in the following day’s weather. When the weather is rainy on a given day, what is the probability that the weather is clear two days later? See figure|0.33

97. Which of the following is the minimum possible depth of a binary tree with 14 nodes? |3

98. When a list of seven elements shown below is rearranged in &lt;b&gt;ascending order&lt;/b&gt;, which of the following sorting algorithms is completed with the minimum number of element exchanges? |Selection sort

99. In computer hardware, what does IRQ stand for?| Interrupt Request

100. From a point of view of better performance, improved fault tolerance, and enhanced data integrity, which of the following RAID configurations is commonly suitable for enterprise systems? |RAID 5

101. With which of the following task scheduling methods is it highly possible for a specific task to continue to wait for the allocation of CPU resources? |The task with the shortest estimated processing time is executed first. The next task is initiated when the currently executed task is completed or suspended for some reason.

102. When a certain job is executed in a computer system, 35 percent of the total processing time of the job is used for CPU and the rest is spent waiting for I/O to complete. If a newer CPU whose speed is three times faster than the current one is installed, approximately how many times faster is the new system than the current system? |1.3

103. In the graph shown below, which of the following is an appropriate description concerning the shortest path from the node “A” to another node? Here, the number shown beside the line indicates the distance between the two adjacent nodes. |The shortest distance from A to F is 9.

104. When the bubble sort algorithm is used for sorting the dataset (23, 43, 56, 12, 87, 14, 87, 15, 90, 23, 10) in descending order, how many data exchanges occur during the first pass? |8

105. The flowchart below shows an algorithm in which two integers are temporarily entered into two variables x and y at the beginning, and then, after comparison of the two integers, the larger number is stored in the variable x and the smaller is in the variable y. In order to complete the algorithm, which of the following should be inserted in the process &lt;b&gt;box A&lt;/b&gt; in the flowchart?|Choose c

106. The main memory can contain 5 pages.&lt;/b&gt; &lt;b&gt;If system using LRU algorithm, which page is swapped out when page 7 is accessed in following sequence of page access?|5

1. Which of the following is equivalent to the logical expression below? Here, “ AND ” has higher precedence than “ OR ”, and “ NOT ” has the highest precedence. |x AND y OR x AND z OR y AND z

2. Th?c hi?n phép chuy?n d?i s? th?p phân sau sang d?ng nh? phân. Xem công th?c và di?n vào d?u?|1011,1100.0000(0011)

3. Trong h? co s? nào thì d?ng th?c sau x?y ra? |7

4. Phuong án nào sau dây là bi?u di?n dúng c?a s? nh? phân âm ? d?ng bù 2 (2&amp;apos;s complement) c?a s? -242 ? h? th?p phân?|0000 1110

5. Phuong án nào sau dây KHÔNG dúng khi chuy?n d?i s? FE ? h? 16 sang các h? co s? khác? Câu h?i d?ng ch?n nhi?u hon 1 dáp án |Choose c

6. Xem công th?c và di?n vào d?u?| BC

7. Xác su?t d? “m?t ng?a” xu?t hi?n hai l?n n?u d?ng ti?n du?c tung b?n l?n là bao nhiêu?|0.375

8. Bi?u di?n nh? phân c?a k?t qu? c?a bi?u th?c s? h?c th?p phân 7 / 32 là bao nhiêu?| 0,00111

9. Xác xu?t d? c? ba qu? bóng là màu tr?ng khi d?ng th?i l?y ra ba qu? bóng t? m?t h?p có ch?a ba qu? d?, ba qu? tr?ng và ba qu? vàng là bao nhiêu? 1/84

10. Cho cây nh? phân mã Huffman nhu du?c v? trong hình. S? nh? phân nào là mã Huffman c?a t? “chuan hoa”| 1111011000001101010001000

11. View the picture and choose right answer | choose D

12. Which of the following data structures uses the LIFO (Last In First Out) method in order to manage data? |Stack

13. See the figure. What is the value of f (4, 2)? |6

14. View the picture and choose right answer.|Choose B

15. The state diagram shown below is a simple Mealy machine. Which of the following transitions is NOT possible in the diagram? | Choose B

16. View the picture and choose right answer.|(NOT x) AND (NOT y)

17. Two players, X and Y play a dice game. A pair of dice is tossed. If the sum of the dice is 2, 4, or 6, X wins the game. Otherwise, Y wins. What is the probability that Y wins the game? |3/4

18. There are a total of 1,900 students in a school, 553 of whom are taking a course in computer science, 667 of whom are in mathematics, and 290 of whom are in both computer science and mathematics. How many students are not taking a course in either computer science or in mathematics?|970

19. What range of decimal numbers can be represented with an 11-bit two&amp;apos;s-complement number?|-1024 to 1023

20. An integer m is stored in a register as a binary value. If this value is shifted to the left by three bits and m is added to the shifted value, how many times as large as m is the resulting number? Here, no overflow occurs.| 9

21. Which of the following is the binary fraction that is equivalent to the decimal fraction 115.625? |1110011.101

22. There is an 8-bit register where integers are represented in binary by using 2’s complement for negative numbers. When the decimal integer “–24” is stored in the register and then arithmetically shifted 2 bits.what is the resulting value in decimal? Here, the leftmost bit of the register is used as a sign bit.|-6

23. When a set of values “5, 4, 3, 2, 8, 6, 0, 1, 9, and 7” is inserted in this order to create a binary search tree, which of the following represents the sequence of node values visited in the post-order traversal of the binary search tree? |1 0 2 3 4 7 6 9 8 5

24. An expression tree is a binary tree that is used to represent a mathematical expression and generate any of the three representations (infix, prefix, and postfix notations) by using one of the three traversals (in-order, pre-order, and post-order traversals) of the binary tree. Which of the following is one of the possible expressions generated by the expression tree shown below?| (A+ B \* C) / ((A + B) \* C)