



**October, 2007**

## **Database Systems Engineer Examination (Morning)**

**Questions must be answered in accordance with the following:**

<b>Question Nos.</b>	<b>Q1 – Q55</b>
<b>Question Selection</b>	<b>All questions are compulsory</b>
<b>Examination Time</b>	<b>9:30 – 11:10 (100 minutes)</b>

**Instructions:**

1. Use a pencil. If you need to change an answer, erase your previous answer completely and neatly. Wipe away any eraser debris.
2. Mark your examinee information and test answers in accordance with the instructions below. Your test will not be graded if you do not mark properly. Do not mark or write on the answer sheet outside of the prescribed places.

**(1) Examinee Number**

Write your examinee number in the space provided, and mark the appropriate space below each digit.

**(2) Date of Birth**

Write your date of birth (in numbers) exactly as it is printed on your examination admission card, and mark the appropriate space below each digit.

**(3) Answers**

Select one answer (a through d) for each question.

Mark your answers as shown in the following sample question.

[Sample Question]

In which month is the Database Systems Engineer Examination conducted?

Answer group

- a) September      b) October      c) November      d) December

Since the correct answer is “b)” (October), mark your answer sheet as follows:

[Sample Reply]

No.	a	b	c	d
Q 1	Ⓐ	●	Ⓒ	Ⓓ

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**Do not open the exam booklet until instructed to do so.**

**Inquiries about the exam questions will not be answered.**

- Q1.** A processor has a cache memory access time of 10 ns and main memory access time of 50 ns. To keep the effective main memory access time at 25 ns or less, what should the minimum hit ratio (in %) of the cache memory be?
- a) 50                    b) 60                    c) 70                    d) 80
- Q2.** A personal computer can display a maximum of  $2^{16}$  colors when the display resolution is set at 800 \* 600 pixels. What is the maximum number of colors that can be displayed when the resolution is set to 1,600 \* 1,200 pixels? Here, none of the main memory is used as the video memory.
- a)  $2^4$                     b)  $2^8$                     c)  $2^{12}$                     d)  $2^{16}$
- Q3.** Which of the following is a correct statement with regard to the preemptive method in OS process control?
- a) A mechanism for allowing the OS to forcibly switch and execute processes is necessary to carry out the preemptive method.  
b) A specific process tends to occupy the processor more often compared to the non-preemptive method.  
c) Each process can autonomously manage the system resources, so this method is suited for multiprogramming.  
d) The overhead required for context switching is smaller compared to the non-preemptive method.
- Q4.** What is the main advantage of a semaphore over an interruption inhibit as a method for locking among tasks using shared resources?
- a) Lock only applies to tasks which use shared resources.  
b) Only a short time is required to achieve lock.  
c) There is no need to consider the occurrence of a deadlock.  
d) There is no need to consider the resource acquisition order.

**Q5.** Which of the following correctly applies to fragmentation?

- a) In systems with frequent acquisition and release of memory region, garbage collection is required each time a memory region is released to prevent fragmentation.
- b) Memory region acquisition and release is faster in a fixed-length block memory pool management system than for variable-length blocks, but the former tends to cause fragmentation more easily.
- c) When fragmentation occurs, the required memory region may not be acquired even if there is enough total free memory space.
- d) With a variable-length block memory pool management system, fragmentation does not occur even if memory regions of various sizes are acquired and released.

**Q6.** How many times will the average wait time “ $W$ ” increase when the window utilization rate “ $\rho$ ” is changed from 0.25 to 0.75, in a M/M/1 queuing model?

- a)  $\frac{1}{3}$
- b) 3
- c) 4.5
- d) 9

**Q7.** A certain program requires 40 ms to read, 30 ms for the CPU to process, and 50 ms to write a data item. What is the maximum number of data items that this program can process per minute, when writing the  $n^{\text{th}}$  data item, CPU processing of the  $(n+1)^{\text{th}}$  data item and reading the  $(n+2)^{\text{th}}$  data item are performed in parallel? Here, the OS overhead is ignored.

- a) 500
- b) 666
- c) 750
- d) 1,200

**Q8.** Of the following indicators or benchmarks for objective performance evaluation, which is the one that evaluates overall system performance including the terminals, networks, software, and others?

- a) Dhrystone/MIPS
- b) Linpack
- c) SPECint/SPECfp
- d) TPC-C

- Q9.** In a certain computer system, the ratio of the functional parts enhanced by improvements to the overall system is  $R$  ( $0 < R < 1$ ), and the performance ratio of the enhanced parts to that of the same parts before the enhancement is  $A$ .  
Select the formula that represents the overall performance ratio at this time.

a)  $\frac{1}{(1 - R) \times A}$

b)  $\frac{1}{(1 - R) + \frac{R}{A}}$

c)  $\frac{1}{R + \frac{1 - R}{A}}$

d)  $\frac{1}{\frac{R}{A}}$

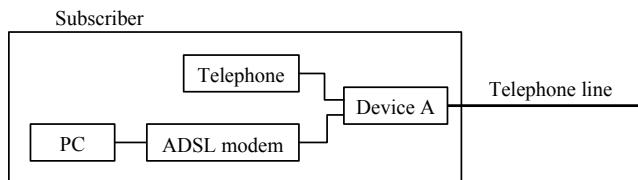
- Q10.** Which of the following is an appropriate explanation of fail soft?
- a) A highly reliable system is constructed by using highly reliable parts and by developing software with few bugs.
  - b) Databases are backed up at certain points in time, and if a failure occurs, the system returns to the state of the time when backup took place and continues the operation.
  - c) When a part of the system fails, functions of the other parts of the system continue the operation.
  - d) When a part of the system fails, the system shifts into a safe mode set in advance in order to avoid fatal effects.

- Q11.** In a particular system, three clients are connected to one server. At least one client must be running concurrently with the server in order for the system to be used. If  $a$  represents the probability that the server is not running and  $b$  represents the probability that one of the clients is not running, which of the following formulas expresses the probability that the system **cannot** be used?

a)  $1 - (1 - a)(1 - b^3)$   
c)  $(1 - a)(1 - b)^3$

b)  $1 - (1 - a)(1 - b)^3$   
d)  $1 - ab^3$

**Q12.** Which of the following is device A connecting the ADSL modem and the telephone in the ADSL service using an existing telephone line?



- a) Dialup router
- b) Hub
- c) Splitter
- d) Terminal adaptor

**Q13.** Which of the following correctly describes data mining?

- a) Created separately from databases for the core business processes, data mining is used mainly for analysis of non-updated time series data.
- b) Data mining is used for analysis on data extracted and customized according to the purpose of analysis, such as data of individuals or that of departments or summary data.
- c) Data mining supports decision-making through multi-dimensional analysis involving interactive operations such as slicing, dicing, and drill-down analysis.
- d) Data mining uses neural networks and statistical analysis techniques on large amounts of accumulated data, to derive principles such as customer-purchasing trends and the like.

**Q14.** Which of the system elements listed below has the following characteristics?

- (1) It is given tasks from the user, autonomously proceeds to the locations (servers) on the network necessary for completing the tasks, and carries them out.
  - (2) It returns to the user when all tasks have been completed.
  - (3) After it has been sent out to the network, the user need not access the network until it has returned.
- a) Agent
  - b) Client
  - c) Process
  - d) Script

**Q15.** Which of the following is a correct statement concerning an elementary technology for computer graphics?

- a) Anti-aliasing smoothes jagged edges by applying an averaging algorithm, etc. to neighboring pixels.
- b) Radiosity involves the tracing and calculation of all the individual light sources which eventually enters the field of view, as it travels from the source, reflecting and refracting repeatedly on object surfaces.
- c) Ray tracing involves the pseudo-modeling of objects as a set of spheroid and ellipsoid objects.
- d) When meta-balls are used, the inter-reflection on object surfaces is directly calculated from the equation for radiant energy.

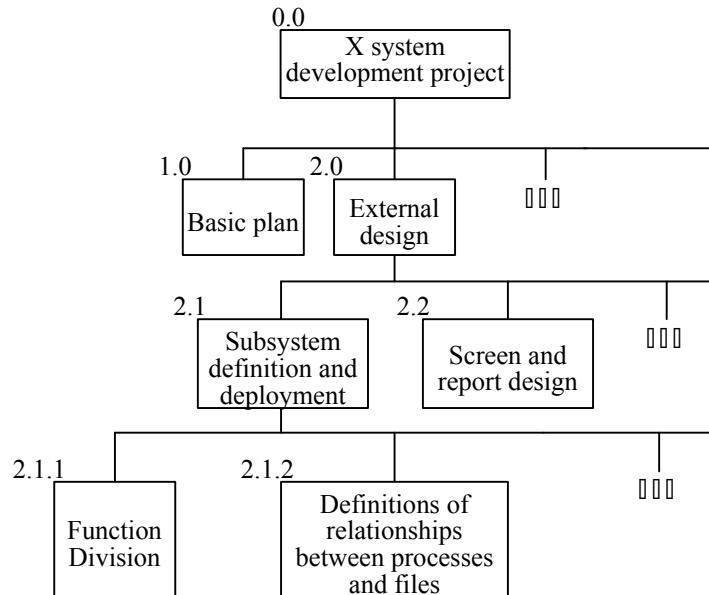
**Q16.** Which of the following corresponds to the concept of foolproof?

- a) Data subject to updating is copied to protect it.
- b) Details of user operations are saved in a log.
- c) The selection of inappropriate items in a menu window is prohibited.
- d) Users are enabled to do operations to cancel entered data.

**Q17.** Which of the following is an appropriate description comparing a UML with a DFD or an E-R diagram?

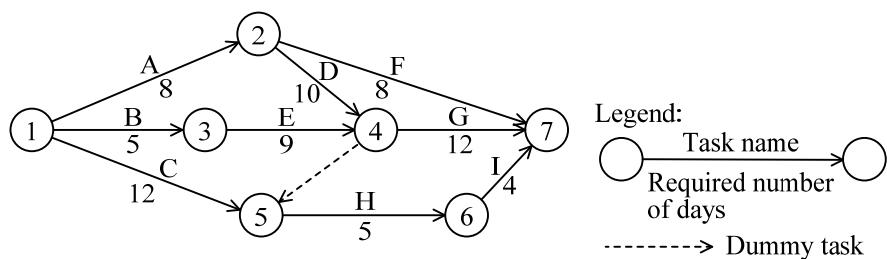
- a) A DFD corresponds to a collaboration diagram or a component diagram in a UML.
- b) A UML cannot describe the data flow, so a DFD needs to accompany it.
- c) A UML cannot describe the relationship of data, so an E-R diagram needs to accompany it.
- d) An E-R diagram corresponds to a class chart that expresses the static structure of a UML.

**Q18.** Select the term that refers to breaking down a project from the overall framework into specific tasks on a detailed level as shown in the figure below.



- a) DFD      b) DOA      c) PERT      d) WBS

**Q19.** The tasks for a project are planned to follow the sequence as shown in the figure below. In order to finish in the fewest number of days as possible, what is the latest day after starting the project, must the project pass through node (5)?



- a) 12      b) 14      c) 18      d) 21

**Q20.** Which of the following RAID types has the objective of increasing the performance but not the reliability?

- a) RAID 0
- b) RAID 1
- c) RAID 3
- d) RAID 5

**Q21.** Which of the following **is not a correct description** of the ANSI/SPARC three-level schema?

- a) The ANSI/SPARC three-level schema is designed to ensure physical and logical data independence.
- b) The approach regarding the external schema is that even if conditions in the real world change, the application program should not be affected, to the fullest extent possible.
- c) The internal schema is a description for implementing conceptual schema on computers through physical files, such as direct access files and VSAM files.
- d) Views of relational databases and subschema of network databases correspond to the conceptual schema.

**Q22.** Which of the following correctly applies to relational database domains?

- a) An attribute must be definable in multiple domains.
- b) A domain is a user-defined schema.
- c) A domain must either be a single basic data type or a user-defined type.
- d) It would be essentially meaningless to compare attributes of different domains.

**Q23.** If the functional dependencies (1) through (7) below, apply to attributes of the "Order" relationship, which of the following is a correct set of primary key attributes? Here, (A, B) denotes a set of attributes A and B.  $A \rightarrow C$  denotes that C is functionally dependent on A.

"Order" relationship:

(Order number, order date, customer number, customer name, product number, product name, quantity, price)

Functional dependencies:

- (1) Order number  $\rightarrow$  Order date
- (2) Order number  $\rightarrow$  Customer number
- (3) Order number  $\rightarrow$  Customer name
- (4) Customer number  $\rightarrow$  Customer name
- (5) (Order number, Product number)  $\rightarrow$  Quantity
- (6) (Order number, Product number)  $\rightarrow$  Price
- (7) Product number  $\rightarrow$  Product name

- a) (Order number)
- b) (Order number, Customer number)
- c) (Order number, Customer number, Product number)
- d) (Order number, Product number)

**Q24.** Which of the following correctly describes functional dependencies? Here, A, B, and C are a set of attributes of a particular relation.

- a) If B is a subset of A, A is functionally dependent on B.
- b) If B is a subset of A and C is functionally dependent on A, C is functionally dependent on B.
- c) If B is functionally dependent on A and C is functionally dependent on A, C is functionally dependent on B.
- d) If the union of B and C is functionally dependent on A, then B and C are each functionally dependent on A.

**Q25.** Which of the following correctly describes the table below, created by an order entry system? The order number is newly issued for each order. The entry number is a serial number issued for each product if there are multiple products in a single order. The order date, order number, and item number are set automatically by the entry system. The customer code, product code, and quantity are entered by the operator. The unit price of the product corresponding to its product code is referred to the ledger.

Order date	Order number	Customer code	Entry number	Product code	Quantity	Unit price
2005-03-05	995867	0256	1	20121	20	20,000
2005-03-05	995867	0256	2	24005	10	15,000
2005-03-05	995867	0256	3	28007	5	5,000

- a) Normalization has not been done.
- b) Only the first normalization has been done.
- c) Up to the second normalization has been done.
- d) Up to the third normalization has been done.

**Q26.** If the following table is to be normalized to the third normal form, how many tables will it divide into? In this case, one order slip is created per customer order, and a customer may order multiple products in a single order.

Order number	Customer code	Customer name	Order date	Product code	Product name	Unit price	Order quantity	Order amount
1055	A7053	Jagger	2004-07-01	T035	TV set A	85,000	10	850,000
1055	A7053	Jagger	2004-07-01	K083	CD Player A	23,000	5	115,000
1055	A7053	Jagger	2004-07-01	S172	HD Recorder B	78,000	3	234,000
2030	B7060	Richards	2004-07-03	T050	TV set B	90,000	3	270,000
2030	B7060	Richards	2004-07-03	S172	HD Recorder B	78,000	10	780,000
3025	C9025	Wyman	2004-07-03	T035	TV set A	85,000	3	255,000
3025	C9025	Wyman	2004-07-03	K085	CD Player B	25,000	2	50,000
3025	C9025	Wyman	2004-07-03	S171	HD Recorder A	50,000	8	400,000
3090	B7060	Richards	2004-07-04	T050	TV set B	90,000	1	90,000
3090	B7060	Richards	2004-07-04	T035	TV set A	85,000	2	170,000

a) 2

b) 3

c) 4

d) 5

**Q27.** Which of the following is a correct statement in regard to the `SELECT` phrase of an SQL statement?

- a) In order to obtain all the columns in a table, it must specify all the columns separated by commas.
- b) It can only specify the columns in the table specified by the `FROM` phrase.
- c) It can repeatedly specify the same column.
- d) It cannot create search results that exclude repetitions.

**Q28.** Which of the following is the table that results from naturally combining the "Registration" and "Assignment" tables?

Registration

Student	Subject
Tom Pitt	Information processing
Tom Pitt	Algebra
Anne Miller	Information processing

Assignment

Subject	Instructor
Information processing	Brad Kostner
Algebra	Kevin Cruise

- a)
- |             | Student | Subject                | Instructor   |
|-------------|---------|------------------------|--------------|
| Tom Pitt    |         | Information processing | Brad Kostner |
| Tom Pitt    |         | Algebra                | Kevin Cruise |
| Anne Miller |         | Information processing | Brad Kostner |
- b)
- | Registration.Student | Registration.Subject   | Assignment. Subject    | Assignment. Instructor |
|----------------------|------------------------|------------------------|------------------------|
| Tom Pitt             | Information processing | Information processing | Brad Kostner           |
| Tom Pitt             | Algebra                | Algebra                | Kevin Cruise           |
| Anne Miller          | Information processing | Information processing | Brad Kostner           |
- c)
- | Registration.Student | Registration.Subject   | Assignment. Subject    | Assignment. Instructor |
|----------------------|------------------------|------------------------|------------------------|
| Tom Pitt             | Information processing | Algebra                | Kevin Cruise           |
| Tom Pitt             | Algebra                | Information processing | Brad Kostner           |
| Anne Miller          | Information processing | Algebra                | Kevin Cruise           |
- d)
- | Registration.Student | Registration.Subject   | Assignment. Subject    | Assignment. Instructor |
|----------------------|------------------------|------------------------|------------------------|
| Tom Pitt             | Information processing | Information processing | Brad Kostner           |
| Tom Pitt             | Information processing | Algebra                | Kevin Cruise           |
| Tom Pitt             | Algebra                | Information processing | Brad Kostner           |
| Tom Pitt             | Algebra                | Algebra                | Kevin Cruise           |
| Anne Miller          | Information processing | Information processing | Brad Kostner           |
| Anne Miller          | Information processing | Algebra                | Kevin Cruise           |

**Q29.** R and S are relations. Which of the following is the correct result for the relational operation of  $R \div S$ ? Here, the  $\div$  symbol represents division.

R	
Store	Product
A	a
A	b
B	a
B	b
B	c
C	c
D	c
D	d
E	d
E	e

S	
Product	
a	
b	
c	

a)

Store
A
A
B
B
B
C
D

b)

Store
A
B
C
D

c)

Store
B

d)

Store
E

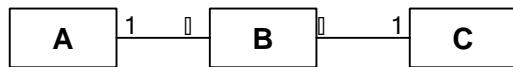
**Q30.** Assume attributes A and B are in a relational data model. The domain of attribute A is a set of  $m$  elements, and the domain of attribute B is a set of  $n$  elements. If relation R is defined as  $R(A, B)$ , what is the maximum number of tuples in R?

- a)  $2^m 2^n$       b)  $(m+n)^2$       c)  $m+n$       d)  $mn$

- Q31.** The relationship of three entities, -part, supplier, and inventory- in a parts inventory control ledger, is described in the E-R diagram below. Which of the following is a correct combination of entities **A** through **C**? Here,  $1\text{---}*$  represents one-to-many cardinality.

Parts inventory control ledger

Part code	Part name	Supplier code	Supplier name	Stocking date	Purchase price	Inventory volume
001	Part R	Z010	Company P	Sept. 1	1,500	1,000
001	Part R	Z010	Company P	Oct. 15	1,400	1,500
002	Part S	Z010	Company P	Sept. 20	800	500
003	Part T	Z015	Store Q	Oct. 8	1,600	1,450



E-R diagram

	<b>A</b>	<b>B</b>	<b>C</b>
a)	Inventory	Part	Supplier
b)	Inventory	Supplier	Part
c)	Part	Inventory	Supplier
d)	Supplier	Part	Inventory

**Q32.** Which of the following is the resulting table when the SQL statement shown below is executed to the "Product" table and the "Sales Details" table? Here, "–" in the table indicates that the value is null.

```
SELECT X.ProductNumber, ProductName, Quantity
FROM Product X LEFT OUTER JOIN SalesDetails Y
ON X.ProductNumber = Y.ProductNumber
```

Product	
Product Number	Product Name
S101	A
S102	B
S103	C
S104	D

SalesDetails				
Sale Number	SaleDate	Product Number	Quantity	Sale Price
U001	2007-02-10	S101	5	7,500
U002	2007-02-26	S104	2	4,000
U002	2007-02-26	S101	10	15,000
U003	2007-03-05	S103	5	5,000
U003	2007-03-05	S104	8	16,000

a)

ProductName	ProductName	Quantity
S101	A	5
S101	A	10
S102	B	–
S103	C	5
S104	D	2
S104	D	8

b)

ProductName	ProductName	Quantity
S101	A	5
S101	A	10
S103	C	5
S104	D	2
S104	D	8

c)

ProductName	ProductName	Quantity
S101	A	15
S102	B	–
S103	C	5
S104	D	10

d)

ProductName	ProductName	Quantity
S101	A	15
S103	C	5
S104	D	10

**Q33.** The following SQL statement is a cursor declaration for reading records in Table X by a COBOL program. Which of the following is the correct phrase to be inserted in A?

A

```
SELECT * FROM X  
ORDER BY 1, 2  
END-EXEC
```

- a) EXEC SQL DECLARE C1 CURSOR FOR
- b) EXEC SQL DECLARE CURSOR FOR C1
- c) EXEC SQL OPEN CURSOR C1 FOR
- d) EXEC SQL OPEN CURSOR DECLARE C1 FOR

**Q34.** Which of the following shows the correct result of executing this SQL statement on the "Members" table below?

```
SELECT x.Member_name  
FROM Members x, Members y  
WHERE x.Leader_member_number = y.Member_number  
AND x.Date_of_birth < y.Date_of_birth
```

Members

Member_number	Member_name	Date_of_birth	Leader_member_number
001	Thomas	1960-03-25	002
002	Shaw	1970-02-15	002
003	Smith	1975-05-27	002
004	Fuller	1960-10-25	004
005	Wayne	1945-09-01	004

- a) 

Member_name
-------------

  
(No such person)
- b) 

Member_name
Smith
- c) 

Member_name
Shaw
Fuller
- d) 

Member_name
Thomas
Wayne

**Q35.** Which of the following shows the correct result of executing this SELECT statement on the "Parts" table below?

```
SELECT Part_classification, COUNT(*) AS Part_quantity, MAX(Unit_price) AS Unit_price
FROM Parts GROUP BY Part_classification HAVING SUM(Quantity_stocked) > 200
```

Parts

Part_number	Part_classification	Unit_price	Quantity_stocked
001	P1	1,500	90
002	P2	900	30
003	P2	950	90
004	P3	2,000	50
005	P1	2,000	100
006	P3	2,500	60
007	P1	1,500	50
008	P2	900	80
009	P3	1,000	40
010	P4	900	80
011	P3	1,500	70
012	P4	950	100

a)

Part_classification	Part_quantity	Unit_price
P1	3	2,000
P2	3	1,000

b)

Part_classification	Part_quantity	Unit_price
P1	3	2,000
P3	4	2,500

c)

Part_classification	Part_quantity	Unit_price
P2	3	1,000
P4	2	950

d)

Part_classification	Part_quantity	Unit_price
P1	3	2,000
P2	3	1,000
P3	4	2,500

**Q36.** If the following SQL statement is executed on the "Product" and "Inventory" tables below, how many rows would the resulting table have?

```
SELECT Product_number FROM Product
WHERE NOT EXISTS(SELECT Product_number FROM Inventory
                 WHERE Inventory_volume > 30
                 AND Product.Product_number = Inventory.Product_number)
```

Product

Product_number	Product_name	Unit_price
AB1805	CD-ROM drive	15,000
CC5001	Digital camera	65,000
MZ1000	Printer A	54,000
XZ3000	Printer B	78,000
ZZ9900	Scanner	98,000

Inventory

Warehouse_code	Product_number	Inventory_volume
WH100	AB1805	20
WH100	CC5001	200
WH100	ZZ9900	130
WH101	AB1805	150
WH101	XZ3000	30
WH102	XZ3000	20
WH102	ZZ9900	10
WH103	CC5001	40

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

**Q37.** Which of the following SQL statements would give the same results as this SQL statement when executed on "Delivery" and "Customer" tables below?

```
SELECT Customer_number, Customer_name FROM Customer
  WHERE Customer_number IN
    (SELECT Customer_number FROM Delivery
      WHERE Product_number = 'G1')
```

Delivery			Customer	
Product_number	Customer_number	Delivery_quantity	Customer_number	Customer_name

- a) 

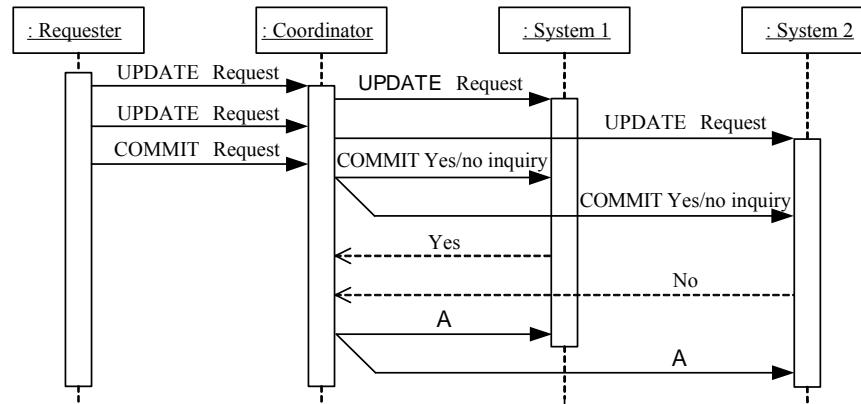
```
SELECT Customer_number, Customer_name FROM Customer
  WHERE 'G1' IN (SELECT Product_number FROM Delivery)
```
- b) 

```
SELECT Customer_number, Customer_name FROM Customer
  WHERE Product_number IN
    (SELECT Product_number FROM Delivery
      WHERE Product_number = 'G1')
```
- c) 

```
SELECT Customer_number, Customer_name FROM Delivery, Customer
  WHERE Product_number = 'G1'
```
- d) 

```
SELECT Customer_number, Customer_name FROM Delivery, Customer
  WHERE Delivery.Customer_number = Customer.Customer_number
  AND Product_number = 'G1'
```

**Q38.** In a distributed database, there is the command sequence shown in the figure below. Which of the following is a command issued by a coordinator in Sequence “A?” Here, the command sequence is denoted using a UML sequence diagram.

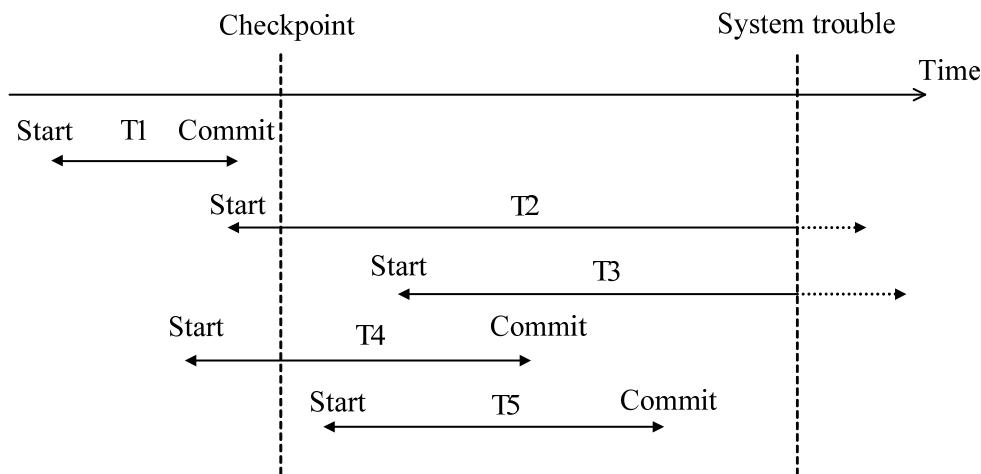


- a) Request to execute COMMIT
- b) Request to execute log writing
- c) Request to execute ROLLBACK
- d) Request to write decision record

**Q39.** In a DBMS, which of the following is a data structure that can be used to detect deadlock?

- a) Queue graph
- b) Resource allocation table
- c) Time-stamp order management table
- d) Transaction priority order management table

**Q40.** A system trouble occurred at the elapsed time shown in the figure below in a DBMS that takes checkpoints. In this case, which transaction(s) can be recovered by roll-forward?



- a) T1
- b) T2 and T3
- c) T4 and T5
- d) T5

**Q41.** Distributed database transactions are divided into multiple sub-transactions and executed at multiple sites. Which of the following correctly describes the transaction commit control in such cases?

- a) Even if two-phase commit is used, instructions from the main site may not reach sites where sub-transactions are executed, so it may not be known whether to commit the sub-transaction or to roll it back.
- b) If two-phase commit is used, in some cases, transactions may be committed even if sub-transactions are rolled back.
- c) With one-phase commit (commit control for a centralized database), even if individual sites independently perform distributed database commits, database consistency among sites can be ensured.
- d) With two-phase commit, even if a commit ready response is received from all sub-transactions, sub-transactions may not all be committed.

**Q42.** Which of the following correctly describes atomicity, which must be implemented by a DBMS?

- a) Either all of the processing of a transaction is executed or none at all.
- b) Once a transaction is complete, the content of the updated database is guaranteed, even if hardware failure occurs.
- c) The processing results of one transaction are not affected by other transaction processing.
- d) The same processing involving the same database should give the same results each time.

**Q43.** In two transactions (T1 and T2), data elements  $a$  and  $b$  are accessed in parallel. For which of the following combinations of T1 and T2 can a serializable level of isolation be ensured? Operations in the transactions are defined below.

LOCK  $x$ : Lock data element  $x$   
 READ  $x$ : Read data element  $x$   
 STORE  $x$ : Write data element  $x$   
 UNLOCK  $x$ : Unlock data element  $x$

T1	T2
READ $a$	READ $a$
LOCK $a$	LOCK $a$
LOCK $b$	LOCK $b$
$a = a + 3$	$a = a + 3$
STORE $a$	STORE $a$
READ $b$	READ $b$
$b = b + 5$	$b = b + 5$
STORE $b$	STORE $b$
UNLOCK $a$	UNLOCK $a$
UNLOCK $b$	UNLOCK $b$

T1	T2
READ $a$	READ $a$
LOCK $a$	LOCK $a$
LOCK $b$	LOCK $b$
$a = a + 3$	$a = a + 3$
STORE $a$	STORE $a$
UNLOCK $a$	UNLOCK $a$
LOCK $b$	LOCK $b$
READ $b$	READ $b$
$b = b + 5$	$b = b + 5$
STORE $b$	STORE $b$
UNLOCK $b$	UNLOCK $b$

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	$a = a + 3$
STORE $a$	STORE $a$
UNLOCK $a$	UNLOCK $a$
LOCK $b$	LOCK $b$
READ $b$	READ $b$
$b = b + 5$	$b = b + 5$
STORE $b$	STORE $b$
UNLOCK $b$	UNLOCK $b$

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	$a = a + 3$
STORE $a$	STORE $a$
UNLOCK $a$	UNLOCK $a$
LOCK $b$	LOCK $b$
READ $b$	READ $b$
$b = b + 5$	$b = b + 5$
STORE $b$	STORE $b$
UNLOCK $b$	UNLOCK $b$

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	
STORE $a$	LOCK $b$
UNLOCK $a$	READ $b$
LOCK $b$	$b = b + 5$
READ $b$	
$b = b + 5$	
STORE $b$	
UNLOCK $b$	

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	
STORE $a$	LOCK $b$
UNLOCK $a$	READ $b$
LOCK $b$	$b = b + 5$
READ $b$	
$b = b + 5$	
STORE $b$	
UNLOCK $b$	

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	
STORE $a$	LOCK $b$
LOCK $b$	READ $b$
READ $b$	$b = b + 5$
$b = b + 5$	
STORE $b$	
UNLOCK $b$	
UNLOCK $a$	

T1	T2
LOCK $a$	LOCK $a$
READ $a$	READ $a$
$a = a + 3$	
LOCK $b$	LOCK $b$
READ $b$	READ $b$
$b = b + 5$	
UNLOCK $b$	
UNLOCK $a$	

**Q44.** For queries in distributed database systems, optimization of join operations that span across the sites is important. Which of the following is a suitable optimization method?

- a) LRU method
- b) Optimistic approach
- c) Semi-join method
- d) Sort/merge method

**Q45.** When storing a large amount of data into a single table, the data can be divided and stored on different disks for parallel processing. In systems such as this, which of the following correctly describes key-range partitioning?

- a) A hash function is applied to the values of the key used for dividing, and the data is divided and stored into the disks corresponding to the values of the function.
- b) Based on functional dependency, data is divided and stored into different tables, with reference relationships using primary and foreign keys maintained.
- c) By switching disks for storing in the order in which the data is generated, even amounts of data are divided and stored into the disks.
- d) Predetermined key values are used for dividing, and disks assigned to those values are used for divided storage.

**Q46.** Which of the following is an appropriate description of public key cryptosystems?

- a) AES is a type of public key cryptosystem chosen by NIST from among the public in 1997.
- b) If a public key cryptosystem is to be used to protect the confidentiality of message contents, the receiver's decryption key is disclosed.
- c) RSA is a type of public key cryptosystem taking advantage of the difficulty of computing prime factorization.
- d) The difficulty of a public key cryptosystem is that the management of the key becomes troublesome.

**Q47.** It is necessary to design a communication system where messages encrypted using a public-key can only be read by the intended recipient, while at the same time, the sender is authenticated. Which of the following systems meets these requirements? In this case, **A** represents the sender and **B** is the recipient. **A**'s public and private keys are **a1** and **a2**, respectively, and **B**'s public and private keys are **b1** and **b2** respectively.

- a) **A** uses **a2** to encrypt the message and signature together before transmission. **B** uses **a1** to decode the received message and signature, and then verifies the message and signature.
- b) **A** uses **b1** to encrypt both a message and a signature, the latter of which is encrypted using **a2**, before transmission. **B** decodes the received message and signature by using **b2** and then uses **a1** to decode the encrypted signature, then verifies the message and signature.
- c) **A** uses **b1** to encrypt the message and signature together before transmission. **B** uses **b2** to decode the received message and signature, and then verifies the message and signature.
- d) **A** uses **b1** to encrypt the signature, then encrypts both the message and the encrypted signature together using **b1**, before transmission. **B** decodes the received message and signature by using **b2** and then uses **b2** again to decode the encrypted signature, then verifies the message and signature.

**Q48.** Which of the following applies to information leakage caused by spyware?

- a) The system administrator provided the password to a caller claiming to have forgotten his/her password, resulting in an unauthorized person learning the password.
- b) When a personal computer was simply discarded as is, the data remaining on the magnetic recording media was read.
- c) When an e-mail was sent without encryption, its contents were read on a network.
- d) When an Internet connection was made, the user's information stored inside the computer was transmitted unknowingly.

**Q49.** Which of the following correctly describes a computer security measure?

- a) To prevent data falsification by means of a utility program, a back-up copy is made of that utility program and compared to the original program.
- b) To prevent falsification of numerical data entered via terminals, the protection level is changed through a storage protection key assigned to the page or segment level in the virtual storage area.
- c) To prevent fractional amounts from interest calculations and the like from being transferred illegally to a specified account (the so-called "salami technique"), a check digit is appended to data.
- d) To prevent leakage of confidential data left in temporary storage, data in the temporary storage area is consistently erased when jobs are completed.

**Q50.** Which of the following is a correct statement for firewall systems?

- a) In the application gateway system, the gateway function must be set for each application protocol.
- b) The circuit gateway system controls the passage of commands.
- c) The packet filtering system allows filtering by checking words contained in an e-mail.
- d) The transport gateway system provides a gateway function that depends on the application protocol.

**Q51.** Which of the following correctly describes risk analysis in information systems?

- a) Evaluated risk amount measures risks as a monetary figure. The amount is expressed as the average expected loss per incident.
- b) In risk analysis, where and in what ways risk items, which will cause loss if they happen, exist in the information system are identified and the magnitude of their impact are evaluated.
- c) The estimated loss associated with risk is the total of the following costs: the cost of investment to prevent loss, the cost for recovery, and the cost of adopting alternative means to continue business operations.
- d) There are two kinds of risk: speculative risk and pure risk. The object of risk analysis for information security is speculative risk.

**Q52.** Which of the following is an appropriate combination of a threat to an information system and a security measure?

	Threat	Security measure
a)	Earthquake and fire	Dual system with fault tolerant computers
b)	Message tampering	Digital signature using a public key cryptosystem
c)	Physical theft and destruction of data	Disk array or firewall
d)	Unauthorized access into data being transmitted	CRC in HDLC protocol

**Q53.** Which of the following is an appropriate description of the use of SSL?

- a) A digital certificate contains an IP address, so if the IP address of a Web server using SSL is to be changed, it is necessary to obtain another digital certificate.
- b) SSL is a protocol developed for communication among designated users, so advanced user registration is indispensable.
- c) The digital certificate used by SSL for personal authentication can be stored on an IC card, etc., so there is no need to limit its storage location to a specific PC.
- d) The length of a common key used for SSL in Japan is limited to less than 128 bits.

**Q54.** Which of the following correctly describes the content of the Common Criteria (CC) that has been reached by integrating and standardizing the TCSEC used by the U.S. and ITSEC for European governmental procurement?

- a) Basic information security technology standards
- b) Security evaluation criteria concerning information technology
- c) Security function standards concerning communication services
- d) Security management protocol standards

**Q55.** Which of the following statements correctly describes the Security Assertion Markup Language (SAML)?

- a) SAML defines a protocol for sending e-mail that is protected from eavesdropping, reading and modification by unauthorized parties.
- b) SAML defines a system for widely publicizing information concerning Web services, and allows functions such as search, which those services provide.
- c) SAML defines a Web service protocol for efficiently managing key information that is used in digital signatures.
- d) SAML defines a Web service protocol for transmitting authentication, attribute and access control information to different domains.