

Question 1:

Say if the following relational schema: $\langle R(A, B, C, D), \{ AB \rightarrow C, C \rightarrow D, C \rightarrow A \} \rangle$

is in 3NF or not, provide a lossless 3NF decomposition.

No, because AB and D are not contained in any key.

- $R_1(A, B, C), \{ AB \rightarrow C, C \rightarrow A \}$
- $R_2(C, D), \{ C \rightarrow D \}$

Question 2:

Two sets of functional dependencies F_1 and F_2 over a schema S are equivalent if:

- ☐ If after applying the transitive closure to both sets, we obtain the same set of functional dependencies.
- ☐ If they are exactly the same set of functional dependencies.
- ☒ They have the same closure.
- ☐ We have not enough

Question 3

Consider the schema $R(A, B, C, D)$. Which of the following sets of functional dependencies is a minimal cover?

- ☐ $AB \rightarrow C, B \rightarrow D, B \rightarrow A$
- ☐ $AB \rightarrow C, D \rightarrow BC$
- ☒ $AB \rightarrow C, D \rightarrow B, D \rightarrow C$
- ☐ $AB \rightarrow A, C \rightarrow BD$

Question 4

What is a foreign key?

- ☒ An integrity constraint
- ☐ A SQL query
- ☐ A trigger
- ☐ None of the other choices

Question 5

Consider the relational schema: $\langle R(A, B, C, D), \{ AB \rightarrow C, C \rightarrow D, C \rightarrow A \} \rangle$ and the following decomposition of R : $R_1(A, B, C)$ $R_2(C, D)$ Is the decomposition R_1, R_2 in 3NF?

- ☐ There is not enough information to answer the question
- ☒ Yes
- ☐ No

Question 6

The set of functional dependencies $AB \rightarrow C, C \rightarrow D, C \rightarrow A$ logically implies:

- ☐ AC \rightarrow D, C \rightarrow B
- ☐ AB \rightarrow D, C \rightarrow B
- ☐ None of the other answers is correct
- ☒ AC \rightarrow D, AB \rightarrow D

Question 7

Consider the schema R(A, B) and S(B, C). Which of the following is legal SQL?

- ☐ select A, AVG(C) as AV from R, S where R.B = S.B group by C
- ☒ select A, AVG(C) as AV from R, S where R.B = S.B group by A
- ☐ select A, AVG(C) as AV from R, S where R.B = S.B group by B

Question 8

Given the tables shown at the end of this question, and without any other assumption, can you say if (B, C, A) is a foreign key for S referencing T?

S(A, B, C)			T(D, E, F)			Z(G, H, F)			R(A, B, C)		
A	B	C	D	E	F	G	H	F	A	B	C
1	a	e	a	e	1				a	e	1
1	a	e	a	e	2				a	f	2
1	a	e	a	e	3				a	g	3
1	a	e	a	e	4				a	null	4

- ☒ It could be, but we cannot know for sure
- ☐ No, it cannot be
- ☐ Yes. It is for sure

Question 9

Consider the table R(A, B) with P_R pages and $|R|$ tuples, and a table S(B, C) with P_S pages and $|S|$ tuples. There is a hash index defined on S.B with lookup cost equal to 2. We need to update every tuple of R that can join with a tuple in S. In particular we need to execute the update command:

```
update R, S
set R.A = 10 where R.A = S.B
```

The cost of the update command is:

- ☐ $P_S + |S| * P_R * 2$
- ☐ $P_R + P_S + |S| * 2$
- ☐ $P_R + P_S + |R| * 2$
- ☐ $P_R + |R| * P_S * 2$
- ☒ $P_R + P_S + |R| * 2$

Question 10

We have an unclustered B+ tree index on the attribute CITY of a table PERSON. The selectivity factor 0.1 and there are 1000 tuples in the table. If the tuple has size 500 Kbytes and the page on the disk is 600 Kbytes, what is the cost to find, retrieve and display on the screen the tuples that have CITY = "Trento"?

- ☐ $(3 + 1) * 0.1 * 1000$
- ☐ $3 * 0.1 + 1000$
- ☐ $3 * 0.1 + 1000$
- ☐ $3 * (1 + 0.1 * 1000)$
- ☒ $3 + 0.1 * 1000$

Question 11

What is the purpose of the index in a SQL database server engine?

- ☐ Just to perform fast searches
- ☐ Just to enhance the query performance
- ☒ All the mentioned reasons
- ☐ Just to provide an index to a record

Question 12

The cost of $\sigma_{A=1}(R \bowtie S)$ is always the same as $\sigma_{A=1}(R) \bowtie S$.

- ☒ No
- ☐ Yes
- ☐ True only if A is a foreign key referencing S
- ☐ Only if A is a key in R or S
- ☐ True only if A is an attribute of both R and S

Question 13

Consider the two tables below and assume ENROLLED.Sid is a foreign key referencing a STUDENT.Sid. Which of the following commands will be executed successfully and will insert a record in the ENROLLED table?

Student					Enrolled		
Sid	Name	Login	Age	GPA	Sid	Cid	Grade
53666	Kayne	A@ca	28	4.2	53666	15-415	C
53655	Tupac	B@ca	26	3.5	53688	15-721	A
53688	Bieber	C@ca	22	3.9	53688	15-826	B
					53655	15-415	C
					53666	15-721	C

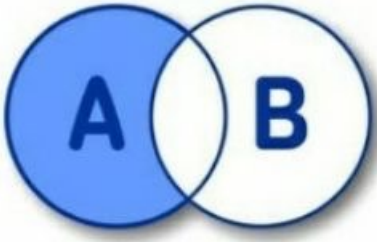
- INSERT INTO ENROLLED values(53667, '15-420', 'C');
- INSERT INTO ENROLLED values(53666, '15-421', 'C');
- INSERT INTO ENROLLED values(53667, '15-415', 'C');
- INSERT INTO ENROLLED values(53666, '15-415', 'C');

- ☐ Only the 1 and 3
- ☒ Only the 2 and 4
- ☐ Only the 3
- ☐ Only the 4

Question 14

Consider two relations (tables) A and B that have exactly the same schema. The attribute C is the key in each of the two tables. A circle in the figure below represents the tuples that belong to a table, and each point in the cycle

represents a tuple in that table. For example, a point inside the circle B represents a tuple that is in the table B. Select the query among those below that returns the tuple in the blue part.



- ☐ $B - A$
- ☐ $A - (A \cup B)$
- ☒ $A - (A \bowtie B)$
- ☐ None are correct
- ☐ $A - (A \cap B)$

Question 15:

Let $R(A,B)$ and $S(B)$ be two relations. The division R/S in relational algebra is equal to:

- ☐ $\pi_B(R) - \pi_B(S - (\pi_B(R) \times S))$
- ☐ $\pi_A(R) - \pi_A(R - (\pi_A(R) \times S))$
- ☒ $\pi_A(R) - \pi_A((\pi_A(R) \times S) - R)$
- ☐ $\pi_B(R) - \pi_A((\pi_B(R) \times S) - R)$

Question 16

A weak entity...

- ☐ Does not participate in any relationship
- ☒ Has its key made of attributes from other entities
- ☐ Is related by an ISA relationship to another entity
- ☐ Does not have a key