UPPSALA UNIVERSITET

Department of Information Technology

INSTRUCTIONS

Please check that you have the correct exam!

This sheet should always be turned in, even if you haven't solved any of the exam questions.

Each solution should be written on a new paper.

Write your exam code on each new paper.

Please use only *one side* of the papers and *do not* use a pencil with red colour.

Sort the solutions in question order, with question 1 first, before you turn them in.

FRONT SHEET FOR EXAMS	**DATE:** 2017-08-19
Course name (incl. group) Database Design I (1DL301)	
Your exam code ☐☐☐☐☐☐	
Semester and year when you were first registered for the course[1]	Programme (or similar)
Time for turning in the exam:	Table number

Nr.	Solved questions (mark with X)	Points earned
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Σ		
Exam grade		

Comment from the teacher:

☐ Exam with bonus points:
Grade is not shown[2].

Grade limits:
VG≥ G≥

5≥ 4≥ 3≥

[1] Please note: If you are NOT registered for the course your exam will NOT be graded.

[2] The final result (points including bonus points and grade) will appear at the student portal when the result has been added to Uppdok.

+1/11/50+

Answer sheet:

0 0 0 0
1 1 1 1
2 2 2 2
3 3 3 3
4 4 4 4
5 5 5 5
6 6 6 6
7 7 7 7
8 8 8 8
9 9 9 9

⟵ please write your exam code in the box below (full code), and also encode it on the left (only the number). For example, if your code is AB0037 you should fill in 0 in the first column, 0 in the second, 3 in the third and 7 in the fourth.

Full exam code:

.....

Q. 1: A B C D E
Q. 2: A B C D E F G
Q. 3: A B C D E
Q. 4: A B C D E F
Q. 5: A B C D
Q. 6: A B C D
Q. 7: A B C D
Q. 8: A B C D
Q. 9: A B C D
Q. 10: A B C D E F G
Q. 11: A B C D E
Q. 12: A B C D E
Q. 13: A B C D E F G
Q. 14: A B C D E F G
Q. 15: A B C D E F G
Q. 16: A B C D E F G
Q. 17: A B C D E F G
Q. 18: A B C D E F G
Q. 19: A B C D E F G
Q. 20: A B C D E F
Q. 21: A B C D
Q. 22: A B C D E F
Q. 23: A B C D E F
Q. 24: A B C D E
Q. 25: A B C D E
Q. 26: A B C D
Q. 27: A B C D
Q. 28: A B C D E F G
Q. 29: A B C D E
Q. 30: A B C D E

+1/1/60+

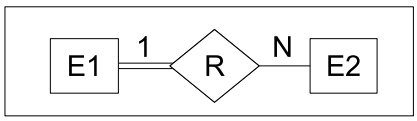
Uppsala University
Department of Information Technology
Database Design I (1DL300/1) – 2017-08-19

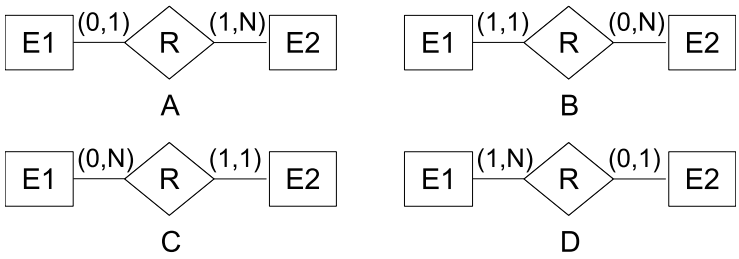
Instructions: Read through the complete exam and note any unclear directives before you start solving the questions. For each question there can be one or more correct answers, but you can choose only one. If you choose a correct answer, you gain 3 points. A wrong answer does not generate negative points – but the teacher reserves the right to penalize answers that are outrageously wrong. The questions are divided into three sections with 10 questions each. To achieve a grade of 3, you must gain at least 18 points in each section. To achieve a grade of 4, you must gain at least 65 points in the whole exam. To achieve a grade of 5, you must collect at least 75 points in the whole exam. You are allowed to use dictionaries to and from English and a calculator, but no other material. Answers must be given exclusively on the answer sheet: answers given on the other sheets will be ignored. To mark an answer fill in the box *completely* (that is, not just crossing it) using a pen.

Please, detach and submit only the page with the answer sheet, thanks. You can keep the questions.

1 Database design

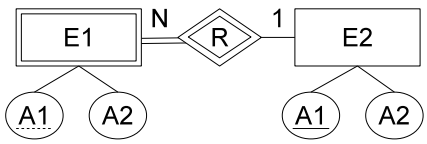
Question 1 Indicate which of the following ER diagrams with min-max notation corresponds to the diagram:





A A B B C C D D E None of the others

Question 2 Which relational schema corresponds to the following ER diagram?



A $E1(\underline{E2, A1}, A2)$, $E2(\underline{A1}, A2)$ (with $E1.E2$ FK ref. $E2.A1$)

B None of the other answers

C $E1(\underline{A1}, A2)$, $E2(\underline{A1}, A2)$, $R(\underline{E1, E2})$ (with $R.E1$ FK ref. $E1.A1$ and $R.E2$ FK ref. $E2.A1$)

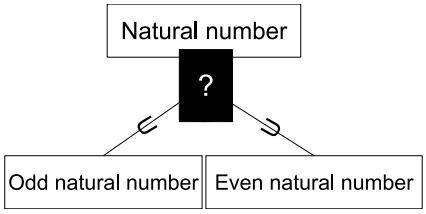
D $E1(\underline{A1, A2})$, $E2(\underline{A1}, A2)$

E $E1(\underline{A1}, A2)$, $E2(\underline{E1, A1}, A2)$ (with $E2.E1$ FK ref. $E1.A1$)

F $E1(\underline{A1}, A2, E2)$, $E2(\underline{A1}, A2)$ (with $E1.E2$ FK ref. $E2.A1$)

G $E1(\underline{A1}, A2)$, $E2(\underline{A1}, A2, E1)$ (with $E2.E1$ FK ref. $E1.A1$)

Question 3 What is the best type of generalization for the following diagram?



A partial and overlapping

B partial and disjoint

C total and overlapping

D total and disjoint

E None of the others

Question 4 Consider a relation in 1NF $R(A, B, C, D, E)$ with the following dependencies:

- $A, B \to C, D, E$
- $C \to A, B, D, E$
- $E \to D$

Which of the following is the result of the normalization of this relation to BCNF?

A None of the other answers

B $R_1(A, B, E)$, $R_2(C, E)$, $R_3(E, D)$

C $R_1(A, B, C, D, E)$, $R_2(C, A, B, D, E)$, $R_3(E, D)$

D $R_1(A, B, C, E)$, $R_2(E, D)$

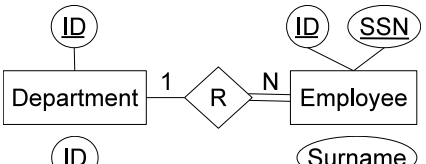
E $R(A, B, C, D, E)$

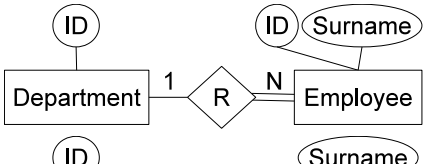
F $R_1(A, B, D)$, $R_2(C, D)$, $R_3(E, D)$

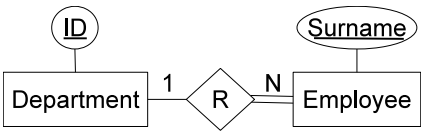
Question 5 Consider the relation corresponding to the following SQL statement:
CREATE TABLE R (A int, B int, C int, PRIMARY KEY (A,B,C))
and assume that there is a functional dependency $C \to B$. Choose a statement that best describes this relation.

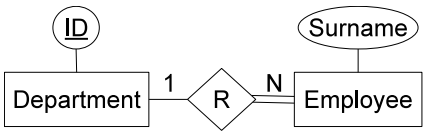
A R is in 2NF but not in 3NF
B The SQL expression is syntactically wrong
C R is in BCNF
D (A,B,C) is a bad choice for an SQL Primary Key

Question 6 Choose the best among the following ER diagrams.

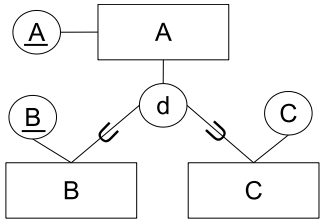
A


B


C


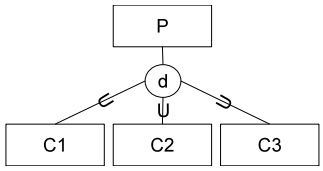
D


Question 7 Which of the following statements best describes the following diagram?



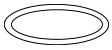
A Entity type C has no key
B Entity type B has two keys
C Entity type A has three attributes
D The diagram is syntactically wrong

Question 8 Which of the following statements best describes the following diagram? (attributes have been omitted)



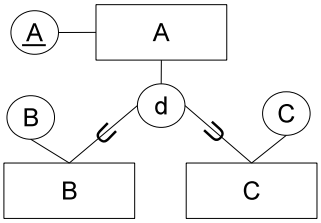
A A C1 cannot be a C2
B A P is a C1, or a C2, or a C3
C A P can be a C1 and a C2 at the same time
D The diagram is syntactically wrong

Question 9 What does the following notation indicate in an ER diagram?



A A weak relationship
B A derived attribute
C A compound key
D A multi-valued attribute

Question 10 Which relational schema corresponds to the following ER diagram? (additional contraints may apply, not shown in the answers)



A $A(\underline{A, B, C}, \text{Is}B, \text{Is}C)$
B None of the other answers
C $A(\underline{A})$, $B(\underline{B})$, $C(\underline{C})$ (with $B.B$ FK ref. $C.C$)
D $A(\underline{A})$, $B(\underline{A, B})$, $C(\underline{A, C})$ (with $B.A$ FK ref. $A.A$ and $C.A$ FK ref. $A.A$)
E $B(\underline{A}, B)$, $C(\underline{A}, C)$
F $A(\underline{A})$, $B(\underline{A, B})$, $C(\underline{A, C})$ (with $B.A$ FK ref. $A.A$ and $C.A$ FK ref. $A.A$)
G $A(\underline{A, B, C}, Type)$

2 SQL

Consider the following database:

T1

C1	C2
A	B
A	C
B	A
A	C

T2

C1	C2
A	C
A	D
B	B
D	C

Question 11 What is the result of the following SQL query? (showing only the content)
SELECT T1.C1

A An empty table

B

A	3
B	1

C

A
B

D

A
A
B
A

E The SQL is incorrect

Question 12 What is the result of the following SQL query? (showing only the content)
SELECT T1.C1
FROM T1

A

A
A
B
A

B An empty table

C

A
B

D

A	3
B	1

E The SQL is incorrect

Question 13 What is the result of the following SQL query? (showing only the content)
SELECT count(*)
FROM T1, T2

A An empty table

B 16

C

6
4
4
2

D The SQL is incorrect

E 8

F 2

G 4

Question 14 What is the result of the following SQL query? (showing only the content)
SELECT T1.C1, count(T2.C2)
FROM T1 Join T2 on T1.C1=T2.C1
WHERE T1.C2=T2.C2
GROUP BY T1.C1

A The SQL is incorrect

B An empty table

C

A	4
B	1
C	1

D

A	1
B	1

E

A	1
B	2

F None of the other answers

G

A	2
B	1

Question 15 What is the result of the following SQL query? (showing only the content)
SELECT C1 FROM T1
UNION
SELECT C2 FROM T2

A

A	C
A	D
B	B
A	C

B

A	A	B	A	C	D	B	C

C

A
B
C
D

D

A
A
B
A
C
D
B
C

E The SQL is incorrect

F An empty table

G None of the other answers

Question 16 What is the result of the following SQL query? (showing only the content)
SELECT C1 FROM T1
WHERE C2 NOT IN
(SELECT C1 FROM T2
WHERE C1>T1.C1)

A The SQL is incorrect

B

A
A
B
B

C None of the other answers

D An empty table

E

B

F

A

G

A
B

Question 17 What is the result of the following SQL query? (showing only the content)
SELECT C2 FROM T1
WHERE C2 NOT IN
(SELECT C1 FROM T2)

A

A
A
B
B

B An empty table

C None of the other answers

D

B

E The SQL is incorrect

F

A

G

A
A
B

Consider the following database:
Student(SID, Name, Surname, Age)
Registration(StudentID, CourseID)
Course(CID, Name, Cost)

Question 18 Which of the following queries extracts the students registered to at least three courses whose cost is unknown?

A SELECT StudentID, Count(CourseID) AS NUM_COURSES
FROM Registration RIGHT JOIN Course ON CourseID = CID
WHERE Cost = 0
AND NUM_COURSES >=3 GROUP BY CourseID

B SELECT StudentID, Count(CourseID) AS NUM_COURSES
FROM Registration LEFT JOIN Course ON CourseID = CID
WHERE Cost = 0
AND NUM_COURSES >=3 GROUP BY CourseID

C SELECT StudentID, Count(CourseID) AS NUM_COURSES
FROM Registration JOIN Course ON CourseID = CID
WHERE Cost IS NULL
AND NUM_COURSES >=3 GROUP BY StudentID

D All answers are correct

E SELECT StudentID
FROM Registration JOIN Course ON CourseID = CID
WHERE Cost <>ALL
AND NUM_COURSES >=3

F SELECT StudentID
FROM Registration JOIN Course ON CourseID = CID
WHERE Cost IS NULL
GROUP BY StudentID
HAVING Count(*)>=3

G None of the other answers

Question 19 Consider the following incomplete SQL instruction:
CREATE VIEW AVERAGE_COST(StudentID, Cost) AS
SELECT StudentID, AVG(_____ Cost)
FROM Course JOIN Registration ON CID=CourseID
GROUP BY _____
Which of the following texts should be added so that the view computes for each student the average cost of his/her courses? (notice that there are two texts to insert)

A 1: *nothing*, 2: AVG(Cost)

B None of the other answers

C 1: DISTINCT, 2: StudentID

D 1: *nothing*, 2: StudentID

E All answers are correct

F 1: DISTINCT, 2: Cost

G 1: *nothing*, 2: Cost

Question 20 Which of the following queries extracts the number of students registered to at least one course whose name contains 'design'?

A SELECT Count(StudentID)
FROM Registration, Course
WHERE Name LIKE '%design%'

B SELECT Count(DISTINCT StudentID)
FROM Registration JOIN Course ON CourseID = CID
WHERE Name LIKE '%design%'

C None of the other answers

D SELECT Count(StudentID)
FROM Registration JOIN Course ON CourseID = CID
WHERE Name LIKE '%design%'

E All answers are correct

F SELECT Count(StudentID)
FROM Registration, Course
WHERE CourseID = CID
WHERE Name = '%design%'
GROUP BY StudentID

3 Theory

Question 21 What is the result of the expression P1 OR P2 if P1 is NULL?

A None of the other answers

B TRUE

C NULL

D FALSE

Question 22 In the relational model, if a set of attributes K is a superkey of a relation schema R then (with $t[K]$ we notate the projection of t on the attributes in K) :

A K is a candidate key of R

B None of the other answers

C R contains at least two different tuples t_1 and t_2 with $t_1[K] \neq t_2[K]$

D R contains exactly two different tuples t_1 and t_2 with $t_1[K] = t_2[K]$

E K is a primary key of R

F R contains at least two different tuples t_1 and t_2 with $t_1[K] = t_2[K]$

Question 23 Consider a relation $R(A_1, \ldots, A_n)$, with:

- $X \subseteq \{A_1, ..., A_n\}$, $Y \subseteq \{A_1, ..., A_n\}$, $Z \subseteq \{A_1, ..., A_n\}$
- $X \to Y$
- $Z \to Y$

A $X \to Z$
B None of the other answers
C $Z \to XY$
D $X \to YZ$
E $X = Z$
F $Z \to X$

Question 24 Consider a relation $R(A, B, C, D)$ in 1NF, where A and B are the only prime attributes. Then we can conclude that:

A R is in BCNF
B R is at least in 2NF
C R is at least in 3NF
D R cannot be in 2NF
E None of the other answers

Question 25 Consider a relation Courses(CID, Cost) and the two following SQL queries:
Q1: SELECT SUM(Cost)/Count(*) FROM Courses
Q2: SELECT AVG(Cost) FROM Courses

A The results of Q1 and Q2 are always the same
B None of the other answers
C The result of Q2 is always lower than the result of Q1
D The results of Q1 and Q2 can be different
E The result of Q1 is always lower than the result of Q2

Question 26 Consider the SQL instruction `delete from T`, where T is a table:

A None of the other answers
B The SQL is incorrect
C When executed, it may change data contained in other tables
D When executed, it will remove T from the database schema

Question 27 Consider a relation $R(A, B, C, D)$ containing 10^7 records. (A,B,C) is the primary key, and B contains 10^5 distinct values. The following SQL prepared statement is executed very frequently:
SELECT D FROM R
Considering this information, which indexes would you create?

A One index on (A,B,C,D)
B None of the other answers
C One index on A, one on B, one on C and one on D
D One index on D

Question 28 What is the strictest isolation level, that is, the one preventing more problems?

- [A] SERIALIZABLE
- [B] READ UNCOMMITTED
- [C] REPEATABLE WRITE
- [D] REPEATABLE READ
- [E] COMMITTED
- [F] READ COMMITTED
- [G] None of the other answers is true

Question 29 User Harry creates a table called X. Then, the following sequence of statements is executed, in this order, by the users indicated at the beginning of each statement:
Harry: GRANT select ON X TO Severus WITH GRANT OPTION
Severus: GRANT select ON X TO Voldemort WITH GRANT OPTION
Voldemort: GRANT select ON X TO Harry WITH GRANT OPTION
Harry: REVOKE select ON X FROM Voldemort CASCADE

Which privileges does Severus have, according to the SQL standard?

- [A] select without grant option
- [B] select with grant option
- [C] select with grant option, update without grant option
- [D] parseltongue
- [E] none

Question 30 In general, what is the maximum number of different clustered indexes that we can create on a relation with three attributes, one of which forms the primary key?

- [A] 0
- [B] 3
- [C] 1
- [D] 8
- [E] 2