

Student Name:

FINAL EXAM
INFSCI 2710, Fall 2022

8 problems, graded out of **100** points.

1. [20 pts] Multiple Choice Grid (*Each multiple choice question may have MORE THAN ONE correct answer*)

Multiple Choice Grid (10 questions)

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

Multiple Choice Questions (up to 2 points each, each circled wrong answer, or missed right answer will cost you a point)

Circle one answer for each question in the grid provided above.

1. You can combine aggregate functions and attribute names in the select list _____

- a. if the attributes are in the grouping list
- b. if the attributes are not in the grouping list
- c. if the attributes are numeric
- d. none of above

2. A many-to-many relationship can connect _____

- a. two strong entity sets
- b. a strong and a weak entity sets
- c. two weak entity sets
- d. none of above

Student Name:

3. A table is in BCNF if ____

- a. a left side in each non-trivial functional dependency for that table is a candidate key
- b. a right side in each non-trivial functional dependency for that table is a candidate key
- c. it has no functional dependencies
- d. none of above

4. A table is in 3NF if ____

- a. it has only trivial functional dependencies
- b. a right side in each non-trivial functional dependency for that table is a candidate key
- c. a right side in each non-trivial functional dependency for that table is a part of a candidate key
- d. none of above

5. A buffer manager is ____

- a. speeding up access to data located on disk
- b. ensuring consistency property of a transaction
- c. ensuring isolation property of a transaction
- d. none of above

6. An index is ____

- a. speeding up access to data located in the main memory
- b. ensures durability property of a transaction
- c. speeding up access to data located on the disk
- d. none of above

7. WAL protocol ____

- a. speeding up access to data located on the disk
- b. ensures isolation property of a transaction
- c. ensures durability property of a transaction
- d. none of above

Student Name:

8. A schedule is serializable if _____

- a. it is recoverable
- b. it is concurrent
- c. it is equivalent to a serial schedule
- d. none of above

9. A schedule is recoverable if _____

- a. it is equivalent to a serial schedule
- b. it is cascadeless
- c. it is serializable
- d. none of above

10. A strict two-phase locking protocol ensures _____

- a. durability
- b. serializability
- c. atomicity
- d. none of above

Student Name:

2. [12 pt] Consider the following relations

Account:

<u>acc_number</u>	<u>c_name</u>	<u>c_age</u>	<u>balance</u>
A1	Dan Brown	35	1000
A2	Bill Evans	40	1000
A3	Dan Brown	40	1000
A4	Mel Gibbson	40	1000
A5	Bill Evans	35	1000
A6	Mel Gibbson	40	1000

Please, answer the following questions (for each of the following questions consider grouping only by a single attribute):

2.1 What is the single attribute you have to group by to obtain a group with the largest number of tuples?

Your answer to the question 2.1:

2.2 What is the number of tuples in the group from the question 2.1?

Your answer to the question 2.2:

2.3 What is the single attribute you have to group by to obtain a group with the smallest number of tuples?

Your answer to the question 2.3:

2.4 What is the number of tuples in the group from the question 2.3?

Your answer to the question 2.4:

2.5 What is the single attribute (except *balance* attribute) you have to group by to obtain the largest total balance in a group?

Your answer the question 2.5:

2.6 What is the total balance in the group from the question 2.5?

Your answer the question 2.6:

2.7 What is the single attribute you have to group by to obtain the smallest total balance in a group?

Your answer the question 2.7:

2.8 What is this smallest total balance in the group from the question 2.7?

Your answer the question 2.8:

Student Name:

3. [10 pt] Consider the following tables:

department:

<i>depname</i>	<i>budget</i>	<i>dmgr</i>
software	4000	1111
hardware	null	null
sale	2000	2222

employee:

<i>eid</i>	<i>ename</i>	<i>depname</i>
1111	Jones	null
2222	Smith	sale
3333	Brown	software

Plot a result table for each of the following SQL queries:

select sum(D.budget)
from department D

result:

select sum(D.budget)
from employee E, department D
where E.depname = D.depname
and D.dmgr = 1111

result:

select count(E.depname)
from employee E

result:

Student Name:

4. [14 pt] Check if the relational schemas R1, R2, R3, R4 specified below are in

(a) BCNF

(b) 3NF

R1(A,B,C,D,E)

Functional dependencies: { CD→BE, B → C, B →DA }

R2(A,B,C,D,E)

Functional dependencies: { CD→BE, B→D }

R3(A,B,C,D,E)

Functional dependencies: { CD→BE, B→CA }

R4(A,B,C,D,E)

Functional dependencies: { CD→ABE, B→A }

Your answer should be represented as the following table (please, do not provide any explanation, each answer should be either “yes”, or “no”):

	BCNF ?	3NF ?
R1		
R2		
R3		
R4		

5. [6 pt] Consider a relation R(A,B,C, D, E, F) and the following functional dependencies that hold on R: AB→C, C→D, EF → C. Consider the following decompositions of R:

(a) R1(C,B,A), R2(D,E,F,A)

(b) R1(E,F,C), R2(B,A,F,D)

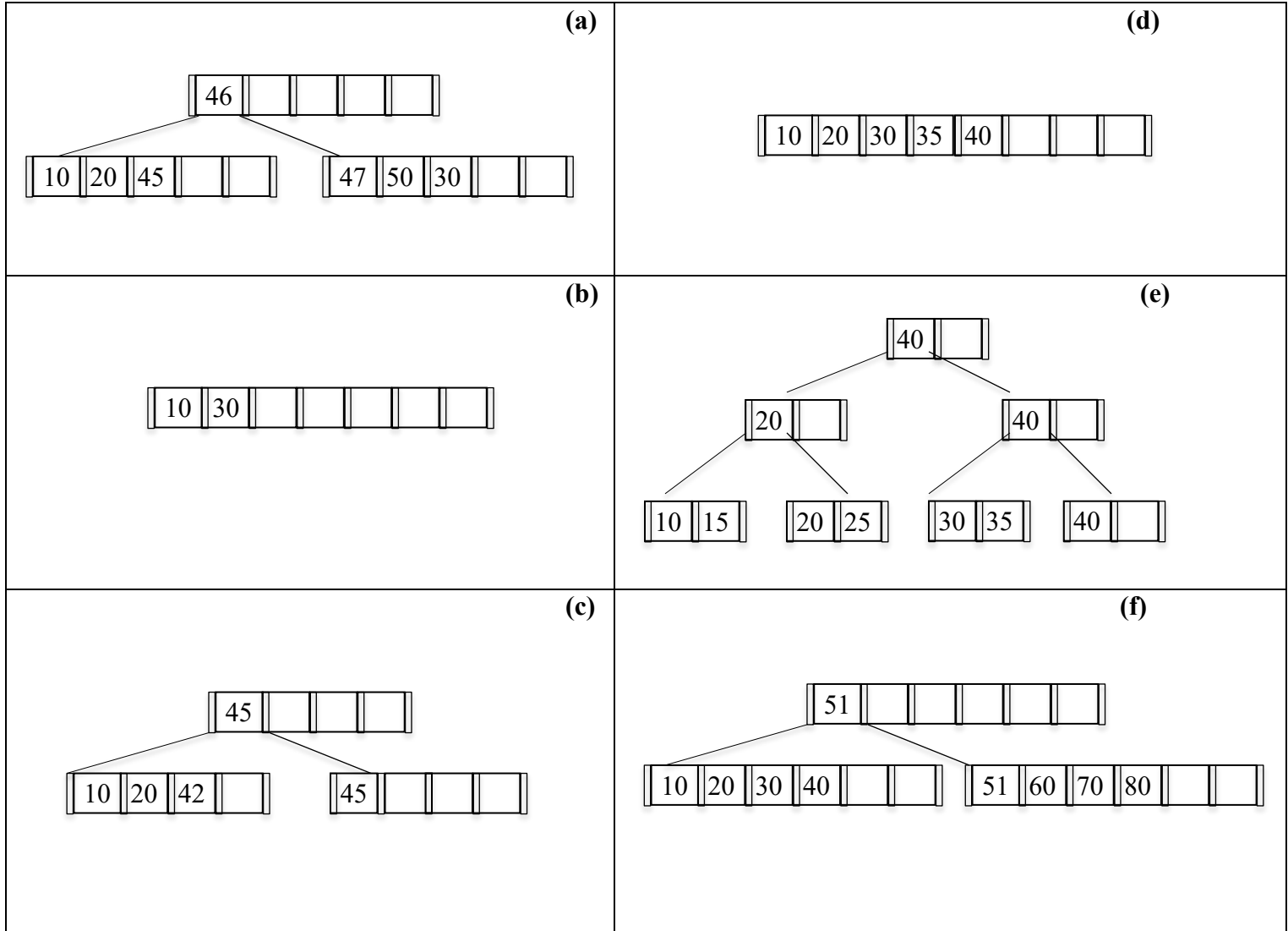
(c) R1(A,B,C,D), R2(C,E,F)

Which of the above decompositions are lossless-join? Your answer should be represented in the following table (please, do not provide any explanation, each answer should be either “yes”, or “no”):

	Lossless-join decomposition? (yes/no)
(a)	
(b)	
(c)	

Student Name:

6. [18 pt] Consider the following B+ trees



For each of above B+-trees specify d and indicate if the tree has been built correctly. Your answer should be represented as the following table (please, do not provide any explanation):

	d	Correct (yes/no)
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		

Student Name:

7. [10 pts] Consider the following concurrent schedule S with transactions T1 and T2 (time is flowing from top to bottom):

T1	T2
R(B); B := B+100; W(B); R(A); A := A-100; W(A); Commit	R(B); B := B+100; W (B); Commit

	<u>Your Answer (yes/no)</u>
Is the schedule S serializable?	
Is the schedule S recoverable?	
Is the schedule S cascadeless?	

Student Name:

8. [10 pt] Assume that, after a crash, the log contains the following records:

<T1 start>
<T1 update, A, 200,600>
<T2 start>
<T2 update, C, 50,100>
<T1 update, B, 300,200>
<T3 start>
<T4 start>
<T3 update, D, 400,200>
<T5 starts>
<T4 update, E, 800,900>
<T5 update, D, 200,100>
<T2 commit>
<T4 update, F,150,250>
<T4 commit>

(a) Which transactions (T1-T5) will be redone during the recovery?

Answer: _____

(b) Which transactions (T1-T5) will be undone during the recovery?

Answer: _____

(c) What will be the value of data items 'C' after the recovery algorithm has finished?

Answer: _____

(d) What will be the value of data items 'B' after the recovery algorithm has finished?

Answer: _____

(e) What will be the value of data items 'E' after the recovery algorithm has finished?

Answer: _____