DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CSE 3330/5330 - Database Systems and File Structures

Exam #2
Friday November 20, 2020
Due Date: Monday November 23, 2020 @ 11.59 pm

	Total Points	Earned
Multiple Choice	13	
Query Questions	47	
Total	60	

Multiple Questions, T/F, Fill In the blanks:

1. (1 point) A functional dependency is a relationship between or among:
    - tables
    - rows
    - relations
    - attributes
2. (1 point) If attributes A and B determine attribute C, then it is also true that:
    - $A \rightarrow C$.
    - $B \rightarrow C$.
    - (A,B) is a composite determinant.
    - C is a determinant
3. (1 point) If attribute A determines both attributes B and C, then it is also true that:
    - $A \rightarrow B$.
    - $B \rightarrow A$.
    - $C \rightarrow A$.
    - $(B,C) \rightarrow A$.
4. (1 point) **TRUE/FALSE**: 3NF is designed to cope with Multi valued dependency
5. (1 point) **TRUE/FALSE:** The cost of a file scan is essentially the same for a heap file and a sorted file.
6. (3 point) Which of the following symbols do not represent relational operators from the original relational algebra?
    - γ
    - θ
    - δ
    - $+$
    - $\times$
7. (1 point) A BCNF is:
    - loss less join and dependency preserving
    - loss less join but not dependency preserving
    - not loss less join but dependency preserving
    - none of these
8. (3 points) In the _____ normal form, a composite attribute is converted to individual attributes.
9. (1 point) The storage media that is operated directly from computer's central processing unit is considered as
    - primary storage
    - secondary storage
    - tertiary storage
    - all of above

Query Questions:

1. (4 points) Is the following table in First normal form (1NF). Explain why or why not. If why not convert to 1NF:

Instructor's name	Course code
Prof. George	(CS101, CS154)
Prof. Atkins	(CS152)

2. (8 points) Reference the table below for the next set of questions:

Course code	Course venue	Instructor's name	Department
MA214	Lecture Hall 18	Prof. George	CS Department
ME112	Auditorium building	Prof. John	Electronics Department

   a. List all functional dependencies for this table?
   b. Is this in Second Normal Form (2NF)? Explain why or why not. If why not convert to 2NF.

3. (5 points) Is the following functional dependency in BCNF (**hint**: *check the lossless join*)

   R=ABCDE, F = {A -> BC, C -> DE)

4. (5 points) Convert the following SQL query to a relational algebra query:

```
select C.name
from LineItem L, Orders O, Customer C, Nation N
where L.oid=O.oid and O.cid=C.cid and C.nid=N.nid
 and N.name = 'Canada' and O.orderdate > '2010-12-31';
```

5. (10 points) For the following question, consider the following schema:

```
Jedi-Teams (master, apprentice)
Jedi(name, side, home-planet)
Government(leader planet, postition)
Inhabitants(specie, planet)
```

   a. Given a query to find all planetary leaders who are apprentices and use the dark side of the force, Express this query in terms of relational algebra:

```
select leader
from Jedi-Teams, Jedi, Government
where apprentice = name and
name = leader and
side = 'dark'
```

   b. Express this query in terms of relational algebra:

```
select count(*), home-planet

from Jedi, Inhabitants

where specie = 'wookies' and

planet = home-planet and

side = 'light'

group by home-planet
```

6. (5 points) Consider the following database schema:

```
Likes (enthusiast, sports)
Frequents (enthusiast, sports channel)
Serves (sports channel, sport)
```

   Write the relational algebra query that answers the following question: which enthusiast watches only sports channel that play only sport they like?

7. (10 points) Solve the following relational expressions for relations below:

User

Id	Name	Age	Gender	OccupationId	CityId
1	John	25	Male	1	3
2	Sara	20	Female	3	4
3	Victor	31	Male	2	5
4	Jane	27	Female	1	3

Occupation

OccupationId	OccupationName
1	Software Engineer
2	Accountant
3	Pharmacist
4	Library Assistant

City

CityId	CityName
1	Halifax
2	Calgary
3	Boston
4	New York
5	Toronto

a. $\Pi_{Name}(\sigma_{Age>25}(User))$
b. $\sigma_{Id>2 \vee Age!=31}(User)$
c. $\sigma_{User.OccupationId=Occupation.OccupationId}(User \times Occupation)$
d. $User \bowtie Occupation \bowtie City$
e. $\Pi_{Name,Gender}(\sigma_{CityName=\text{"Boston"}}(User \bowtie City))$