COMP9120 Replacement Exam

50 Possible Points

Due: Mon Dec 20, 2021 19:55

Attempt 1

IN PROGRESS
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Unlimited Attempts Allowed
Available: Dec 20, 2021 17:00 until Dec 20, 2021 19:55

Details

Replacement Exam for COMP9120

Q1: Good Music Studio has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The company has wisely chosen you as a database designer and your task is to draw an ER diagram based on the following information: — 10 marks

- Each musician that records at Good Music Studio has an id, a name, an address, and a phone number. Musicians often share the same address.
- Each instrument used in songs recorded at Good Music Studio has a unique identification number, a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat).
- Each album recorded on the Good Music Studio has a unique identification number, a title, a copyright date.
- Each song recorded at Good Music Studio has a title and an author.
- Each musician may play several instruments, and a given instrument may be played by several musicians.
- Each album has a number of songs on it, but no song may appear on more than one album.
- Each song is performed by one or more musicians, and a musician may perform a number of songs.
- Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

Q2: Consider the following relational database schema — 5 marks

```
Student(studentId, studentName, major, age)
Class(className, classTime, roomNumber, lecturerId)
Enrolled(studentId, className)
Faculty(lecturerId, lecturerName, deptName)
```

Answer the following questions using SQL expression

(a) Find the age of the oldest student who is either a 'Computer Science' major or enrolled in a course taught by 'Albert Einstein'.

(b) Find the names of faculty members who take more than 2 classes

Note that you are allowed to create view, if needed, for answering any of these queries.

Q3: Consider the following relational database schema — 5 marks

```
Employee(employeeId, employeeName, age, salary)
Works(employeeId, deptId)
Dept(deptId, deptName, budget, managerId)
```

Answer the following questions using relational algebra expression

(a) Print the names and ages of each employee who works in both the Hardware department and the Software department.

(b) Find the department names that is managed by the same manager

In case you cannot type the usual RA Greek letters easily, you should use the following convention. Operator parameters should be enclosed in square brackets.

Selection	σ	S	**Union**	$\cup$	U
Projection	π	P	**Intersection**	$\cap$	I
Cross-product	$\times$	X	**Difference**	-	D
Join	$\bowtie$	J	**Rename**	ρ	R
Conditional Join	$\bowtie_\theta$	CJ	**AND** **OR**	$\wedge$ $\vee$	**and** **or**

$\pi_{title}(\sigma_{points=6 \ \wedge \ semester = \text{'2021-S2'}}(courses))$ can be written as

P[title] (S[points = 6 and semester = '2021-S2'] (courses))

Q4: Consider the following Project table: — 4 marks

Project_id	Project_title	Budget
P01	Data Science	2000
P02	Machine Learning	5000
P03	Artificial Intelligence	2500
P04	Deep Learning	100
P05	Data Visualization	null

```
Query 1:
select avg(budget) from project;
```

```
Query 2:
select sum(budget) / count(*) from project;
```

Will the output of these two queries be the same? Explain your answer.

Q5: Determine whether the following schedule is conflict serializable or not; justify your answer by drawing the precedence graph. — 5 marks

W1(A), R1(B), W3(E), W2(C), R4(D), W1(E), R2(A), R4(B), R3(C), W3(D)

If the schedule is conflict serializable, please also give a conflict equivalent serial schedule.

Q6: Consider the following relations: — 4 marks

```
CREATE TABLE Books (
   title              varchar(40) PRIMARY KEY,
   publisherId        integer NOT NULL,
   publicationDate    date,
   type               varchar(10),
   numberOfPages      integer NOT NULL
);
```

```
CREATE TABLE publisher (
    publisherId          integer PRIMARY KEY,
    name                 varchar(40) NOT NULL,
    age                  integer
);
```

Write ALTER TABLE statement to perform the following:

(a) To remove the not-null constraint from "numerOfPages" column in Books table

(b) To rename the relation's name from "publisher" to "publishingCompany"

Q7: Suppose you have a file with 10,000 pages and you have three buffer pages. How many runs will you produce in the first pass of external merge sort? — 4 marks

Q8: Suppose you are given the following relation. — 6 marks

```
PlayerC(playerId, teamName, teamCity, coachName)
```

For the following sets of FDs, assuming those are the only dependencies that hold for *Player* relation, do the following:

(a) Identify all the candidate key(s) for Player.

(b) Is Player relation in BCNF? Explain your answer. If Player relation is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.

```
playerId → teamName
teamName, teamCity → coachName
playerId → teamCity
```

Q9: Consider a table of 1 GigaByte (GB, 10^9 bytes). Assuming the fastest Solid-State Drives with disk scanning speed of 8GB/s, how much time do we need to scan the entire table using linear scan? — 4 marks

Q10: Let relation R(X, Y, Z) has 10,000 tuples and 500 tuples of R fit on one block and S(A, B, C) has 5,000 tuples and 100 tuples of S fit on one block. Note that one page contains maximum one block. Estimate the cost of Indexed-Nested loop join if the cost of traversing index and fetching all matching tuples of R is 10. — 3 marks

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Further information on academic honesty, academic dishonesty, and the resources available to all students can be found on the academic integrity pages on the current students website: https://sydney.edu.au/students/academic-integrity.html.

Further information for on research integrity and ethics for postgraduate research students and students undertaking research-focussed coursework such as Honours and capstone research projects can be also be found on the current students website: https://sydney.edu.au/students/research-integrity-ethics.html.

Compliance statement

In submitting this work, I acknowledge I have understood the following:

- I have read and understood the University of Sydney's Academic Honesty in Coursework Policy 2015.
- The work is substantially my own and where any parts of this work are not my own I have indicated this by acknowledging the source of those parts of the work and enclosed any quoted text in quotation marks.
- The work has not previously been submitted in part or in full for assessment in another unit unless I have been given permission by my unit of study coordinator to do so.
- The work will be submitted to similarity detection software (Turnitin) and a copy of the work will be retained in Turnitin's paper repository for future similarity checking. Note: work submitted by postgraduate research students for research purposes is not added to Turnitin's paper repository.
- Engaging in plagiarism or academic dishonesty in research-focussed work will lead to the University commencing proceedings under the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016.
- Engaging in plagiarism or academic dishonesty in coursework will, if detected, lead to the University commencing proceedings under the Academic Honesty in Coursework Policy 2015 and the Academic Honesty Procedures 2016.
- Engaging in plagiarism or academic dishonesty in research-focussed work will lead to the University commencing proceedings under the Research Code of Conduct 2013 and the Academic Honesty Procedures 2016.
- Engaging another person to complete part or all of the submitted work will, if detected, lead to the University commencing proceedings against me for potential student misconduct under the University of Sydney (Student Discipline) Rule 2016.

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