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DBMS I (CS3550)

Final Exam. (18 Questions, 72 Max Points)
Time: 110 minutes (7:10PM to 9:00PM) Pages: 5

IIT
Hyderabad, India
18th October 2024

Important Instructions:

- Please write your answers on the answer sheet provided. At the end of the exam, make sure to mark your answers to the question paper as well. Remember to take the question paper with you when you leave.
- The answer sheets will not be returned after evaluation. Following the exam, the answer keys will be provided. Please cross-check your answers with those marked on your question paper, and feel free to email me if you have any doubts.
- Each question is worth four marks. For all multiple-choice questions, one or more options may be correct. You must write all the correct options, separated by commas. If you believe that all the options are correct, write "ALL" Please note that there will be no partial marking.
- **Negative Marking** - One mark will be deducted for each incorrect answer.
- No supporting materials, including notebooks, bags, mobile phones, or any other electronic devices, are permitted.

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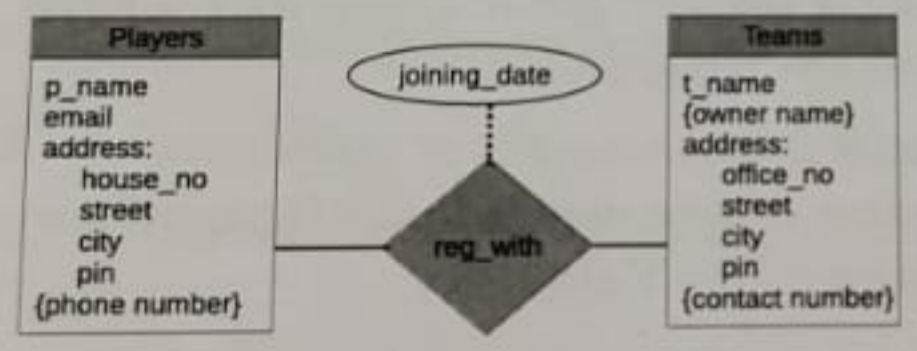
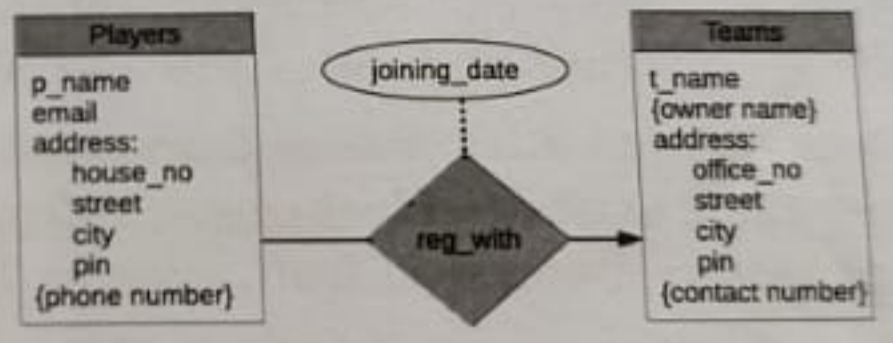
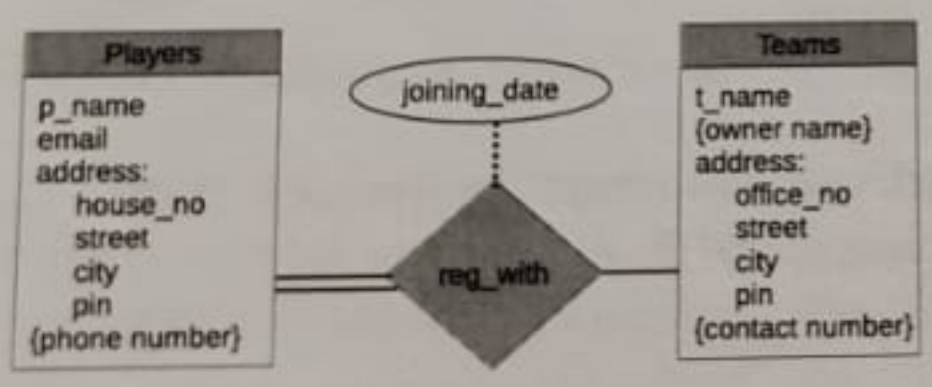
1. Consider a basic setup of the Indian Premier League (IPL) where you need to manage details for both players and franchises. Each player is always linked to a specific franchise (team). However, a franchise may not have any players associated with it, which could happen right after a new franchise is formed. Which of the following ER-Diagrams best represents this setup accurately?



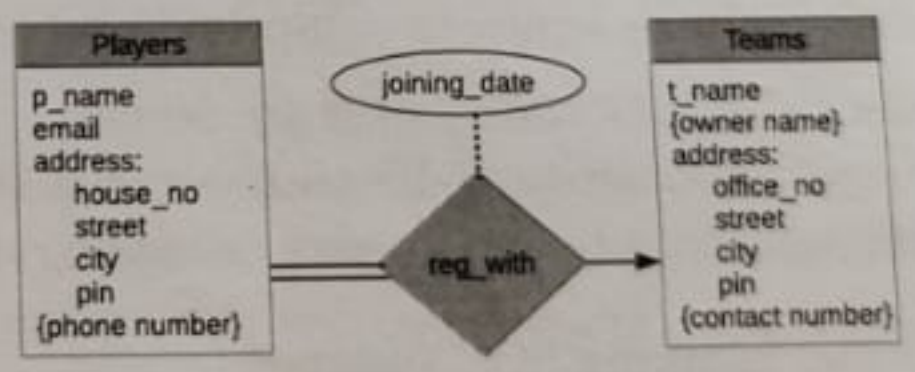
(A)



(B)



(C)

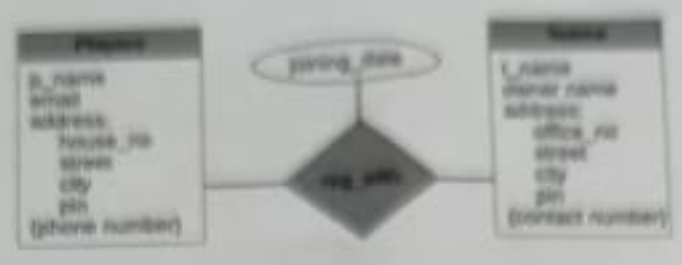


(D)

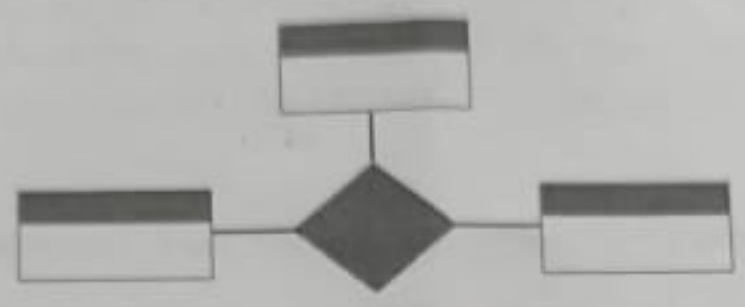
Note: Only write the correct option(s) in the answer sheet.

2. How many relations (tables) are necessary to convert the correct ER-diagram from the previous question into a logical schema? **Note:** Only provide the number in the answer sheet. *This question will be considered invalid if your answer to the previous question is incorrect.* ***Also, this question has no negative marking.***

3. Consider the following ER-Diagram. This ER-Diagram is unrelated to Question 1. Assume that the ER-Diagram is correct according to the given requirements. How many **foreign keys** are needed to translate this ER-Diagram into a logical schema? **Note:** Only write the numeric value in the answer sheet. [4]



4. Consider the following ER-Diagram. Which of the following statements is/are correct in terms of the equivalent ER-Diagram with binary relationships? [4]



A) Four *entity sets* and three *relationship sets* are required.

B) Three *entity sets* and three *relationship sets* are required.

C) Three *entity sets* and two *relationship sets* are required.

D) Four *entity sets* and four *relationship sets* are required.

5. Which of the following SQL statement(s) contain correlated sub-queries? [4]

A) **select** course_id **from** section **as** S **where** semester='Fall' **and** year=2009 **and exists**(**select** * **from** section as T **where** semester='Spring' **and** year=2010 **and** S.course_id=T.course_id);

B) **select distinct** S.ID, S.name **from** students **as** S **where not exists ((select** course_id **from** course **where** dept_name='Biology') **except (select** T.course_id **from** takes **as** T **where** S.ID=T.ID));

C) **select distinct** course_id **from** section **where** semester = 'Fall' **and** year= 2009 **and** course_id **in (select** course_id **from** section **where** semester = 'Spring' **and** year= 2010);

D) **select distinct** course_id **from** section **where** semester = 'Fall' **and** year= 2009 **and** course_id **not in (select** course_id **from** section **where** semester = 'Spring' **and** year= 2010);

6. Consider the following SQL statement: [4]

```
SELECT dept_name, avg_salary
FROM (SELECT dept_name, AVG(salary) AS avg_salary
      FROM instructor GROUP BY dept_name)
WHERE avg_salary > 42000
```

Which of the following queries are equivalent to the above SQL statement?

A) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **group** by dept_name **having** avg_salary > 42000

B) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **group** by dept_name **where** avg_salary > 42000

C) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **where** avg_salary > 42000 **group by** dept_name

D) **select distinct** dept_name, **avg**(salary) **as** avg_salary **from** instructor **group** by dept_name **where** avg_salary > 42000

7. Consider two relations: [4]

students(roll, s_name, dept, m_id); // roll is primary key and m_id is mentor id.

faculties(id, f_name, dept, salary) // id is the primary key.

Some students are assigned a mentor faculty member, and a faculty member can mentor multiple students. What this following query is showing?

```
(SELECT roll, s_name, f_name FROM students, faculties WHERE m_id=id)
UNION
(SELECT null, null, f_name FROM faculties WHERE id NOT IN(SELECT m_id FROM students))
UNION
(SELECT roll, s_name, null FROM students WHERE m_id NOT IN(SELECT id FROM faculties));
```

A) Left Outer Join

B) Right Outer Join

C) Full Outer Join

D) Natural Join

8. Which of the following statement(s) are not correct? [4]

A) A transaction in the database is allowed to execute partially.

B) A transaction in the database is not allowed to execute partially and must be rolled back.

C) A transaction in the database is not required to be rolled back if committed successfully.

D) All the above statements are wrong.

9. Consider two relations r and s. Rewrite the relational algebra expression $r \cap s$, using the fundamental operations of relational algebra. **Note:** Just write the relational algebra expression. Do not write anything else in the answer sheet. [4]

10. Consider two relations: $r(A, B)$ and $s(B, C)$. Which of the fundamental relational algebra operations (except $\times$) are required to convert $r \times s$ equivalent to a natural join expression $(r \bowtie s)$? **Note:** You must provide the minimum number of operations. If you include any unnecessary operations or miss an essential one, your answer will be considered as incorrect. [4]

11. Consider the following relational algebra expression on a the relation **instructor**(*ID, dept_name, gender, salary*) [4]

$$\sigma_{avg\_salary>30000}(\rho_{T(dept\_name,avg\_salary)}({}_{dept\_name}\mathcal{G}_{avg(salary)}(instructor)))$$

Which of the following SQL statement(s) accurately represent the above expression?

A) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **where** avg_salary > 30000 **group by** dept_name

B) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **group by** dept_name **where** avg_salary > 30000

C) **select** dept_name, **avg**(salary) **as** avg_salary **from** instructor **group by** dept_name **having** avg_salary > 30000

D) None of the above.

12. Which function is used to count the number of rows in a SQL query? [4]

A) COUNT(*) B) SUM() C) TOTAL() D) ROW_COUNT()

13. What is the default ordering of the ORDER BY clause in SQL? [4]

A) DESC (Descending)

B) ASC (Ascending)

C) Random

D) None

14. Which of the following SQL queries will return rows that exist in one table but not in another (assuming Table1 and Table2 have the same structure)? [4]

A) SELECT * FROM Table1 UNION Table2;

B) SELECT * FROM Table1 EXCEPT SELECT * FROM Table2;

C) SELECT * FROM Table1 INTERSECT SELECT * FROM Table2;

D) SELECT * FROM Table1 FULL JOIN Table2;

15. What does the following query do? [4]

```
SELECT Name
FROM Employees
WHERE DepartmentID IN (SELECT DepartmentID FROM Departments WHERE Location = 'New York');
```

A) It selects employees whose department is located in New York.

B) It selects departments located in New York.

C) It selects all employees in the database.

D) It returns all departments with a New York location.

16. What does the following query do? [4]

```
SELECT Salary
FROM Employees E1
WHERE N-1 = (SELECT COUNT(DISTINCT Salary)
             FROM Employees E2
             WHERE E2.Salary > E1.Salary);
```

A) This query retrieves the N^{th} lowest salary from the Employees table.
B) This query retrieves the N^{th} highest salary from the Employees table.
C) This query retrieves the $(N-1)^{th}$ highest salary from the Employees table.
D) None of the above.

17. What does the following query do? 4

```
SELECT MAX(Salary)
FROM Employees
WHERE Salary < (SELECT MAX(Salary) FROM Employees);
```

A) This query retrieves the second highest salary from the Employees table.
B) This query retrieves the highest salary from the Employees table.
C) This query retrieves the second lowest salary from the Employees table.
D) None of the above.

18. What does the following query do? 4

```
WITH DepartmentSalaries AS (
    SELECT DepartmentID, SUM(Salary) AS TotalSalary
    FROM Employees
    GROUP BY DepartmentID
)
SELECT D.DepartmentID, D.TotalSalary, Department.Name
FROM DepartmentSalaries D
JOIN Department ON D.DepartmentID = Department.DepartmentID
ORDER BY D.TotalSalary DESC;
```

Write your answer in three lines. **No negative marking for this question.**