Started on	Friday, 7 February 2025, 10:35 AM
State	Finished
Completed on	Friday, 7 February 2025, 10:50 AM
Time taken	14 mins 50 secs
Marks	14.50/28.00
Grade	**1.55** out of 3.00 (**51.79**%)

Question 1

Incorrect

Mark -0.25 out of 1.00

Consider a relation R(A, B, C, D) with the functional dependencies:

1. A → B
2. B → C
3. C → D

What is the highest normal form satisfied by R?

a. Only in 2NF
b. 3NF but not BCNF ✕
c. BCNF
d. 1NF

The correct answer is: 1NF

Question 2

Correct

Mark 2.00 out of 2.00

Given the following SQL query:

Film (FilmID, Title, Year, Genre, DirectorID)
Director (DirectorID, Name, BirthYear, Nationality)
Actor (ActorID, Name, BirthYear, Nationality)
Film_Actor (FilmID, ActorID, Role)

```
SELECT f.Title
FROM Film f
WHERE NOT EXISTS (
    SELECT 1
    FROM Film_Actor fa
    JOIN Actor a ON fa.ActorID = a.ActorID
    WHERE fa.FilmID = f.FilmID AND a.Nationality <> 'American'
);
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\pi_{\text{Title}}(\text{Film}) - \pi_{\text{Title}}(\text{Film} \bowtie \text{Film\_Actor} \bowtie \sigma_{\text{Nationality}=\text{'Non-American'}}(\text{Actor}))$
- b. $\pi_{\text{Title}}(\text{Film}) - \pi_{\text{Title}}(\text{Film} \bowtie \text{Film\_Actor} \bowtie \sigma_{\text{Nationality}\neq\text{'American'}}(\text{Actor}))$ ✓
- c. $\pi_{\text{Title}}(\sigma_{\text{Nationality}=\text{'American'}}(\text{Film}))$
- d. $\pi_{\text{Title}}(\text{Film} \bowtie \sigma_{\text{Nationality}=\textit{not}\text{'American'}}(\text{Actor}))$

The correct answer is: $\pi_{\text{Title}}(\text{Film}) - \pi_{\text{Title}}(\text{Film} \bowtie \text{Film\_Actor} \bowtie \sigma_{\text{Nationality}\neq\text{'American'}}(\text{Actor}))$

Question 3

Correct

Mark 1.00 out of 1.00

Which of the following relations is in BCNF?

- a. R(X, Y, Z) with functional dependency X → Y, Y → Z
- b. R(P, Q, R) with functional dependency P → Q, where P is not a candidate key
- c. R(A, B, C) with functional dependency A → B and A → C, where A is a candidate key ✓
- d. R(M, N, O) with functional dependency M → N and N → O, where M is not a candidate key

The correct answer is: R(A, B, C) with functional dependency A → B and A → C, where A is a candidate key

Question 4

Incorrect

Mark 0.00 out of 2.00

Consider a relation R(A, B, C, D, E, F) with the following functional dependencies:

1. A → B
2. B → C
3. CD → E
4. E → F

The candidate key is AD.

What is the highest normal form this relation satisfies?

- a. In 3NF but not in BCNF
- b. Only in 3NF
- c. Only in BCNF
- d. In both 3NF and BCNF ✗

The correct answer is: In 3NF but not in BCNF

Question 5

Partially correct

Mark 0.50 out of 1.00

A relation is in 3NF if:

- a. Every determinant is a superkey
- b. Every non-prime attribute depends only on a superkey or is part of a candidate key ✓
- c. No partial dependencies exist
- d. The relation contains no transitive dependencies

The correct answers are: Every non-prime attribute depends only on a superkey or is part of a candidate key, The relation contains no transitive dependencies

Question 6

Correct

Mark 2.00 out of 2.00

Consider a relation R(P, Q, R, S, T, U) with the following functional dependencies:
1. PQ → R
2. R → S
3. S → TU
4. T → Q

Using the attribute closure method, is PQ → T derivable from the given FDs?

- a. Yes ✓
- b. No

The correct answer is: Yes

Question 7

Partially correct

Mark 0.25 out of 1.00

Given a relation R(X, Y, Z, W) with functional dependencies:

1. XY → ZW
2. Z → Y

Which of the following is a candidate key?

- a. XZ
- b. ZW ✗
- c. Y
- d. XY ✓

The correct answers are: XY, XZ

Question 8

Correct

Mark 1.00 out of 1.00

A decomposition preserves dependencies if:

- a. 3NF decomposition is never dependency preserving
- b. Each functional dependency must appear in exactly one decomposed relation
- c. The original functional dependencies can be derived from decomposed relations ✓
- d. Decomposition is always dependency preserving in BCNF

The correct answer is: The original functional dependencies can be derived from decomposed relations

Question 9

Partially correct

Mark 0.25 out of 1.00

Which of the following is true about BCNF decomposition?

- a. BCNF decomposition is always lossless and dependency preserving
- b. Every BCNF decomposition has at least one redundancy ✗
- c. BCNF decomposition eliminates all transitive dependencies
- d. A BCNF decomposition may not always preserve dependencies ✓

The correct answers are: A BCNF decomposition may not always preserve dependencies, BCNF decomposition eliminates all transitive dependencies

Question 10

Partially correct

Mark 1.50 out of 2.00

Given the following SQL query:

empAge(empNo,age)

```
SELECT DISTINCT E1.empNo
FROM empAge E1
JOIN empAge E2
ON E1.age > E2.age;
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\pi_{\text{empNo1}}(\text{empAge} \bowtie_{\text{age}>\text{age1}} \rho_{\text{empNo1,age1}}(\text{empAge}))$
- b. $\pi_{\text{empNo}}(\text{empAge} \bowtie_{\text{age1}>\text{age}} \rho_{\text{empNo1,age1}}(\text{empAge}))$ ✗
- c. $\pi_{\text{empNo}}(\text{empAge} \bowtie_{\text{age}>\text{age1}} \rho_{\text{empNo1,age1}}(\text{empAge}))$ ✓
- d. $\pi_{\text{empNo}}(\text{empAge} \times \rho_{\text{empNo1,age1}}(\text{empAge}))$

The correct answer is: $\pi_{\text{empNo}}(\text{empAge} \bowtie_{\text{age}>\text{age1}} \rho_{\text{empNo1,age1}}(\text{empAge}))$

Question 11

Partially correct

Mark 0.25 out of 1.00

A decomposition is lossless if:

- a. The intersection of decomposed relations contains a candidate key or allows recovery of the original relation ✓
- b. All decomposed relations are in BCNF
- c. There is no transitive dependency ✗
- d. Every FD appears in at least one decomposed relation

The correct answers are: The intersection of decomposed relations contains a candidate key or allows recovery of the original relation, All decomposed relations are in BCNF

Question 12

Correct

Mark 2.00 out of 2.00

Consider a relation R(X, Y, Z, W, V) with the following functional dependencies:
1. XY → Z
2. Z → W
3. W → V
4. V → X

The candidate key is XY.

Which functional dependency (or dependencies) violate BCNF?

- a. XY → Z
- b. W → V ✓
- c. V → X ✓
- d. Z → W ✓

The correct answers are: Z → W , W → V , V → X

Question 13

Correct

Mark 2.00 out of 2.00

Consider a relation R(X, Y, Z, W, V) with functional dependencies:
1. X → YZ
2. Y → W
3. Z → V

R is decomposed into R1(X, Y, Z), R2(Y, W), and R3(Z, V).

Is this decomposition dependency preserving?

- a. No
- b. Yes ✓

The correct answer is: Yes

Question 14

Correct

Mark 1.00 out of 1.00

Which of the following functional dependencies prevents a relation from being in BCNF but not in 3NF?

- a. A → B, where A is a superkey
- b. A → B, where A is not a superkey but B is a prime attribute ✓
- c. A → B, where A is not a superkey and B is not a prime attribute
- d. A → B, where B is a superkey

The correct answer is: A → B, where A is not a superkey but B is a prime attribute

Question 15

Not answered

Marked out of 2.00

Given the following SQL query:

Employee(eId, Name)
Brand(bId, bName)
Own(eId, bId)

```
SELECT O1.eId
FROM Own O1
WHERE NOT EXISTS (
    SELECT B.bId
    FROM Brand B
    WHERE NOT EXISTS (
        SELECT *
        FROM Own O2
        WHERE O2.eId = O1.eId AND O2.bId = B.bId
    )
);
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\pi_{\text{eId}}\left((\pi_{\text{eId}}(\text{Own}) \times \pi_{\text{bId}}(\text{Own})) \div \pi_{\text{bId}}(\text{Brand})\right)$
- b. $\pi_{\text{eId}}\left(\pi_{\text{eId,bId}}(\text{Own}) \div \pi_{\text{bId}}(\text{Own})\right)$
- c. $\pi_{\text{eId}}(\text{Own}) - \pi_{\text{eId}}\left((\pi_{\text{eId}}(\text{Own}) \times \pi_{\text{bId}}(\text{Brand})) - \pi_{\text{eId,bId}}(\text{Own})\right)$
- d. $\pi_{\text{eId}}\left(\pi_{\text{eId,bId}}(\text{Own}) \div \pi_{\text{bId}}(\text{Brand})\right)$

The correct answers are: $\pi_{\text{eId}}\left(\pi_{\text{eId,bId}}(\text{Own}) \div \pi_{\text{bId}}(\text{Brand})\right)$
, $\pi_{\text{eId}}(\text{Own}) - \pi_{\text{eId}}\left((\pi_{\text{eId}}(\text{Own}) \times \pi_{\text{bId}}(\text{Brand})) - \pi_{\text{eId,bId}}(\text{Own})\right)$

Question 16

Complete

Not graded

Consider a relation R(P, Q, R, S, T, U) with the following functional dependencies:
1. P → QR
2. Q → S
3. R → TU

Which of the following functional dependencies must also hold?

- [x] a. P → STU
- [ ] b. Q → TU
- [x] c. P → QRT
- [ ] d. S → U
- [ ] e. QR → P

The correct answers are: P → STU , P → QRT , Q → TU

Question 17

Correct

Mark 1.00 out of 1.00

Given the following SQL query:

```
SELECT student_id
FROM Enrollments
WHERE course = 'Math'
INTERSECT
SELECT student_id
FROM Enrollments
WHERE course = 'Science';
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\sigma_{\text{course}='Math'}(\text{Enrollments}) \cap \sigma_{\text{course}='Science'}(\text{Enrollments})$
- b. $\pi_{\text{student\_id}}(\sigma_{\text{course}='Math'}(\text{Enrollments})) \cap \pi_{\text{student\_id}}(\sigma_{\text{course}='Science'}(\text{Enrollments}))$ ✓
- c. $\pi_{\text{student\_id}}(\text{Enrollments} \bowtie_{\text{course}='Math'} \bowtie_{\text{course}='Science'})$
- d. $\pi_{\text{student\_id}}(\text{Enrollments})$

The correct answer is: $\pi_{\text{student\_id}}(\sigma_{\text{course}='Math'}(\text{Enrollments})) \cap \pi_{\text{student\_id}}(\sigma_{\text{course}='Science'}(\text{Enrollments}))$

Question 18

Not answered

Marked out of 2.00

Given the following SQL query:

```
SELECT *
FROM Employee
WHERE Salary > 50000 AND Department <> 'Finance';
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\sigma_{\text{Salary}>50000}(\text{Employee}) - \sigma_{\text{Department}='Finance'}(\text{Employee})$
- b. $\sigma_{\text{Salary}>50000}(\text{Employee})$
- c. $\sigma_{\text{Salary}>50000}(\text{Employee}) \cap \sigma_{\text{Department}\neq'Finance'}(\text{Employee})$
- d. $\text{Employee} \bowtie \sigma_{\text{Salary}>50000}(\text{Employee})$

The correct answers are: $\sigma_{\text{Salary}>50000}(\text{Employee}) - \sigma_{\text{Department}='Finance'}(\text{Employee})$
, $\sigma_{\text{Salary}>50000}(\text{Employee}) \cap \sigma_{\text{Department}\neq'Finance'}(\text{Employee})$

Question 19

Not answered

Marked out of 2.00

Consider a relation R(M, N, O, P, Q, R) with the following functional dependencies:
1. MN → OP
2. O → Q
3. P → R

R is decomposed into R1(M, N, O, P) and R2(O, Q, P, R).

Is this decomposition lossless?

- a. Yes
- b. No

The correct answer is: Yes

Question 20

Not answered

Marked out of 1.00

Given the following SQL query:

```
SELECT DISTINCT E.Lname, E.Fname
FROM Employee E, Department D
WHERE E.Dno = D.Dnumber AND D.Dname = 'Research';
```

Which of the following Relational Algebra expressions correctly represents this query?

- a. $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \bowtie \text{Department}))$
- b. $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \times \text{Department}))$
- c. $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \bowtie_{\text{Dnumber=Dno}} \text{Department}))$
- d. $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \bowtie_{\text{Dno=Dnumber}} \text{Department}))$

The correct answers are: $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \bowtie_{\text{Dno=Dnumber}} \text{Department}))$
, $\pi_{\text{Lname,Fname}}(\sigma_{\text{Dname}='Research'}(\text{Employee} \bowtie_{\text{Dnumber=Dno}} \text{Department}))$