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Marks	14.50/47.00
Grade	**0.93** out of 3.00 (**30.85**%)

Question 1

Complete

Mark 1.00 out of 1.00

Assuming set semantics, State true or false for the following statement:

The operator ⋈ is a combination of (σ, Π, x).

- True
- False

The correct answer is 'True'.

Question 2

Complete

Mark 1.00 out of 2.00

Schema :
Consider the following university database schema:
Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of all students enrolled in at least one course? (Note: there can be more than expressions)

- a. $\pi_{\text{Name}}(\text{Student} \bowtie \text{Enrollment})$
- b. $\pi_{\text{Name}}(\text{Student} \ltimes \text{Enrollment})$
- c. $\pi_{\text{Name}}(\text{Student} \bowtie \text{Enrollment} \bowtie \text{Course})$
- d. $\pi_{\text{Name}}(\text{Student}) - \pi_{\text{Name}}(\text{Student} \ltimes \text{Enrollment})$

The correct answers are: $\pi_{\text{Name}}(\text{Student} \bowtie \text{Enrollment})$
, $\pi_{\text{Name}}(\text{Student}) - \pi_{\text{Name}}(\text{Student} \ltimes \text{Enrollment})$

Question 3

Complete

Mark 1.00 out of 1.00

What does cardinality in an ER model define?

- a. None of the others
- b. The total number of entities in a database
- c. The number of foreign keys in a table
- d. The number of attributes in an entity

The correct answer is: None of the others

Question 4

Complete

Mark 1.00 out of 1.00

What is a weak entity?

- a. An entity that does not have a primary key and relies on a strong entity
- b. An entity that does not have any attributes
- c. An entity that is stored as a separate database table
- d. An entity that has multiple relationships

The correct answer is: An entity that does not have a primary key and relies on a strong entity

Question 5

Complete

Mark 1.00 out of 1.00

Assuming set semantics, State true or false for the following statement:

The full outer-join operator $\overset{\bowtie}{}$ can be expressed as a combination of ($\bowtie$, $\overset{\bowtie}{}$, $\cup$).

- True
- False

The correct answer is 'True'.

Question 6

Complete

Mark 0.00 out of 1.00

State true or false for the following statement:

$(R \cap S) - T = R \cap (S - T)$, holds for both sets and bags

- (•) True
- ( ) False

The correct answer is 'False'.

Question 7

Complete

Mark 2.00 out of 4.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Find students who have taken both Course C1 and Course C2? (Note: there can be more than expressions)

- [ ] a. $\pi_{Name}\left((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \cap \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student\right)$
- [ ] b. $\pi_{Name}\left((\sigma_{E1.CID='C1'}(Enrollment) \bowtie_{E1.SID=E2.SID} \sigma_{E2.CID='C1'}(Enrollment)) \bowtie Student\right)$
- [x] c. $\pi_{Name}\left((\sigma_{E1.CID='C1'}(Enrollment) \bowtie_{E1.SID=E2.SID} \sigma_{E2.CID='C2'}(Enrollment)) \bowtie Student\right)$
- [ ] d. $\pi_{Name}\left((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \cup \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student\right)$

The correct answers are: $\pi_{Name}\left((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \cap \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student\right)$
, $\pi_{Name}\left((\sigma_{E1.CID='C1'}(Enrollment) \bowtie_{E1.SID=E2.SID} \sigma_{E2.CID='C2'}(Enrollment)) \bowtie Student\right)$

Question 8

Complete

Mark 2.00 out of 2.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will retrieve the titles of all courses offered by the 'Mathematics' department. (Note: there can be more than expressions)

- a. None of the above
- b. $\pi_{\text{Title}}(\sigma_{\text{Credits}>3}(\text{Course}))$
- c. $\sigma_{\text{Title}='Mathematics'}(\text{Course})$
- d. $\pi_{\text{Title}}(\sigma_{\text{Department}='Mathematics'}(\text{Course}))$

The correct answer is: $\pi_{\text{Title}}(\sigma_{\text{Department}='Mathematics'}(\text{Course}))$

Question 9

Complete

Mark 2.00 out of 4.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of students who are enrolled in Course C1 but not in Course C2. (Note: there can be more than expressions)

- a. $\pi_{Name}\left((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) - \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student\right)$
- b. $\pi_{Name}\left((\pi_{SID}(Enrollment \bowtie \sigma_{CID='C1'}(Course)) - \pi_{SID}(Enrollment \bowtie \sigma_{CID='C2'}(Course))) \bowtie Student\right)$
- c. $\pi_{Name}\left((\pi_{SID}(Enrollment \bowtie \sigma_{CID='C1'}(Course)) - \pi_{SID}(\sigma_{CID='C2'}(Enrollment \bowtie Course))) \bowtie Student\right)$
- d. $\pi_{Name}\left(\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \bowtie Student\right) - \pi_{Name}\left(\pi_{SID}(\sigma_{CID='C2'}(Enrollment)) \bowtie Student\right)$

The correct answers are: $\pi_{Name}\left((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) - \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student\right)$
, $\pi_{Name}\left((\pi_{SID}(Enrollment \bowtie \sigma_{CID='C1'}(Course)) - \pi_{SID}(Enrollment \bowtie \sigma_{CID='C2'}(Course))) \bowtie Student\right)$

Question 10

Complete

Mark -0.25 out of 1.00

Which of the following is true about an entity in an ER model?

- a. An entity represents a real-world object or concept
- b. An entity must always have a relationship with another entity
- c. Entities can only have one attribute
- d. An entity is always a physical object

The correct answer is: An entity represents a real-world object or concept

Question 11

Complete

Mark 0.00 out of 1.00

State true or false for the following statement:

$R \cap (S \cup T) = (R \cap S) \cup (R \cap T)$ holds for both sets and bags.

- True
- False

The correct answer is 'False'.

Question 12

Complete

Mark 1.00 out of 1.00

State true or false for the following statement:

$R - (R - S) = R \cap S$, holds for both sets and bags.

- True
- False

The correct answer is 'True'.

Question 13

Complete

Mark 2.00 out of 2.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of professors who teach at least one course? (Note: there can be more than expressions)

- a. None of the above
- b. $\pi_{\text{Name}}(\sigma_{\text{Salary}>50000}(\text{Professor}))$
- c. $\pi_{\text{Name}}(\sigma_{\text{PID}=\text{Teaches.PID}}(\text{Professor} \times \text{Teaches}))$
- d. $\pi_{\text{Name}}(\text{Teaches} \bowtie \text{Professor})$

The correct answers are: $\pi_{\text{Name}}(\text{Teaches} \bowtie \text{Professor})$
, $\pi_{\text{Name}}(\sigma_{\text{PID}=\text{Teaches.PID}}(\text{Professor} \times \text{Teaches}))$

Question 14

Complete

Mark 1.00 out of 1.00

Assuming set semantics, State true or false for the following statement:

The grouping operator γ (gamma) can do duplicate elimination.

- True
- False

The correct answer is 'True'.

Question 15

Complete

Mark -0.25 out of 1.00

In an ER diagram, a double rectangle is used to represent?

a. A multi-valued attribute

b. A strong entity

c. A weak entity

d. A recursive relationship

The correct answer is: A weak entity

Question 16

Not answered

Marked out of 1.00

Which of the following is NOT a type of attribute in an ER model?

a. Recursive

b. Composite

c. Derived

d. Simple

The correct answer is: Recursive

Question 17

Not answered

Marked out of 1.00

What symbol is used to represent a relationship in an ER diagram?

a. Ellipse

b. Triangle

c. Rectangle

d. Diamond

The correct answer is: Diamond

Question 18

Not answered

Marked out of 1.00

What is the primary key in an ER model?

a. A unique identifier for an entity

b. A relationship between two entities

c. A type of attribute that stores numerical values

d. A foreign key in a different table

The correct answer is: A unique identifier for an entity

Question 19

Not answered

Marked out of 2.00

A hospital manages Doctors, Patients, and Appointments through a three-way relationship called DoctorAssignment, which models:

- A Doctor is assigned to a Patient for a specific Appointment.
- A Doctor can attend multiple Appointments, but each Appointment is handled by exactly one Doctor.
- A Patient can have multiple Appointments, possibly with different Doctors.

How can this three-way relationship be simplified while preserving all constraints?

a. Split into two binary relationships, introducing an associative entity:
`DoctorSchedules(Doctor – Appointment)` (One-to-Many)
`PatientAppointments(Patient – Appointment, withassignedDoctorID)` (Many-to-One, but stores the DoctorID explicitly)

b. Introduce a direct Many-to-Many relationship between Doctor and Patient and remove the need for an Appointment entity.

c. Create two binary relationships:

`Treats(Doctor – Patient)` (Many-to-Many)
`Schedules(Patient – Appointment)` (One-to-Many)

d. Create an associative entity called DoctorPatient to store `(DoctorID, PatientID, AppointmentID)` and keep the three-way relationship.

The correct answer is: Split into two binary relationships, introducing an associative entity:
`DoctorSchedules(Doctor – Appointment)` (One-to-Many)
`PatientAppointments(Patient – Appointment, withassignedDoctorID)` (Many-to-One, but stores the DoctorID explicitly)

Question 20

Not answered

Marked out of 1.00

Assuming set semantics, State true or false for the following statement:

The grouping operator γ, can be expressed as a combination of (σ, Π, ∪).

- True
- False

The correct answer is 'False'.

Question 21

Not answered

Marked out of 4.00

Suppose we have the following schema:
`Person(id, name)`,
`CarType(carTypeId, type)`,
`Car(carId, ownerId, carTypeId, carName)`
describing, respectively, people, types of cars, and cars and their owners. The data corresponding to these tables is as follows:

`Person`

ID	NAME
1	Madeleine
2	Alice
3	Nalini

`CarType`

CarTypeId	Type
1	Small
2	Medium
3	Large

`Car`

CarId	OwnerId	CarTypeId	CarName
1	1	1	Nano
2	2	2	Santro

Select the correct returned tuple of the following SQL query:

```
select distinct Q.name from
    (select P.name, C.carName, CT.carTypeId
    from Person P
    left outer join Car C on (C.ownerId = P.id)
    inner join CarType CT on (C.carTypeId = CT.carTypeId)) as Q
```

a. Alice, Nalini

b. Alice, Madeleine

c. None of above

d. Alice, Madeleine, Nalini

The correct answer is: Alice, Madeleine

Question 22

Not answered

Marked out of 1.00

State true or false for the following statement:

$R \cup (S \cap T) = (R \cup S) \cap (R \cup T)$, holds for both sets and bags.

- True
- False

The correct answer is 'True'.

Question 23

Not answered

Marked out of 4.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of students who have taken at least one of the courses C1 or C2.
(Note: there can be more than expressions)

- a. $\pi_{Name}(\sigma_{CID='C1' \vee CID='C2'}(Enrollment) \bowtie Student)$
- b. $\pi_{Name}((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \cup \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student)$
- c. $\pi_{Name}(\sigma_{CID='C1'}(Enrollment) \bowtie \sigma_{CID='C2'}(Enrollment) \bowtie Student)$
- d. $\pi_{Name}(\pi_{SID}(\sigma_{CID='C1' \vee CID='C2'}(Enrollment)) \bowtie Student)$

The correct answers are: $\pi_{Name}((\pi_{SID}(\sigma_{CID='C1'}(Enrollment)) \cup \pi_{SID}(\sigma_{CID='C2'}(Enrollment))) \bowtie Student)$
, $\pi_{Name}(\pi_{SID}(\sigma_{CID='C1' \vee CID='C2'}(Enrollment)) \bowtie Student)$

Question 24

Not answered

Marked out of 2.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of all students majoring in 'Computer Science'. (Note: there can be more than expressions)

- a. $\pi_{\text{Name}}(\sigma_{\text{Major}='ComputerScience'}(\text{Student}) \bowtie \pi_{\text{Name}}(\text{Student}))$
- b. $\sigma_{\text{Name}='ComputerScience'}(\text{Student})$
- c. $\pi_{\text{Name}}(\sigma_{\text{Major}='ComputerScience'}(\text{Student}))$
- d. $\pi_{\text{Name}}(\text{Student} \bowtie \sigma_{\text{Major}='ComputerScience'}(\text{Course}))$

The correct answers are: $\pi_{\text{Name}}(\sigma_{\text{Major}='ComputerScience'}(\text{Student}))$
, $\pi_{\text{Name}}(\sigma_{\text{Major}='ComputerScience'}(\text{Student}) \bowtie \pi_{\text{Name}}(\text{Student}))$

Question 25

Not answered

Marked out of 4.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Find courses that are either taught by Professor A or taken by Student X but not both? (Note: there can be more than expressions)

- a. $\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) \cup \pi_{CID}(\sigma_{SID='X'}(Enrollment))) - (\pi_{CID}(\sigma_{PID='A'}(Teaches)) \cap \pi_{CID}(\sigma_{SID='X'}(Enroll\right.$
- b. $\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) - \pi_{CID}(\sigma_{SID='X'}(Enrollment))) \cap (\pi_{CID}(\sigma_{SID='X'}(Enrollment)) - \pi_{CID}(\sigma_{PID='A'}(Te\right.$
- c. $\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) \cup \pi_{CID}(\sigma_{SID='X'}(Enrollment))) - \pi_{CID}(\sigma_{PID='A'}(Teaches) \cap \sigma_{SID='X'}(Enrollment))\right.$
- d. $\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) - \pi_{CID}(\sigma_{SID='X'}(Enrollment))) \cup (\pi_{CID}(\sigma_{SID='X'}(Enrollment)) - \pi_{CID}(\sigma_{PID='A'}(Te\right.$

The correct answers are:
$\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) \cup \pi_{CID}(\sigma_{SID='X'}(Enrollment))) - (\pi_{CID}(\sigma_{PID='A'}(Teaches)) \cap \pi_{CID}(\sigma_{SID='X'}(Enrollment)))\right)$
,
$\pi_{CID}\left((\pi_{CID}(\sigma_{PID='A'}(Teaches)) - \pi_{CID}(\sigma_{SID='X'}(Enrollment))) \cup (\pi_{CID}(\sigma_{SID='X'}(Enrollment)) - \pi_{CID}(\sigma_{PID='A'}(Teaches)))\right)$

Question 26

Not answered

Marked out of 2.00

Consider the following university database schema:

Student (SID, Name, Age, Major, GPA)
Course (CID, Title, Department, Credits)
Enrollment (SID, CID, Semester, Grade)
Professor (PID, Name, Department, Salary)
Teaches (PID, CID, Semester)

Which of the following relational algebra expression(s) will Retrieve the names of students with an 'A' grade in at least one course? (Note: there can be more than expressions)

- a. $\pi_{\text{Name}}\left(\sigma_{\text{Grade}='A'}\left(\text{Enrollment} \bowtie \text{Student}\right)\right)$
- b. $\pi_{\text{Name}}\left(\text{Enrollment} \bowtie \sigma_{\text{Grade}='A'}\left(\text{Course}\right)\right)$
- c. $\pi_{Name}(Student \bowtie (Enrollment \bowtie \sigma_{Grade='A'}(Enrollment)))$
- d. $\sigma_{\text{Name}='A'}\left(\text{Enrollment} \bowtie \text{Student}\right)$

The correct answers are: $\pi_{\text{Name}}\left(\sigma_{\text{Grade}='A'}\left(\text{Enrollment} \bowtie \text{Student}\right)\right)$
, $\pi_{Name}(Student \bowtie (Enrollment \bowtie \sigma_{Grade='A'}(Enrollment)))$