1. Which operator selects tuples based on a condition?

(a) π (Project)

(b) σ (Select)

(c) ⋈ (Join)

(d) δ (Rename)

2. The result of πA,B (R) is:

(a) All tuples of R with only attributes A and B.

(b) All tuples of R with all attributes except A and B.

(c) All tuples of R with duplicates removed.

(d) An empty relation.

3. R ∪ S is the same as:

(a) R - S

(b) S - R

(c) R ∩ S

(d) None of the above

4. The natural join of R and S joins them on:

(a) All common attributes.

(b) The primary key of R and the foreign key of S.

(c) The first matching attribute pair.

(d) There is no natural join for every relation.

5. πΣAge>18(Students). Which statement is TRUE?

(a) It first selects all students and then filters by age.

(b) It first filters by age and then selects all students.

(c) It always returns the same result as σAge>18(Students).

(d) It requires more processing than σAge>18(Students).

6. The maximum cardinality of πName (σAuthor='Stephen King' (Authors ⋈ Books)) is:

(a) The number of Stephen King books.

(b) The number of authors.

(c) The total number of books in the database.

(d) Cannot be determined without knowing relation sizes.

7. Consider the relation Orders(OrderID, CustomerID, ProductID). How can you find the average monthly revenue for each product, grouped by year?

(a) πProductID, Year(Date), avg(PriceQuantity) (Orders)

(b) πProductID, Year(Date), sum(PriceQuantity)/count() (Orders ⋈ Products)

(c) πProductID, Year(Date), sum(PriceQuantity)/12 (Orders ⋈ Products)

(d) It is impossible to calculate monthly revenue directly in relational algebra.

9. Given tables: Movies(ID, Title, ReleaseYear), Directors(ID, Name), DirectedBy(MovieID, DirectorID). Which expression finds the director who directed the most movies in the last decade?

(a) πName (Directors ⋈ σReleaseYear>2013 (Movies ⋈ DirectedBy))

(b) πName (Directors ⋈ (σReleaseYear>2013 (Movies) ⋈ DirectedBy))

(c) πDirectorID, MovieID (σReleaseYear>2013 (Movies ⋈ DirectedBy))

(d) Cannot be determined without additional information.

1. b
2. a
3. d
4. a
5. c
6. a
7. c
8. b

Here are the questions rewritten with symbols:

1. What does the set difference operation (R - S) allow you to find in relational algebra?

a) Rows in both relations

b) Rows in R but not in S

c) Common rows between R and S

d) A join between R and S

2. What operation allows you to combine columns from two relations?

a) ∪ (Union)

b) ∩ (Intersect)

c) ⋈ (Join)

d) π (Project)

3. In the expression R(A,B,C) × S(C,D,E), how are R and S joined?

a) Natural Join on column C

b) Theta join on column C

c) Cartesian product

d) Union on all columns

4. What does the rename operation δ allow you to do?

a) Change attribute names

b) Remove duplicate tuples

c) Project specific columns

d) Select rows based on a condition

5. Which of the following algebraic operations is most efficient for large data volumes?

a) σ (Selection)

b) π (Projection)

c) × (Cartesian product)

d) ∩ (Intersection)

6. What operation could allow you to find customers who placed orders in 2021 or 2022?

a) σ (Select)

b) ∪ (Union)

c) π (Project)

d) ∩ (Intersect)

7. In the Orders(OrderID, CustomerID, Amount) relation, how could you find the minimum order amount per customer?

a) π(CustomerID, min(Amount))(Orders)

b) σ(min(Amount))(Orders)

c) π(OrderID, CustomerID, min(Amount))(Orders)

d) Cannot be determined

8. What boolean operation allows you to combine the results of two selection predicates?

a) ¬ (NOT)

b) ∨ (OR)

c) ALL

d) DISTINCT

9. An aggregate operation performed without a GROUP BY clause returns exactly one row named \_\_\_

a) Scalar result

b) Vector result

c) Singleton result

d) Summary row

10. What keyword could you add to this expression to eliminate duplicate CustomerID values from the output? πCustomerID, sum(Amount)(Orders)

a) DISTINCT

b) GROUP BY

c) ALL

d) UNIQUE

1. b
2. c
3. a
4. a
5. b
6. a
7. a
8. b
9. a
10. a

Given the relations:

Students(sid, sname, gpa)

Courses(cid, cname, credits)

Relational Algebra Expression:

πsname, cname (σgpa>3.5 (Students ⋈ Courses))

Which SQL statement is equivalent?

a) SELECT sname, cname

FROM Students, Courses

WHERE gpa > 3.5

b) SELECT DISTINCT sname, cname

FROM Students JOIN Courses

ON Students.cid = Courses.cid

WHERE gpa > 3.5

c) SELECT DISTINCT sname, cname

FROM Students INNER JOIN Courses

ON Students.cid = Courses.cid

WHERE Students.gpa > 3.5

d) SELECT sname, cname

FROM Students NATURAL JOIN Courses

WHERE gpa > 3.5

Answer: c

Given the relations:

Employees(eid, name, salary, managerid)

Managers(mid, mname)

Relational Algebra Expression:

πmname(Managers) ∪ πname(Employees)

Which SQL statement is equivalent to the relational algebra expression if duplicate elimination is required in the result?

a) SELECT DISTINCT name

FROM Employees

UNION

SELECT DISTINCT mname

FROM Managers

b) SELECT mname

FROM Managers

UNION ALL

SELECT name

FROM Employees

c) SELECT name AS mname

FROM Employees

FULL OUTER JOIN

Managers ON Employees.managerid = Managers.mid

d) SELECT mname AS name

FROM Managers

LEFT JOIN

Employees ON Managers.mid = Employees.managerid

ANSWER: a