

CS348 Fall 2019
Midterm
Tuesday 10/01 8:00pm-9:00pm

Remember to fill in the following bubble card fields:

- Student ID: Use the 10 digit ID number on your student ID card.
- Last Name and First Name
- Test/Quiz: 001, Course: 348
- Instructor: Your PSO GTA's last name.
- Section number: Your "PSO Section Number".

Read all instructions before beginning the exam

- This is a closed book exam.
- You need only a pencil and eraser for this exam.
- You should **TURN OFF** your cellphone and any smart device e.g., watch, etc.
- You may leave after you have turned in the bubble sheet and all pages of the exam booklet. You will not be able to change any answers after turning in your exam booklet.
- Do not attempt to look at other students' work. Keep your answers to yourself. Any violation will be considered academic dishonesty.
- There are 41 multiple choice questions. Each one is worth 2.5 points.
- Answer the questions on the bubble sheet given to you. Only the answers on the bubble sheet will be graded.
- This exam contains 13 pages (including this cover page)
- Read and sign the statement below. Wait for instructions to start the exam before continuing to the next page.

"I signify that the answers provided for this examination are my own and that I have not received assistance from other students nor given any assistance to other students."

Signature:

Logistics

1. Have you read the instructions in Page 1, signed the disclosure at the bottom of Page 1, and filled the bubble sheet with your ID, name, etc.?

A. Of course, I did.

B. No.

2. Have you tuned off your cellphone?

A. Of course, I did.

B. No.

Part 1: Database users, concepts and architecture

3. Which of the following statements is **TRUE** about the content of a database?

A. The database schema changes frequently.

B. The database state changes every time the database is updated.

C. The database state refers to the structure of a database at a moment in time.

D. A valid state does not need to satisfy all the constraints of the database.

E. A valid state needs to satisfy *only* the structure of the database.

4. Which of the following is the oldest database model?

A. Deductive.

B. Network.

C. Relational.

D. Physical.

E. Object-oriented.

5. Which of the following is **not** considered an emerging application at the present time?

A. Biological and genome.

B. Geographic Information Systems (GIS).

C. Mobile.

D. Multimedia.

E. Numeric and textual.

6. Which of the following is **TRUE** regarding the database end users?

A. End-users are responsible for defining the data structure and constraints against the database.

B. Casual end users access the database occasionally when needed. The majority of end-users are casual users.

C. End-users can access data for queries and reports. But they are not allowed to make any change on the database.

D. Stand-alone end users maintain their own databases by creating one with ready-to-use packaged applications.

E. End-users are considered as actors behind the scene.

7. Which of the following is not an example of physical data independence?

A. Modification of the file organization or storage structure.

B. Utilizing storage devices.

C. Making changes to the data model.

D. Changing indexes.

E. Using different data structures.

8. Which of the following users is responsible for authorizing access to the database, coordinating and monitoring its use, acquiring software and hardware resources, controlling its use and monitoring efficiency of operations?

A. Application Programmer.

B. Business analyst.

C. Database administrator.

D. Database designer.

E. End-users.

Part 2: Entity-Relationship Model (ER) and Enhanced Entity Relationship (EERD) Model

9. Suppose the values of the attribute AGE are calculated by BIRTHDAY, then AGE should be displayed in the ER model as:
- A. Double rectangular box.
 - B. Oval box while underlining the attribute's name.
 - C. Dashed oval box.**
 - D. Double oval box.
 - E. Dashed diamond box.
10. Which of the following is one of the multiple inheritance characteristics?
- A. Every subclass has only one superclass.
 - B. A subclass can be subclass of more than one superclass.**
 - C. Has exactly three subclasses.
 - D. A superclass can be a subclass of any class.
 - E. None of the above.
11. In the Enhanced Entity-Relationship (EER) Modeling, a collection of entities in form of set is called?
- A. Object.
 - B. Schema.
 - C. Class.**
 - D. Construct.
 - E. Tuple.
12. What does Hierarchy mean in the Enhanced Entity-Relationship (EER) model?
- A. Every subclass has more than one superclass.
 - B. Every subclass is partial disjoint.
 - C. A subclass needs to be a shared subclass.
 - D. Every subclass is a total overlapping.
 - E. Every subclass has only one superclass.**

13. Consider the entities *student*, *class*, *instructor*, *socialsecuritycard* in a schema as well as the following assumptions:

1. A student may have more than one social security card (legally with the same unique social security number), and every social security number belongs to a unique student.
2. Assuming that every class has a unique instructor but instructors were allowed to team teach.

Select the right cardinality ratios of the relationships,

- A. *student* **many-to-1** *socialsecuritycard*
- B. *student* **many-to-many** *socialsecuritycard*
- C. *class* **many-to-many** *instructor*
- D. *student* **1-to-many** *socialsecuritycard*
- E. C and D

14. Consider the schema with car dealer details,

DEALERS(*did*: int, *dname*: string, *daddress*: string)

CARS(*cid*: int, *ccolor*: string, *cmaker*: string)

CATALOG(*did*: int, *cid*: int, *cprice*: float)

Select all multi-valued and/or composite attributes.

- A. *cmaker*
- B. ***ccolor* and *daddress***
- C. *cprice*
- D. *cmaker* and *ccolor*
- E. *did* and *cid*

15. Which statement is **TRUE** about superclasses and subclasses?

- A. An entity could be a member of a subclass, but not a member of a superclass.
- B. Every entity in a superclass must be a member of some subclasses.
- C. Superclass and subclass can be represented in ER model.
- D. Only superclasses can participate in relationship types.

E. Every entity in a subclass must have all attributes of superclass.

16. In some specializations, we can determine exactly the entities that will become members of each subclass by placing a condition on the value of some attribute of the superclass. Such subclasses are called

- A. Object-defined subclasses.
- B. User-defined subclasses.
- C. Commit-defined subclasses.
- D. State-defined subclass.

E. Predicate-defined subclasses.

17. The degree of a relationship type is _____?

- A. The sum of cardinality ratios.
- B. The maximum participation.
- C. The sum of attributes of each related entity types.
- D. The number of participating entity types.**
- E. Possibly an infinite number.

18. Suppose $Z : Z = \{S1, S2, \dots, Sn\}$ is a set of subclasses with same superclass G . Which constraint is satisfied by the condition $S1 \cup S2 \cup \dots \cup Sn = G$?

- A. Disjoint.
- B. Lattice.
- C. Total.**
- D. Partial.
- E. Overlapping.

19. Which of the following subclass type constraints allows an entity to be a member of at most one subclass?

- A. Lattice constraint.
- B. Disjointness constraint.**
- C. Completeness constraint.

- D. Hierarchy constraint.
- E. Overlapping constraint.

Part 3: Relational Algebra and Calculus

20. Which of the following operation(s) require(s) the participating relations to be union compatible?
- A. Difference.
 - B. Intersection.
 - C. Union.
 - D. All of the above.**
 - E. $A + C$
21. Both UNION and INTERSECTION cannot be treated as n -ary operations applicable to any number of relations because both are also associative operations; that is, $R \cup (S \cup T) = (R \cup S) \cup T$ and $(R \cap S) \cap T = R \cap (S \cap T)$
- A. True.
 - B. False.**
22. Both UNION and INTERSECTION are commutative operations; that is, $R \cup S = S \cup R$ and $R \cap S = S \cap R$
- A. True.**
 - B. False.
23. Consider a relationship that stores midterm grades of students from all sections $R(\text{SectionId}, \text{StudentId}, \text{Grade})$. Which operation correctly calculates the average grade in each section?
- A. $\mathcal{F}_{\text{AVERAGE Grade}}(R)$
 - B. $\mathcal{F}_{\text{AVERAGE Grade}}(\text{SectionId})$
 - C. $\text{SectionId } \mathcal{F}_{\text{AVERAGE Grade}}(R)$**
 - D. $\text{Grade } \mathcal{F}_{\text{AVERAGE SectionId}}(R)$
 - E. $R \mathcal{F}_{\text{AVERAGE Grade}}(\text{SectionId})$
24. Which of the following tuple relational calculus expression is equivalent to $\forall x \in r(P(x))$

- A. $\neg \exists x \in r(P(x))$
B. $\neg \exists x \in r(\neg P(x))$
C. $\exists x \notin r(P(x))$
D. $\neg \exists x \notin r(\neg P(x))$
E. None of the above.
25. Assume that there are two relations $A(M,N)$ and $B(M,N)$. Which queries are equivalent??
1. $\Pi_M(A \bowtie B)$
 2. $\Pi_M(A) \bowtie \Pi_M(B)$
 3. $\Pi_M(\Pi_{M,N}(A) \cap \Pi_{M,N}(B))$
 4. $\Pi_M(\Pi_{M,N}(A) - (\Pi_{M,N}(A) - \Pi_{M,N}(B)))$
- A. 1 and 2
B. 2 and 3
C. 3 and 4
D. 1, 2 and 4
E. 1 3 and 4
26. What is the result of the following relational algebra expression?
- $$\Pi_{CourseId}((\Pi_{StudId}(\sigma_{gender='Female'}(student)) \times \Pi_{CourseId}(enroll)) - enroll)$$
- A. Courses where there are only female students.
B. Courses where there are no female students.
C. Courses where there is a subset of female students.
D. Courses where there are no male students.
E. Students that are female.
27. Which of the following statements is **TRUE**?
- A. Tuple Relational Calculus (TRC) is a procedural language.
B. Relational Algebra (RA) is a procedural language.
C. TRC, DRC and RA are all non-procedural language

- D. TRC, DRC and RA are all procedural language.
- E. None of the above
28. Which of the following queries cannot be expressed using $(\cup, -, x, \pi, \rho, \sigma)$
- A. All employees of a given department.
- B. All students who are siblings.
- C. The sum of all employees' salaries.**
- D. Department address of every employee.
- E. Employees whose name is the same as their department name.
29. Which of the following relational algebra operations can be expressed using other operations.
- A. Cartesian product.
- B. Division.**
- C. Rename.
- D. Select.
- E. Set difference.
30. What is the result of $R_1 \div R_2$?

$$R_1$$

A	B
a1	b1
a1	b3
a2	b2
a3	b1
a3	b3
a3	b4

$$R_2$$

B
b1
b3

- A. $B:\{b1, b2\}$
- B. $B:\{b1, b2, b3, b4\}$

C. A:{a1, a3}

D. A:{a1, a2, a3}

E. AB: {a1 b1, a3 b3}

Part 4: Relations, keys, constraints and SQL

31. Referential integrity is specified via

A. PRIMARY KEY clause.

B. UNIQUE clause.

C. FOREIGN KEY clause.

D. DEFAULT clause.

E. None of the above.

32. Consider the *student* entity in a database schema of Purdue,

STUDENT(*pid*: int, loginname: string, courses: string, club-memberships: string, has_gymmembership: bool)

Identify the candidate key in the given schema? (*Hint: this questions is not asking for the primary key*)

A. clubmemberships

B. courses

C. has_gymmembership

D. loginname

E. pid

33. An OUTER JOIN operation which keeps all tuples of first and second relation is classified as _____

A. LEFT OUTER JOIN.

B. RIGHT OUTER JOIN.

C. FULL OUTER JOIN.

D. HALF OUTER JOIN.

E. BOTH OUTER JOIN.

34. The participation constraint specifies whether the existence of an entity depends on its being related to another entity via the relationship type.

A. True.

B. False.

35. We must choose either **CASCADE** or **RESTRICT** for drop operation. If _____ is chosen, all constraints and views that reference the column are dropped automatically from the schema, along with the column.

A. **AUTHORIZE.**

B. CASCADE.

C. **CASE.**

D. **RECURSIVE.**

E. **RESTRICT.**

36. Consider the following table, which SQL query result is not correct?

Product		
Pid	Price	Store
P1	20	S1
P2	10	S1
P1	30	S2
P1	20	NULL
P2	NULL	S2

A. **SELECT SUM(PRICE) FROM Product WHERE Pid = P1; returns {50}**

B. **SELECT SUM(PRICE) FROM Product WHERE Pid = P2; returns {10}**

C. **SELECT COUNT(*) FROM Product GROUP BY Store HAVING Store = 'S2'; returns {2}**

D. SELECT store FROM Product GROUP BY store; returns {'S1', 'S2'}

E. **SELECT AVG(price) from Product WHERE Pid = P2; returns {10}**

37. Which of the following SQL statement(s) retrieve(s) all employees in department 5 whose salary is between \$30,000 and \$40,000.

- A. `SELECT * FROM emp WHERE (salary BETWEEN 30000 AND 40000) AND Dno = 5;`
 - B. `SELECT * FROM emp WHERE (salary > 30000 AND Salary < 40000) AND Dno = 5;`
 - C. `SELECT * FROM emp WHERE (salary >= 30000 AND Salary <= 40000) AND Dno = 5;`
 - D. `SELECT * FROM emp WHERE (salary IN 30000 AND 40000) AND Dno = 5;`
 - E. A + B**
38. Which SQL query is used to extract name of students who have valid address?
- A. `SELECT sname FROM Student;`
 - B. `SELECT sname FROM Student WHERE address != NULL;`
 - C. `SELECT sname FROM Student WHERE address <> NULL;`
 - D. `SELECT sname FROM Student WHERE address is not NULL;`**
 - E. `SELECT sname FROM Student WHERE address is NULL;`
39. To remove duplicate rows from the results of an SQL SELECT statement, which qualifier specified must be included?
- A. Distinct.**
 - B. Unique.
 - C. Primary.
 - D. Remove Duplicates.
 - E. Only.
40. Suppose when creating a table, you want to set a constraint that class *start_time* needs to be smaller than *end_time*, which command should be used?
- A. CHECK.**
 - B. CONSTRAINTS.
 - C. DEFAULT.
 - D. LIMIT.

E. SET.

41. **(Bonus opinion question)** How did you find the exam?

A. Super easy.

B. Moderate

C. Hard.

D. Very hard.

E. I don't know.