

CS 4400 Exam 2

Practice

Name: _____

GT account (gtg, gth, msmith3, etc): _____ Section (e.g., B1): _____

Signature: _____

- Failure to properly fill in the information on this page will result in a deduction of up to 4 points from your exam score.
- Signing signifies that you agree to comply with the **Academic Honor Code of Georgia Tech**.
- Calculators and cell phones are NOT allowed.

Completely fill in the box corresponding to your answer choice for each question.

- | | | | | |
|-----|-------|-------|-------|-------|
| 1. | [A] | [B] | [C] | [D] |
| 2. | [A] | [B] | [C] | [D] |
| 3. | [A] | [B] | [C] | [D] |
| 4. | [A] | [B] | [C] | [D] |
| 5. | [A] | [B] | [C] | [D] |
| 6. | [A] | [B] | [C] | [D] |
| 7. | [A] | [B] | [C] | [D] |
| 8. | [A] | [B] | [C] | [D] |
| 9. | [A] | [B] | [C] | [D] |
| 10. | [A] | [B] | [C] | [D] |
| 11. | [A] | [B] | [C] | [D] |
| 12. | [A] | [B] | [C] | [D] |
| 13. | [A] | [B] | [C] | [D] |
| 14. | [A] | [B] | [C] | [D] |
| 15. | [A] | [B] | [C] | [D] |
| 16. | [A] | [B] | [C] | [D] |
| 17. | [A] | [B] | [C] | [D] |
| 18. | [A] | [B] | [C] | [D] |
| 19. | [A] | [B] | [C] | [D] |
| 20. | [A] | [B] | [C] | [D] |
| 21. | [A] | [B] | [C] | [D] |
| 22. | [A] | [B] | [C] | [D] |
| 23. | [A] | [B] | [C] | [D] |
| 24. | [A] | [B] | [C] | [D] |
| 25. | [A] | [B] | [C] | [D] |

Number missed: _____ Final Score: _____

Pubs Database Schema

author(*author_id*, *first_name*, *last_name*)

author_pub(*author_id*, *pub_id*, *author_position*)

book(*book_id*, *book_title*, *month*, *year*, *editor*)

pub(*pub_id*, *title*, *book_id*)

- *author_id* in *author_pub* is a foreign key referencing *author*
- *pub_id* in *author_pub* is a foreign key referencing *pub*
- *book_id* in *pub* is a foreign key referencing *book*
- *editor* in *book* is a foreign key referencing *author*(*author_id*)
- Primary keys are underlined

Pubs Database State

r(author)

<u>author_id</u>	<u>first_name</u>	<u>last_name</u>
1	John	McCarthy
2	Dennis	Ritchie
3	Ken	Thompson
4	Claude	Shannon
5	Alan	Turing
6	Alonzo	Church
7	Perry	White
8	Moshe	Vardi
9	Roy	Batty

r(author_pub)

<u>author_id</u>	<u>pub_id</u>	<u>author_position</u>
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

r(book)

<u>book_id</u>	<u>book_title</u>	<u>month</u>	<u>year</u>	<u>editor</u>
1	CACM	April	1960	8
2	CACM	July	1974	8
3	BST	July	1948	2
4	LMS	November	1936	7
5	Mind	October	1950	NULL
6	AMS	Month	1941	NULL
7	AAAI	July	2012	9
8	NIPS	July	2012	9

r(pub)

<u>pub_id</u>	<u>title</u>	<u>book_id</u>
1	LISP	1
2	Unix	2
3	Info Theory	3
4	Turing Machines	4
5	Turing Test	5
6	Lambda Calculus	6

Figure 1: Relational Database Schema

Name: _____ GTAccount: _____ Section: _____

Scratch page

- [4] 1. Which of the following statements is true with regard to the relational data model?
- A. A domain for an attribute is a set of atomic values.
 - B. Several attributes in one relation schema may have the same domain.
 - C. A tuple in a relation consists of one value from each attribute domain of that relation.
 - D. All of the above
- [4] 2. Which of the following is the mathematical definition of a relation, $r(R)$, of degree n ?
- A. $r(R) \subseteq \text{dom}(A_1) \times \text{dom}(A_2) \times \dots \times \text{dom}(A_n)$
 - B. $r(R) \subseteq \text{dom}(A_1) \cap \text{dom}(A_2) \cap \dots \cap \text{dom}(A_n)$
 - C. $r(R) \subseteq \text{dom}(A_1) \cup \text{dom}(A_2) \cup \dots \cup \text{dom}(A_n)$
 - D. none of the above
- [4] 3. Which of the following are properties of the relational model?
- A. Attribute values in tuples are indivisible.
 - B. Facts not asserted explicitly are assumed to be false.
 - C. Relations are sets.
 - D. All of the above.
- [4] 4. Which of the following is true about a minimal superkey?
- A. There can be only one.
 - B. The default superkey is always a minimal superkey.
 - C. Every minimal superkey is a primary key.
 - D. Every superkey contains a minimal superkey as a subset.
- [4] 5. In a relation schema with 3 attributes, each of which is a candidate key, how many superkeys are there?
- A. 1
 - B. 3
 - C. 6
 - D. 7
- [4] 6. In a relation schema with 3 attributes, each of which is a candidate key, how many choices are there for the primary key?
- A. 1
 - B. 3
 - C. 6
 - D. 7
- [4] 7. May a tuple in a relation have a NULL value for a foreign key attribute?
- A. Yes
 - B. No
- [4] 8. May a tuple in a relation have a NULL value for a primary key attribute?
- A. Yes
 - B. No
- [4] 9. Which kind of constraint cannot be specified in the relational model?
- A. referential integrity constraints
 - B. semantic constraints, a.k.a., business rules
 - C. entity integrity constraints
- [4] 10. Meow!
- A. True

Refer to database schema in Figure 1 for the remaining questions.

- [4] 11. What is the degree of the *author* relation?
- A. 2
 - B. 3
 - C. 9
- [4] 12. The *author_pub* relation has how many superkeys?
- A. 1
 - B. 2
 - C. 3
- [4] 13. Can the tuple <6, 'Teen', 'Candles'> be inserted into the *author* relation without causing an integrity violation?
- A. Yes
 - B. No
- [4] 14. Can the tuple <10, NULL, 'Pointers'> be inserted into the *author* relation without causing an integrity violation?
- A. Yes
 - B. No
- [4] 15. The deletion of the second tuple in the *author* relation (<2, 'Dennis', 'Ritchie'>) causes an integrity violation for which relations?
- A. *author_pub*
 - B. *book*
 - C. *pub*
 - D. A and B above.
- [4] 16. If cascading deletes is in effect for all relations and the tuple <2, 'Dennis', 'Ritchie'> is deleted, how many other tuples will be deleted from the database?
- A. 0
 - B. 2
 - C. 3
- [4] 17. How many tuples will be returned by the following relational algebra query?

$$\pi_{book_title}(book)$$

- A. 7
- B. 5
- C. 2
- D. 1

[4] 18. What question does the following expression answer?

$$|\pi_{author_id}(author) - \pi_{editor}(book)|$$

- A. How many authors are book editors.
- B. How many authors are not book editors.
- C. What are the names of the authors who are book editors.
- D. What are the names of the authors who are not book editors.

[4] 19. Which of the following relational algebra expressions returns the names of all authors who are book editors?

- A. $\pi_{first_name, last_name}((\pi_{author_id}(author) - \pi_{editor}(book)) * author)$
- B. $\pi_{first_name, last_name}(author \bowtie_{author_id=editor} book)$
- C. $\pi_{first_name, last_name}(author * author_pub)$

[4] 20. Which of the following relational algebra expressions returns the names of all authors who are **not** book editors?

- A. $\pi_{first_name, last_name}((\pi_{author_id}(author) - \pi_{editor}(book)) * author)$
- B. $\pi_{first_name, last_name}(author \bowtie_{author_id=editor} book)$
- C. $\pi_{first_name, last_name}(author * author_pub)$

[4] 21. Which of the following relational algebra expressions returns the names of all authors who have at least one publication in the database?

- A. $\pi_{first_name, last_name}((\pi_{author_id}(author) - \pi_{editor}(book)) * author)$
- B. $\pi_{first_name, last_name}(author \bowtie_{author_id=editor} book)$
- C. $\pi_{first_name, last_name}(author * author_pub)$

[4] 22. Which of the following relational algebra expressions returns books that were published before 1960 or after 2000?

- A. $\sigma_{year < 1960}(book) \wedge \sigma_{year > 2000}(book)$
- B. $\sigma_{year < 1960}(book) \cup \sigma_{year > 2000}(book)$
- C. $\sigma_{year < 1960 \wedge year > 2000}(book)$

[4] 23. How many tuples are returned by the following relational algebra expression?

$$author \bowtie_{author_id=editor} book$$

- A. 8
- B. 11
- C. 13

[4] 24. What question does the following relational algebra expression answer?

$$author * (author_pub * (\sigma_{month='July'}(book) * pub))$$

- A. Which authors were born in July?
- B. Which authors authored a pub that was published in July?
- C. Which authors edited books that were published in July?

[4] 25. How many tuples does the previous relational algebra expression return?

- A. 1
- B. 2
- C. 3
- D. 4