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

$author(\underline{author\_id}, first\_name, last\_name)$

$author\_pub(\underline{author\_id}, \underline{pub\_id}, author\_position)$

$book(\underline{book\_id}, book\_title, month, year, editor)$

$pub(\underline{pub\_id}, title, book\_id)$

- *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*)

author_id	first_name	last_name
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*)

author_id	pub_id	author_position
1	1	1
2	2	1
3	2	2
4	3	1
5	4	1
5	5	1
6	6	1

r(*book*)

book_id	book_title	month	year	editor
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*)

pub_id	title	book_id
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

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Scratch page

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[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. $r(R) \subseteq dom(A_1) \times dom(A_2) \times .... \times dom(A_n)$

B. $r(R) \subseteq dom(A_1) \cap dom(A_2) \cap .... \cap dom(A_n)$

C. $r(R) \subseteq dom(A_1) \cup dom(A_2) \cup .... \cup dom(A_n)$

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 specied 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

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[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?

$$author \rtimes_{author\_id=editor} book$$

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