Databases Midterm Practice

Name (print clearly): _____ Section: (e.g., B1) _____

Signature: _____

Student account username (e.g., msmith3): _____

1 Database Concepts and EER Models

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: _____

- Signing signifies that you agree to comply with the **Academic Honor Code**.
- Calculators and cell phones are NOT allowed.

[4] 1. Which of the following is/are example(s) of metadata?

A. Types of data elements

B. Structure of records

C. Constraints

D. All of the above

[4] 2. What is the first step in database development?

A. Requirements analysis

B. Conceptual design

C. Logical design

D. Physical design

[4] 3. Which of the following are advantages of the database approach?

A. Storing metadata with the data

B. Insulation between data and programs.

C. Multiple views of the data for different users.

D. All of the above.

[4] 4. Which database technology is most pervasive and the focus of this course?

A. Hierarchical databases

B. Relational databases

C. Object-oriented databases

D. Document-oriented databases

[4] 5. Abstraction is ...

A. selective ignorance.

B. suppression of details.

C. for a particular application.

D. All of the above

[4] 6. Data independence is ...

A. the ability to store data on independent disks.

B. isolation of changes at one schema level from levels above it.

C. the freedom to change the data without consulting the DBA.

D. All of the above

[4] 7. The primary goal of the three-schema database architecture is

A. data integrity.

B. data independence.

C. data cohesion.

D. data processing.

[4] 8. External schemas

A. are views tailored to particular users

B. are specified with ER models

C. specify the storage structure of the data

D. None of the above

[4] 9. Conceptual models

A. provide a high-level but concrete view of data understandable by end users and database developers.

B. are developed after requirements analysis.

C. may influence changes in requirements as developers iterate the design with users.

D. All of the above

[4] 10. Entity-relationship models contain

A. entities, relationships and SQL code.

B. entities, constraints and storage schemas.

C. entities, attributes and relationships.

D. mappings bewtween levels of the three-schema architecture.

[4] 11. Structural constraints between entity types and relationships include

A. participation constraints.

B. cardinality ratios.

C. data types.

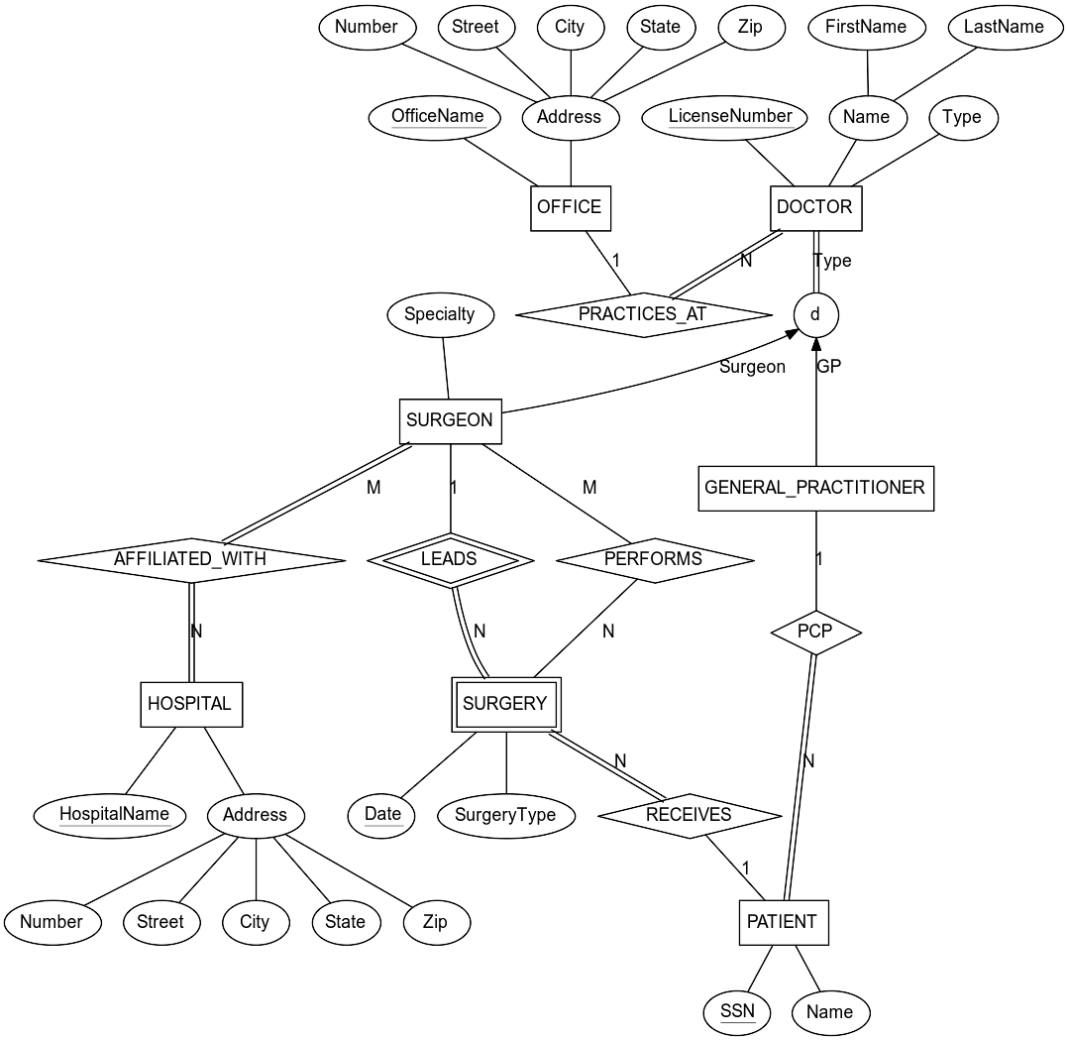
D. A and B above.

[4] 12. A weak entity has a key.

A. True

B. False

Refer to the following EER diagram for the remaining questions.



[4] 13. Can there be two OFFICE instances at the same Address?

A. Yes

B. No

[4] 14. Can there be an OFFICE instance without any DOCTORs who PRACTICE_AT that OFFICE?

A. Yes

B. No

[4] 15. Can there be a DOCTOR instance that does not PRACTICE_AT an OFFICE?

A. Yes

B. No

[4] 16. How many OFFICEs may a DOCTOR PRACTICE_AT?

A. 1

B. 0 or more

C. 1 or more

[4] 17. What is the full set of possible values for the Type attribute of DOCTOR?

A. {'Surgeon', 'GP', 'ER', NULL}

B. {'Surgeon', 'GP', 'ER'}

C. {'Surgeon', 'GP', NULL}

D. {'Surgeon', 'GP'}

[4] 18. Making no assumptions about the number of instances of any other entity type, the number of SURGEON instances is ____ the number of DOCTOR instances.

A. less than

B. equal to

C. less than or equal to

D. greater than

[4] 19. Can there be any DOCTOR instances that are not either SURGEON instances or GENERAL_PRACTITIONER instances?

A. Yes

B. No

[4] 20. Does the existence of a PATIENT instance imply the existence of an OFFICE instance?

A. Yes

B. No

[4] 21. If there are five SURGERY instances, how many DOCTOR instances are there?

A. Five or more

B. One or more

C. Two or more

D. Cannot be determined from the information given

[4] 22. How many HOSPITALs must a SURGEON be AFFILIATED_WITH?

A. One or more

B. Zero or more

C. More than 2

[4] 23. Which of the following is a valid key for a SURGERY instance?

A. $< Date, SurgeryType >$

B. $< SurgeryType, Specialty >$

C. $< LicenseNumber, Date >$

D. $< Date, SurgeryType, SSN >$

[4] 24. Given this EER model, how may SURGERYs may a SURGEON LEAD on a given Date?

A. 1

B. many

C. none

[4] 25. Given this EER model, if we wanted the SurgeryType attribute for each SURGERY instance to have the same value as the Specialty attribute of the SURGEON who LEADs the surgery, we would enforce this correponsdence with a

A. data integrity constraint.

B. semantic constraint/business rule.

C. participation constraint.

D. heuristic.

2 Relational Model and Relational Algebra

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]
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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

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

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

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

[4] 10. What is the degree of the *author* relation?

A. 2

B. 3

C. 9

[4] 11. The *author_pub* relation has how many superkeys?

A. 1

B. 2

C. 3

[4] 12. Can the tuple `<6, 'Teen', 'Candles'>` be inserted into the *author* relation without causing an integrity violation?

A. Yes

B. No

[4] 13. Can the tuple `<10, NULL, 'Pointers'>` be inserted into the *author* relation without causing an integrity violation?

A. Yes

B. No

[4] 14. 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] 15. 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] 16. 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] 17. 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] 18. 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] 19. 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] 20. 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] 21. 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] 22. How many tuples are returned by the following relational algebra expression?

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

A. 8
B. 11
C. 13

[4] 23. 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] 24. How many tuples does the previous relational algebra expression return?

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