Databases Final Exam Practice

ER-Relational Mapping, SQL, Relational Design, Physical DMBS Design

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.

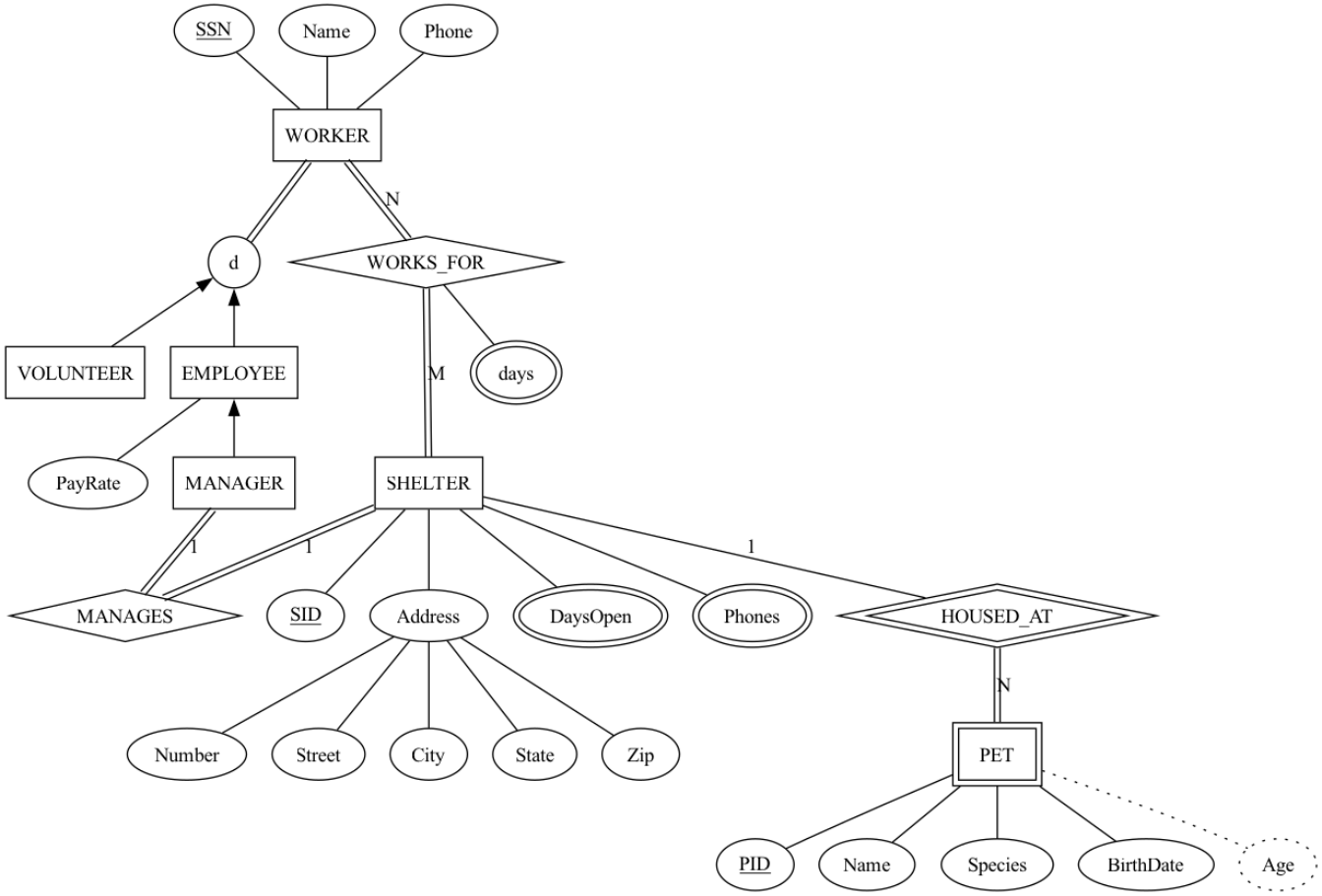
Completely fill in the box corresponding to your answer choice for each question.

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: _____ Written Score: _____

Name: _____ NetID (e.g., msmith3): _____

Refer to the following EER diagram for Questions 1 – 7



Name: _____ NetID (e.g., msmith3): _____

1. Which of the following (sets of) relation schemas is a correct mapping of the SHELTER entity type? (Disregard the MANAGES relationship.)
    A. SHELTER(SID, Number, Street, City, State, Zip, DaysOpen, Phones)
    B. SHELTER(SID, Number, Street, City, State, Zip, Phones), DaysOpen(SID, Day)
    C. SHELTER(SID, Number, Street, City, State, Zip), DaysOpen(SID, Day), Phones(SID, Phone)
    D. All of the above.

2. Which of the following relation schemas is a correct mapping of the PET entity type?
    A. PET(PID, Name, Species, BirthDate, Age)
    B. PET(PID, Name, Species, BirthDate)
    C. PET(PID, SID, Name, Species, BirthDate)
    D. None of the above

3. Which of the following sets of relation schemas is a correct mapping of the WORKS_FOR relationship (Disregard multivalued attributes of SHELTER.)?
    A. WORKER(SSN, Name, Phone, SID), SHELTER(SID, Number, Street, City, State, Zip)
    B. WORKER(SSN, Name, Phone), SHELTER(SID, Number, Street, City, State, Zip, SSN)
    C. WORKER_SHELTER(SSN, SID), WORK_DAYS(SSN, SID, Day)
    D. WORKER_SHELTER(SSN, SID, Days)

4. What's the least number of tables necessary to model the WORKER - VOLUNTEER - EMPLOYEE - MANAGER class hierarchy?
    A. 1
    B. 2
    C. 3
    D. 4

5. Which of the following sets of relation schemas acceptably represenents the WORKER - VOLUNTEER - EMPLOYEE - MANAGER class hierarchy?
    A. WORKER(SSN, Name, Phone), VOLUNTEER(SSN), EMPLOYEE(SSN,PayRate), MANAGER(SSN)
    B. EMPLOYEE(SSN, Name, Phone, PayRate, IsManager), VOLUNTEER(SSN)
    C. WORKER(SSN, Name, Phone, PayRate, IsManager)
    D. All of the above.

6. Which of the following create table statements creates a PET table that accurately models the PET entity type?
    A. create table pet(PID int primary key, Name varchar(20), Species varchar(20), Birthdate date)
    B. create table pet(PID int primary key, Name varchar(20), Species varchar(20), Birthdate date, SID int)
    C. create table pet(PID int, Name varchar(20), Species varchar(20), Birthdate date, SID int, primary key (PID, SID), foreign key (SID) references shelter(SID))
    D. None of the above.

7. Which of the following create table statements creates a table that accurately models the WORKS_FOR relationship? (Disregard multivalued attributes.)
    A. create table worker_shelter(SSN int, SID int, days enum (M, Tu, W, Th, F))
    B. create table worker_shelter(SSN int, SID int, primary key (SSN, SID), foreign key (SSN) references worker (SSN), foreign key (SID) references shelter (SID))
    C. create table worker_shelter(SSN int, SID int, primary key (SSN))
    D. None of the above.

Name: _____ NetID (e.g., msmith3): _____

Refer to the following create table statements and table data for Questions 8 – 10.

```
create table dorm (
    dorm_id integer primary key auto_increment,
    name text not null,
    spaces integer
);


create table student (
    student_id integer primary key auto_increment,
    name text,
    gpa float(3,2),
    dorm_id integer not null,
    foreign key (dorm_id) references dorm(dorm_id)
);
```

```
mysql> select * from dorm;
+---------+-----------+--------+
| dorm_id | name      | spaces |
+---------+-----------+--------+
|       1 | Armstrong |    124 |
|       2 | Brown     |    158 |
+---------+-----------+--------+
2 rows in set (0.00 sec)

mysql> select * from student;
+------------+-------+------+---------+
| student_id | name  | gpa  | dorm_id |
+------------+-------+------+---------+
|          1 | Alice | 3.60 |       1 |
|          2 | Bob   | 2.70 |       1 |
+------------+-------+------+---------+
2 rows in set (0.00 sec)
```

8. Which of the following insert statements will succeed?
   A. `insert into dorm (name, spaces) values('Caldwell', 158);`
   B. `insert into dorm values('Caldwell', 158);`
   C. `insert into dorm (name, spaces) values(null, 158);`
   D. All of the above.

9. Which of the following insert statement is certain to succeed?
   A. `insert into student (name, gpa, dorm_id) values ('Cheng', 3.6, 3);`
   B. `insert into student (name, gpa, dorm_id) values ('Cheng', 3.6, 1);`
   C. `insert into student (name, gpa) values ('Cheng', 3.6);`
   D. All of the above.

10. Which of the following delete statements will fail?
    A. `delete from student`
    B. `delete from dorm where name = 'Brown';`
    C. `delete from dorm where name = 'Armstrong';`
    D. None of the above.

Name: _____ NetID (e.g., msmith3): _____

Pubs Database Schema

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

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

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

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

- $author\_id$ 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	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: Pubs Database

Name: _____ NetID (e.g., msmith3): _____

For the questions on this page, refer to Figure 1.

11. Query giving author first name and last name who have published in CACM.

12. Query giving all authors and the books they have edited, including authors who are not book editors.

13. Query giving all author first names and last names who have published more than one pub.

14. Author of the oldest pub in the database.

15. How many rows returned by `select * from book natural join pub`?

Relational Design

16. Given the following relation schemas and functional dependencies:

    LOTS1(PropertyiId , CountyName, Lot, Area, Price)
    LOTS2(CountyName , TaxRate)

    - FD1: PropertyId → CountyName, Lot, Area, Price, TaxRate
    - FD2: CountyName, Lot → PropertyId, Area, Price, TaxRate
    - FD3: CountyName → TaxRate
    - FD4: Area → Price

    What is the highest normal form satified by these schemas?

    A. 1NF
    B. 2NF
    C. 3NF
    D. BCNF

17. Given the following relation schemas and functional dependencies:

    LOTS1A(PropertyId, CountyName, Lot, Area)
    LOTS1B(Area, Price)
    LOTS2(CountyName, TaxRate)

    - FD1: PropertyId → CountyName, Lot, Area
    - FD2: CountyName, Lot → PropertyId, Area
    - FD3: CountyName → TaxRate
    - FD4: Area → Price

    What is the highest normal form satified by these schemas?

    A. 1NF
    B. 2NF
    C. 3NF
    D. BCNF

18. Given the following relation schemas and functional dependencies:

    R1(Instructor , Course)
    R2(Instructor, Student)

    - FD1: Student, Course → Instructor
    - FD2: Instructor → Course.

    What is the highest normal form satified by these schemas?

    A. 1NF
    B. 2NF
    C. 3NF
    D. BCNF

Name: _____ NetID (e.g., msmith3): _____

Physical DMBS Design

19. How is data stored in a log-structured storage engine, e.g., LSM-trees?
    A. Files containing append-only sequences of records
    B. B-trees
    C. B^+-trees
    D. Hashes

20. How is data stored in a page-oriented storage engine?
    A. A sorted, balanced, tree-structured collection of fixed-size blocks, or pages, such as a B-tree.
    B. Hash tables
    C. Inverted splay trees
    D. File cabinets

21. What is the primary trade-off of indexes in terms of read vs. write performance?
    A. Indexes speed up reads but slow down writes.
    B. Indexes speed up writes but slow down reads.
    C. Indexes speed up both reads and writes.
    D. Indexes slow down both reads and writes.

22. Which of the following techniques limits the size of data files in a database that uses LSM-trees?
    A. Compaction
    B. Coercion
    C. Conflagration

23. Which of the following techniques makes B-trees more reliable (reslient to crashes)?
    A. Writing every modification to the database to a *write-ahead log (WAL)* before applying changes to the B-tree.
    B. Using latches (lightweight locks) to control concurrent access to the B-tree.
    C. All of the above

24. Which of the following are advantages of LSM-trees compared to B-trees?
    A. LSM-trees are usually faster for writes.
    B. LSM-trees usually support higher write throughput.
    C. LSM-trees usually use less disk space due to better compression and less fragmentation (e.g., unused space in blocks in a B-tree).
    D. All of the above

25. Which of the following are advantages of B-trees compared to LSM-trees?
    A. Reads are usually faster on B-trees.
    B. More predictable performance. In LSM-trees compaction processes can lead to unpredictable temprary performance degradation.
    C. B-trees better support transaction processing because each key exists in only one place in the index, so transaction isolation can be implemented with locks on small ranges of keys that can be directly attached to the tree.
    D. All of the above

26. Which of the following acronyms refers to safety guarantees provided by transactions?

    A. ACID

    B. BASE

    C. PH

27. Which of the following best describes the *atomicity* property of database transactions?

    A. The writes in a transaction either all succeed (transaction is *committed*) or all fail (transaction is *rolled back* or *aborted*).

    B. Invariants, i.e., statements about data, that are true before a transactoin remain true afterwards.

    C. Concurrently executing transactions are isolated from each other, i.e., they don't interfere with each other.

    D. The promise that once a transaction has committed successfully, any data it has written will not be forgotten, even if there is a hardware fault or the database crashes.

28. Which of the following best describes the *consistency* property of database transactions?

    A. The writes in a transaction either all succeed (transaction is *committed*) or all fail (transaction is *rolled back* or *aborted*).

    B. Invariants, i.e., statements about data, that are true before a transactoin remain true afterwards.

    C. Concurrently executing transactions are isolated from each other, i.e., they don't interfere with each other.

    D. The promise that once a transaction has committed successfully, any data it has written will not be forgotten, even if there is a hardware fault or the database crashes.

29. Which of the following best describes the *isolation* property of database transactions?

    A. The writes in a transaction either all succeed (transaction is *committed*) or all fail (transaction is *rolled back* or *aborted*).

    B. Invariants, i.e., statements about data, that are true before a transactoin remain true afterwards.

    C. Concurrently executing transactions are isolated from each other, i.e., they don't interfere with each other.

    D. The promise that once a transaction has committed successfully, any data it has written will not be forgotten, even if there is a hardware fault or the database crashes.

30. Which of the following best describes the *durability* property of database transactions?

    A. The writes in a transaction either all succeed (transaction is *committed*) or all fail (transaction is *rolled back* or *aborted*).

    B. Invariants, i.e., statements about data, that are true before a transactoin remain true afterwards.

    C. Concurrently executing transactions are isolated from each other, i.e., they don't interfere with each other.

    D. The promise that once a transaction has committed successfully, any data it has written will not be forgotten, even if there is a hardware fault or the database crashes.