NAME:_____

COM S 363: Exam 1

Time: 75 minutes

NOTES:

- This is a closed book closed notes exam.
- Write your name and answer legibly; if the grader can't read, you receive no point.
- Attempt all problems. Write solutions on these sheets. Ask for scratch papers if needed. Put your name on any extra sheet and hand them in with your exam
- Questions being on the next sheet. Fill in your name now, but do not turn the page until the signal is given.
- Mark the session where you are in:

Ying Cai's Session[ ]   Shashi Gardia's Session[ ]

| Problem	Max Points	Points
1	30	
2	20	
3	8	
4	12	
5	30	
Total	100	

1. (30 points) Construct an E-R diagram for a hospital to record the following information.
   (a) The hospital has a set of patients and a set of medical doctors
   (b) Each patient has SSN, PName, IC (insurance company), DateIn and DateOut.
   (c) Each doctor has a DID, DName, and Specialization.
   (d) Each patient must have at least one doctor as his/her primary doctor
   (e) A patient may undergo a medical test, each of which has a TID, TName, Date, Time, and Result
   (f) A patient may have multiple tests, but each test is only for one patient
   (g) Each test is performed by one and only one doctor

Grading Criteria
   • Each entity/relationship set takes 4 points, totally 4 * 6 = 24 points
   • Each constraint takes 1 points totally 1 * 6 = 6 points
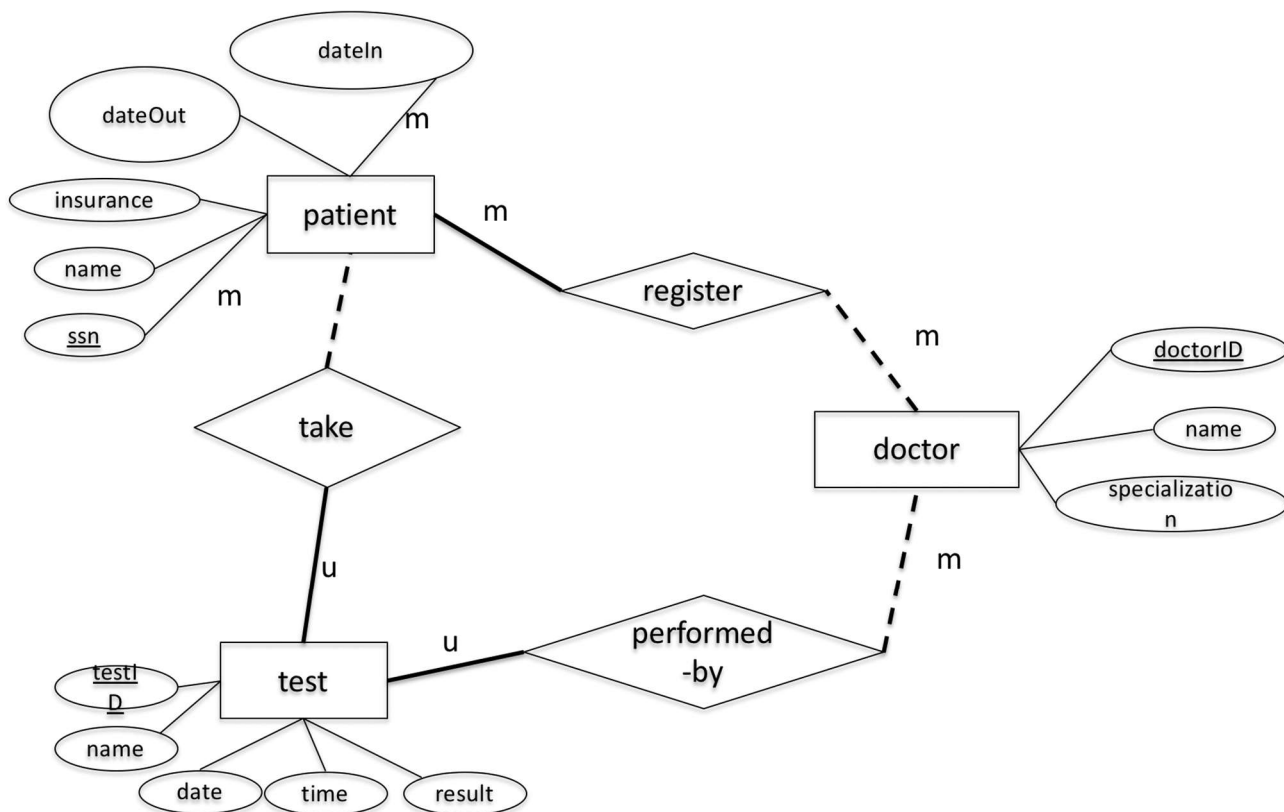
2. (20 points) Convert the following E-R diagram into a set of relations. For each relation, use SQL's "create table" to specify its name, attributes, and constraints (i.e., key, primary key, and foreign key).
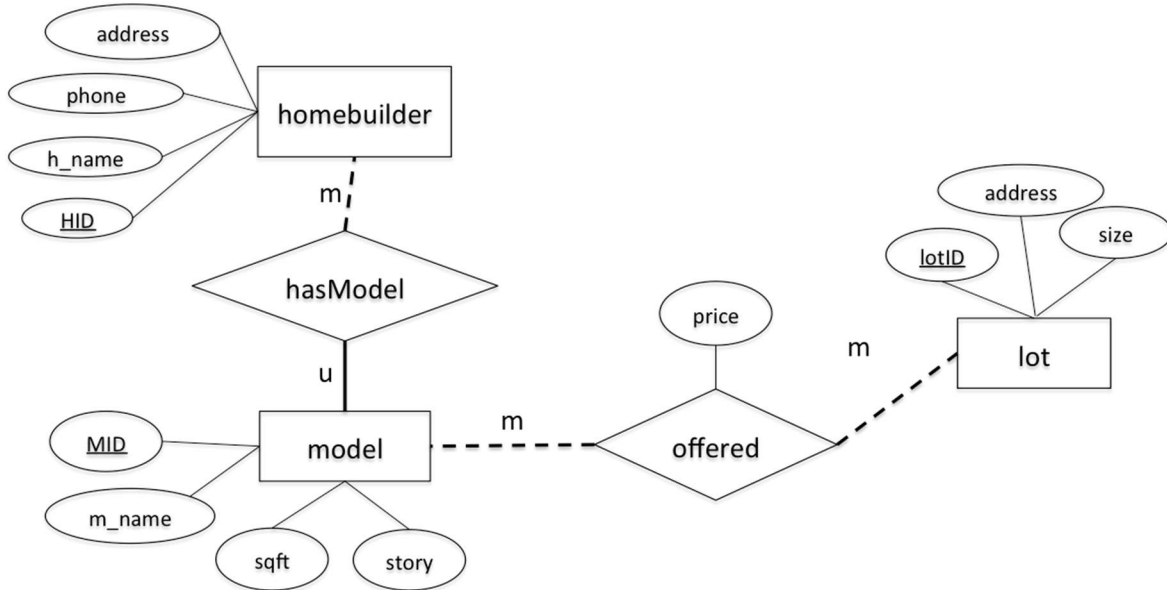
Grading criteria:
- Each table takes 4-5 points, depending on the number of tables
- Primary key and foreign key, each take 1 point
- As long as one table is created for one relationship/entity set, get at least 2 point
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CREATE TABLE Homebuilder
(hID varchar (20),
 name varchar (20),
 phone varchar (20),
 addresss varchar (20),
 PRIMARY KEY (hID))

CREATE TABLE Model
(hID varchar (20), NOT NULL
 mID varchar (20),
 name varchar(20),
 sqft int,
 story int,
 PRIMARY KEY (mID),
 FOREIGN KEY (hID) references Homebuilder (hID))

CREATE TABLE Lot
(lotID varchar (20),
 address varchar (20),
 size int,
 PRIMARY KEY (lotID))

CREATE TABLE offered
(lotID varchar(20),
 mID varchar(20),
 price int,
 PRIMARY KEY (lotID, mID),
 FOREIGN KEY (lotID) references Lot(LotID),
 FOREIGN KEY (mID) references Model(mID))

3. (8 points) Prove the following implied dependencies or disprove using counter examples:

(a) (3 points) {W --> Y, X --> Z} ==> {WX --> Y}

W-->Y ==> WX-->XY (augmentation rule)

Since XY-->Y (trivial), we have WX-->Y

(b) (3 points) {X --> Y, X --> W, WY --> Z} ==> {X --> Z}

Since X-->Y, we have WX-->WY (augmentation rule);

Since X-->W, we have X-->WX (augmentation rule); so we have X-->WX-->WY-->Z

So X-->Z

(c) (2 points) {X --> Y} ==> {X --> YZ}

false

X   Y   Z
x1   y1   z1
x1   y1   z2

4. (12 points) Consider a relation R with five attributes A, B, C, D, and E and the set of dependencies
F={A --> BC, B --> C, BCD --> E, A-->B}.

(a) (4 points) Compute $\{A\}^+$

$\{A\}+ = \{A, B, C\}$

(c) (8 points) Compute a minimum cover of F

1) make right hand attribute single
F={A--> B, A-->C, B --> C, BCD --> E, A-->B}.

2) make left hand attribute minimum
F={A-->B, A-->C, B-->C, BC->E}

3) make dependencies minimum
F={A-->B, B-->C, BD->E}

5. (30 points) Consider a relation R with five attributes A, B, C, D, and E and the set of dependencies

F ={A --> B, BC --> E, ED --> A}

(a) (5 points) For each of the following attributes, determine if it is a key. Explain.

    i.   ACD

      Yes, {ACD}+ = {ABCDE}

    ii.   AE

      No

    iii.   BCDE

      No, BCD is a key, so BCDE is a super key

    iv.   BCD
      Yes

    v.   CDE
      Yes

(b) (3 points) List all dependencies in F, if any, which violate BCNF.

    All violate

(c) (2 points) List all dependencies in F, if any, which violate 3NF.

    None violates

(d) (10 points) Suppose R is decomposed into R1(AB) and R2(ACDE).

    i.   Is this decomposition lossless? Explain.

              Common attribute is A and A is a key in R1, so lossless decomposition

    ii.   Is this decomposition dependency-preserving? Explain.

    No. BC-->E is lost

(e) (10 points) Give R a 3NF decomposition that is lossless and dependency preserving.

    R ==> R1(AB) and R2(ACDE).

    R2(ACDE) ==>R3(EDA) and R4(CED)

    Since BC-->E is lost, add R5(BCE)

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