UMass Lowell
Department of Computer Science
Fall 2016

Instructor: Prof. Chen
TA: Xinzi Sun

COMP.3090 Midterm

Closed Book, 75 Minutes
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Problem	Score	
1	(40%)	24
2	(26%)	13
3	(34%)	20
EC	(10%)	0
Total	(100%)	57

NOTE: Write clearly -- if your handwriting can not be read easily, your exam will not be graded.

Problem 1

(8 points each question)

Given the following schema:

movies (title, year, length, genre, studioName)
stars (name, address, gender, birthdate)
starsIn (title, year, name)

Write the following queries in Relational Algebra.

A Find the title of movies made by studio MGM.

$\Pi_{(title)}\left(\sigma_{(studioName = 'MGM')} Movies\right)$

$\Pi_{title}\left(\sigma_{(studioName = 'MGM')} Movies\right)$

B Find the name and address of stars who have starred in "Star Wars".

$R_1 := \left(\sigma_{(name\ AND\ Address)} \bowtie N_{(title = 'Star\ Wars')} Stars\right)$

$\Pi_{(R_1)}$

$\Pi_{name, address}\left(\sigma_{title = 'Star\ War'}\right)$ (StarsIN starIn

C Find the name of stars who have starred in both action movie and sci-fi movie.

$R_1 := (\Pi_{(name)}\ StarsIn \bowtie_{(genre\ 'action')} movies)$

$R_2 := (\Pi_{(name)}\ StarsIn \bowtie_{(genre\ 'sci\text{-}fi')} Movies)$

$R_3 := R_1 \cap R_2$

$R_1(\Pi_{name}(genre = 'action')\ (StarsIn \bowtie movie)$

$R_2(\Pi_{name}\ (genre = 'sci\text{-}fi')\ (StarsIn \bowtie movie)$

$R_3 = R_1 \cap R_2.$

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D Find the name of stars who have starred in at least two movies.

$\Pi_{(name)}(\rho_{S1}(title, year, name) \bowtie_{(S1.title = StarsIn.title}\ StarsIn)$

S1.year = StarsIn.year

S1.name = StarsIn.name

S1.title StarsIn.title

$\Pi_{(name)}((\rho_{S1}(StarsIn) \bowtie StarsIn)$

S1.name = StarsIn.name

S1.year != StarsIn.year

S1.tittle != StarsIn.title

E Find the name of stars who have starred in exactly one movie.

0

~~$\Pi_{(name)}$~~

R_1 : Π_{name} (Psi (starIn))

R_2 = D.

R_3 = $R_1 - R_2$.

Problem 2

(26 points)

Consider a relation with schema R(A,B,C,D) and Functional Dependency rules $AB \rightarrow C$, $AD \rightarrow B$, $BC \rightarrow D$, $BC \rightarrow A$

A (6 points)

Find all keys of R.

A	B	C
A	D	B
B	C	D
D	C	A

A B

A B C X

A → A
B → B
C → C
D → D

AB → C
AD → B
BC → D
BC → A

AB → ABC
AD → ADB
BC → BCD
BC

A+ = A
B+ = B
C+ = C
D+ = D

AB + = ABCD
AC + = AC
AD + = ADBC
BC + = BCDA
BD + = BD
CD + = CDAB.

B (10 points)

What is BCNF? Is R in BCNF? Why?

(1)

(2)

C (10 points)

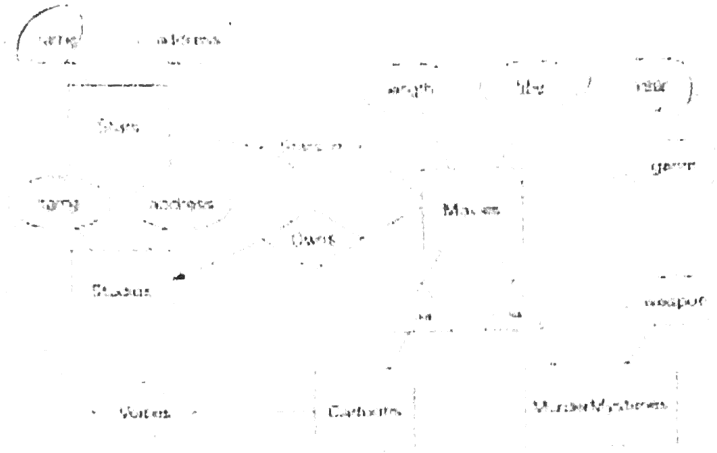
What is 3NF? Is R in 3NF? Why?

(1)

(2)

B (14 points) 10

Convert the following E/R diagram to relational database schemas.



Movie(length, title, year, genre, StarName, StarAddress)

Owns(name, title, year, genre, StarName)

MovieStars(length, title, year, genre, weapon)

Studio(name, address)

Stars(name, address, movieTitle, movieYear) - 6 4

Problem Extra Credit

(10 points)

Using the same schema as in Problem 1, write the following query in Relational Algebra:
Find the name of stars who have starred in every movie made by studio MGM.

$R_1 \leftarrow \Pi_{title}(\sigma_{studioname = 'MGM'}(Movies))$

$R_2 \leftarrow R_1 \bowtie_{(R_1.title = StarIn.title)} StarIn$

$R_3 \leftarrow R_2 \bowtie_{(R_2.title = R_{2a}.title \text{ AND } R_2.name \neq R_{2a}.name)} (\rho_{R_{2a}} R_2)$

$R_1 \leftarrow \Pi_{title}(\sigma_{studioname = 'MGM'}(Movies)) \bowtie StarIn$

$R_2 \leftarrow \Pi_{name}(R_1)$

$S \leftarrow \Pi_{title}(\sigma_{studioname = 'MGM'}(Movies))$

$T \leftarrow \Pi_{title, name}(StarIn)$

$temp1 \leftarrow \Pi_{name}(T)$

$temp2 \leftarrow \Pi_{name}(S \times temp1 - T)$

$result \leftarrow \Pi_{name}(stars \bowtie (temp1 - temp2))$