Qualifying Exam Questions for Database
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Dept. of Computer Science
New Mexico State University

(100 points; Open book)

For Questions 1 and 2, consider the following movie database schema (Primary key for each table is underlined).
• Film(<u>filmID</u>, filmTitle, type)   //the id, title, and type of a film
• Actor(<u>actorID</u>, actorName, age)   //the id, name, and age of an actor (or actress)
• Play(<u>actorID</u>, <u>filmID</u>, payment)   //the actor (with id actorID) plays in a film (with id filmID) with the given payment.

1. (20%) Write an SQL statement to answer each of the following queries.
(i) (8%) Find the names of all actors who played in the "Harry Potter" film series.
(ii) (12%) Find the names of all the actors who co-played together with "Daniel Radcliffe" in at least three movies.

2. (20%) Write a relational algebra expression (or a set of relational algebra expressions) to answer each of the following queries.
(i) (8%) Find the titles of the films which "Mel Gibson" played.
(ii) (12%) Assume that every actor is paid differently in the same movie. Find the name of the actor who was paid more than everyone in the movie "Avatar".

3. (25%) Consider the relation schema R = (A, B, F, I, T, Y).
Suppose that the following dependencies hold:
T → B, Y
A, T → B, F
Y → I
T → I
A → F
Answer the following questions and justify your answers.

(i) (10%). List all the candidate keys of relation R.
(ii) (10%). Assume that we decompose relation R to two relations: R1 = (A, B, F, T, Y) and R2 = (I, T).
(a) Is this a loss-less join decomposition? (b) Is this a dependency preserving decomposition?
(iii) (5%). Decompose R into a set of relations which are in 3NF such that no redundant information is stored in the database, and the decomposition is lossless join and dependency preserving.

4. (20%) Consider the empty extendable hash table in Figure 1. A bucket can store at most 2 entries, and the address table is set to have at most 8 pointers. Different entries are inserted into and deleted from the table. Table 1 shows the 16-bit hash values of the entries.

Insert the entries: "Ben", "Steve", "James", "Alice", "Paul" and "Daniel" into this table in order. Show the contents of this table for the following THREE instants: (a) (6%) after the insertion of "James", (b) (6%) after the insertion of "Paul", and (c) (8%) after the insertion of "Daniel". Draw out the contents of

the bucket address table and the buckets at those THREE different instants. Show clearly the number of bits used in the hash functions for each bucket and the address table.

Key	Hash Value
Ben	1000 0100 0100 1001
Steve	1010 0101 1001 1110
Alice	1110 1101 1100 0001
Daniel	1001 0110 1101 1100
Paul	1001 1101 1010 1001
James	0101 1100 0011 0101

0

0
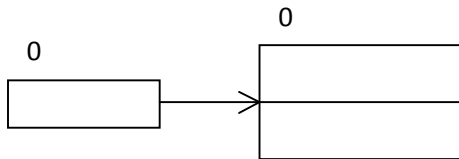
5. (20%) Suppose there are two transactions
      T1: R1[A] W1[A] R1[B] W1[B]
      T2: R2[A] W2[A] R2[B] W2[B]
Please give **three** conflict-serializable schedules that are **not serial schedules** and are composed of the operations of T1 and T2.