Homework #3

Name: Student ID: Assigned Date: 2021-10-26

1. Here are two relations:

   $R(A, B)$: $\{(0,1), (2,3), (0,1), (2,4), (3,4)\}$

   $S(B, C)$: $\{(0,1), (2,4), (2,5), (3,4), (0,2), (3,4)\}$

   Compute the following:

   (a) $\pi_{A+B,A^2,B^2}(R)$; (6%)

   (b) $\pi_{B+1,C-1}(S)$; (6%)

   (c) $R ⟕ S$; (6%)

   (d) $R ⟖ S$; (6%)

   (e) $R ⟗ S$. (6%)

2. The following running example of movie database has keys defined for all its relations.

```
Movies(title, year, length, genre, studioName, producerC#)
StarsIn(movieTitle, movieYear, starName)
MovieStar(name, address, gender, birthdate)
MovieExec(name, address, cert#, netWorth)
Studio(name, address, presC#)
```

   Declare the following referential integrity constraints for the movie database as in this exercise.

   (a) A movie that appears in StarsIn must also appear in Movie. Handle violations by rejecting the modification. (10%)

   (b) A star appearing in StarsIn must also appear in MovieStar. Handle violations by deleting violating tuples. (10%)

3. Write the following constraint for attributes of the relation.

```
Movies(title, year, length, genre, studioName, producerC#)
```

The studio name can only be Disney, Fox, MGM, or Paramount. (10%)

4. Write the following constraints as tuple-based CHECK constraints on one of the relations of our running movies example:

```
Movies(title, year, length, genre, studioName, producerC#)
StarsIn(movieTitle, movieYear, starName)
MovieStar(name, address, gender, birthdate)
MovieExec(name, address, cert#, netWorth)
Studio(name, address, presC#)
```

If the constraint actually involves two relations, then you should put constraints in both relations so that whichever relation changes, the constraint will be checked on insertions and updates. Assume no deletions; it is not always possible to maintain tuple-based constraints in the face of deletions.

(a) A name that appears in MovieStar must not also appear in MovieExec. (10%)

(b) A Studio name that appears in Studio must also appear in at least one Movies tuple. (10%)

5. Write the assertions for the following database schemas:

```
Product(maker, model, type)
PC(model, speed, ram, hd, price)
Laptop(model, speed, ram, hd, screen, price)
Printer(model, color, type, price)
```

(a) If a laptop has a larger main memory than a PC, then the laptop must also have a higher price than the PC. (10%)

(b) If the relation Product mentions a model and its type, then this model must appear in the relation appropriate to that type. (10%)