CS4.301 Data and Applications Homework 1

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Movie : Rush Hour (1998)

Introduction to the Mini-World

Set in the high-stakes world of the movie Rush Hour, this mini-world explores the core of the action-packed thriller by incorporating a criminal database used by US Law Enforcement Agencies to track down criminals and maintain surveillance on criminal organizations.

Purpose of the Database

The database would help in efficient catching of criminals and steady deliverance of justice. The fact that Juntao's identity was a complete mystery in the film should not be the case if the database works.

Users of the Database

Law enforcement agencies like FBI, NSA, LAPD, US Department of Justice, Bureau of Counterterrorism, US Department of Homeland Security

Applications of the Database

- Help detectives catch criminals(like Juntao) faster
- Help counter-terrorism branches to mark out areas of possible danger
- Help the LAPD to maintain criminal Records
- Help NSA understand national threats better
- Help US-DOJ to craft cases against criminals with better information
- Help US-DHS to maintain internal stability better

Database Requirements

a. Assumptions

- Each victim is associated with exactly one crime
- Each individual of interest is associated with at max one criminal organisation
- Name for victims and Individuals of interest isnt a primary key, and need not be unique

b. Weak Entity Types

Entity Type	Attributes	Attribute Type	Data Type	Constraints
Victims of Crime	Name	Simple	String	not null, partial key
	Date of Birth	Simple	Date	not null
	Crime Involved	Simple	String	not null
Individuals of Interest	Name	Simple	String	not null, partial key
	Identification Marks	Simple	String	-
	Crimes (Type, Date, Description)	Multi-valued composite	(String, Date, String)	-
	Location of Activity	Composite	String	-
Inventory for Agencies	Item Name	Simple	String	not null, partial key
	Item Type(Weapon, Vehicle)	Simple	String	not null
	Quantity	Simple	Integer	not null
	Acquisition Date	Simple	Date	not null

Table 1: Weak Entities

c. Strong Entity Types

Entity Type	Attributes	Attribute Type	Data Type	Constraints
Agency	Agency Name	Simple	String	not null, primary key
	President	Simple	String	not null
	Headquarter Location	Composite (City, Street, Zip Code)	String	not null
Agents	Code Name	Simple	String	not null, primary key
	Status(Active, inactive)	Simple	boolean	not null
	Classification Level	Simple	String	not null
	Date of Joining	Simple	Date	not null
	Operations Worked On	Multi-value	String	-
	Skills	Multi-value	String	-
Staff and Other Employees	Employee ID	Simple	Integer	not null, primary key
	Name	Simple	String	not null
	Date of Joining	Simple	Date	not null
	Skills	Multi-value	String	-
Cases	ID	Simple	Integer	not null, primary key
	Year	Simple	Integer	not null
	Classification Level	Simple	String	not null
	Status (Open, Closed)	Simple	Boolean	not null
	Description	Multi-value	String	not null
Criminal Organizations	Name	Simple	String	not null, primary key
	Type (Terror, drug cartel, etc.)	Simple	String	-

Table 2: Strong Entities

d. Relationship Types

Relationship Name	Participating Entities	Degree	Constraints (min, max)
Individual of Interest Related to Individual of Interest	Individual of Interest – Individual of Interest	1	(0, N) and (0, M) for both entities.
Agents Work In Agency	Agents – Agency	2	(1,1) for Agents; (1,N) for Agency.
Staff Work In Agency	Staff – Agency	2	(1,1) for Staff; (1,N) for Agency.
Inventory Associated to Agency	Inventory – Agency	2	(1,1) for Inventory; (0,N) for Agency.
Criminal Organization Monitored By Agency	Criminal Organization – Agency	2	(1, N) for Criminal Organization; (0, M) for Agency
Individual of Interest Belonging To Criminal Organization	Individual of Interest – Criminal Organization	2	(0, 1) for Individual of Interest; (1, N) for Criminal Organization
Agent In-charge Of Case	Agent – Cases	2	(0, 1) for Agents; (1, 1) for Cases
Victims in Case involving Individual of Interest	Cases – Victims of Crime – Individuals of Interest	3	(1,1) for Cases; (1, N) for Victims (0, M) for Individuals of Interest.
Agency and Agents Work on Case Involving Individuals of Interest	Agency – Agents – Cases – Individuals of Interest	4	(1, A) for Agency; (1, B) for Agents; (1,1) for Cases; (0, C) for Individuals of Interest.

Table 3: Relationships Between Entities with Degree and (min, max) Constraints

e. Degree more than 2 relationship types

The last 2 relationships mentioned in the table have degree 4.

Functional Requirements

Modifications

These operations modify the database content.

- **Insert**: Adding a new row (Entity instances) to any of the Entity types (schema) [except Agency] Examples:
  - Employing a new employee, or adding a new Individual of Interest
- **Delete**: Deleting an Entity instance from any Entity types [except Inventory(we update Quantity attribute to 0 instead), Agents(put it as inactive instead)]
  - Deleting the entry associated with an employee once he exits the agency
- **Update** : Updating the value of an Entity instance [except Criminal Organisation]
  - Update the cases worked on for agents based on new cases

Retrieval

- **Selection**
  - List cases an agent is working on.
  - List agencies working on a case.
- **Projection**
  - Show skills of Agents specified.
  - Show the Presidents of Agencies.
- **Aggregate**
  - Finding total Weapons held by an Agency.
  - Average age (derived from DOB) of people murdered.
- **Search**
  - Search for cases by their descriptions.
  - Search for Individuals of Interest by the Crimes Committed.
- **Analysis**
  - Find Agents with specific experience (worked on more than 10 cases).

Summary

The following database conceptually deals with the needs of every law enforcement agency, and would in the context of the movie Rush Hour, help the detective to catch the kidnapper faster and more efficiently, unfortunately reducing the plot of the movie.