Databases Autumn 2025

Hand-In Exercise 1

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Total Points	

Task	Points

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This template showcases various useful latex commands and setups. Remove this for your actual hand-in.

Task 1

Relational algebra is a treat with LaTeX, as can be seen in Equation (1):

$$\pi\left[Attribute1, Attribute2\right]\left(\sigma\left[Attribute = Something\right]\left(Entity1\right) \bowtie Entity2\right) \tag{1}$$

Task 2

(a) Person on Name:
$$\sigma\left[Name =' ChristopherNolan'\right]\left(Person\right) \tag{2}$$

Activity on SceneAuthor:
$$\sigma\left[Activity =' director'\right]\left(SceneAuthor\right) \tag{3}$$

Add join on both:

$$\pi\left[MovieID, SceneID\right]\left(\sigma\left[Name =' ChristopherNolan' \wedge Activity =' director'\right]\right.$$
$$\left.\left(Person \bowtie SceneAuthor\right)\right) \tag{4}$$

(b) Movie on Title:
$$\sigma[MovieTitle =' Inception'](Movie) \tag{5}$$

Hans Zimmer as composer (within that movie):

$$\pi\left[MovieID, SceneID\right]$$
$$\left(\sigma\left[MovieTitle =' Inception' \wedge Name =' HansZimmer' \wedge Activity =' composer'\right]\right.$$
$$\left.\left(Movie \bowtie SceneAuthor \bowtie Person\right)\right) \tag{6}$$

Christopher Nolan as screenwriter (within that movie):

$$\pi\left[MovieID, SceneID\right]$$
$$\left(\sigma\left[MovieTitle =' Inception' \wedge Name =' ChristopherNolan' \wedge Activity =' screenwriter'\right]\right.$$
$$\left.\left(Movie \bowtie SceneAuthor \bowtie Person\right)\right) \tag{7}$$

Intersect on scene key then output SceneID:

$$\pi\left[SceneID\right]$$
$$((\pi\left[MovieID, SceneID\right]$$
$$(\sigma\left[MovieTitle ='Inception' \wedge Name ='HansZimmer' \wedge Activity ='composer'\right]$$
$$(Movie \bowtie SceneAuthor \bowtie Person)))\cap$$
$$(\pi\left[MovieID, SceneID\right]$$
$$(\sigma\left[MovieTitle ='Inception' \wedge Name ='ChristopherNolan' \wedge Activity ='screenwriter'\right]$$
$$(Movie \bowtie SceneAuthor \bowtie Person)))) \quad (8)$$

(c) Person on Name:
$$\sigma\left[Name ='QuentinTarantino'\right](Person) \quad (9)$$

Actor role on ScenePerformer:
$$\sigma\left[Role ='actor'\right](ScenePerformer) \quad (10)$$

Director activity on SceneAuthor:
$$\sigma\left[Activity ='director'\right](SceneAuthor) \quad (11)$$

Combine and output scene Titles:
$$\pi\left[Title\right](\sigma\left[Name ='QuentinTarantino' \wedge Role ='actor' \wedge Activity ='director'\right]$$
$$(Scene \bowtie ScenePerformer \bowtie SceneAuthor \bowtie Person)) \quad (12)$$

(d) Actor on ScenePerformer:
$$\sigma\left[Name ='RobertDowneyJr.' \wedge Role ='actor'\right](ScenePerformer \bowtie Person) \quad (13)$$

Author on SceneAuthor:
$$\sigma\left[Name ='RobertDowneyJr.'\right](SceneAuthor \bowtie Person) \quad (14)$$

Union on MovieID, then output MovieTitle:

$$\pi\left[MovieTitle\right]$$
$$((\pi\left[MovieID\right](\sigma\left[Name ='RobertDowneyJr.' \wedge Role ='actor'\right](ScenePerformer \bowtie Person))$$
$$\cup \pi\left[MovieID\right](\sigma\left[Name ='RobertDowneyJr.'\right](SceneAuthor \bowtie Person))) \bowtie Movie) \quad (15)$$

(e) Actor on ScenePerformer:
$$\sigma\left[Name ='ScarlettJohansson' \wedge Role ='actor'\right](ScenePerformer \bowtie Person) \quad (16)$$

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Stunt double on ScenePerformer:

$$\sigma\left[Name =' ScarlettJohansson' \wedge Role =' stuntdouble'\right](ScenePerformer \bowtie Person) \quad (17)$$

Intersect on scene key, then output Titles:

$$\pi\left[Title\right]$$
$$((\pi\left[MovieID, SceneID\right](\sigma\left[Name =' ScarlettJohansson' \wedge Role =' actor'\right]$$
$$(ScenePerformer \bowtie Person)) \cap \pi\left[MovieID, SceneID\right]$$
$$(\sigma\left[Name =' ScarlettJohansson' \wedge Role =' stuntdouble'\right](ScenePerformer \bowtie Person))) \bowtie Scene)$$
$$(18)$$

(f) Person on Name (subset of Person):

$$F_{1.1} = \{p|p \in Person \wedge p.Name =' ChristopherNolan'\} \quad (19)$$

Activity on SceneAuthor (subset of SceneAuthor):

$$F_{1.2} = \{sa|sa \in SceneAuthor \wedge sa.Activity =' director'\} \quad (20)$$

Join by PID, output (MovieID,SceneID) without Person:

$$\{\langle sa.MovieID, sa.SceneID\rangle|sa \in F_{1.1} \wedge \exists p\left(p \in F_{1.2} \wedge p.PID = sa.PID\right)\} \quad (21)$$