Andrew Zurn

CSCI 331 – HW 3

Relational Languages

10/3/13

**Relational Algebra**

1) All\_Course\_aIDs 🡸 π areaID (Training\_Course)

All\_DB\_aIDs 🡸 π aID (σ aTitle = 'Databases' (Technology\_Area))

All\_DB\_Course\_aIDs 🡸 All\_Course\_aIDs \* All\_DB\_aIDs

Result 🡸 π cID, cTitle, cHours ( All\_DB\_Course\_aIDs **J** aID = aID (Training\_Course))

2) All\_Course\_aIDs 🡸 π aID (Training\_Course)

All\_DB\_aIDs 🡸 π aID (σ aTitle = 'Databases' (Technology\_Area))

All\_DB\_Course\_aIDs 🡸 All\_Course\_aIDs \* All\_DB\_aIDs

All\_DB\_Course\_cIDs 🡸 π cID ( All\_DB\_Course\_aIDs **J** aID = aID (Training\_Course))

EIDs\_Taken\_DB\_Course 🡸 π eID ( All\_DB\_Course\_cIDs **J** cID = cID (Takes))

Result 🡸 π eID, eFirst, eLast, eTitle ( EIDs\_Taken\_DB\_Couse **J** eID = eID (Employee))

3) All\_Course\_aIDs 🡸 π aID (Training\_Course)

All\_DBNW\_aIDs 🡸 π aID (σ aTitle = 'Databases' OR aTitle = 'Networks' (Technology\_Area))

All\_DBNW\_Course\_aIDs 🡸 All\_Course\_aIDs \* All\_DBNW\_aIDs

All\_DBNW\_Course\_cIDs 🡸 π cID ( All\_DBNW\_Course\_aIDs **J** aID = aID (Training\_Course))

EIDs\_Taken\_DBNW\_Course 🡸 π eID ( All\_DBNW\_Course\_cIDs **J** cID = cID (Takes))

Result 🡸 π eID, eFirst, eLast, eTitle ( EIDs\_Taken\_DBNW\_Course **J** eID = eID (Employee))

4) All\_DB\_aIDs 🡸 π aID (σ aTitle = 'Databases' (Technology\_Area))

All\_NW\_aIDs 🡸 π aID (σ aTitle = 'Networks' (Technology\_Area))

All\_DB\_Course\_cIDs 🡸 π cID ( All\_DB\_Course\_aIDs **J** aID = aID (Training\_Course))

All\_NW\_Course\_cIDs 🡸 π cID ( All\_NW\_Course\_aIDs **J** aID = aID (Training\_Course))

EIDs\_Taken\_DB\_Course 🡸 π eID ( All\_DB\_Course\_cIDs **J** cID = cID (Takes))

EIDs\_Taken\_NW\_Course 🡸 π eID ( All\_NW\_Course\_cIDs **J** cID = cID (Takes))

EIDs\_DB\_No\_NW\_Course 🡸 EIDs\_Taken\_DB\_Course – EIDs\_Taken\_NW\_Course

Result 🡸 π eID, eFirst, eLast, eTitle (EIDs\_DB\_No\_NW\_Course **J** eID = eID (Employee))

5) All\_DB\_aIDs 🡸 π aID (σ aTitle = 'Databases' (Technology\_Area))

All\_NW\_aIDs 🡸 π aID (σ aTitle = 'Networks' (Technology\_Area))

All\_DB\_Course\_cIDs 🡸 π cID ( All\_DB\_Course\_aIDs **J** aID = aID (Training\_Course))

All\_NW\_Course\_cIDs 🡸 π cID ( All\_NW\_Course\_aIDs **J** aID = aID (Training\_Course))

EIDs\_Taken\_DB\_Course 🡸 π eID ( All\_DB\_Course\_cIDs **J** cID = cID (Takes))

EIDs\_Taken\_NW\_Course 🡸 π eID ( All\_NW\_Course\_cIDs **J** cID = cID (Takes))

EIDs\_DB\_And\_NW\_Course 🡸 EIDs\_Taken\_DB\_Course ∩ EIDs\_Taken\_NW\_Course

Result 🡸 π eID, eFirst, eLast, eTitle (EIDs\_DB\_And\_NW\_Course **J** eID = eID (Employee))

6) All\_eIDs 🡸 π eID (Employee)

All\_eIDs\_Taken\_Course 🡸 π eID (Takes)

All\_eIDs\_Not\_Taken\_Course 🡸 All\_eIDs – All\_eIDs\_Taken\_Course

Result 🡸 π eID, eFirst, eLast, eTitle (All\_eIDs\_Not\_Taken\_Course **J** eID = eID (Employee))

7) Takes\_Copy 🡸 π eID2, cID2 ρ(eID2, cID2) (Takes)

Takes\_Cross\_Takes\_Copy 🡸 Takes x Takes\_Copy

EIDs\_Diff\_Courses 🡸 π eID (σ eID = eID2 AND cID <> cID2 (Takes\_Cross\_Takes\_Copy))

Result 🡸 π eID, eFirst, eLast, eTitle (EIDs\_Diff\_Courses **J** eID = eID (Employee)

8) CIDs\_With\_Titles 🡸 π cID, aTitle ( Training\_Course **J** areaID = aID (Technology\_Area))

EIDs\_Takes\_Course 🡸 π eID, aTitle (CIDs\_With\_Titles \* Takes)

EIDs\_Takes\_Course\_Copy 🡸 π eID2, aTitle2 ρ(eID2, aTitle2) (EIDs\_Takes\_Course)

EIDs\_Takes\_Cross 🡸 EIDs\_Takes\_Course x EIDs\_Takes\_Course\_Copy

EIDs\_1+\_Area 🡸 π eID (σ eID = eID2, aTitle <> aTitle2 (EIDs\_Takes\_Cross))

Result 🡸 π eID, eFirst, eLast, eTitle (EIDs\_1+\_Area **J** eID = eID (Employee))

9) Lowest\_Salary 🡸 ϝ Min(Salary) (Employee)

Result 🡸 Lowest\_Salary **J** MIN\_Salary = Salary (Employee)

10) All\_Internet\_aIDs 🡸 π aID (σ aTitle = 'Internet' (Technology\_Area))

All\_Internet\_cIDs 🡸 π cID ( All\_Internet\_aIDs **J** aID = aID (Training\_Course))

EIDs\_Takes\_CIDs 🡸 π eID, cID (Takes)

EIDs\_Taken\_All\_Internet 🡸 EIDs\_Takes\_CIDs ÷ All\_Internet\_cIDs

Resut 🡸 π eID, eFirst, eLast, eTitle ( EIDs\_Taken\_All\_Internet **J** eID = eID (Employee))

11) All\_EIDs 🡸 π eID (Employee)

All\_Internet\_aIDs 🡸 π aID (σ aTitle = 'Internet' (Technology\_Area))

All\_Internet\_cIDs 🡸 π cID ( All\_Internet\_aIDs **J** aID = aID (Training\_Course))

All\_Combos 🡸 All\_EIDs x All\_Internet\_cIDs

EIDs\_Takes\_CIDs 🡸 π eID, cID (Takes)

Diff 🡸 All\_Combos – EIDs\_Takes\_CIDs

Matches 🡸 π eID (EIDs\_Takes\_CIDs – Diff)

Result 🡸 π eID, eFirst, eLast, eTitle ( Matches **J** eID = eID (Employee))

12) All\_EIDs\_All\_CIDs 🡸 π eID, cID (Takes)

EIDs\_Join\_Course 🡸 π eID, areaID (All\_EIDs\_All\_CIDs **J** cID = cID (Training\_Course))

Tech\_Area\_Join\_EIDs 🡸 π eID, aID, aTitle (EIDs\_Join\_Course **J** areaID = aID (Technology\_Area))

Count\_EIDs\_Per\_Area 🡸 ( aTitle ϝ Count(eID) (Tech\_Area\_Join\_EIDs )

COUNT\_RESULT 🡸 π TechAreaID, Title, Total\_Enrolles ρ(eID, TechAreaID, Title, Total\_Enrollees) (Count\_EIDs\_Per\_Area)

13) All\_Leaders 🡸 π eID, aID (Employee **J** eID = aLeadID (Technology\_Area)

All\_Course\_Title 🡸 π aID, aTitle, cID (Technology\_Area **J** aID = areaID (Training\_Course))

EIDs\_Taken\_Courses\_Titles 🡸 π eID, aTitle (Takes **LOJ** cID = cID (All\_Course\_Title))

Result 🡸 π eFirst, eLast, aTitle (EIDs\_Taken\_Courses\_Titles **J** eID = eID (Employee))

**Relational Calculus**

1) { ***c***.cID, ***c***.cTitle, ***c.***cHours | **TRAINING\_COURSE**(**c**)and (∃***a***)( **TECHNOLOGY \_AREA**(**a**) and ***c***.areaID = ***a***.aID) }

2) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***c***)(**TAKES**(***c***) and ***c***.eID = ***e***.eID and (∃***c***)**TRAINING\_COURSE**(**c**) ***c***.areaID = ***a***.aID and (∃***a***)( **TECHNOLOGY \_AREA**(**a**) and aTitle = ‘Databases’) }

3) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***c***)(**TAKES**(***c***) and ***c***.eID = ***e***.eID and (∃***c***)**TRAINING\_COURSE**(**c**) ***c***.areaID = ***a***.aID and (∃***a***)( **TECHNOLOGY \_AREA**(**a**) and ***a***.aTitle = ‘Databases’ or ***a***.aTitle = ‘Networks’ ) }

4) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***t***)(**TAKES**(***t***) and ***t***.eID = ***e***.eID and (∃***c***) (∃***a***) (**TRAINING\_COURSE**(***c***) and **TECHNOLOGY\_AREA**(***a***) and ***c***.areaID = ***a****.*aID and ***a***.aTitle = ‘Databases’) and (∃***c2***) (∃***a2***) (**TRAINING\_COURSE**(***c2***) and **TECHNOLOGY\_AREA**(***a2***) and ***c***.areaID = ***a****.*aID and NOT (***a***.aTitle = ‘Networks’) }

5) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***t***)(**TAKES**(***t***) and ***t***.eID = ***e***.eID and (∃***c***) (∃***a***) (**TRAINING\_COURSE**(***c***) and **TECHNOLOGY\_AREA**(***a***) and ***c***.areaID = ***a****.*aID and ***a***.aTitle = ‘Databases’) and (∃***c2***) (∃***a2***) (**TRAINING\_COURSE**(***c2***) and **TECHNOLOGY\_AREA**(***a2***) and ***c***.areaID = ***a****.*aID and (***a***.aTitle = ‘Networks’)) }

6) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***t***)(**TAKES**(***t***) and NOT (***e***.eID = ***t***.eID) ) }

7) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and NOT (∀***t***)(NOT **TAKES**(***t***) and (***e***.eID = ***t***.eID) ) }

8) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***t***)(**TAKES**(***t***) and ***t***.eID = ***e***.eID and (∃***c***) (**TRAINING\_COURSE**(***c***) and (∃***c2***) (**TRAINING\_COURSE**(***c2***) and NOT (***c***.cID = ***c1***.cID)) }

9) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∃***t***)(**TAKES**(***t***) and ***t***.eID = ***e***.eID and (∃***c***) (∃***a***) (**TRAINING\_COURSE**(***c***) and **TECHNOLOGY\_AREA**(***a***) and ***c***.areaID = ***a****.*aID) and (∃***c2***) (∃***a2***) (**TRAINING\_COURSE**(***c2***) and **TECHNOLOGY\_AREA**(***a2***) and ***c***.areaID = ***a****.*aID and NOT (***a***.aTitle = ***a1***.aTitle) }

10) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (∀***t***)( ∃ ***c***)( ∃ ***a***)(NOT **TAKES**(***t***) or NOT ( **TECHNOLOGY\_AREA**(***a***) and ***a***.aTitle = ‘Internet’ ) OR (**TRAINING\_COURSE**(***c***) and ***t***.cID = ***c***.cID and ***a***.aID = ***c***.areaID ))}

11) { ***e***.eID, ***e***.eFirst, ***e***.eLast, ***e***.eTitle | **EMPLOYEE**(***e***) and (NOT(∃***t***))( ∃ ***c***)( ∃ ***a***)( **TAKES**(***t***) and ( **TECHNOLOGY\_AREA**(***a***) and ***a***.aTitle = ‘Internet’ ) and NOT (**TRAINING\_COURSE**(***c***) and ***t***.cID = ***c***.cID and ***a***.aID = ***c***.areaID ))}

12) { e | **EMPLOYEE**(***e***) and (∃***t***) (∃***a***) (∃***c***)( **TAKES**(***t***) and **TRAINING\_COURSE**(***c***) and **TECHNOLOGY\_AREA**(***a***) and ***t***.cID = ***c***.cID and ***c***.areaID = ***a***.aID and ***e***.eID = ***a***.aLeadID ) }