CSCI 403 - Database Management
Project 6 - Relational Algebra Problems

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Problem 1: Consider the relation shown in figure 1, named *album*. What relation results from each of the following expressions?

(a) $\pi_{artist}(album)$

artist
U2
Jethro Tull
Kansas

(b) $\sigma_{year=1980}(album)$

artist	**title**	**year**
U2	Boy	1980
Kansas	Audio-Visions	1980
Jethro Tull	A	1980

(c) $\pi_{artist}(\sigma_{year>1985}(album))$

artist
U2
Jethro Tull

Problem 2: Consider the relation shown in figure 2, named *members*, as well as the *album* relation from figure 1. What relation results from each of the following expressions or sequences?

(a) $\pi_{artist,member}(\sigma_{title='Boy'}(album * members))$

artist	**member**
U2	The Edge
U2	Bono
U2	Adam Clayton
U2	Larry Mullen Jr.

(b) $\pi_{artist,member}(\sigma_{title='Boy'}(album) * members)$

artist	member
U2	The Edge
U2	Bono
U2	Adam Clayton
U2	Larry Mullen, Jr.

(c) $R1 = \sigma_{title='A'}(album)$
$R2 = \pi_{year}(R1)$
$R3 = R2 \bowtie_{year=begin\_year} members$
$\pi_{artist,member}(R3)$

artist	member
Jethro Tull	Mark Craney
Jethro Tull	Eddie Jobson

(d) $R1 = \sigma_{member='Bono'}(members)$
$R2 = \rho_{(a,m,y)}(R1)$
$R3 = members \bowtie_{artist=a} R2$
$\pi_{member}(R3)$

member
The Edge
Bono
Adam Clayton
Larry Mullen, Jr.

Problem 3: Considering the relations in figures 1 and 2, which of the following algebraic expressions is valid?

(a) $\pi_{title}(\sigma_{year=1980}(album))$ valid ✓

(b) $\sigma_{year=1980}(\pi_{title}(album))$ invalid ✗

(c) $\sigma_{foo='blah'}(members)$ invalid ✗

(d) $\sigma_{foo='blah'}(\rho_{(foo,bar,baz)}(members))$ valid ✓

Problem 4: Considering the relations in figures 1 and 2, which of the following algebraic expressions pairs are equivalent?

(a) $\pi_{member,begin\_year}(\sigma_{begin\_year=1980(members)})$ and $\sigma_{begin\_year=1980}(\pi_{member,begin\_year}(members))$
Equivalent ✓

(b) $\sigma_{year=1980}(\sigma_{artist='U2'}(album))$ and $\sigma_{artist='U2'}(\sigma_{year=1980}(album))$
Equivalent ✓

(c) $\pi_{(artist,title,member,year)}(\sigma_{artist=group}(album \times \rho_{(group,member,begin\_year)}(members)))$ and $\pi_{(artist,title,member,year)}(album * members)$
Equivalent ✓

artist	title	year
U2	Wide Awake in America	1985
Jethro Tull	Rock Island	1989
U2	Boy	1980
Jethro Tull	The Broadsword and the Beast	1982
U2	War	1983
Kansas	Audio-Visions	1980
U2	Rattle and Hum	1988
Jethro Tull	A	1980
Jethro Tull	Under Wraps	1984
Jethro Tull	Crest of a Knave	1987

Figure 1: The relation *album*

artist	member	begin_year
U2	The Edge	
U2	Bono	
Jethro Tull	Ian Anderson	1967
Kansas	Steve Walsh	
U2	Adam Clayton	
Kansas	Phil Ehart	
Jethro Tull	Barriemore Barlow	1971
Kansas	Dave Hope	
Kansas	Billy Greer	
Jethro Tull	Mark Craney	1980
Jethro Tull	Eddie Jobson	1980
Jethro Tull	Dee Palmer	1976
Kansas	Robby Steinhardt	
Jethro Tull	Martin Barre	1968
U2	Larry Mullen, Jr.	
Jethro Tull	John Evan	1970
Kansas	Kerry Livgren	
Jethro Tull	Dave Pegg	1979
Kansas	Richard Williams	

Figure 2: The relation *members*