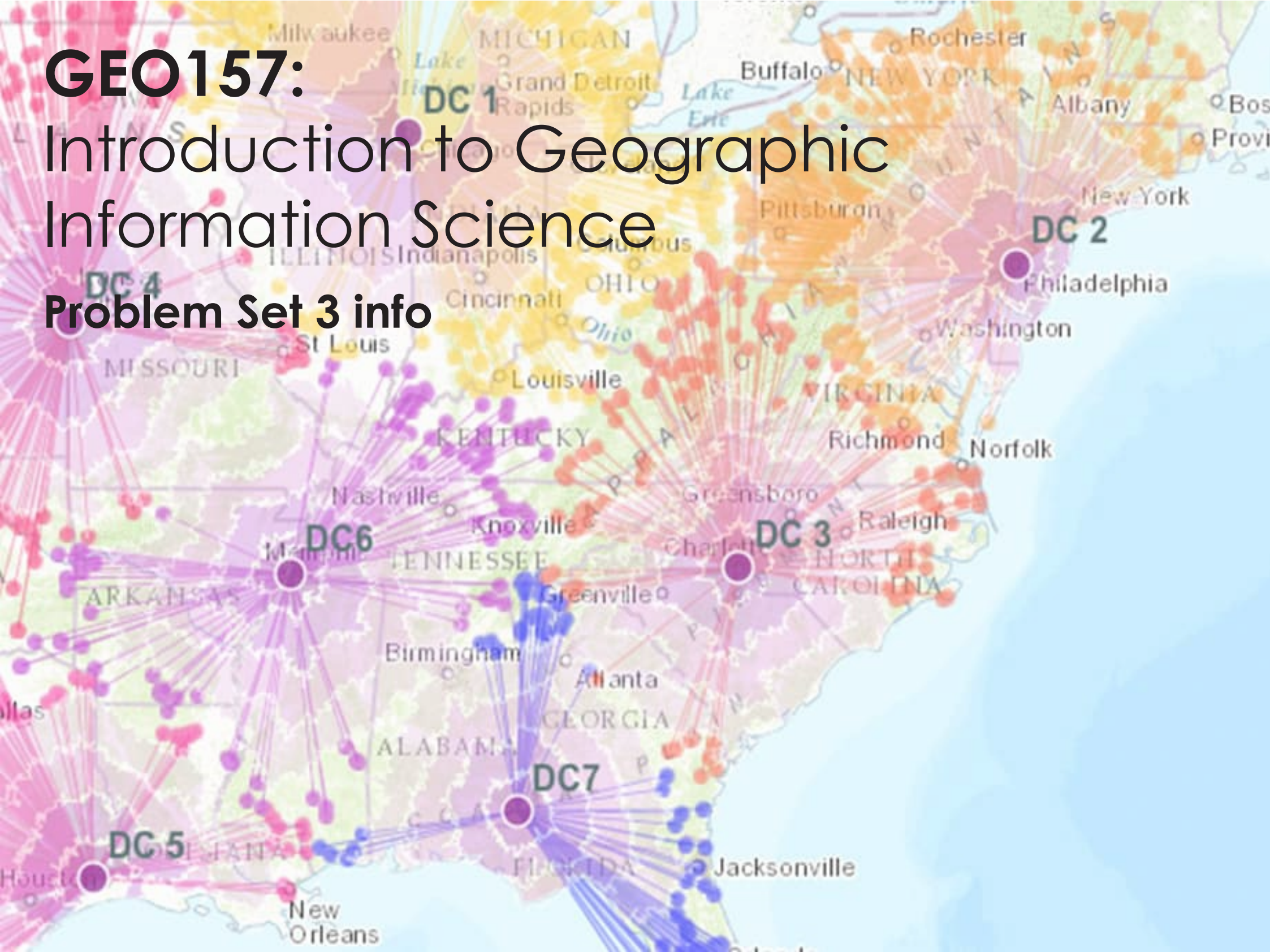


GEO157:

Introduction to Geographic Information Science

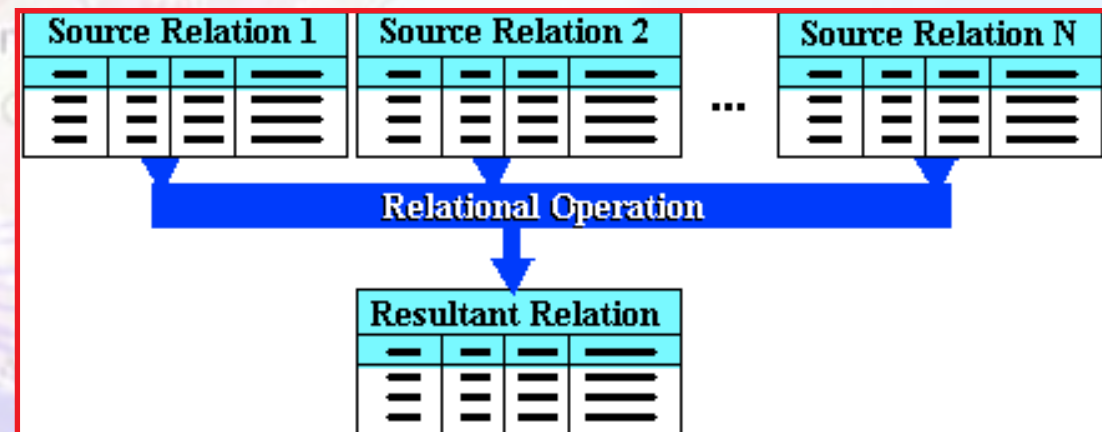
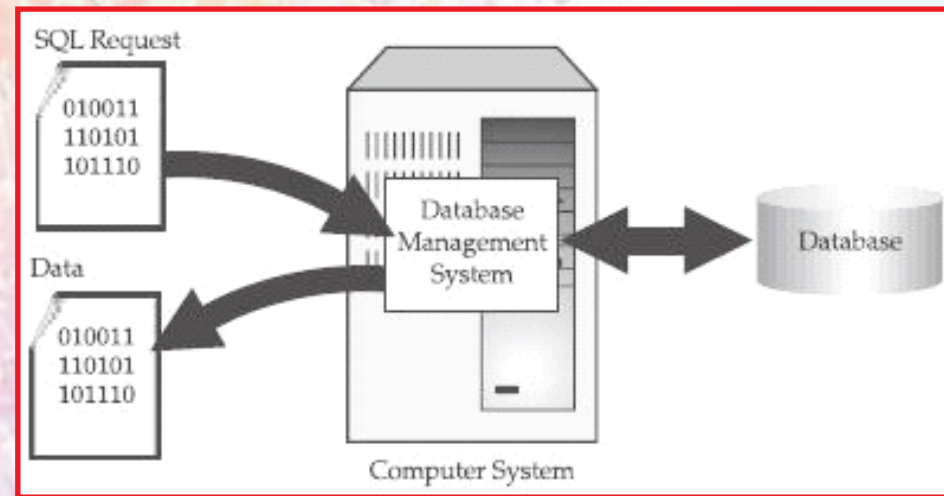
Problem Set 3 info



Relational Algebra

- Takes relations (tables) as input and returns relations as output. Use tables to create tables.
- Relational algebra allows us to QUERY a database:
 - Restrict
 - Project
 - Union
 - Intersection
 - Difference
 - Product
 - Join
 - Divide

(The above can be combined to make queries and select specific records and items in a database.)



Relational Algebra

a) union

ID	type	color	size	age
1	a	blue	big	old
6	g	dun	huge	young

ID	type	color	size	age
2	c	green	big	young
4	d	black	big	older

union

ID	type	color	size	age
1	a	blue	big	old
4	d	black	big	older
6	g	dun	huge	young
2	c	green	big	young

b) intersect

ID	color	size
1	blue	big
2	green	big
3	red	small
4	black	big
5	mauve	tiny
6	dun	huge
7	ecru	small

ID	color	size
1	blue	big
5	mauve	tiny
9	ivory	big

intersect

ID	color	size
1	blue	big
5	mauve	tiny

c) difference

ID	color	size
1	blue	big
2	green	big
3	red	small
4	black	big
5	mauve	tiny
6	dun	huge
7	ecru	small

ID	color	size
1	blue	big
5	mauve	tiny
9	ivory	big

difference

ID	color	size
2	green	big
3	red	small
4	black	big
6	dun	huge
7	ecru	small

d) join

ID	type
1	a
2	b
3	b
4	a

type	color	size	age
a	blue	big	old
b	dun	tiny	old

join

ID	type	color	size	age
1	a	blue	big	old
2	b	dun	tiny	old
3	b	dun	tiny	old
4	a	blue	big	old

- **Union** – combines tables to return records found in either or both tables
- **Intersection** – returns records that occur in both input tables
- **Difference** – Returns records that are in the first, but not the second table (order of tables matters!)
- **Join** – combines two tables through values in keys. Values in one or more keys are matched across tables

Relational Algebra

a) restrict

ID	type	color	size	age
1	a	blue	big	old
2	c	green	big	young
3	a	red	small	mid
4	d	black	big	older
5	x	mauve	tiny	oldest
6	g	dun	huge	young
7	c	ecru	small	mid

restrict →

ID	type	color	size	age
1	a	blue	big	old
4	d	black	big	older
6	g	dun	huge	young
2	c	green	big	young

b) project

ID	type	color	size	age
1	a	blue	big	old
2	c	green	big	young
3	a	red	small	mid
4	d	black	big	older
5	x	mauve	tiny	oldest
6	g	dun	huge	young
7	c	ecru	small	mid

project →

ID	color	size
1	blue	big
2	green	big
3	red	small
4	black	big
5	mauve	tiny
6	dun	huge
7	ecru	small

c) product

No.	Dir.
1	N
2	S

product

App.
Yes
Yes
No

→

No.	Dir.	App.
1	N	Yes
2	S	Yes
1	N	No
2	S	No

d) divide

type
m
n
r

divide by

size
1
2

per

type	size
m	1
m	2
m	3
m	4
n	2
r	1
r	3

→

type
m

- **Restrict** – operation that often returns a reduced set of rows
- **Project** – return entire columns, subsetting a table
- **Product** – combines all unique values in one table with the values from another creating a larger table
- **Divide** – relational divide where one table is divided by another in relation to a third

Relational Tables Examples (i)

Forests

Forest Name	Forest-ID	Location	Size
Nantahala	1	N. Carolina	184,447
Cherokee	2	N. Carolina	92,271

Trails

Trail Name	Forest-ID
Bryson's Knob	1
Slickrock Falls	2
North Fork	1
Cade's Cove	1
Cade's Cove	2
Appalachian	1
Appalachian	2

Recreational features

Feature	Description	Activity 1	Activity 2
Wfall	Waterfall	Photography	Swimming
Ogrth	Old-Growth Forest	Photography	Hiking
Vista	Scenic Overlook	Photography	Viewing
Wlife	Wildlife Viewing	Photography	Birding
Cmp	Camping	Camping	-

Characteristics

Trail Name	Feature	Difficulty
Bryson's Knob	Vista	E,M
Bryson's Knob	Ogrth	E,M
Slickrock Falls	Ogrth	M
Slickrock Falls	Wfall	M
North Fork	-	M
Cade's Cove	Ogrth	E
Cade's Cove	Wlife	E
Appalachian	Wfall	M,D
Appalachian	Ogrth	M,D
Appalachian	Vista	M,D
Appalachian	Wlife	M,D
Appalachian	Cmp	M,D

Relational Tables Examples (ii)

Forests

Forest Name	Forest-ID	Location	Size
Nantahala	1	N. Carolina	184,447
Cherokee	2	N. Carolina	92,271

Trails

Trail Name	Forest-ID
Bryson's Knob	1
Slickrock Falls	2
North Fork	1
Cade's Cove	1
Cade's Cove	2
Appalachian	1
Appalachian	2

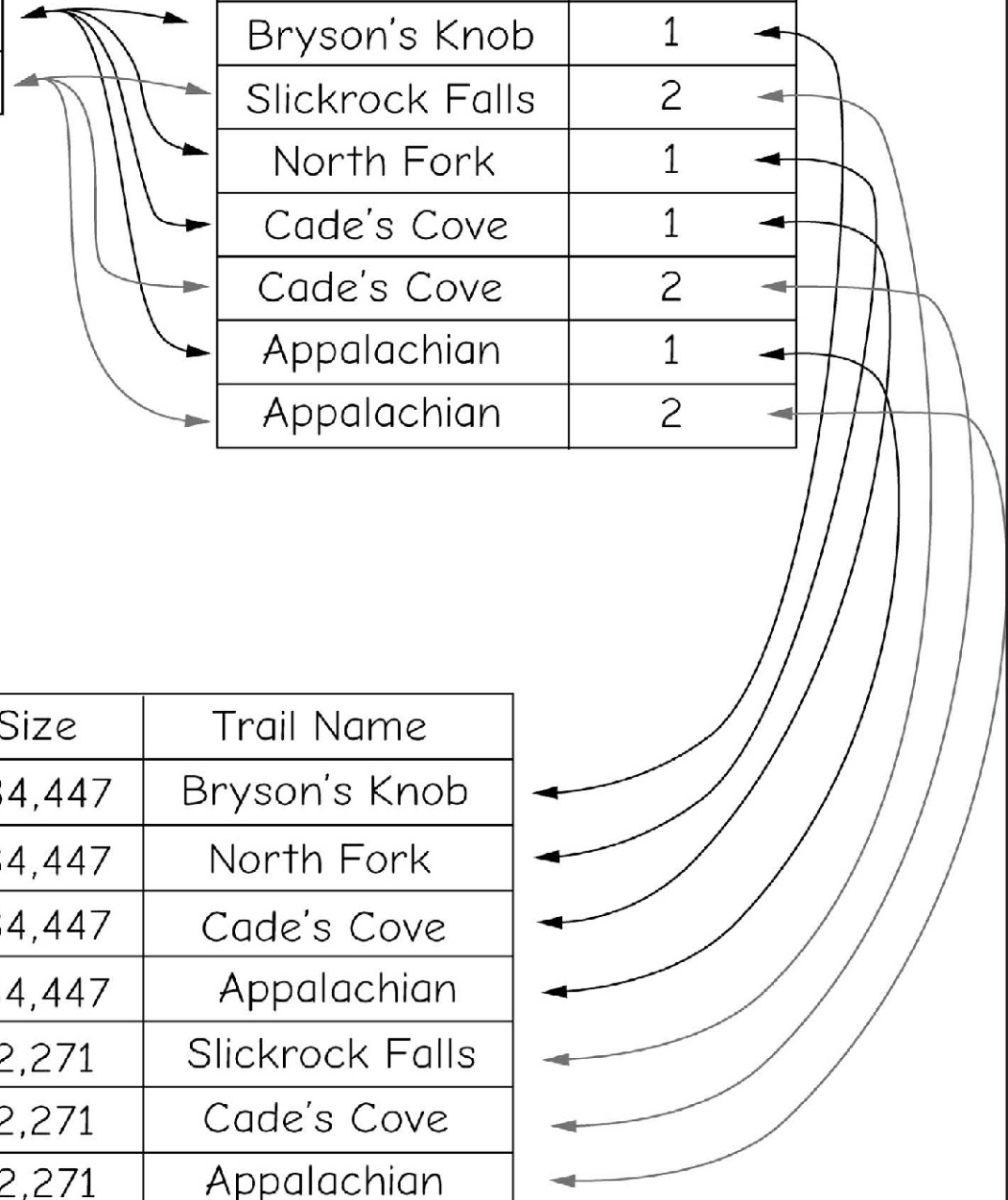


Table from Relational Join

Forest Name	Forest-ID	Location	Size	Trail Name
Nantahala	1	N. Carolina	184,447	Bryson's Knob
Nantahala	1	N. Carolina	184,447	North Fork
Nantahala	1	N. Carolina	184,447	Cade's Cove
Nantahala	1	N. Carolina	184,447	Appalachian
Cherokee	2	N. Carolina	92,271	Slickrock Falls
Cherokee	2	N. Carolina	92,271	Cade's Cove
Cherokee	2	N. Carolina	92,271	Appalachian