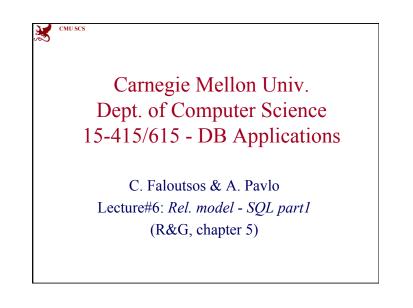
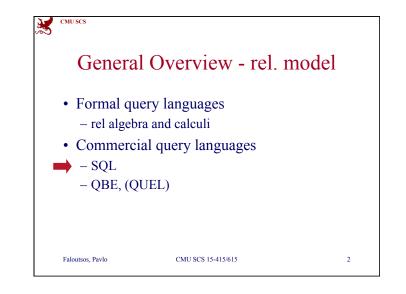
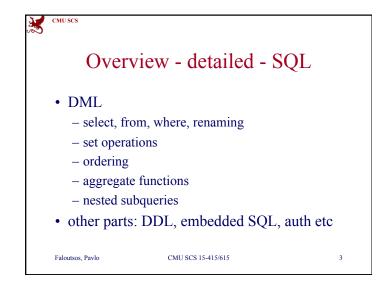
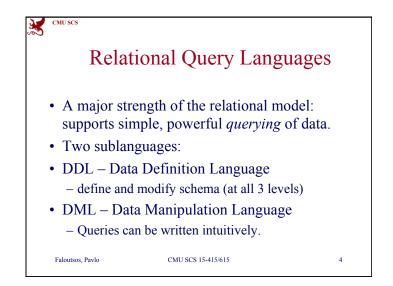
1

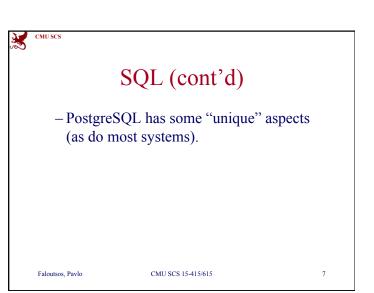


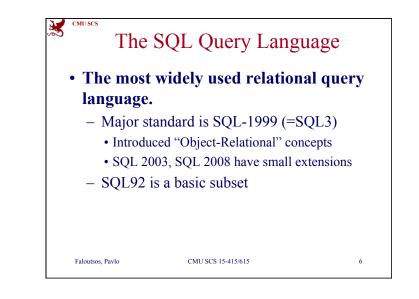






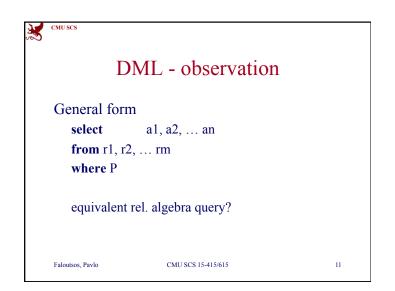






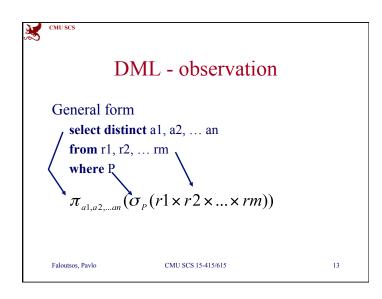
X	CMU SCS		
		DML	
	General form		
	select a1, a2,	an	
	from r1, r2, r	m	
	where P		
	[order by]		
	[group by]		
	[having]		
	Faloutsos, Pavlo	CMU SCS 15-415/615	8

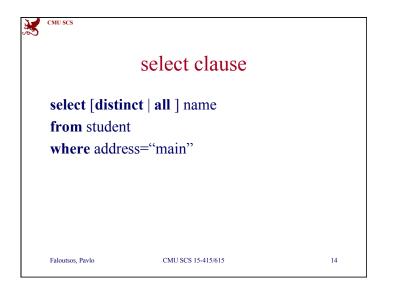
D		nder:	011#	М	ini T	I dh	
K	emn	ider.	our	IVI	IIII-(
STUDENT				C	LASS		
Ssn	Name	Add	Iress	c	-id	c-name	units
123	smith	mai	n str	1	5-413	s.e.	2
234	jones	fork	oes ave	1	5-412	0.S.	2
		TAKES					
		SSN	c-id	gra	de		
			15-413	A	ue		
			15-413	В	_		
				-			

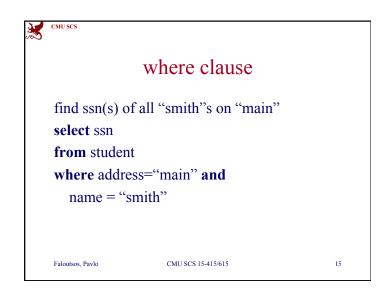


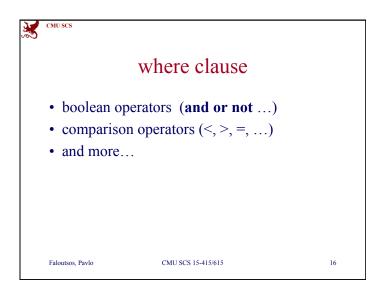
X	CMU SCS	
	DML - eg:	
	<pre>find the ssn(s) of everybody called "smith" select ssn from student where name="smith"</pre>	
	Faloutsos, Pavlo CMU SCS 15-415/615	10

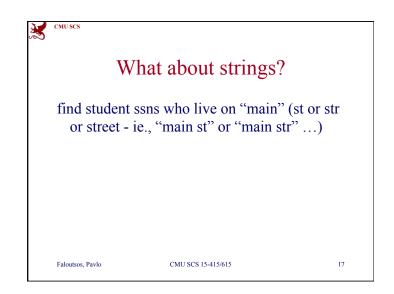
CMU SCS	
DML - observation	
General form	
select a1, a2, an	
from r1, r2, rm	
where P	
$\pi_{a1,a2,\ldots,an}(\sigma_{P}(r1 \times r2 \times \ldots \times rm))$	
Faloutsos, Pavlo CMU SCS 15-415/615	12



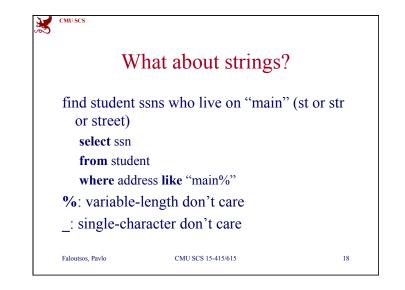


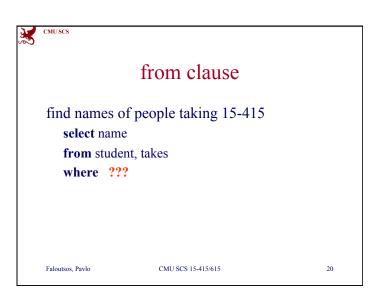


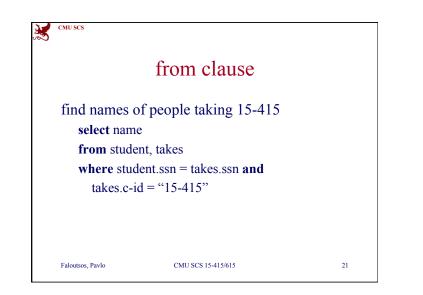


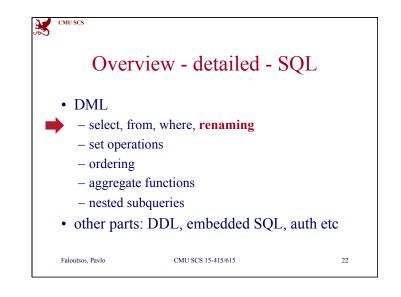


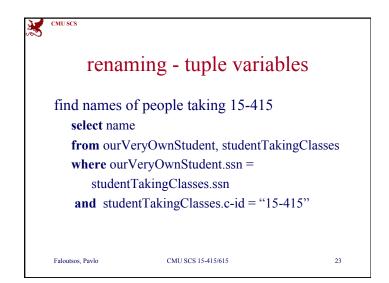
		C	-1			
		from	clat	ise		
find na	mes of	people t	akina	15_41	5	
IIIu IIa		people i	aking	, 13-41	5	
	1					
OTUDENT.						
STUDENT				CLASS		
STUDENT Ssn	Name	Addres	s	CLASS c-id	c-name	units
<u>Ssn</u>		Addres main st	-			
<u>Ssn</u> 123	Name		r	<u>c-id</u>	s.e.	2
<u>Ssn</u> 123	Name smith	main st forbes a	r ave	<u>c-id</u> 15-413	s.e.	2
<u>Ssn</u> 123	Name smith	main st forbes a	r ave	<u>c-id</u> 15-413 15-412	s.e.	
<u>Ssn</u> 123	Name smith	main st forbes a TAKES SSN	r ave	<u>c-id</u> 15-413 15-412 grade	s.e.	2



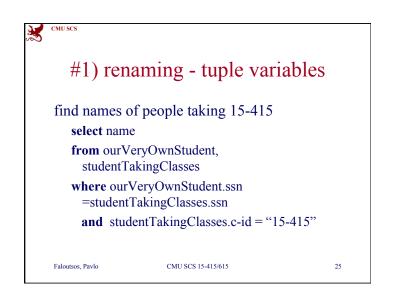


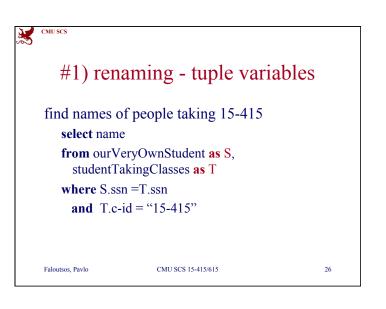


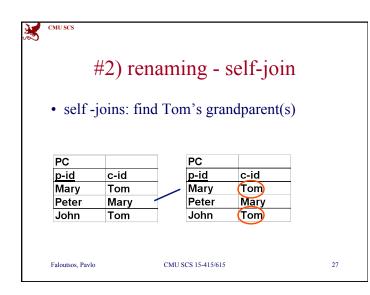


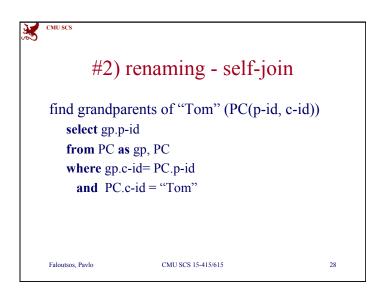


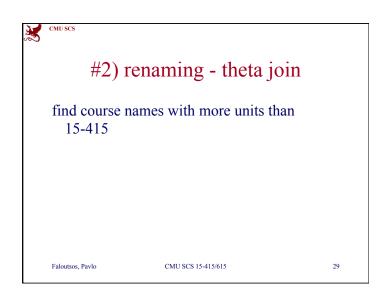


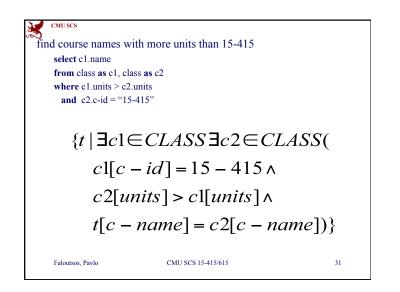


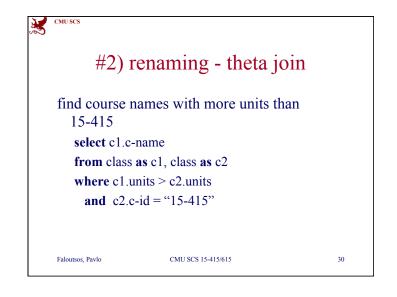


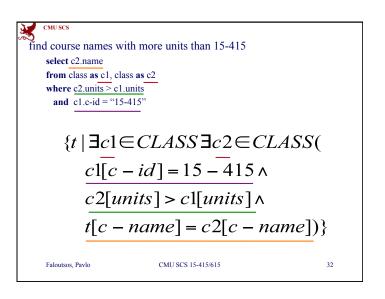


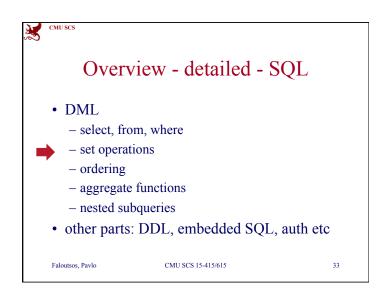


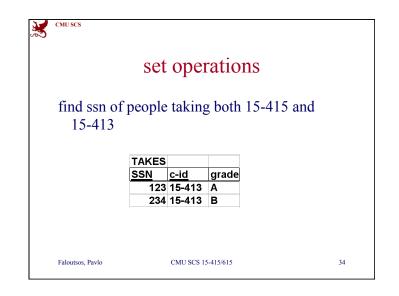




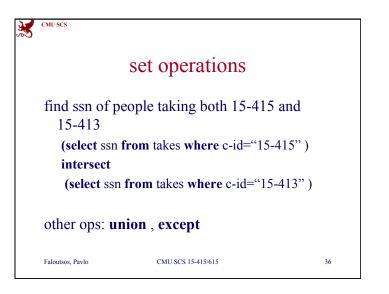


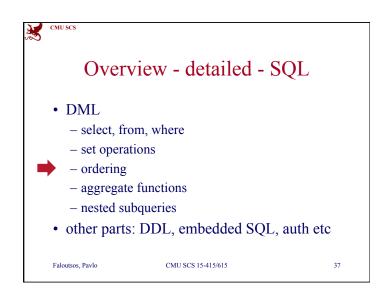


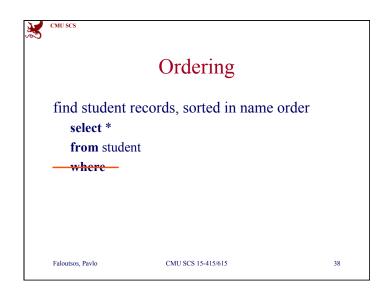


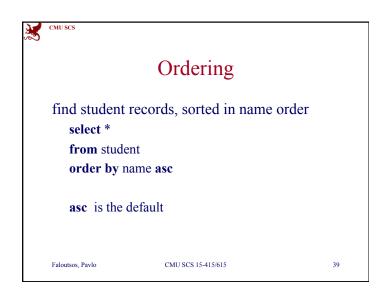


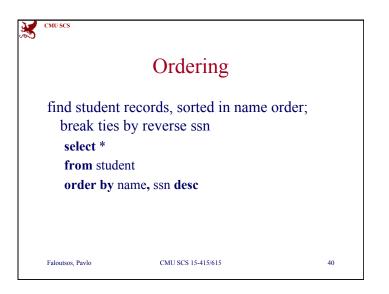


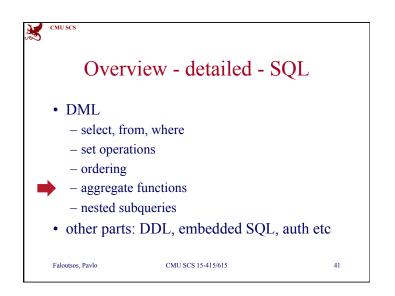


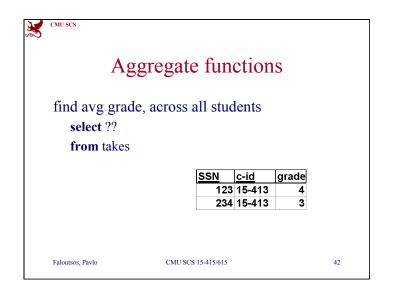


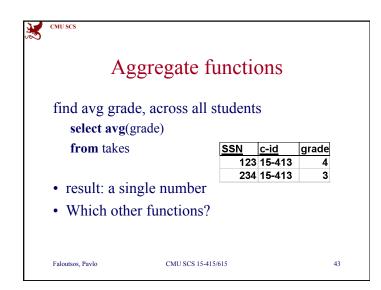


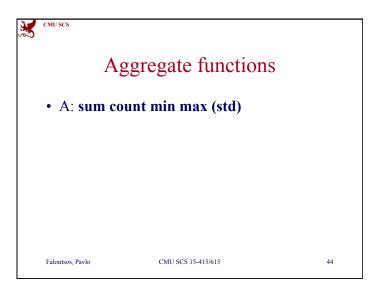




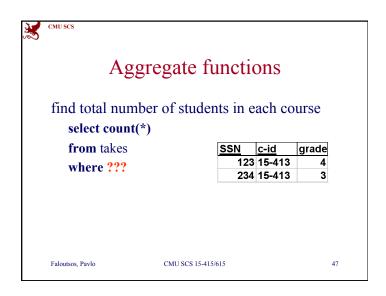




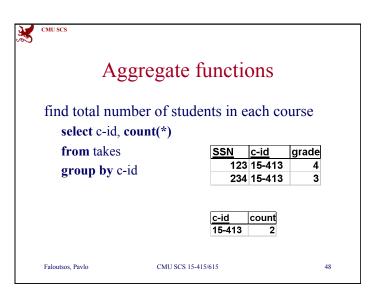




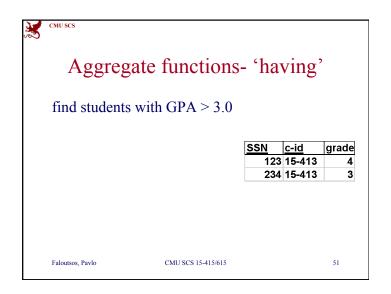
5	CMU SCS				
	Aggre	egate fu	inctio	ons	
	find total number select count(*)	of enroll	ments		
	from takes		SSN	c-id	grade
			123	15-413	4
			234	15-413	3



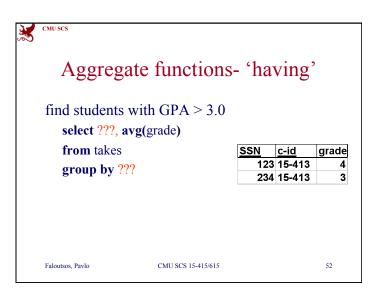
X	CMU SCS					
	Aggre	gate fi	inctio	ons		
	find total number <pre>select count(*)</pre>	of studer	nts in 1	5-415		
	from takes		SSN	c-id	grade	
	where c-id="15-	415"	123	15-413	4	
	where e la 15	110	234	15-413	3	
	Faloutsos, Pavlo	CMU SCS 15-415	/615			46



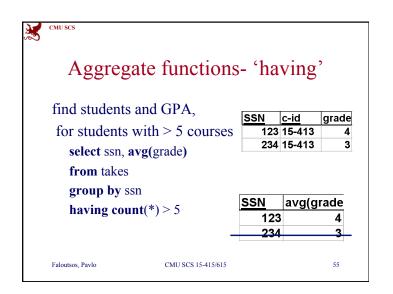
CMU SCS				
Ag	gregate fi	unctio	ons	
find total num select c-id, c		nts in e	ach co	ourse
from takes		SSN	c-id	grade
group by c-i	id		15-413	4
order by c-i		234	15-413	3
		c-id	count	
		15-413	2	



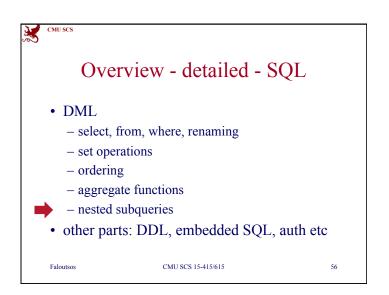
CMU SCS				
Aggreg	gate func	tions		
find total number of and <u>sort by coun</u>			course	2
select c-id, count((*) as pop	SSN	c-id	grade
from takes			15-413	4
		234	15-413	3
group by c-id				
group by c-id order by pop des		non	1	
.	c	pop 13 2]	
.	_ <u>c-id</u>]	



CMU SCS				
Aggrega	ate functions	s- 'ha	ving	,
find students	with GPA > 3.0			
		<u>SSN</u>	<u>c-id</u>	grade
select ssn, a	vg(grade)		15-413	4
from takes		234	15-413	3
group by ss	n			
???		SSN	avg(g	rade
		123	3	4
		234		3

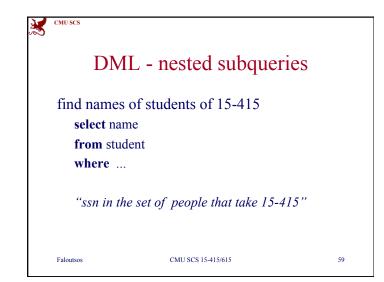


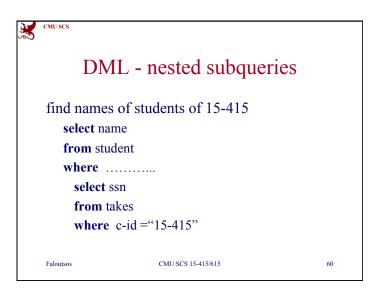
CMU SCS			
Aggregate functions	- 'ha	ving	,
<pre>find students with GPA > 3.0 select ssn, avg(grade) from takes group by ssn having avg(grade)>3.0</pre>		3	grade 4 3 grade 4 3
'having' <-> 'where' for groups	5		
Faloutsos, Pavlo CMU SCS 15-415/615			54

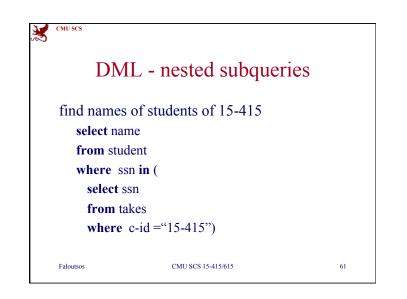


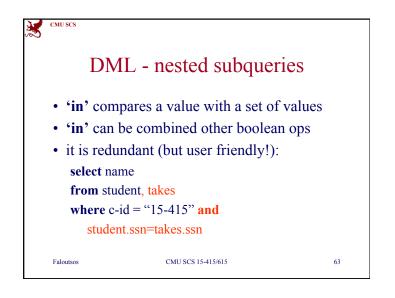
CMU SCS		
	DML	
General for	m	
select a1,	a2, an	
from r1, r	2, rm	
where P		
[order by]	
[group by	7]	
[having	.]	
Faloutsos	CMU SCS 15-415/615	57

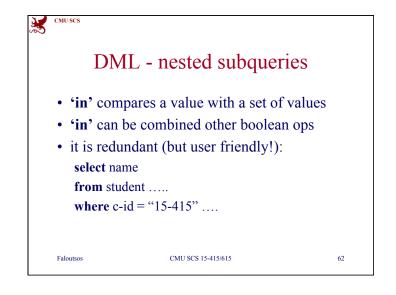
	IV	emi	nder	: our	IV.	lini-U	Jdb	
STUE						CLASS		
Ssn		Name	۸d	dress		cLASS c-id	c-name	units
<u>5311</u>	123	smith		in str		15-413		units
		jones		bes ave		15-412		
L		,						
			TAKES	5				
			SSN	<u>c-id</u>	gr	ade		
			123	3 15-413	Α			
			234	1 15-413	В			

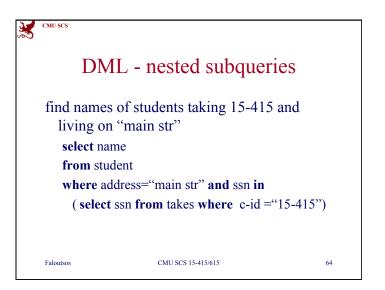


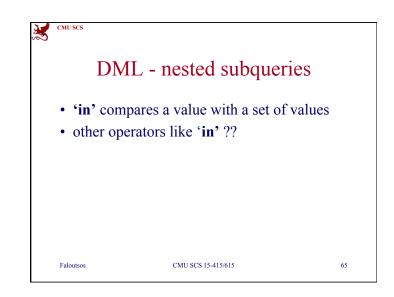


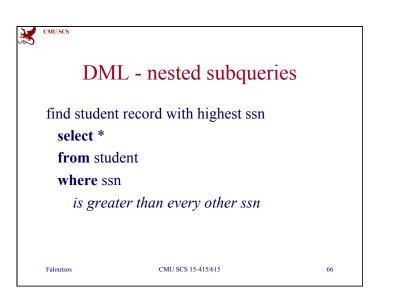


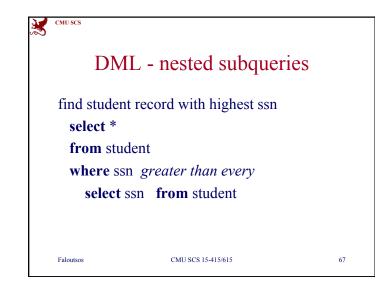


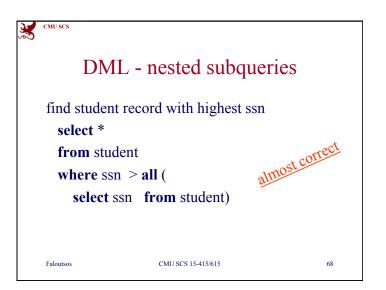


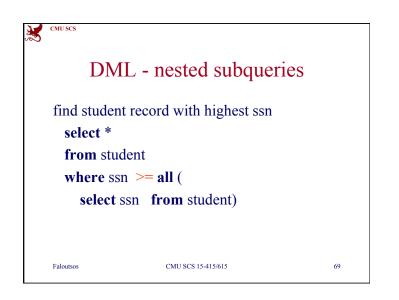


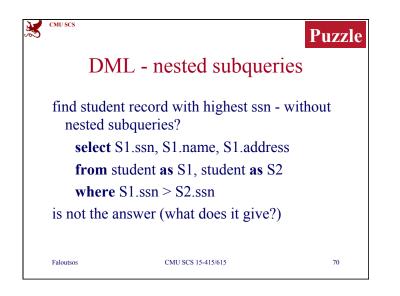




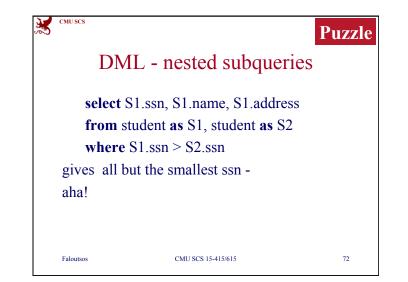


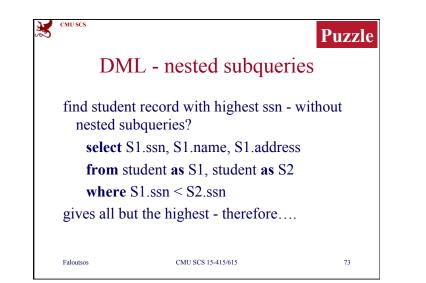


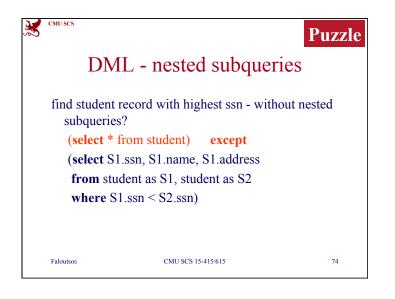


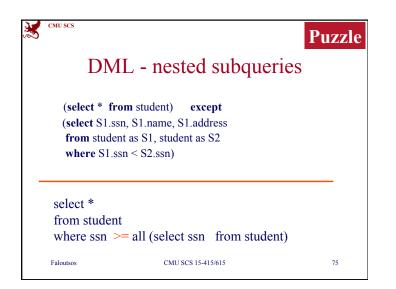


CMU SCS								P	uzzle
	DML	, - 1	neste	d	subq	u	eries		
S 1				S	2				
STUDENT				S	TUDENT				
<u>Ssn</u>	Name	Add	ress	S	sn	Name		Address	
123	smith	mai	n str		123	sn	nith	ma	in str
234	jones	forb	es ave		234	jones		forbes ave	
	S1 x	S2	<u>S1. ssr</u>		S2.ssn]
			1	23	1:	23			
			2	34	1:	23			
S1.ssn>S2.ssn			1		23	234			
			2	34	23	34			
Faloutsos			CMU SCS	15-41	5/615				71

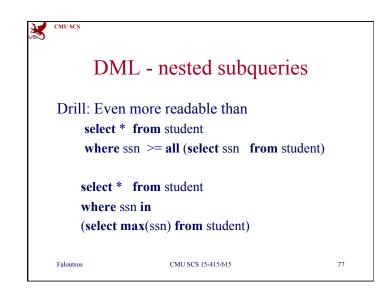


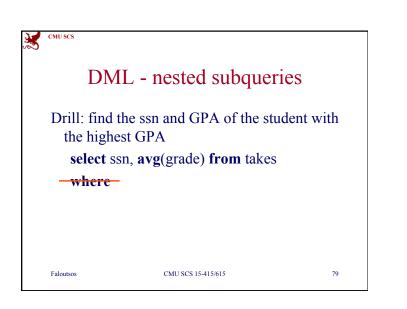




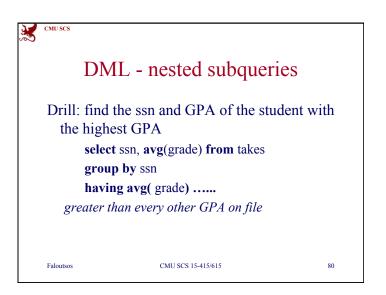


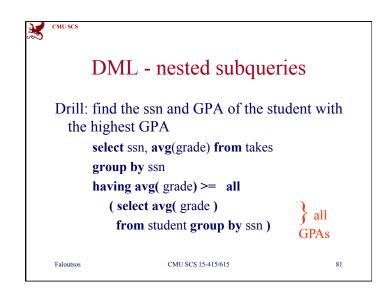


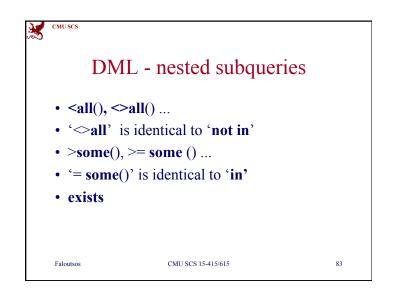


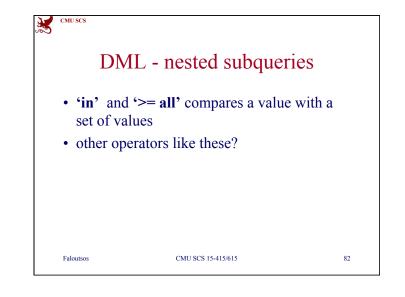


I	DML -	- nes	sted s	subar	ieries	
-				940 90		
Drill [.] f	ind the	ssn of	the st	ident w	vith the	
2	est GPA	0011 01		accent w	in the	
STUDENT				CLASS		
<u>Ssn</u>	Name	Addre	ess	c-id	c-name	units
123	smith	main	str	15-413	s.e.	2
234	jones	forbe	s ave	15-412	0.S.	2
			TAKES			
			SSN	c-id	grade	
			123	15-413	Α	
			234	15-413	В	
			U SCS 15-415/			78









	DM	[, - r	nested	l subo	merie	25	
					14011		
	for 'ex olled i		find all	l course	es that r	nobody	Į
-			class	with no	o tuples i	in 'take	s'
select	t c-id f		class	with no	o tuples i	in 'take	es'
select	t c-id f	rom c			o tuples i c-name		es '
select TAKES	t c-id f			CLASS	c-name		?s '
select TAKES SSN 123	t c-id f <u>c-id</u>	rom c grade		CLASS <u>c-id</u>	c-name s.e.		es '

