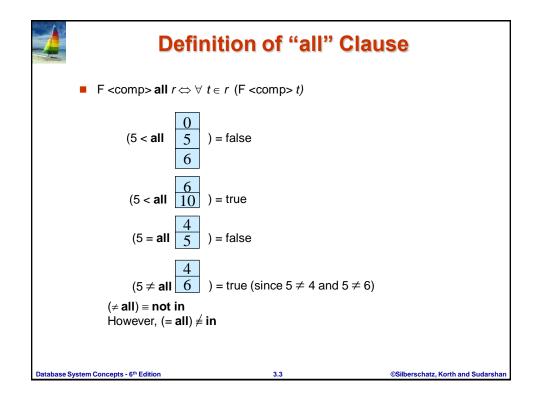
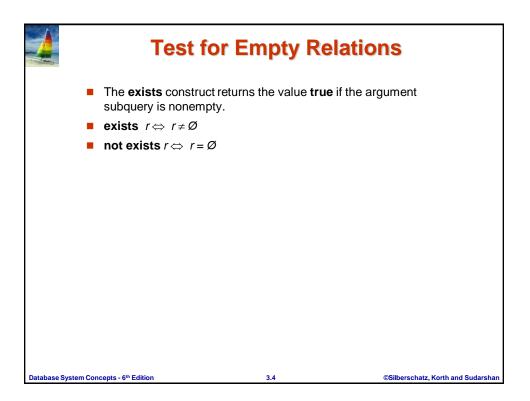
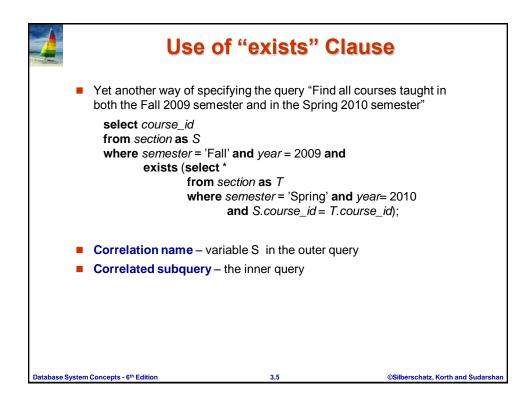
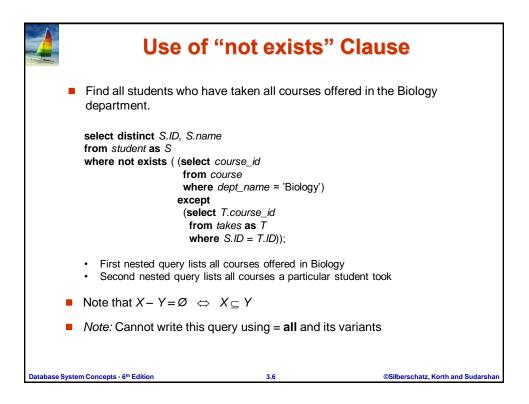


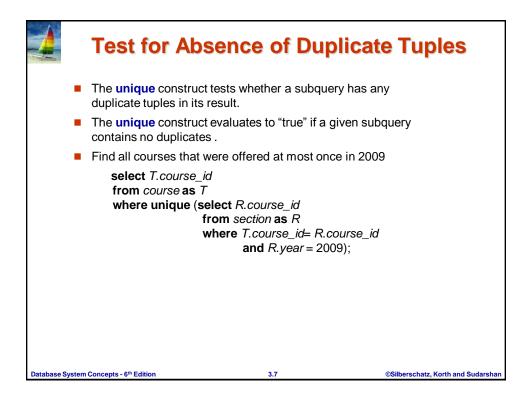
	Set Com	parison – "a	II" Clause
	 Find the names of all in salary of all instructors 		
	select name from instructor where salary > all	l (select salary from instructor where dept name = 'Bi	ology');
Database	System Concepts - 6 th Edition	3.2	©Silberschatz. Korth and Sudarshan

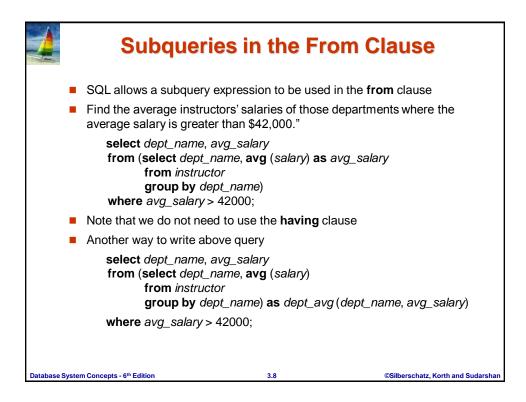


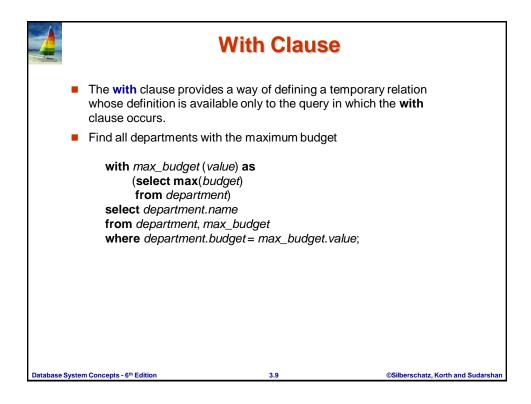


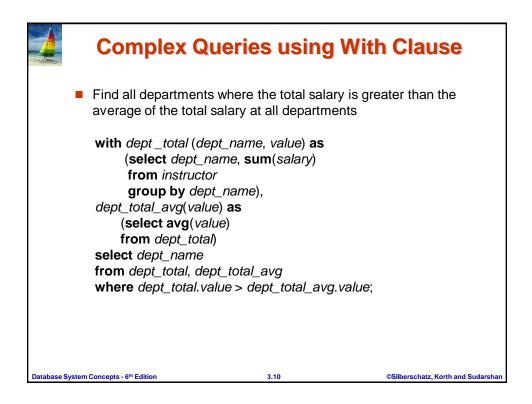


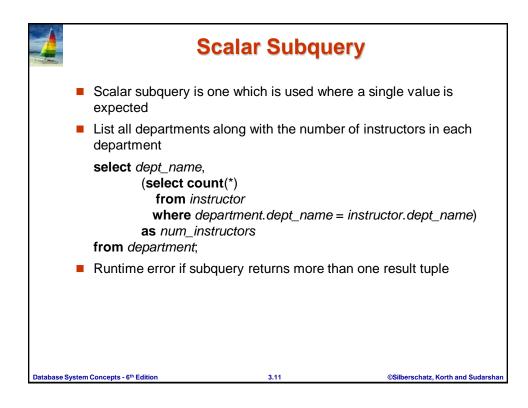


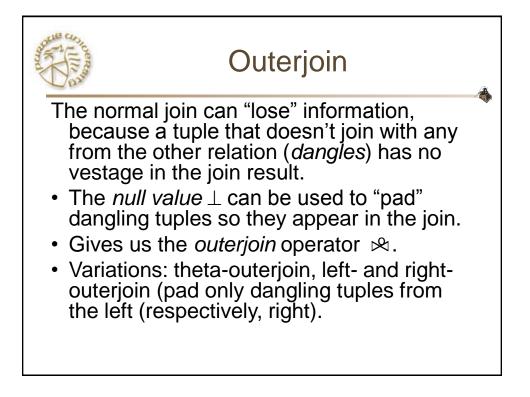












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上市に	12	-	

Join operations – Example

Relation course

course_id	title	dept_name	credits
BIO-301	Genetics	Biology	4
CS-190	Game Design	Comp. Sci.	4
	Robotics	Comp. Sci.	3

Relation prereq

course_id	prereq_id
BIO-301	BIO-101
CS-190	CS-101
CS-347	CS-101

Observe that

prereq information is missing for CS-315 and

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COURSE INFORMATION IS MISSING FOR CS-437

_	course natu	Left C	Juter J join prereq			
	course_id	title	dept_name	credits	prereq_id	
	BIO-301	Genetics	Biology	4	BIO-101	İ
	CS-190	Game Design		4	CS-101	
	CS-315	Robotics	Comp. Sci.	3	null	
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Right Outer Join

course natural right outer join prereq

course_id	title	dept_name	credits	prereq_id
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-347	null	null	null	CS-101

	Jo	ined F	Relations	
	in operations take other relation.	two relati	ons and return as a result	
	ese additional opera pressions in the fror		typically used as subquery	
			tuples in the two relations present in the result of the join.	
ma			in each relation that do not ation (based on the join	
Ja	oin types		Join Conditions	
iı	nner join		natural	
16	eft outer join		on < predicate>	
	ght outer join ull outer join		$\mathbf{using}(A_1, A_1, \dots, A_n)$	

4.17

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Full Outer Join

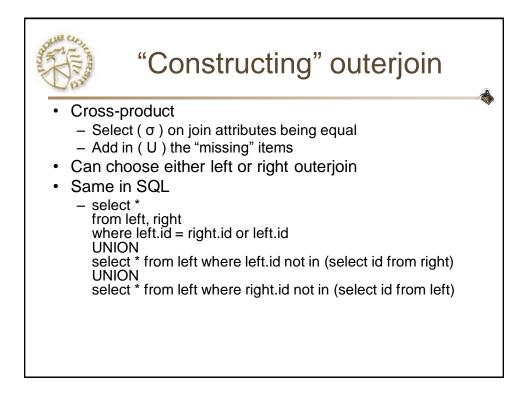
course natural full outer join prereq

course_id	title	dept_name	credits	prereq_id
	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-315	Robotics	Comp. Sci.	3	null
CS-347	null	null	null	CS-101

- Is outerjoin operation (🖄) fundamental?
- A. Yes, it is a fundamental relational operation
- B. No, it can be written using other relational operations

4.19

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		t.	a
	1		4
	1		
-			
1	4	-	2

Join operations – Example

Relation course

course_id	title	dept_name	credits
BIO-301	Genetics	Biology	4
CS-190	Game Design	Comp. Sci.	4
	Robotics	Comp. Sci.	3

Relation prereq

course_id	prereq_id
BIO-301	BIO-101
CS-190	CS-101
CS-347	CS-101

Observe that

prereq information is missing for CS-315 and

4.21

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course information is missing for CS-437 Database System Concepts - 6th Edition

		Jo	ined Re	lation	s – E	xamp	oles	
•			n er join prere urse_id = pre	•	_id			
		course_id	title	dept_name	credits	prereq_id	course_id	
	İ	BIO-301	Genetics	Biology	4	BIO-101	BIO-301	
		CS-190	Game Design		4	CS-101	CS-190	
	со	urse left	outer join pl	roroa on				
			irse_id = prer	•	id			
			• •	•	id credits	prereq_ia	course_id	
		urse.cou	ırse_id = prer	eq.course_ dept_name		prereq_id		
		urse.cou course_id	irse_id = prer	eq.course_ dept_name Biology	credits			
		course_id BIO-301	rrse_id = prer title Genetics	eq.course_ dept_name Biology	credits	BIO-101	BIO-301	
		<i>course_id</i> BIO-301 CS-190	rse_id = prer title Genetics Game Design	eq.course_ dept_name Biology Comp. Sci.	credits 4 4	BIO-101 CS-101	BIO-301 CS-190	



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Joined Relations – Examples

• course natural right outer join prereq

course_id	title	dept_name	credits	prereq_id
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-347	null	null	null	CS-101

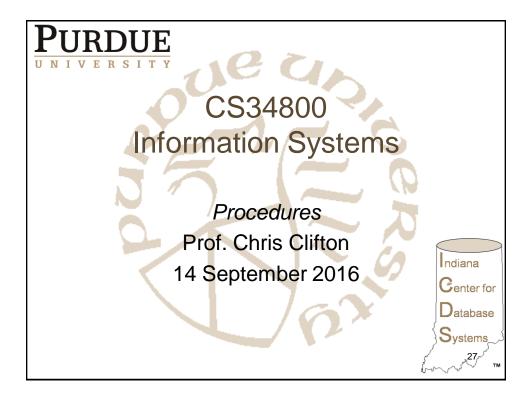
course full outer join prereq using (course_id)

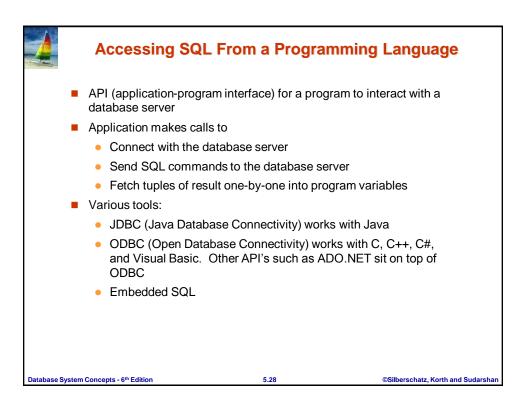
course_id	title	dept_name	credits	prereq_id
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-315	Robotics	Comp. Sci.	3	null
CS-347	null	null	null	CS-101

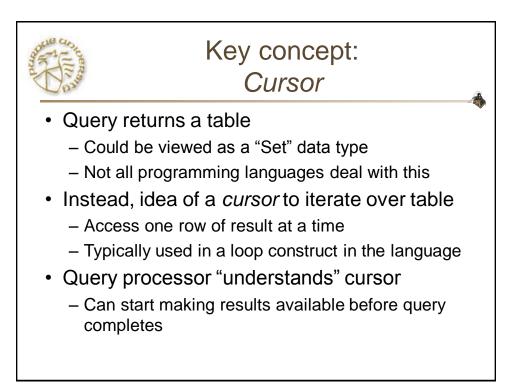
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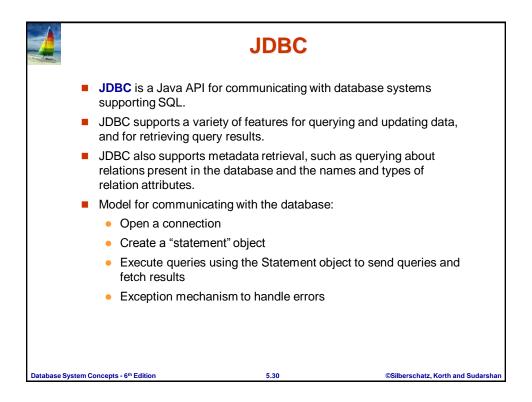
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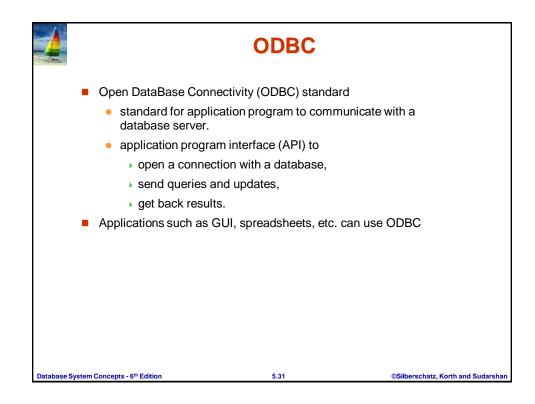
and the state	Extended ("Nonclassical") Relational Algebra	A		
Adds features needed for SQL, bags.				
1.	Duplicate-elimination operator δ .			
2.	Extended projection.			
3.	Sorting operator τ .	orting operator τ.		
4.	4. Grouping-and-aggregation operator γ .			
5.	Outerjoin operator 🔌 .			
1				

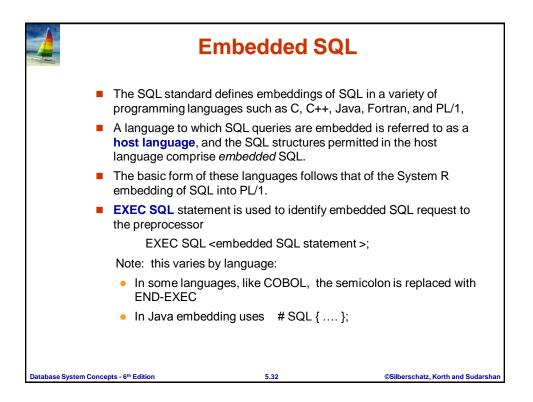


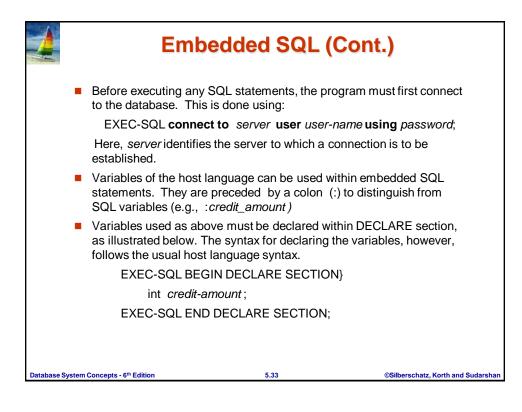


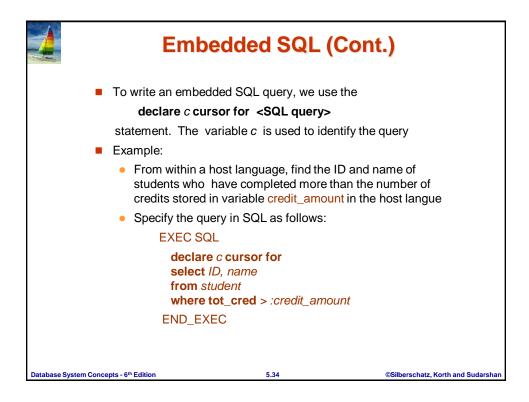


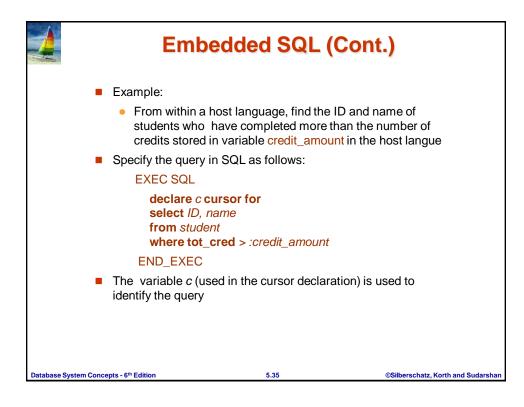


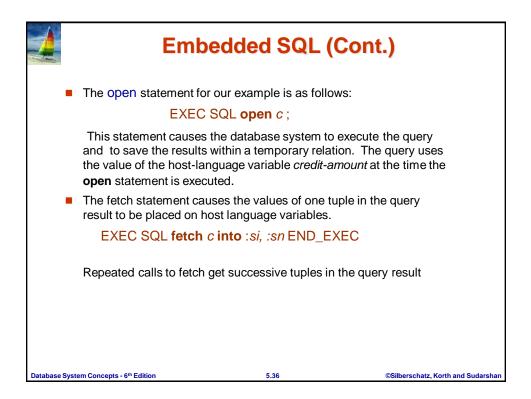


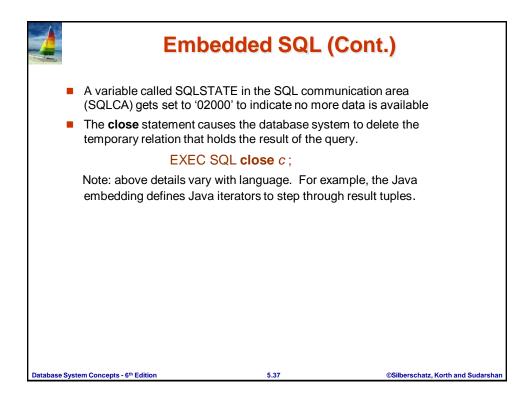


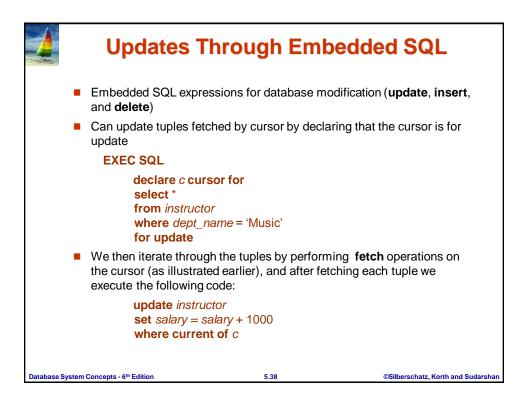


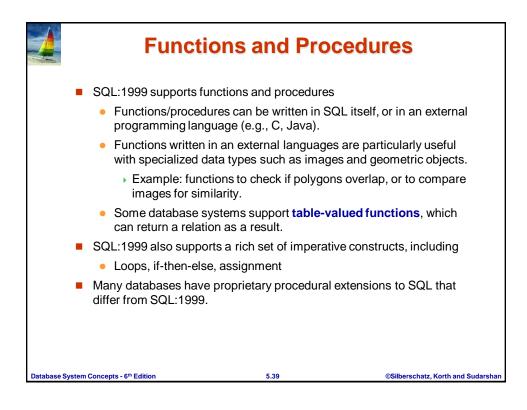


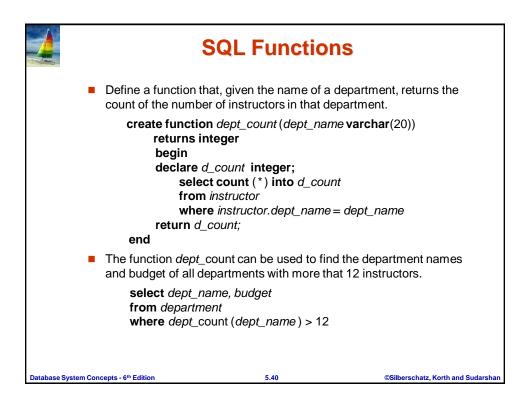


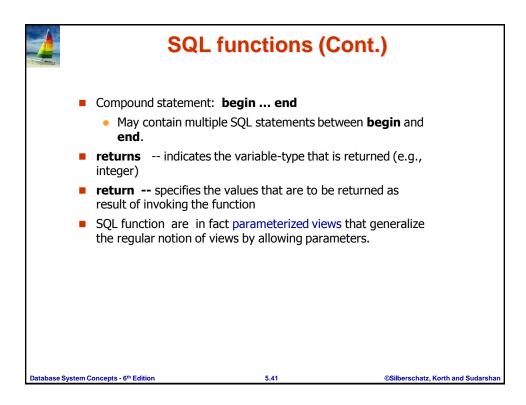


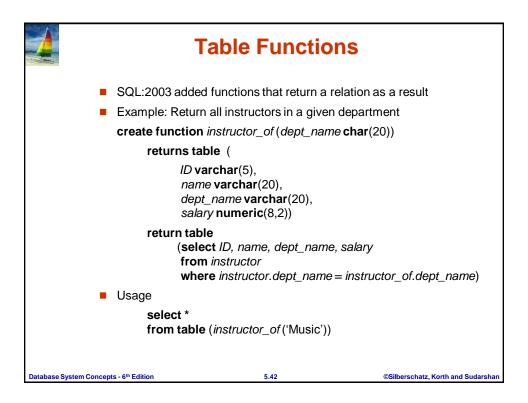


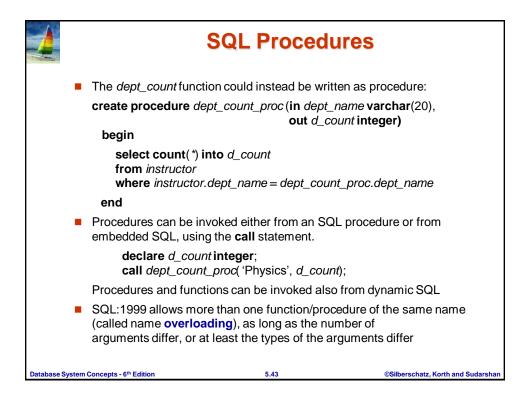


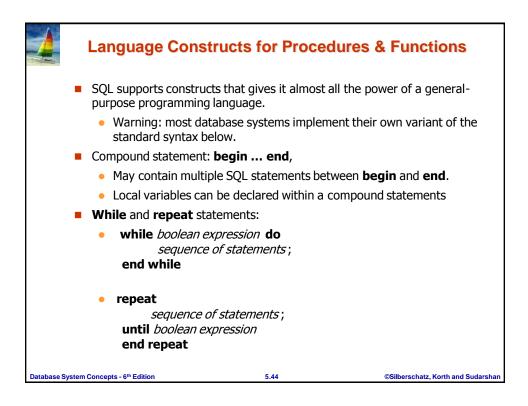












	Language Constructs (Cont.)				
	Example: Find the but	over all results of a query udget of all departments	-		
	declare <i>n</i> integer d for <i>r</i> as select <i>budget</i> fro do set <i>n</i> = <i>n</i> + r end for	om department			
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