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Exercise 1

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Exercise 1 a)

Implement `DPsize`. Referring to the script, your implementation may either follow the pseudocode or you can take the improvement described in the text into account. You may use the helper classes provided in the solution code.

Solution

See code.

Exercise 1 b)

Include a counter variable in the innermost for loop. What counter values do you observe for query graphs with different shapes and number of relations?

Solution

If you implemented the improved algorithm, your counter variables should match with the formulas given in the description of `DPsize` in the script. (Otherwise they are larger. Why?)

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Exercise 2

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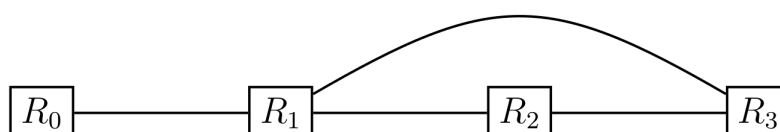
Exercise 2 a)

What is the sequence of subgraphs created by the function `EnumerateCsg` for the following query graph?

Create a table similar to the one discussed in the lecture (see script).

Mark recursive calls to the function `EnumerateCsgRec`.

Index numbers in relation names denote the order in which BFS (breadth-first search) visits the nodes.



Solution

$S$	EnumerateCsg		emit
	$X$	$N = \mathcal{N}(S) \setminus X$	
	outer ( $i = 3$ )		$\{ 3 \}$
x $\{ 3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
	outer ( $i = 2$ )		$\{ 2 \}$
x $\{ 2 \}$	$\{ 0,1,2 \}$	$\{ 3 \}$	$\{ 2,3 \}$
xx $\{ 2,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
	outer ( $i = 1$ )		$\{ 1 \}$
x $\{ 1 \}$	$\{ 0,1 \}$	$\{ 2,3 \}$	$\{ 1,2 \}$
			$\{ 1,3 \}$
			$\{ 1,2,3 \}$
xx $\{ 1,2 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
xx $\{ 1,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
xx $\{ 1,2,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
	outer ( $i = 0$ )		$\{ 0 \}$
x $\{ 0 \}$	$\{ 0 \}$	$\{ 1 \}$	$\{ 0,1 \}$
xx $\{ 0,1 \}$	$\{ 0,1 \}$	$\{ 2,3 \}$	-
			$\{ 0,1,2 \}$
			$\{ 0,1,3 \}$
			$\{ 0,1,2,3 \}$
xxx $\{ 0,1,2 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
xxx $\{ 0,1,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
xxx $\{ 0,1,2,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-

Exercise 2 b)

Recall the query graph from the last exercise. Note down all subgraphs generated by the function `EnumerateCmp` for  $S_1 = \{1\}$ .

Solution

$S$	EnumerateCmp		emit
	$X$	$N$	
(outer)	$\{ 0,1 \}$	$\{ 2,3 \}$	$\{ 3 \}$
x $\{ 3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-
(outer cont.)			$\{ 2 \}$
x $\{ 2 \}$	$\{ 0,1,2 \}$	$\{ 3 \}$	$\{ 2,3 \}$
xx $\{ 2,3 \}$	$\{ 0,1,2,3 \}$	$\emptyset$	-

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## Exercise 3

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*Bonus*

*Query optimization is not rocket science.  
When you flunk out of query optimization, we make you go build rockets.*

Look through this presentation:  
<https://www.slideshare.net/GraySystemsLab/pass-summit-2010-keynote-david-dewitt>