QO - Week 7

January 1, 2021

Exercise 1

Size	Join Entry in DP Table
Size 1	Trivial with one of base relations: $\{0\}, \{1\}, \{2\}, \{3\}, \{4\}$
Size 2	Trivial with edges in the query graph: $\{0,1\}, \{0,3\}, \{1,2\}, \{2,3\}, \{1,4\}$
Size 3	Grow with 1 new relation: $\{0,1\} \bowtie \{2\}, \{0,1\} \bowtie \{3\}, \{0,1\} \bowtie \{4\}$ $\{0,3\} \bowtie \{1\}, \{0,3\} \bowtie \{2\}$ $\{1,2\} \bowtie \{0\}, \{1,2\} \bowtie \{3\}, \{1,2\} \bowtie \{4\}$ $\{2,3\} \bowtie \{0\}, \{2,3\} \bowtie \{1\}$ $\{1,4\} \bowtie \{0\}, \{1,4\} \bowtie \{2\}$ Order by DP Table Entry: $\{0,1,2\} : \{0,1\} \bowtie \{2\}, \{1,2\} \bowtie \{0\}$ $\{0,1,3\} : \{0,1\} \bowtie \{3\}, \{0,3\} \bowtie \{1\}$ $\{0,1,4\} : \{0,1\} \bowtie \{4\}, \{1,4\} \bowtie \{0$ $\{0,2,3\} : \{0,3\} \bowtie \{2\}, \{2,3\} \bowtie \{0\}$ $\{1,2,3\} : \{1,2\} \bowtie \{3\}, \{2,3\} \bowtie \{1\}$ $\{1,2,4\} : \{1,2\} \bowtie \{4\}, \{1,4\} \bowtie \{2\}$
Size 4	Grow with 1 new relation: $\{0,1,2\} \bowtie \{3\}, \{0,1,2\} \bowtie \{4\}$ $\{0,1,3\} \bowtie \{2\}, \{0,1,3\} \bowtie \{4\}$ $\{0,1,4\} \bowtie \{2\}, \{0,1,4\} \bowtie \{3\}$ $\{0,2,3\} \bowtie \{1\}$ $\{1,2,3\} \bowtie \{0\}, \{1,2,3\} \bowtie \{4\}$ $\{1,2,4\} \bowtie \{0\}, \{1,2,4\} \bowtie \{3\}$ Order by DP Table Entry: $\{0,1,2,3\} : \{0,1,2\} \bowtie \{3\}, \{0,1,3\} \bowtie \{2\}, \{0,2,3\} \bowtie \{1\}, \{1,2,3\} \bowtie \{0\}$ $\{0,1,2,4\} : \{0,1,2\} \bowtie \{4\}, \{0,1,4\} \bowtie \{2\}, \{1,2,4\} \bowtie \{0\}$ $\{0,1,3,4\} : \{0,1,3\} \bowtie \{4\}, \{0,1,4\} \bowtie \{3\}$ $\{1,2,3,4\} : \{1,2,3\} \bowtie \{4\}, \{1,2,4\} \bowtie \{3\}$
Size 5	Trivial with all base relations: $\{0,1,2,3,4\}$: $\{0,1,2,3\} \bowtie \{4\}$ $\{0,1,2,4\} \bowtie \{3\}$ $\{0,1,3,4\} \bowtie \{2\}$ $\{1,2,3,4\} \bowtie \{0\}$

Table 1: 1. DPSizeLinear without Cross Product

Binary Representation	Set Representation	Subsets Enumeration
00000		
00001	$\{0\}$	$\emptyset$
00010	$\{1\}$	$\emptyset$
00011	$\{1,0\}$	$\{0\} \bowtie \{1\}$
00100	$\{2\}$	$\emptyset$
00101	$\{2,0\}$	$\{0\} \bowtie \{2\}$
00110	$\{2,1\}$	$\{1\} \bowtie \{2\}$
00111	$\{2,1,0\}$	$\{2,0\} \bowtie \{1\}, \{2,1\} \bowtie \{0\}, \{2\} \bowtie \{1,0\}$
01000	$\{3\}$	$\emptyset$
01001	$\{3,0\}$	$\{0\} \bowtie \{3\}$
01010	$\{3,1\}$	$\{1\} \bowtie \{3\}$
01011	$\{3,1,0\}$	$\{3,0\} \bowtie \{1\}, \{3,1\} \bowtie \{0\}, \{3\} \bowtie \{1,0\}$
01100	$\{3,2\}$	$\{2\} \bowtie \{3\}$
01101	$\{3,2,0\}$	$\{3,0\} \bowtie \{2\}, \{3,2\} \bowtie \{0\}, \{3\} \bowtie \{2,0\}$
01110	$\{3,2,1\}$	$\{3,1\} \bowtie \{2\}, \{3,2\} \bowtie \{1\}, \{3\} \bowtie \{2,1\}$
01111	$\{3,2,1,0\}$	$\{3,1,0\} \bowtie \{2\}, \{3,2,0\} \bowtie \{1\}$ $\{3,2,1\} \bowtie \{0\}, \{3\} \bowtie \{2,1,0\}$
10000	$\{4\}$	
10001	$\{4,0\}$	$\{0\} \bowtie \{4\}$
10010	$\{4,1\}$	$\{1\} \bowtie \{4\}$
10011	$\{4,1,0\}$	$\{4,0\} \bowtie \{1\}, \{4,1\} \bowtie \{0\}, \{4\} \bowtie \{1,0\}$
10100	$\{4,2\}$	$\{2\} \bowtie \{4\}$
10101	$\{4,2,0\}$	$\{4,0\} \bowtie \{2\}, \{4,2\} \bowtie \{0\}, \{4\} \bowtie \{2,0\}$
10110	$\{4,2,1\}$	$\{4,1\} \bowtie \{2\}, \{4,2\} \bowtie \{1\}, \{4\} \bowtie \{2,1\}$
10111	$\{4,2,1,0\}$	$\{4,1,0\} \bowtie \{2\}, \{4,2,0\} \bowtie \{1\}$ $\{4,2,1\} \bowtie \{0\}, \{4\} \bowtie \{2,1,0\}$
11000	$\{4,3\}$	$\{3\} \bowtie \{4\}$
11001	$\{4,3,0\}$	$\{4,0\} \bowtie \{3\}, \{4,3\} \bowtie \{0\}, \{4\} \bowtie \{3,0\}$
11010	$\{4,3,1\}$	$\{4,1\} \bowtie \{3\}, \{4,3\} \bowtie \{1\}, \{4\} \bowtie \{3,1\}$
11011	$\{4,3,1,0\}$	$\{4,1,0\} \bowtie \{3\}, \{4,3,0\} \bowtie \{1\}$ $\{4,3,1\} \bowtie \{0\}, \{4\} \bowtie \{3,1,0\}$
11100	$\{4,3,2\}$	$\{4,2\} \bowtie \{3\}, \{4,3\} \bowtie \{2\}, \{4\} \bowtie \{3,2\}$
11101	$\{4,3,2,0\}$	$\{4,2,0\} \bowtie \{3\}, \{4,3,0\} \bowtie \{2\}$ $\{4,3,2\} \bowtie \{0\}, \{4\} \bowtie \{3,2,0\}$
11110	$\{4,3,2,1\}$	$\{4,2,1\} \bowtie \{3\}, \{4,3,1\} \bowtie \{2\}$ $\{4,3,2\} \bowtie \{1\}, \{4\} \bowtie \{3,2,1\}$
11111	$\{4,3,2,1,0\}$	$\{4,3,1,0\} \bowtie \{2\}, \{4,3,2,0\} \bowtie \{1\}$ $\{4,3,2,1\} \bowtie \{0\}, \{4,2,1,0\} \bowtie \{3\}$ $\{4\} \bowtie \{3,2,1,0\}$

Table 2: 2. DPSubLinear with Cross Product

Connected Sub-graphs	Complementary Sub-graphs
$\{4\}$	$\emptyset$
$\{3\}$	$\emptyset$
$\{2\}$	$\{4\}$ $\{3\}$
$\{2,3\}$	$\{4\}$
$\{2,4\}$	$\{3\}$
$\{2,3,4\}$	$\emptyset$
$\{1\}$	$\{3\}$ $\{2,3\}$ $\{2,3,4\}$
$\{1,3\}$	$\{2\}$ $\{2,4\}$
$\{1,2,3\}$	$\{4\}$
$\{1,2,3,4\}$	$\emptyset$
$\{0\}$	$\{2\}$ $\{2,3\}$ $\{2,4\}$ $\{2,3,4\}$ $\{1\}$ $\{1,3\}$ $\{1,2,3\}$ $\{1,2,3,4\}$
$\{0,1\}$	$\{3\}$ $\{2\}$ $\{2,3\}$ $\{2,4\}$ $\{2,3,4\}$
$\{0,2\}$	$\{4\}$ $\{3\}$ $\{1\}$ $\{1,3\}$
$\{0,1,2\}$	$\{4\}$ $\{3\}$
$\{0,1,3\}$	$\{2\}$ $\{2,4\}$
$\{0,2,3\}$	$\{4\}$ $\{1\}$
$\{0,2,4\}$	$\{3\}$ $\{1\}$ $\{1,3\}$
$\{0,2,3,4\}$	$\{1\}$
$\{0,1,2,3\}$	$\{4\}$
$\{0,1,2,4\}$	$\{3\}$
$\{0,1,2,3,4\}$	$\emptyset$

Table 3: 43. DPccp