

Solutions for Exercise Sheet 8

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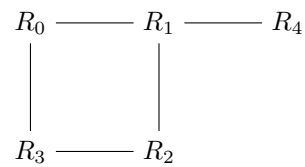
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Our solutions for [Exercise Sheet 8](#).

Exercise 1

Given the following query graph



1. enumerate all connected subgraph-complement-pairs as produced by DPccp (not just connected subgraphs!).
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Since the nodes are already numbered, we will use those numbers for the DPccp algorithm.

We will use an abbreviated notation for sets without curly brackets and commas. Therefore, set 0124 in our abbreviated notation corresponds to the set $\{0, 1, 2, 4\}$.

In the following “trace”, we use the notation $a : b, c, d$ to mean that component a is paired with components b, c , and d , by this order. Also, expressions of type “Expand $a, X = b$ ” means that EnumerateCsgRec is being called with arguments $G, S = a$, and $X = b$.

- 4: -
- Expand 4, $X = 01234$: -
- 3: -
- Expand 3, $X = 0123$: -
- 2: 3
- Expand 2, $X = 012$:
 - 23: -
 - Expand 23, $X = 01234$: -
- 1: 2, 23, 4
- Expand 1, $X = 01$:
 - 12: 3, 4
 - 14: 2, 23
 - 124: 3
 - Expand 12, $X = 0124$:
 - * 123: 4
 - * Expand 123, $X = 01234$: -
 - Expand 14, $X = 0124$: -
 - Expand 124, $X = 0124$:
 - * 1234: -
 - * Expand 1234, $X = 01234$: -
- 0: 1, 12, 14, 123, 124, 1234, 3, 23
- Expand 0, $X = 0$:
 - 01: 2, 23, 3, 4
 - 03: 1, 12, 14, 124 2
 - 013: 2, 4
 - Expand 01, $X = 013$:
 - * 012: 3, 4
 - * 014: 2, 23, 3
 - * 0124: 3
 - * Expand 012, $X = 01234$: -
 - * Expand 014, $X = 01234$: -
 - * Expand 0124, $X = 01234$: -
 - Expand 03, $X = 013$:
 - * 023: 1, 14
 - * Expand 023, $X = 0123$: -
 - Expand 013, $X = 013$:
 - * 0123: 4
 - * 0134: 2
 - * 01234: -

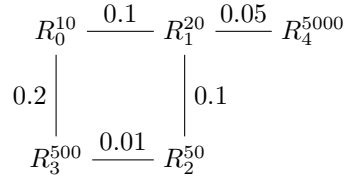
- * Expand 0123, $X = 01234$: -
- * Expand 0134, $X = 01234$: -
- * Expand 01234, $X = 01234$: -

So the final list of pairs over which DPccp will iterate is the following (first iterate over all possible values of S_1 , and for each value of S_1 iterate over the corresponding possible values of S_2):

- $S_1 = 2, S_2 = 3$
- $S_1 = 1, S_2 = 2, 23, 4$
- $S_1 = 12, S_2 = 3, 4$
- $S_1 = 14, S_2 = 2, 23$
- $S_1 = 124, S_2 = 3$
- $S_1 = 123, S_2 = 4$
- $S_1 = 0, S_2 = 1, 12, 14, 123, 124, 1234, 3, 23$
- $S_1 = 01, S_2 = 2, 23, 3, 4$
- $S_1 = 03, S_2 = 1, 12, 14, 124, 2$
- $S_1 = 013, S_2 = 2, 4$
- $S_1 = 012, S_2 = 3, 4$
- $S_1 = 014, S_2 = 2, 23, 3$
- $S_1 = 0124, S_2 = 3$
- $S_1 = 023, S_2 = 1, 14$
- $S_1 = 0123, S_2 = 4$
- $S_1 = 0134, S_2 = 2$

Exercise 2

Given the following query graph, perform two simplification steps, and show the resulting query graph after each step.



$$orderingBenefit(X \bowtie R_1, X \bowtie R_2) = \frac{C((X \bowtie R_1) \bowtie R_2)}{C((X \bowtie R_2) \bowtie R_1)}$$

1. $oB(R_3 \bowtie R_0, R_3 \bowtie R_2) = \frac{1000*50*0.01+1000}{250*10*0.2+250} = \frac{1500}{750} = 2$
2. $oB(R_1 \bowtie R_4, R_1 \bowtie R_0) = \frac{5000*10*0.1+5000}{20*5000*0.05+20} = \frac{10000}{5020} = 1.992$
3. $oB(R_1 \bowtie R_2, R_1 \bowtie R_0) = \frac{100*10*0.1+100}{20*50*0.1+20} = \frac{200}{120} = 1.667$
4. $oB(R_0 \bowtie R_3, R_0 \bowtie R_1) = \frac{1000*20*0.1+1000}{20*500*0.2+20} = \frac{3000}{2020} = 1.486$
5. $oB(R_2 \bowtie R_3, R_2 \bowtie R_1) = \frac{250*20*0.1+250}{100*500*0.01+100} = \frac{750}{600} = 1.25$
6. $oB(R_1 \bowtie R_4, R_1 \bowtie R_2) = \frac{5000*50*0.1+5000}{100*5000*0.05+100} = \frac{30000}{25100} = 1.196$

1. $oB(R_0 \bowtie \{R_2, R_3\}, R_0 \bowtie R_1) = \frac{1250*0.1*20+1500}{250+20+1000} = \frac{4000}{1270} = 3.150$
2. $oB(R_1 \bowtie R_4, R_1 \bowtie R_0) = \frac{5000*20*0.05+5000}{20*5000*0.06+20} = \frac{10000}{5020} = 1.992$
3. $oB(R_1 \bowtie R_2, R_1 \bowtie R_0) = \frac{100*10*0.1+100}{20*50*0.1+20} = \frac{200}{120} = 1.667$
4. $oB(R_2 \bowtie R_3, R_2 \bowtie R_1) = \frac{250*20*0.1+250}{100*500*0.01+100} = \frac{750}{600} = 1.25$
5. $oB(R_1 \bowtie R_4, R_1 \bowtie R_2) = \frac{5000*50*0.1+5000}{100*5000*0.05+100} = \frac{30000}{25100} = 1.196$

