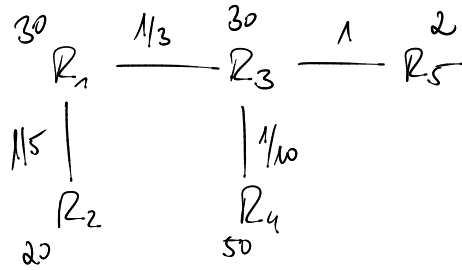


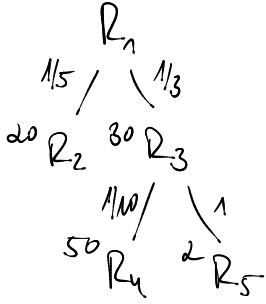
KKBT

Query Graph

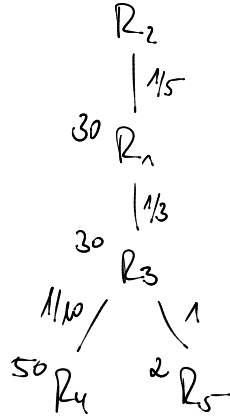


Precedence Graphs

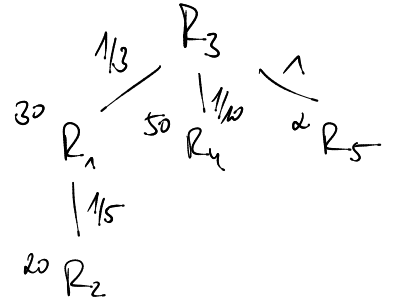
rooted in R_1



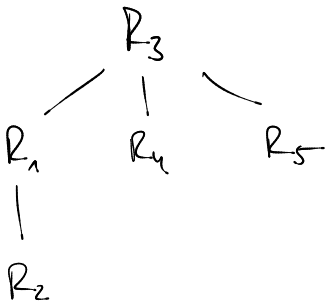
rooted in R_2



rooted in R_3

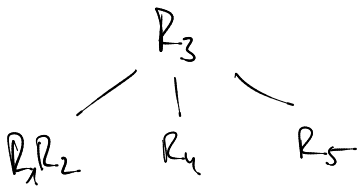


KKBT on the precedence graph rooted in R_3



	n	s	c	T	rank
R_1	30	1/3	10	10	9/10
R_2	20	1/5	4	4	3/4
R_4	50	1/10	5	5	4/5
R_5	2	1	2	2	1/2
$R_1 R_2$			50	40	39/50

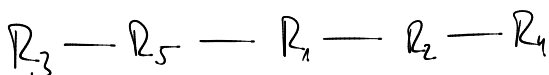
contradictory sequence $R_1 R_2$:
normalize



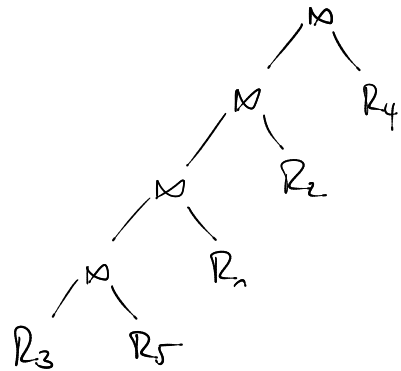
merge chains ascending in rank



denormalize

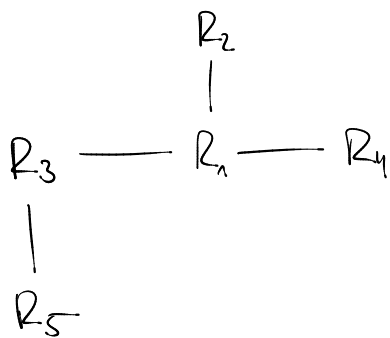


resulting join tree:



perform this on all precedence graphs and pick the cheapest tree

DP_{cap}



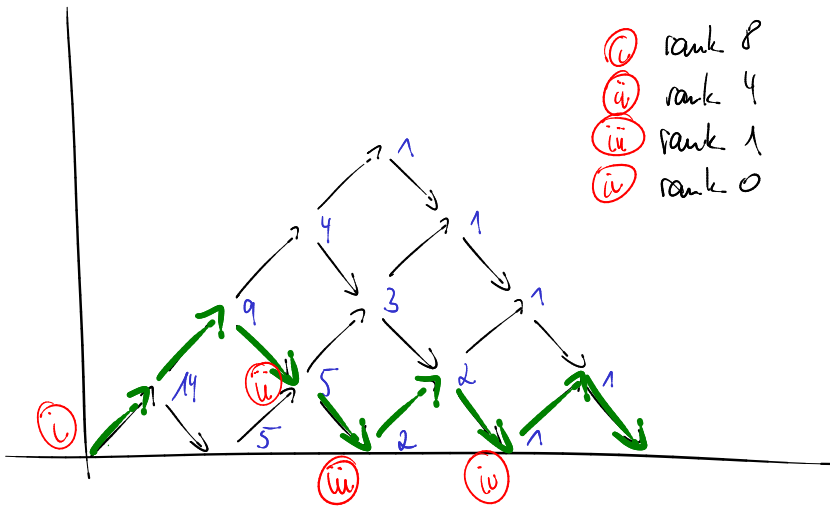
connected component	complement	plan candidate (ignoring commutativity)
5	/	/
4	/	/
3	5	$R_3 \times R_5$
35	/	/
2	/	/
1	4	$R_1 \times R_4$
	3	$R_1 \times R_3$
	35	$R_1 \times \{R_3, R_5\}$
	2	$R_1 \times R_2$
14	3	$\{R_1, R_4\} \times R_3$
	35	$\{R_1, R_4\} \times \{R_3, R_5\}$
	2	$\{R_1, R_4\} \times R_2$
13	5	$\{R_1, R_3\} \times R_5$
	4	$\{R_1, R_3\} \times R_4$
	2	$\{R_1, R_3\} \times R_2$
12	4	$\{R_1, R_2\} \times R_4$
	3	$\{R_1, R_2\} \times R_3$
	35	$\{R_1, R_2\} \times \{R_3, R_5\}$
135	4	$\{R_1, R_3, R_5\} \times R_4$
	2	$\{R_1, R_3, R_5\} \times R_2$

⋮

Unrank the permutation with rank 8 of 4 relations:

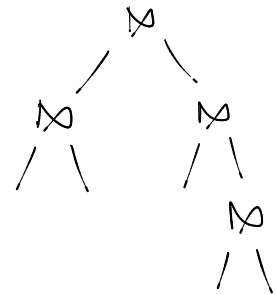
current permutation	i	current rank	swap indexes
$R_1 R_2 R_3 R_4$	4	8	$3 \leftrightarrow 0$
$R_4 R_2 R_3 R_1$	3	2	$2 \leftrightarrow 2$
$R_4 R_2 R_3 R_1$	2	0	$1 \leftrightarrow 0$
$R_2 R_4 R_3 R_1$	1	0	$1 \leftrightarrow 1$

Unrank the shape with rank 8 of a tree with 4 leaves:



- 1) step up as long as the number of paths from there exceeds current rank
- 2) reduce current rank by the number of paths not taken when stepping down

Dyck word: $(()) () () \Rightarrow$ Tree shape



Quick Pick

