

Vineopt and friends

Software made by Kaj Holmberg since 2002:

Vineopt: Visual network optimization (Tcl/Tk, C, C++, fortran)

Vileopt: Visual linear optimization (Tcl/Tk)

Nileopt: Visual nonlinear optimization (Tcl/Tk, SciPy)

Vigropt: Visual group optimization (Python, Tkinter, NumPy)

Vikeopt (Snowplan): Visual *k*-Chinese postman problem solver (Python, Tkinter, NumPy, SciPy, Mayavi, matplotlib, networkx)

Viseopt: Visual Sudoku help (Python, Tkinter, NumPy)

Small improvements each year/all the time/when I have the time.

Now large: vineopt 70 000 lines of code (excl opt).

Tcl/Tk good for graphics etc, bad for computations.

Python better, many extensions, Tkinter for graphics.

C good for fast computations, as is fortran.

Dine

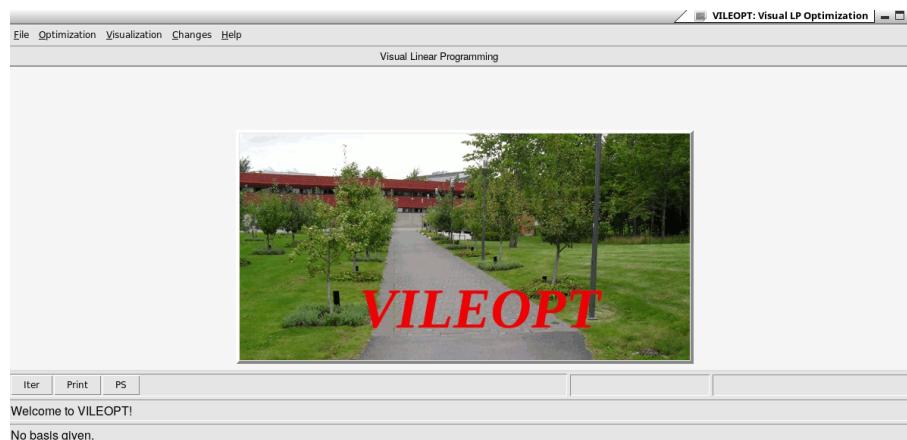
Small starting program:

dine (C)

Checks where it is run, especially if student.

```
[kaj@hohome vineopt]$ ./dine
+++++ Dine at Kaj's: Running opt labs (Vineopt, Vileopt, Nileopt) +++++
Tue May 30 11:08:13 2017
What to run?
k=0: Quit
k=1: Run Vineopt
k=2: Run Vileopt
k=3: Run Nileopt
k=4: Run Vineopt without maps
k=5: Run Vineopt for ORSS
k=6: Run Snowplan
k=7: Run Nileopt with more functions
k=8: Clean all
+100: Do not remove temporary files at exit
(Many temporary files are created, so you are advised to run dine in a separate directory.)
Give number! █
```

Vileopt starting



Purpose: Manually controlled pivots in the simplex method.

Create, save, read, change problem.

Vileopt problem

LP-problem							
$Z = 4.0 x_1 + 3.0 x_2 + 3.0 x_3 + x_4 + x_5$							
$\text{s.t. } x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 100.0$							
$5.0 x_4 + 3.0 x_5 + x_7 = 20.0$							
2.0 x_1	$+ x_2$	$+ x_3$	$+ 3.0 x_4$	$+ 4.0 x_5$	$+ x_8$	$= 120.0$	
$x_1,$	$x_2,$	$x_3,$	$x_4,$	$x_5,$	$x_6,$	$x_7,$	$x_8 \geq 0$
<input type="button" value="Close"/>							

Vileopt tableau

VILEOPT: Visual LP Optimization

File Optimization Visualization Changes Help

Visual Linear Programming

$Z =$	$4.0 x_1 + 3.0 x_2 + 3.0 x_3 + x_4 + x_5 + x_6$	$= 100.0$
S.t.	$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 \leq 100.0$	
	$2.0 x_1 + x_2 + x_3 + 3.0 x_4 + 4.0 x_5 + x_6, x_7, x_8 \geq 0$	$= 20.0$
		≥ 120.0

Iter Print PS Problem: ten1706. Variables: 8. Constraints: 3.

Welcome to VILEOPT!

No basis given.

Vileopt pivot

VILEOPT: Visual LP Optimization

File Optimization Visualization Changes Help

Visual Linear Programming

Bas	z	x ₁	x ₂	x ₃	x ₄	x ₅	x ₆	x ₇	x ₈	b
z	1	-4.000	-3.000	-3.000	-1.000	-1.000	0	0	0	0
x₆	0	1	1	1	1	1	1	0	0	100.000
x₇	0	0	0	0	5.000	3.000	0	1	0	20.000
x₈	0	2.000	1	1	3.000	4.000	0	0	1	120.000

Choose entering variable at the top and leaving variable to the left and hit pivot.
Basic variables: 6 7 8

Pivot

Iter Print PS Problem: ten1706. Variables: 8. Constraints: 3.

Welcome to VILEOPT!

Basic variables: 6 7 8.

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5 / 1

Vileopt iteration 2

VILEOPT: Visual LP Optimization

File Optimization Visualization Changes Help

Visual Linear Programming

Bas	z	x ₁	x ₂	x ₃	x ₄	x ₅	x ₆	x ₇	x ₈	b
z	1	0	-1.000	-1.000	5.000	7.000	0	0	2.000	240.000
x₆	0	0	0.500	0.500	-0.500	-1.000	1	0	-0.500	40.000
x₇	0	0	0	0	5.000	3.000	0	1	0	20.000
x₁	0	1	0.500	0.500	1.500	2.000	0	0	0.500	60.000

Choose entering variable at the top and leaving variable to the left and hit pivot.
Basic variables: 6 7 1

Pivot

Iter Print PS Problem: ten1706. Variables: 8. Constraints: 3.

Welcome to VILEOPT!

Basic variables: 6 7 1.

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6 / 1

Vileopt tabular change

Problem data

Objective function							
c ₁ : 4.0	c ₂ : 3.0	c ₃ : 3.0	c ₄ : 1.0	c ₅ : 1.0	c ₆ : 0.0	c ₇ : 0.0	c ₈ : 0.0
Constraint coefficients							
a ₁₁ : 1.0	a ₁₂ : 1.0	a ₁₃ : 1.0	a ₁₄ : 1.0	a ₁₅ : 1.0	a ₁₆ : 1.0	a ₁₇ : 0.0	a ₁₈ : 0.0
a ₂₁ : 0.0	a ₂₂ : 0.0	a ₂₃ : 0.0	a ₂₄ : 5.0	a ₂₅ : 3.0	a ₂₆ : 0.0	a ₂₇ : 1.0	a ₂₈ : 0.0
a ₃₁ : 2.0	a ₃₂ : 1.0	a ₃₃ : 1.0	a ₃₄ : 3.0	a ₃₅ : 4.0	a ₃₆ : 0.0	a ₃₇ : 0.0	a ₃₈ : 1.0
Right-hand-side							
b ₁ : 100.0	b ₂ : 20.0	b ₃ : 120.0					
<input type="button" value="Exit (no save) <F3>"/> <input type="button" value="Save and exit"/>							

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7 / 1

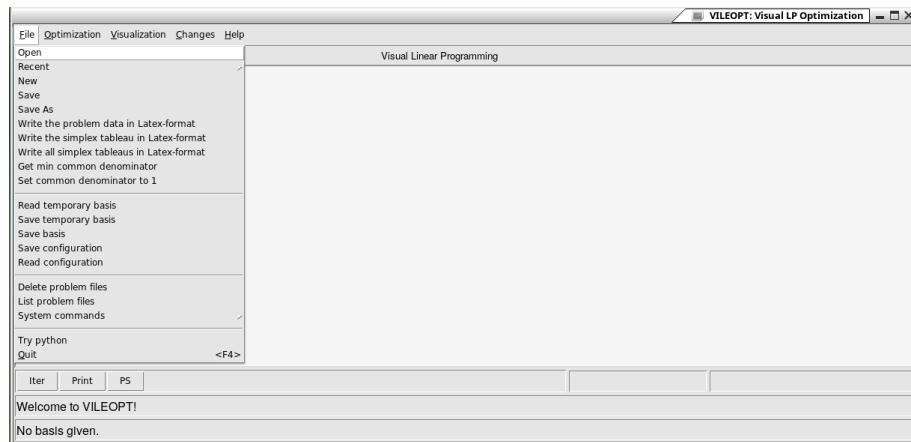
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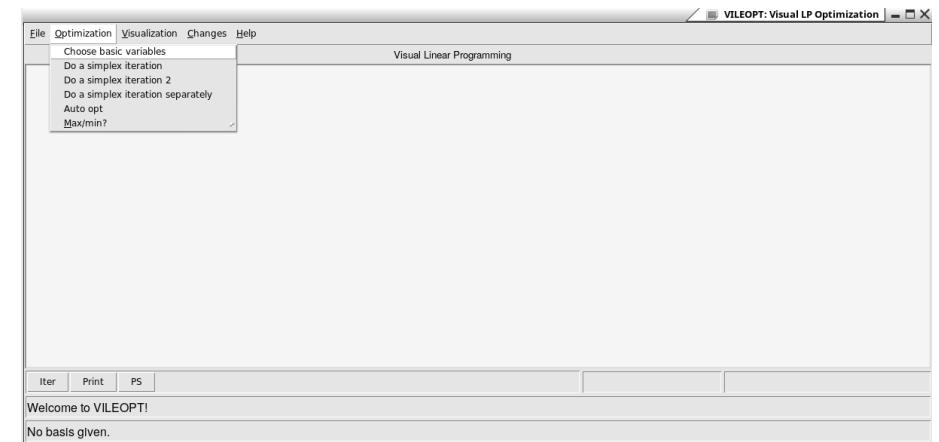
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8 / 1

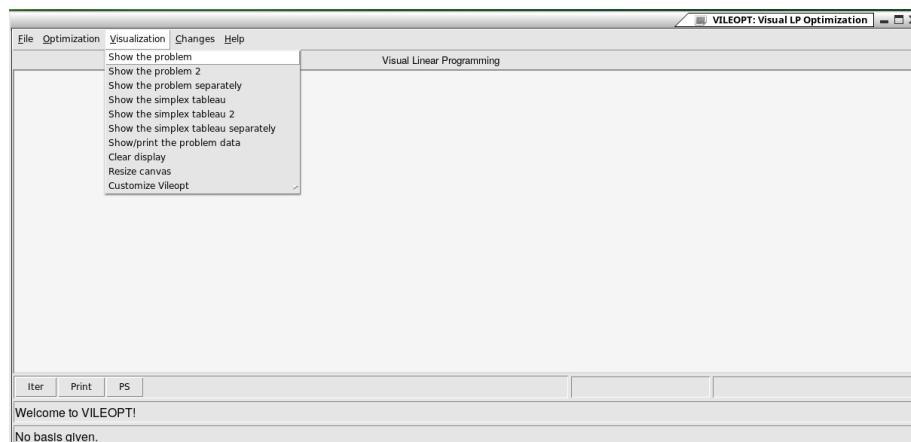
Vileopt menu 1



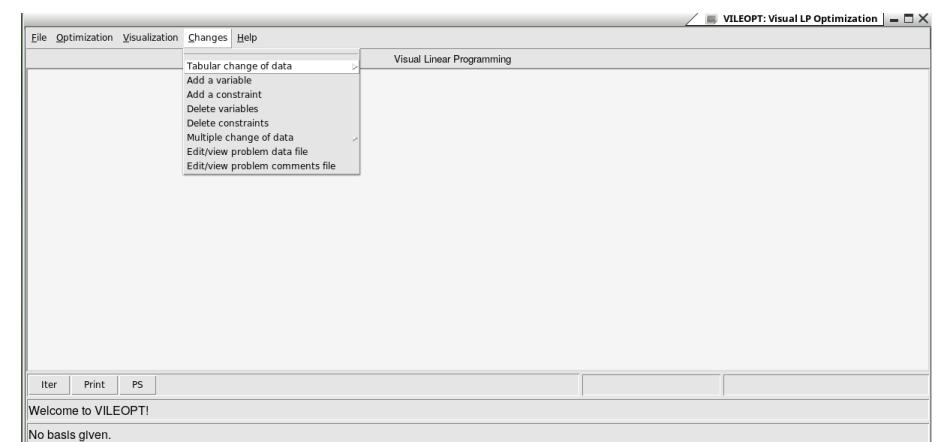
Vileopt menu 2



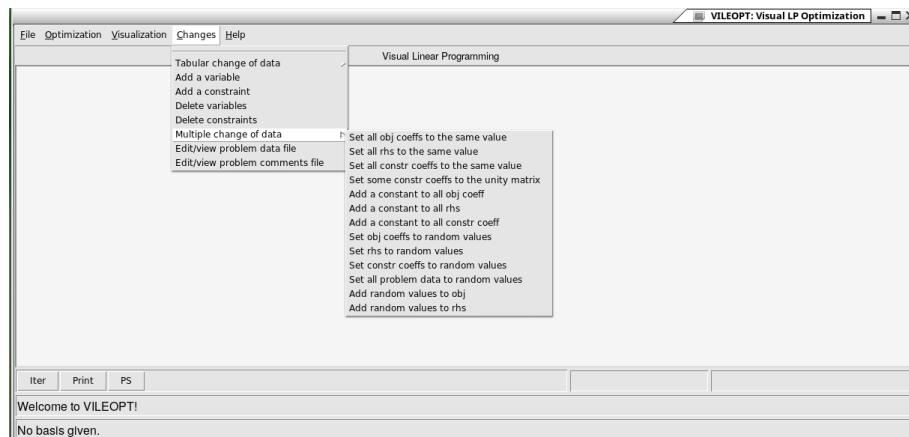
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9 / 1
Vileopt menu 3



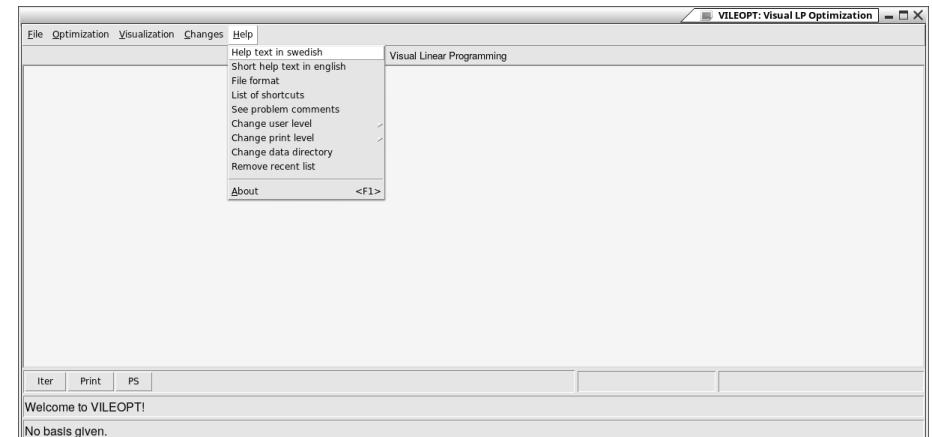
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10 / 1
Vileopt menu 4



Vileopt menu 4b



Vileopt menu 5



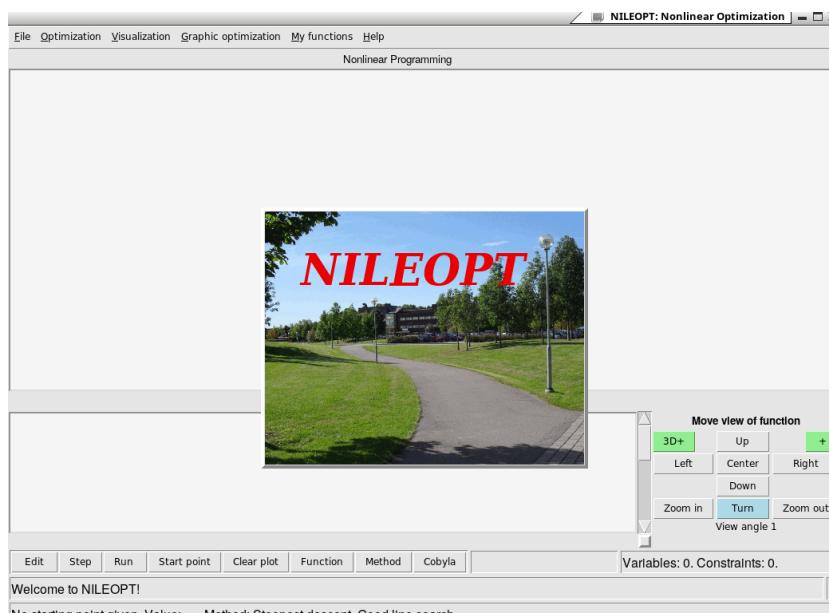
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13 / 1

Nileopt starting



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14 / 1

Nileopt purpose

Illustrate solution of nonlinear optimization problems.

Create, read save, change problems. Simplified AMPL-syntax.

Solve constrained problem (with Cobyla/Scipy).

Step through solution of unconstrained problems

with many methods (steepest descent, Newton, several quasi-Newton, several conjugate gradient).

Compare the methods visually.

Show contours and 3D-image.

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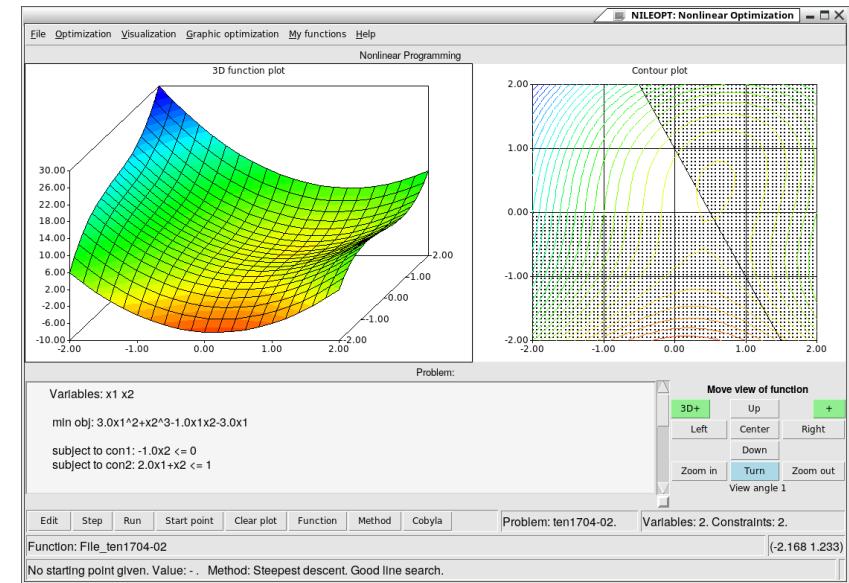
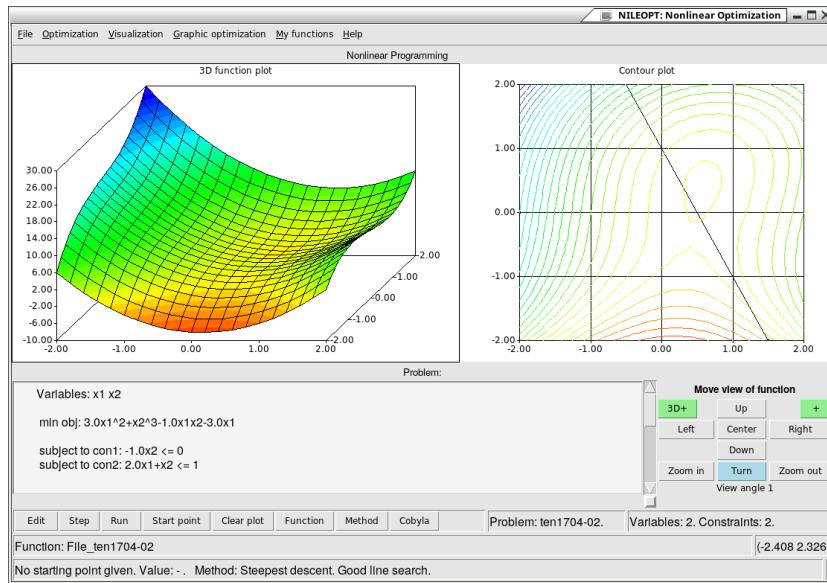
15 / 1

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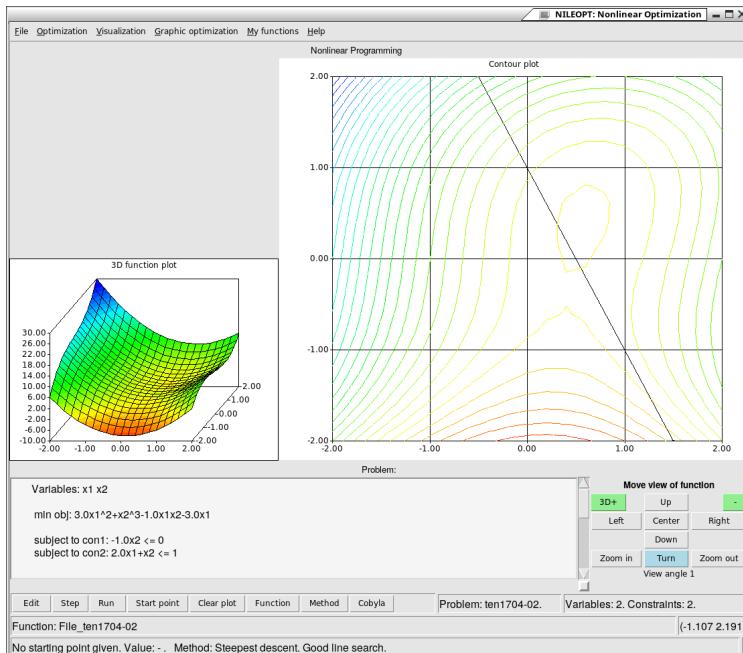
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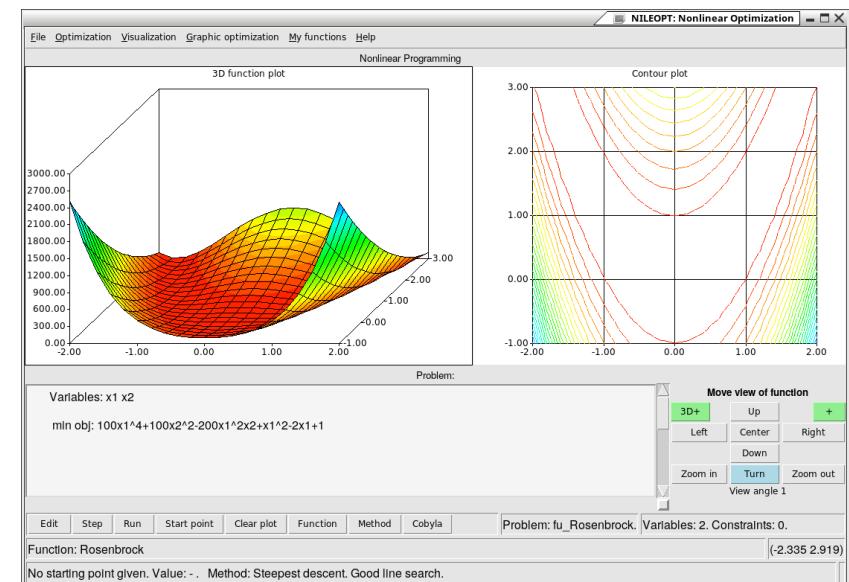
16 / 1



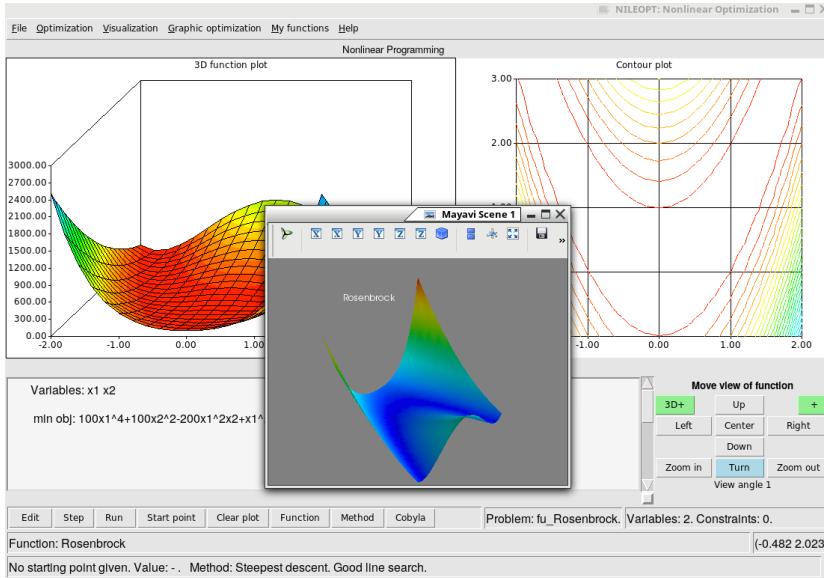
Nileopt layout 2



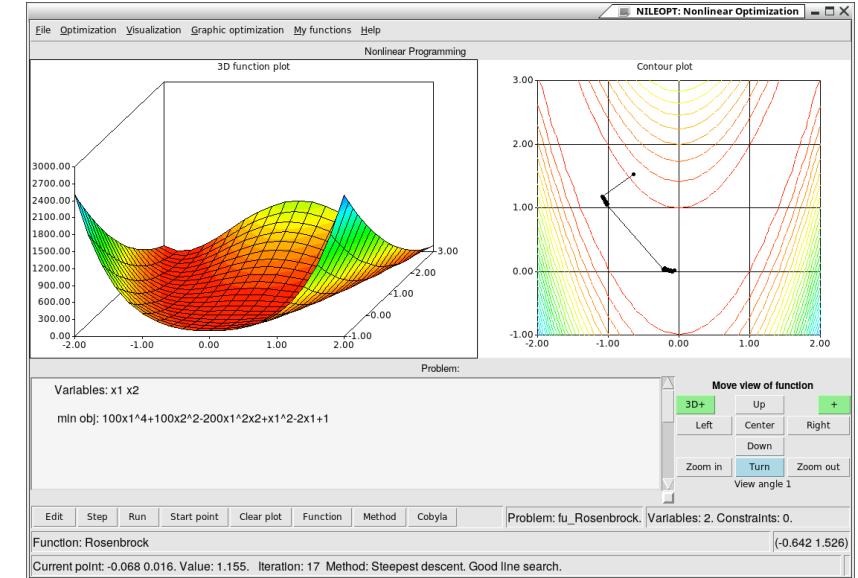
Nileopt: Rosenbrock



Nileopt: Rosenbrock - 3D view



Nileopt: Rosenbrock: Steepest descent



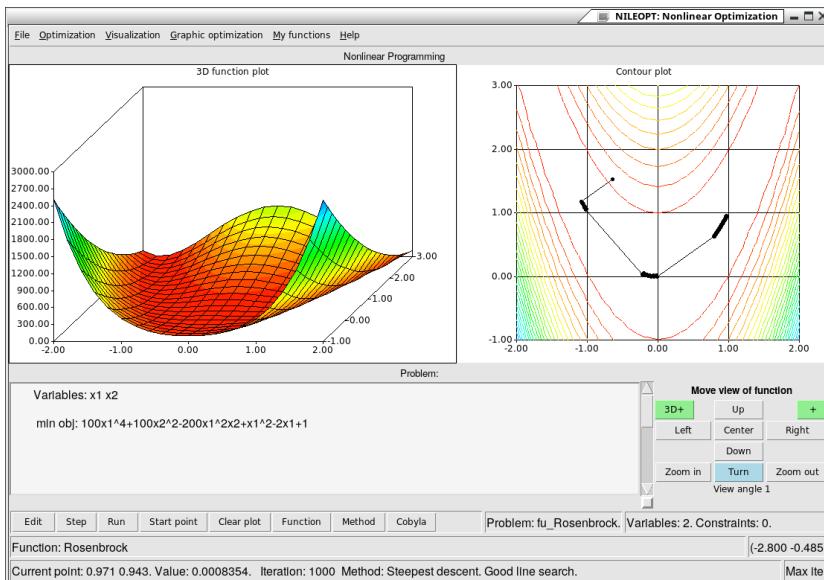
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21 / 1

Nileopt: Rosenbrock: Steepest descent



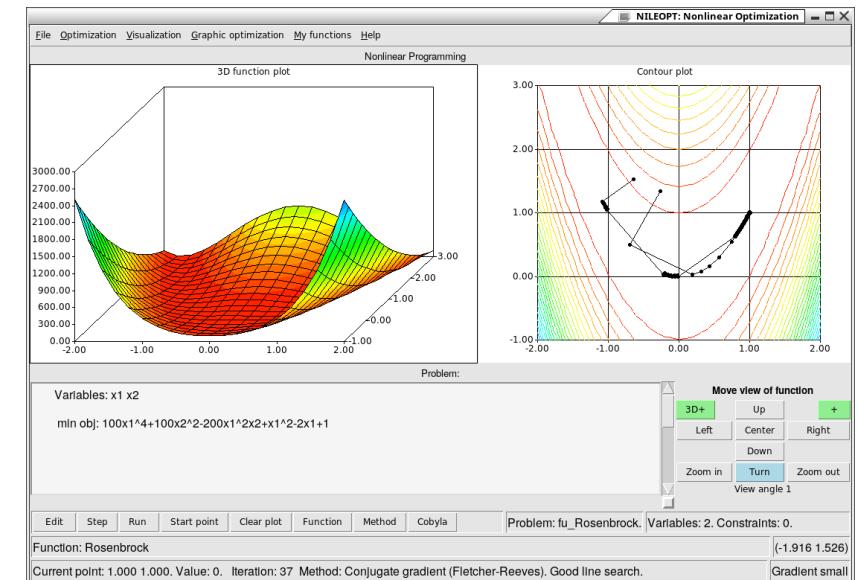
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22 / 1

Nileopt: Rosenbrock: Steepest descent - conjugate gradient



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23 / 1

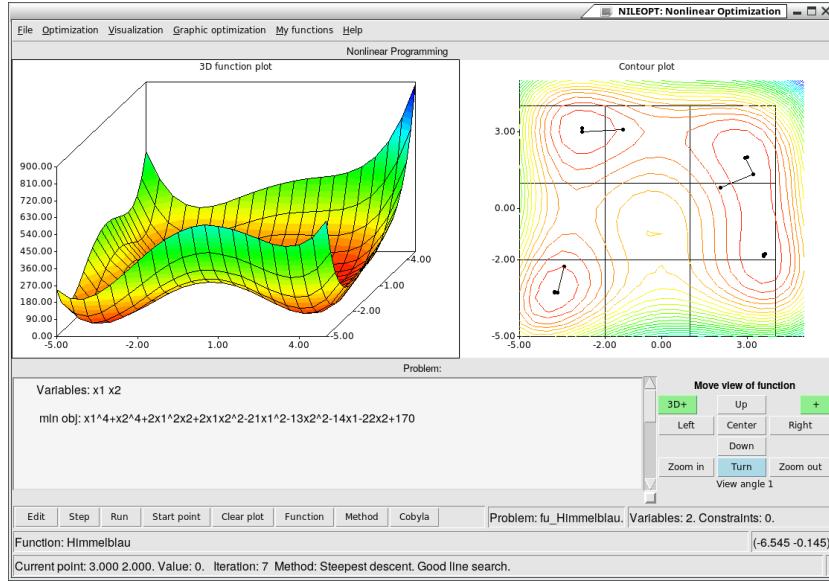
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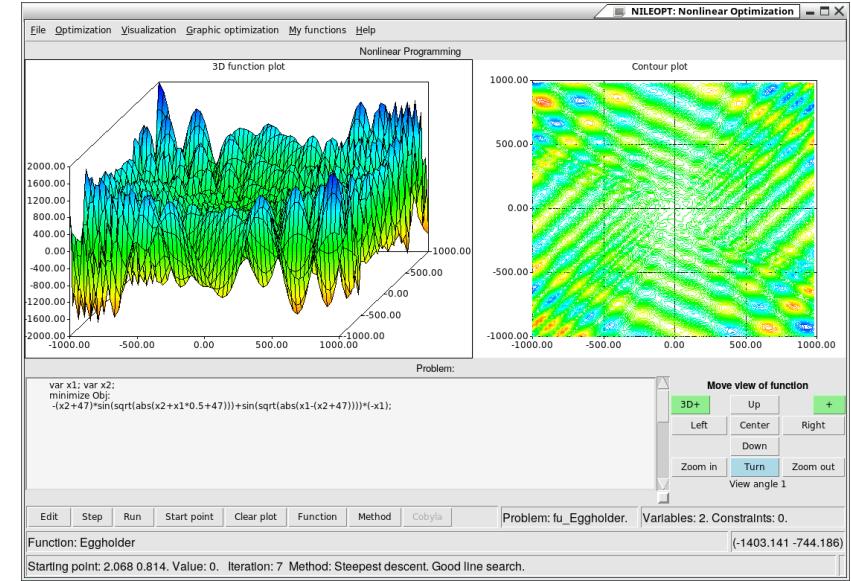
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24 / 1

Nileopt: Himmelblau, local optima



Nileopt: Eggholder



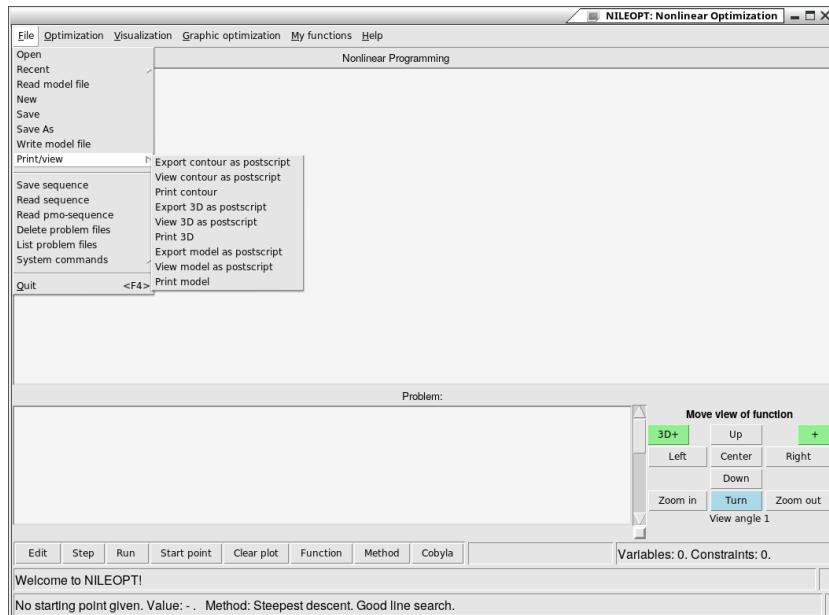
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25 / 1

Nileopt menu 1



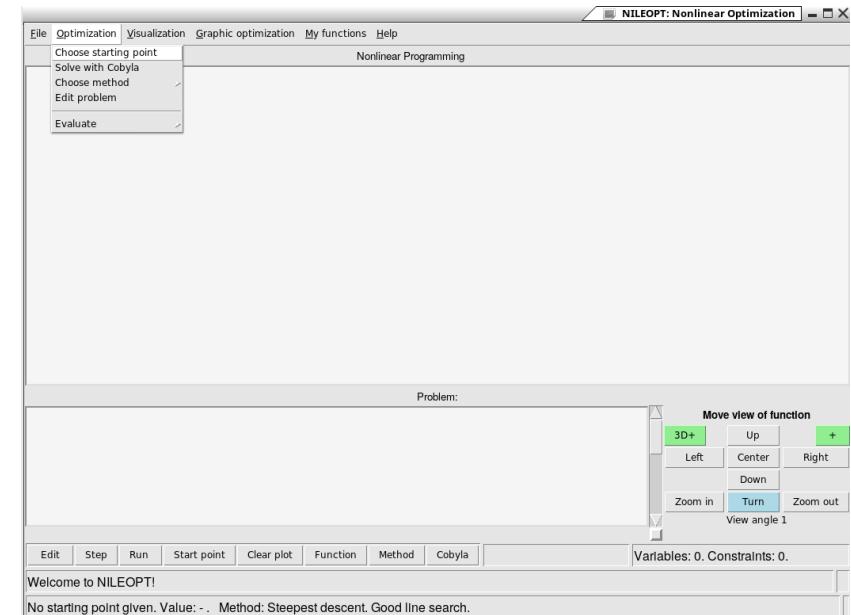
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26 / 1

Nileopt menu 2



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27 / 1

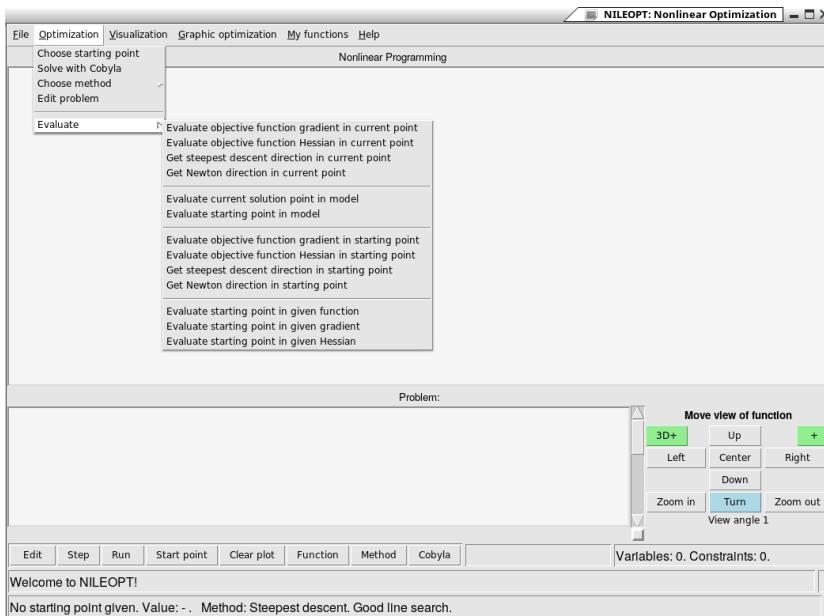
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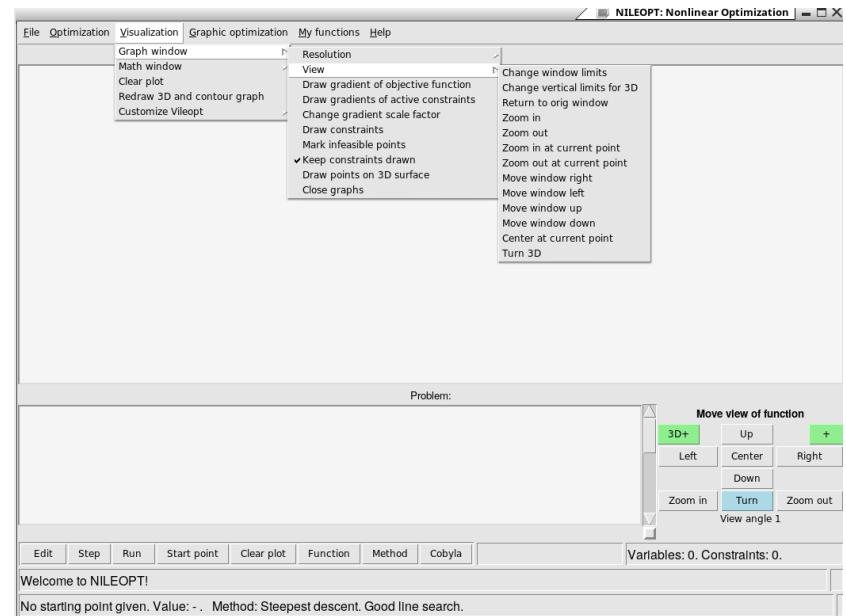
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28 / 1

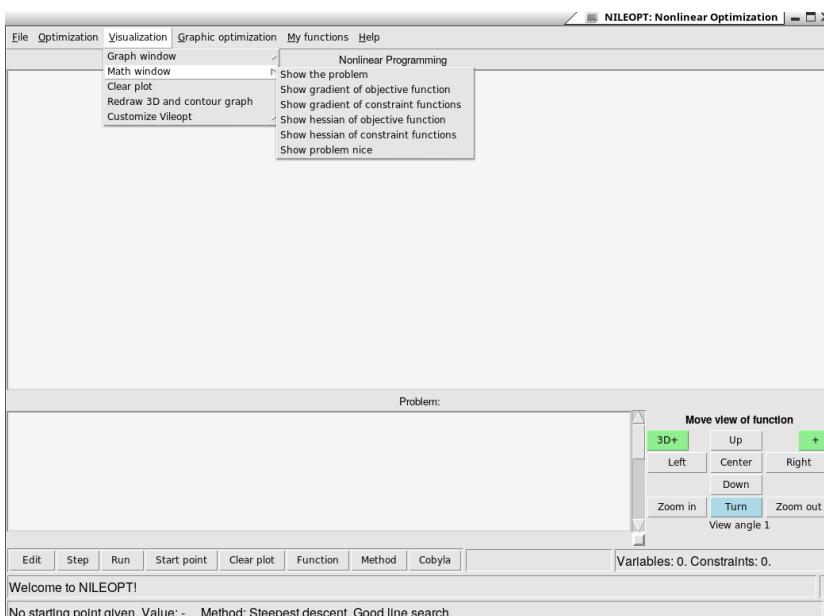
Nileopt menu 2b



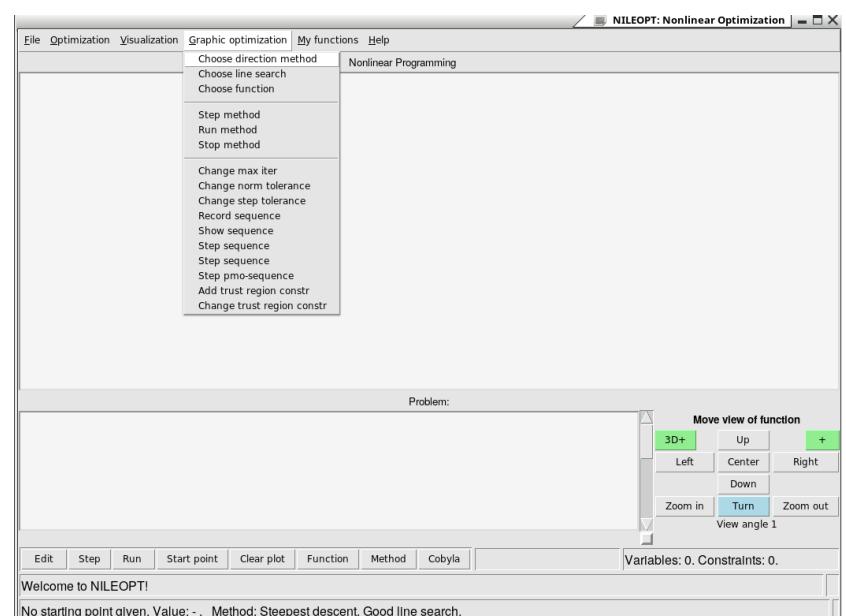
Nileopt menu 3a



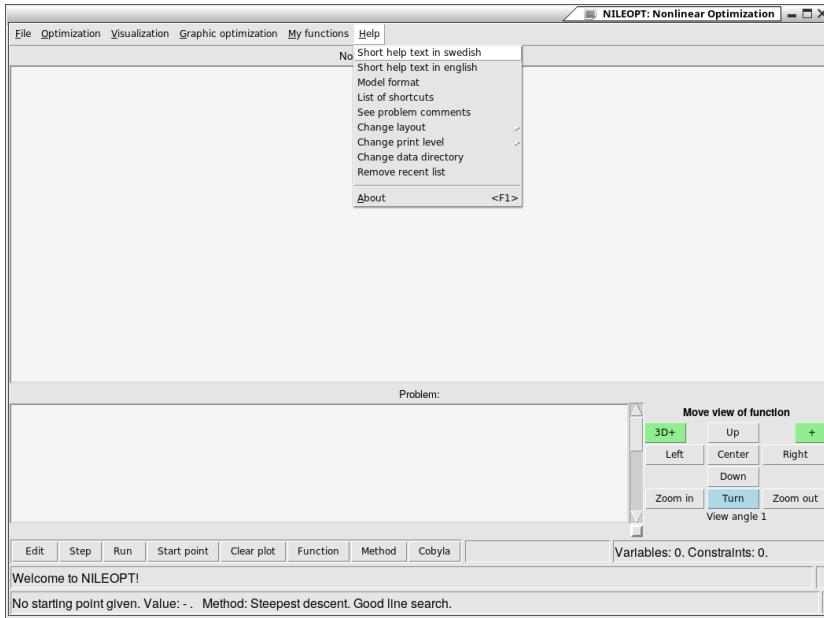
Nileopt menu 3b



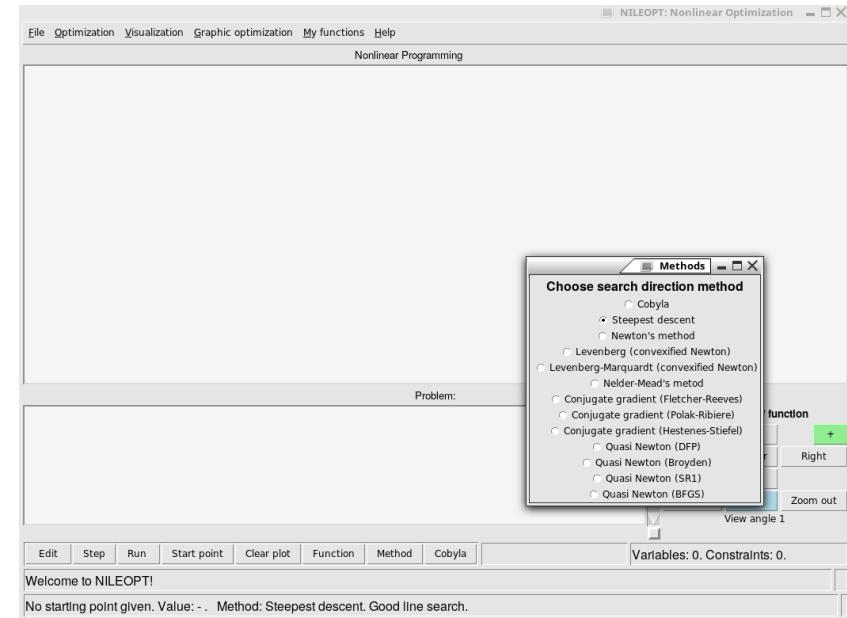
Nileopt menu 4



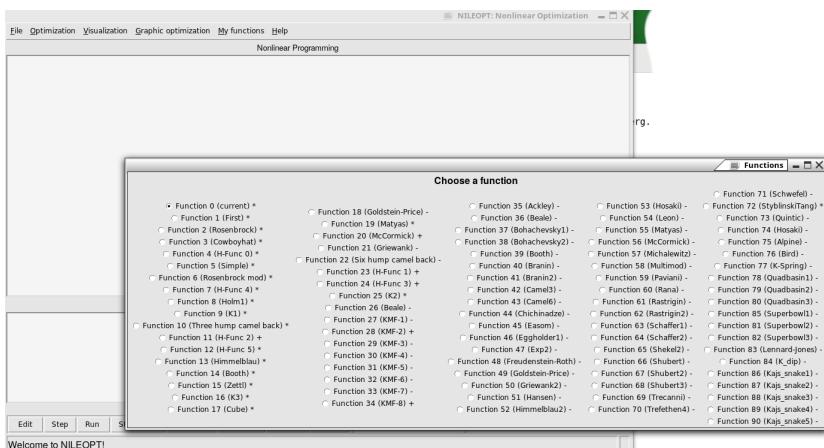
Nileopt menu 5



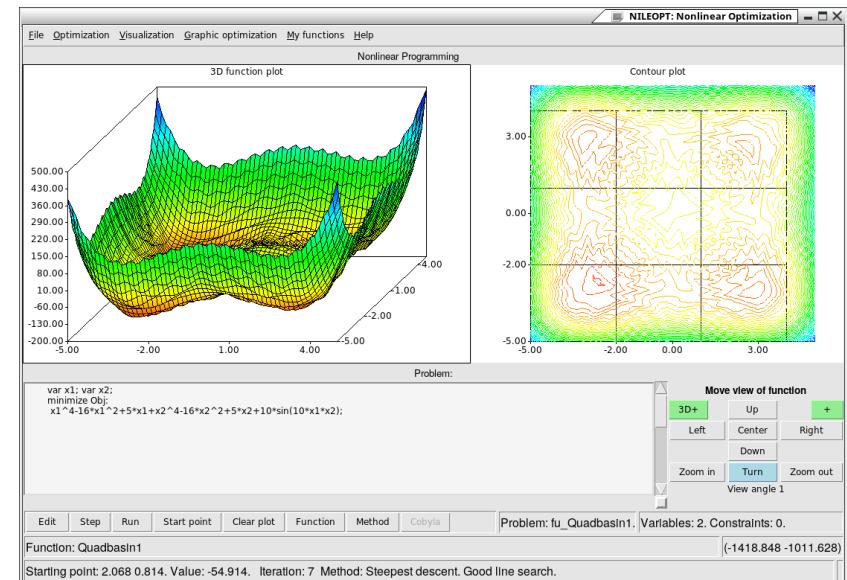
Nileopt menu 6



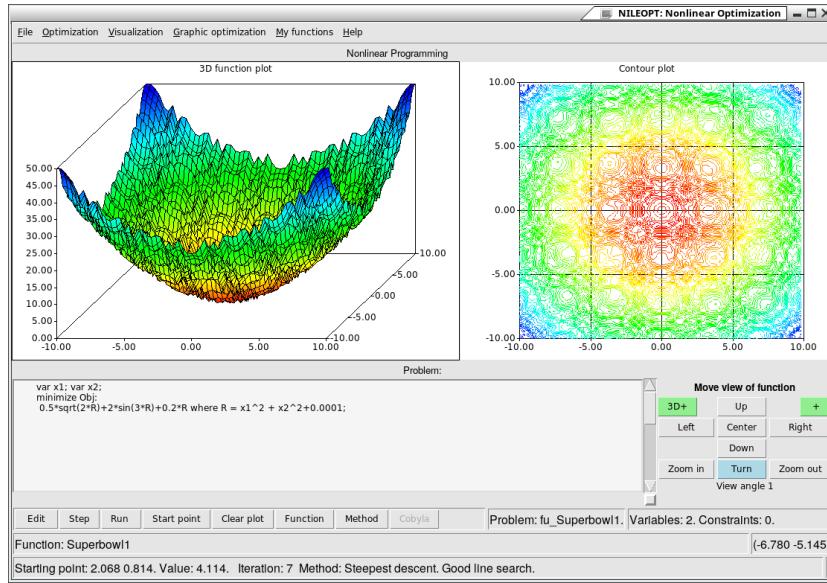
Nileopt menu 7



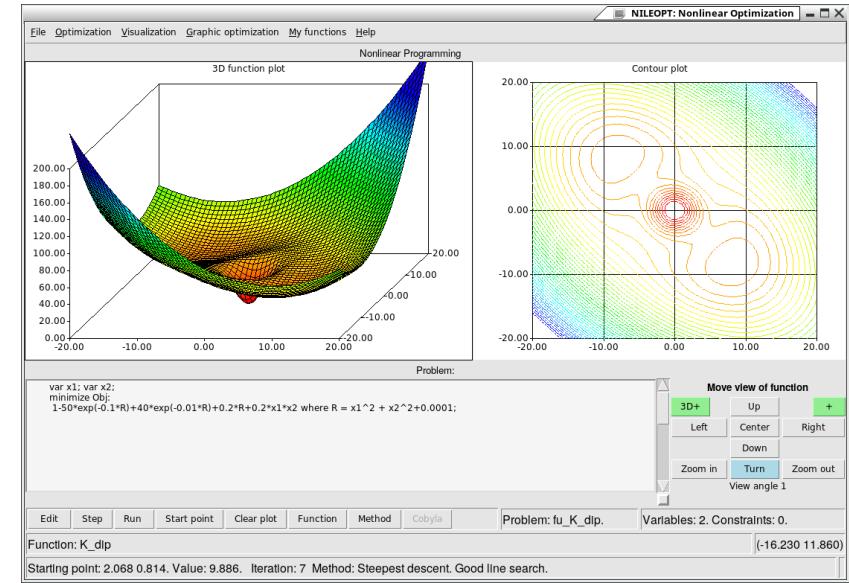
Nileopt: Quadbasin



Nileopt: Superbowl



Nileopt: Dip



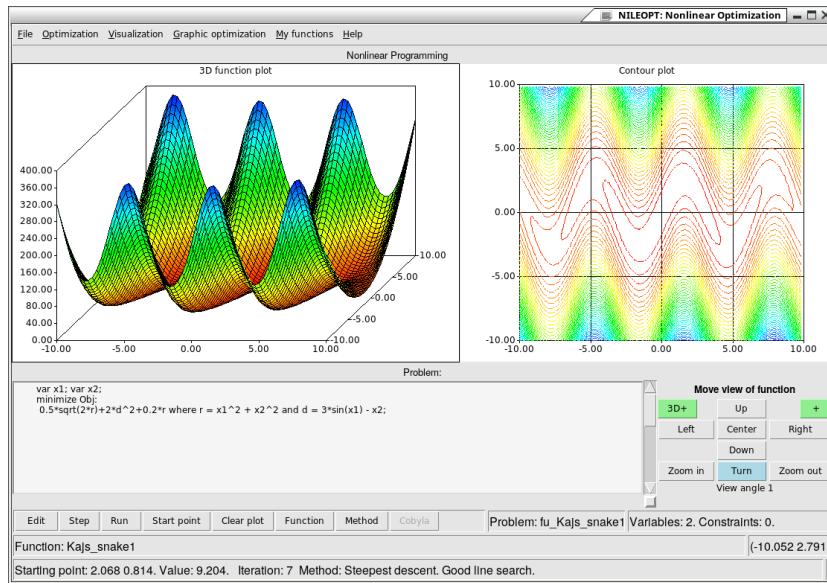
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37 / 1

Nileopt: Kaj's snake 1



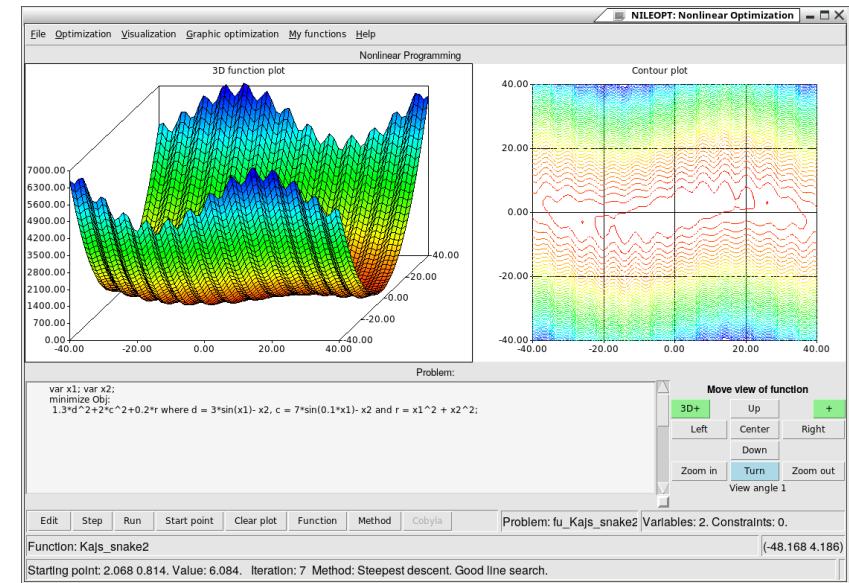
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38 / 1

Nileopt: Kaj's snake 2



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39 / 1

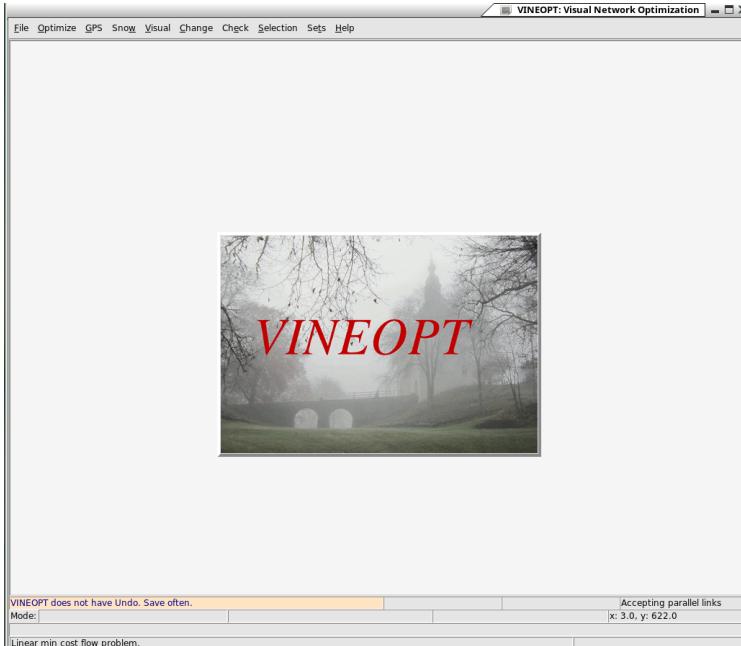
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40 / 1

Vineopt starting



Vineopt purpose

Create, save, read, change network problems (of different types).
Solve network optimization problems (of many types).
View the graph and solution (in many different ways).
Zoom, move picture.
Show OpenStreetMap as background.
Show node/link sets with colours.
Read and show GPS-tracks.
Used for research in IP telecom and snow removal.

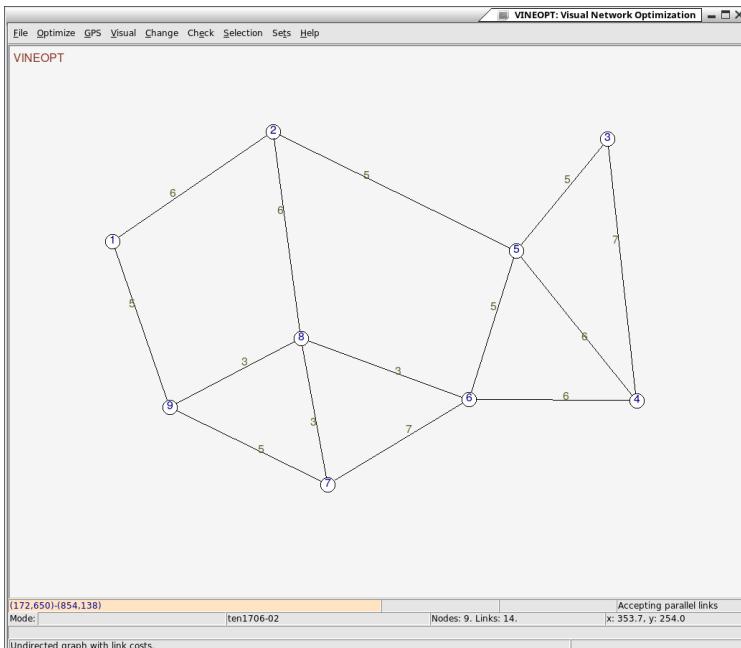
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41 / 1

Vineopt: undirected graph



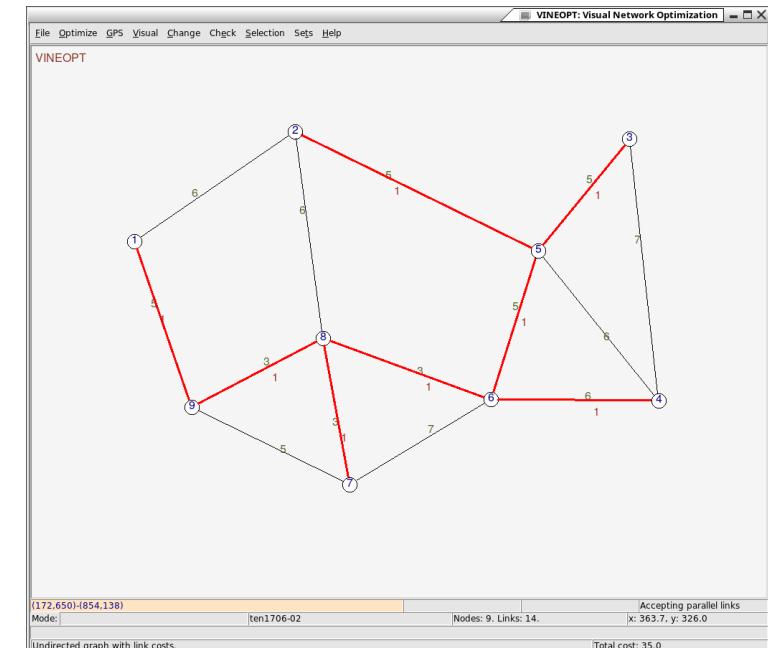
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42 / 1

Vineopt: MST



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43 / 1

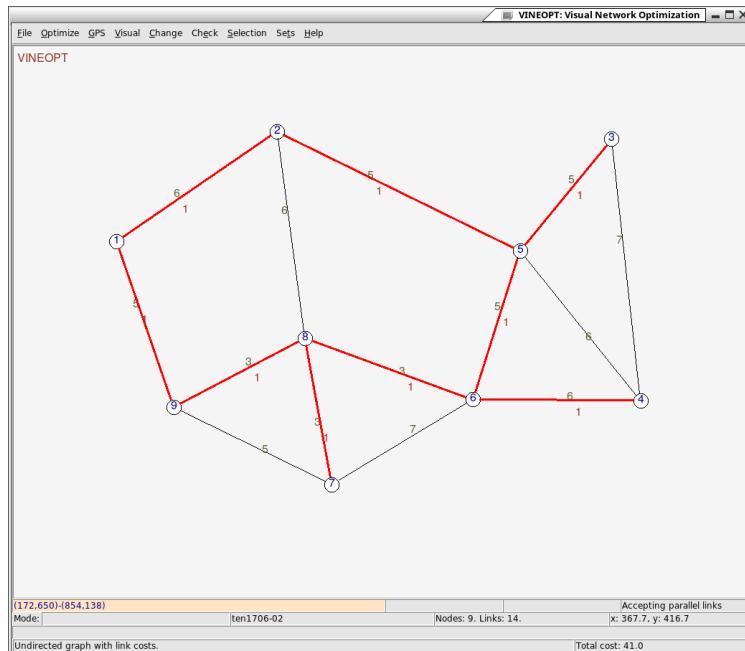
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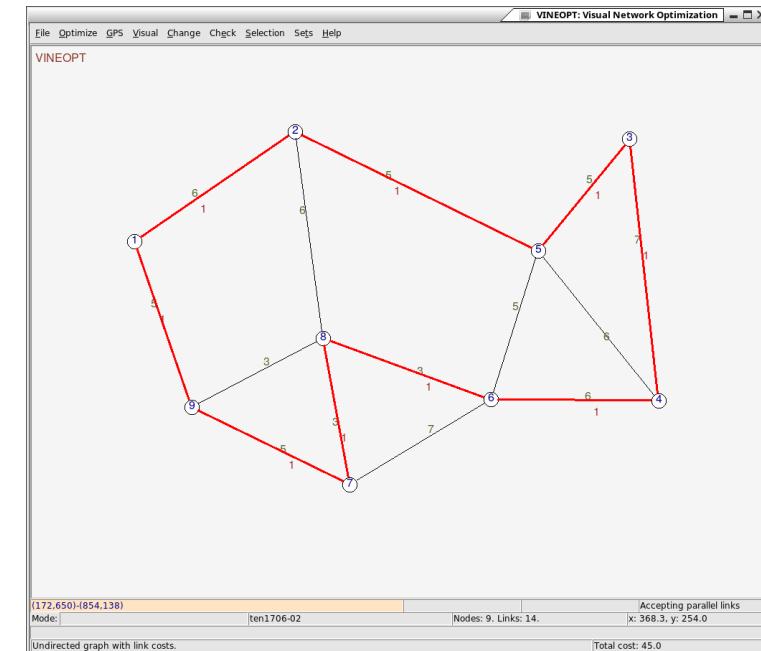
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44 / 1

Vineopt: 1-tree



Vineopt: TSP



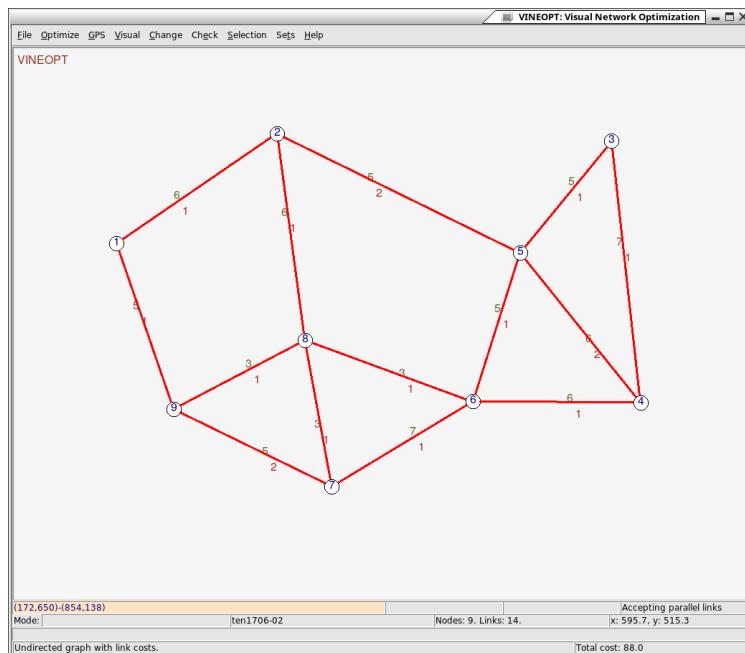
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45 / 1

Vineopt: Chinese postman



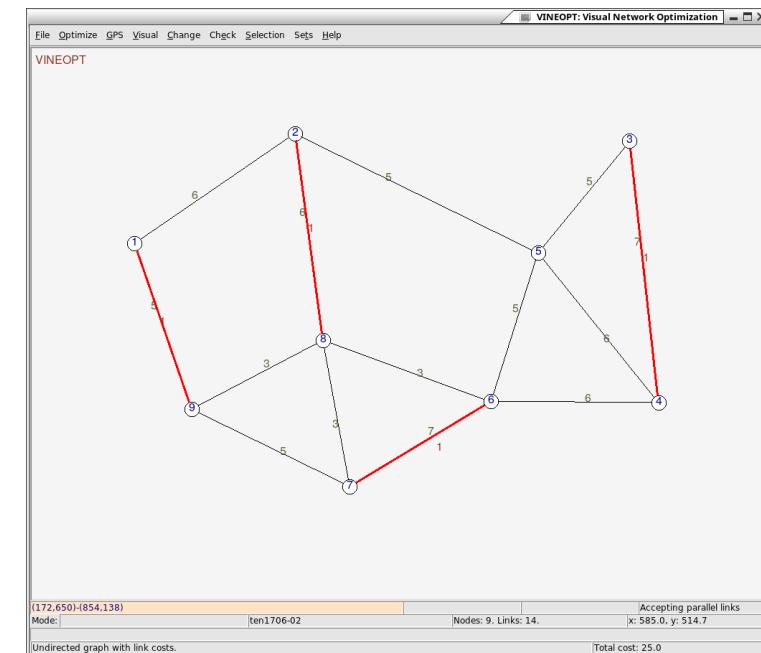
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46 / 1

Vineopt: matching



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47 / 1

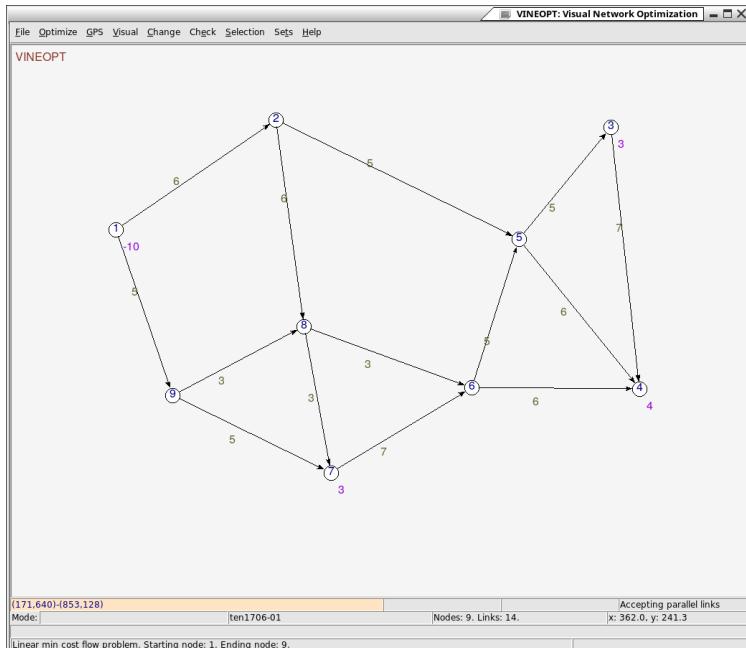
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48 / 1

Vineopt: directed network



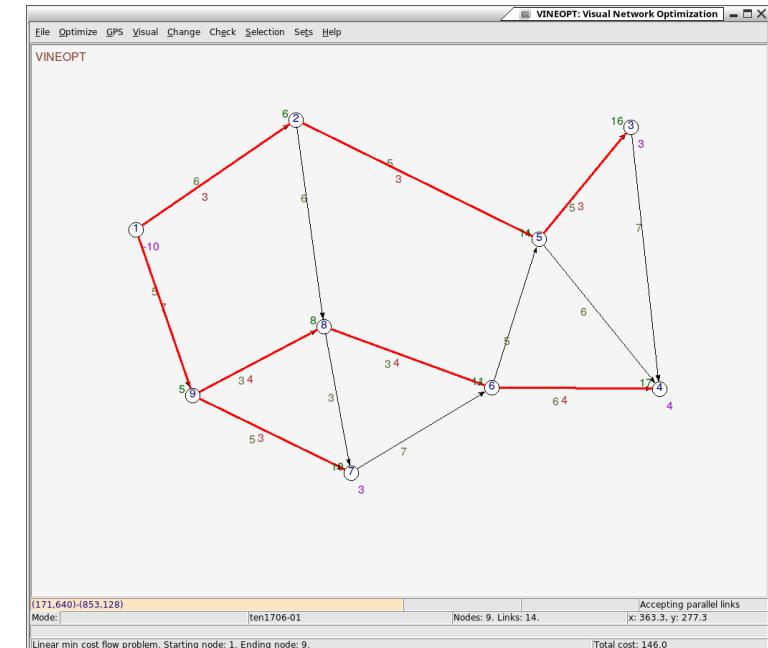
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49 / 1

Vineopt: min cost flow



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50 / 1

Vineopt: solution in tables

Current data						
Total cost: 146.0						
Link: 0: (1,2): Cost: 6.00,	Lowb: 0,	Cap: 99999999,	Flow: 3,	Red cost: 0,		
Link: 1: (1,9): Cost: 5.00,	Lowb: 0,	Cap: 99999999,	Flow: 7,	Red cost: 0,		
Link: 2: (2,5): Cost: 5.00,	Lowb: 0,	Cap: 99999999,	Flow: 3,	Red cost: 0,		
Link: 3: (2,8): Cost: 6.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 4,		
Link: 4: (3,4): Cost: 7.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 6,		
Link: 5: (5,3): Cost: 5.00,	Lowb: 0,	Cap: 99999999,	Flow: 3,	Red cost: 0,		
Link: 6: (5,4): Cost: 6.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 0,		
Link: 7: (6,4): Cost: 6.00,	Lowb: 0,	Cap: 99999999,	Flow: 4,	Red cost: 0,		
Link: 8: (6,5): Cost: 5.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 5,		
Link: 9: (7,6): Cost: 7.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 6,		
Link: 10: (8,6): Cost: 3.00,	Lowb: 0,	Cap: 99999999,	Flow: 4,	Red cost: 0,		
Link: 11: (8,7): Cost: 3.00,	Lowb: 0,	Cap: 99999999,	Flow: 0,	Red cost: 1,		
Link: 12: (9,7): Cost: 5.00,	Lowb: 0,	Cap: 99999999,	Flow: 3,	Red cost: 0,		
Link: 13: (9,8): Cost: 3.00,	Lowb: 0,	Cap: 99999999,	Flow: 4,	Red cost: 0,		

Dismiss <F3>

Save in file

Print

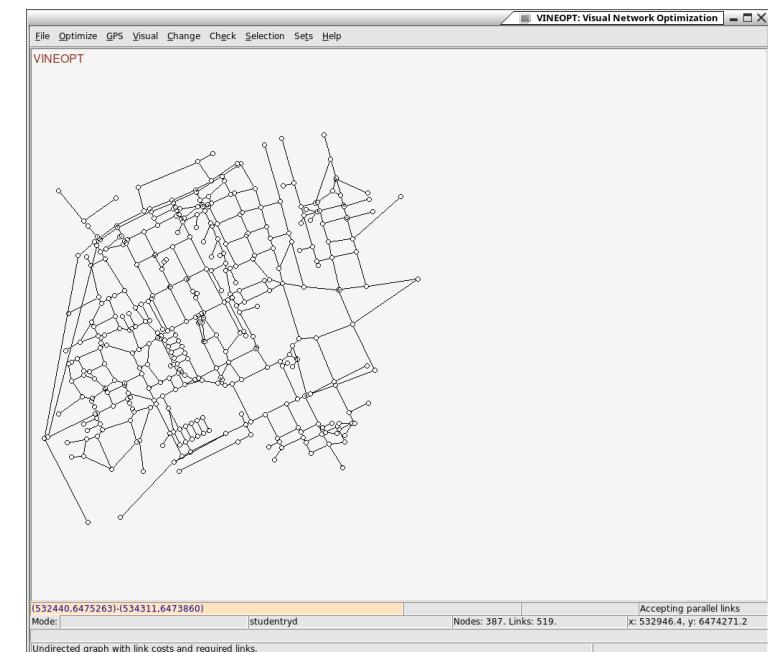
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51 / 1

Vineopt: Ryd - student part



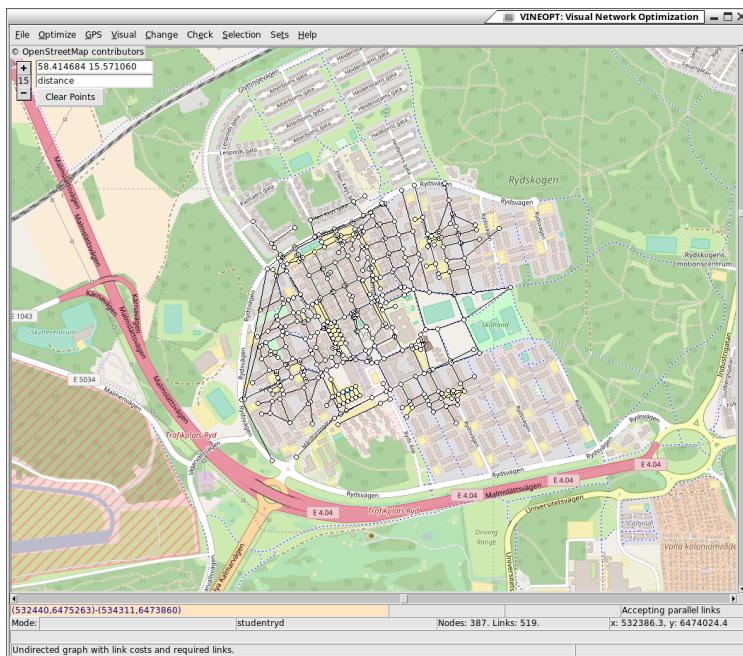
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52 / 1

Vineopt: Ryd - student part with OSM background



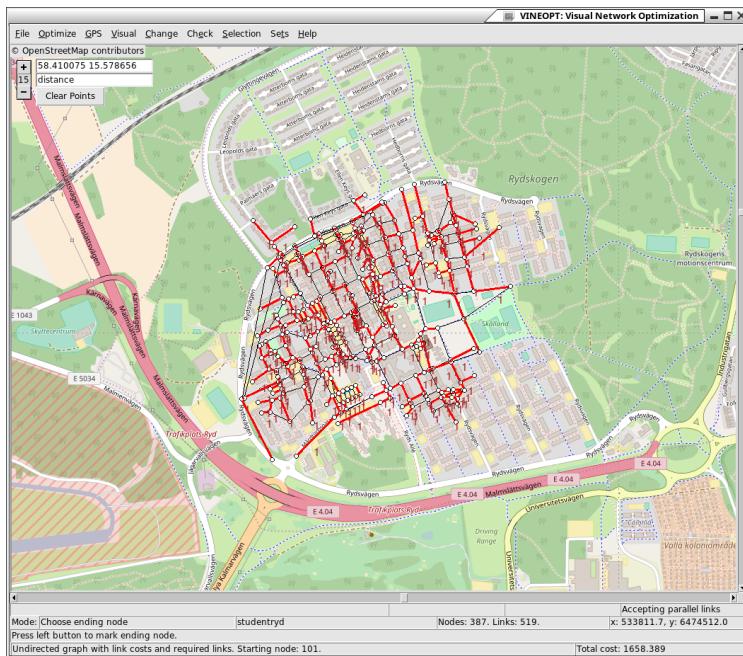
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53 / 1

Vineopt: MST in Ryd



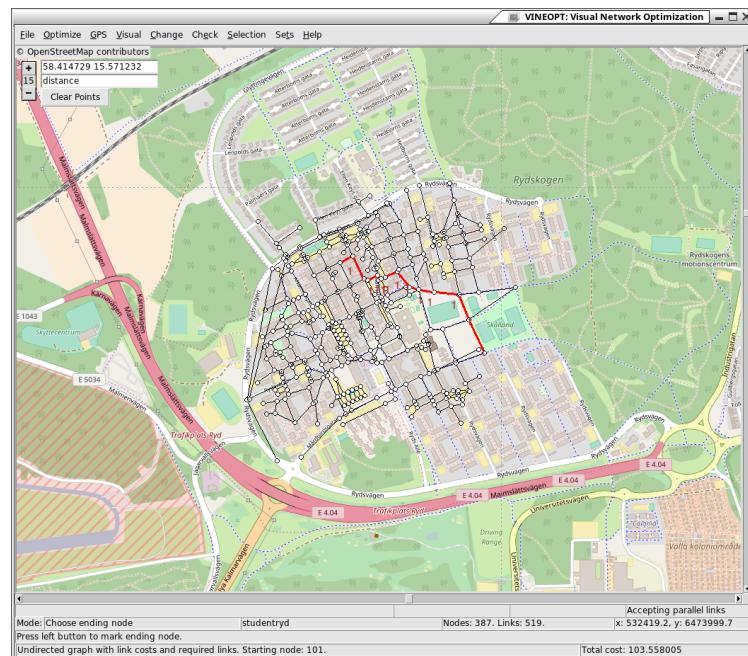
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55 / 1

Vineopt: shortest path in Ryd



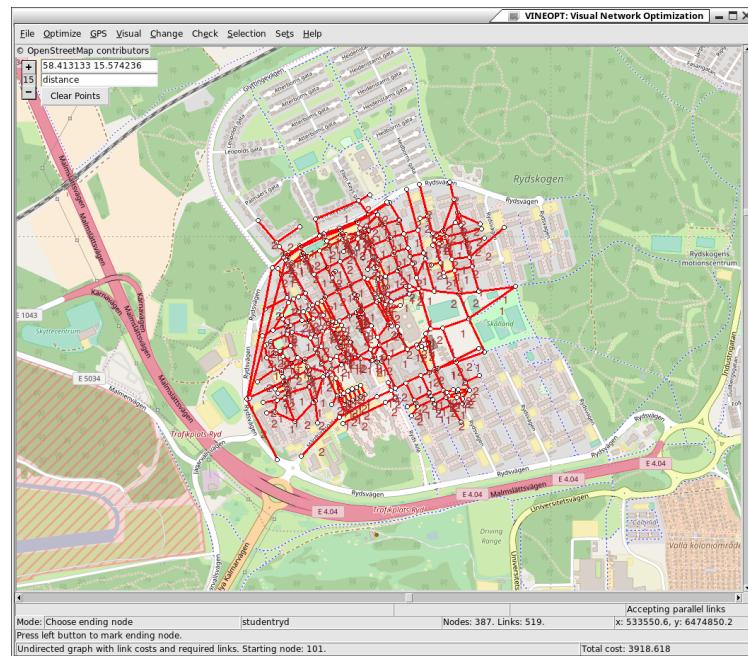
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54 / 1

Vineopt: Chinese postman in Ryd



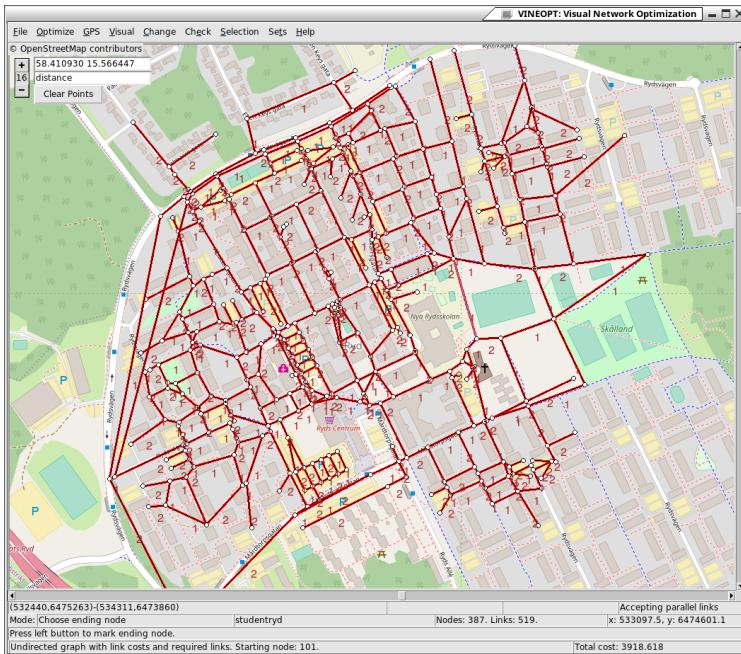
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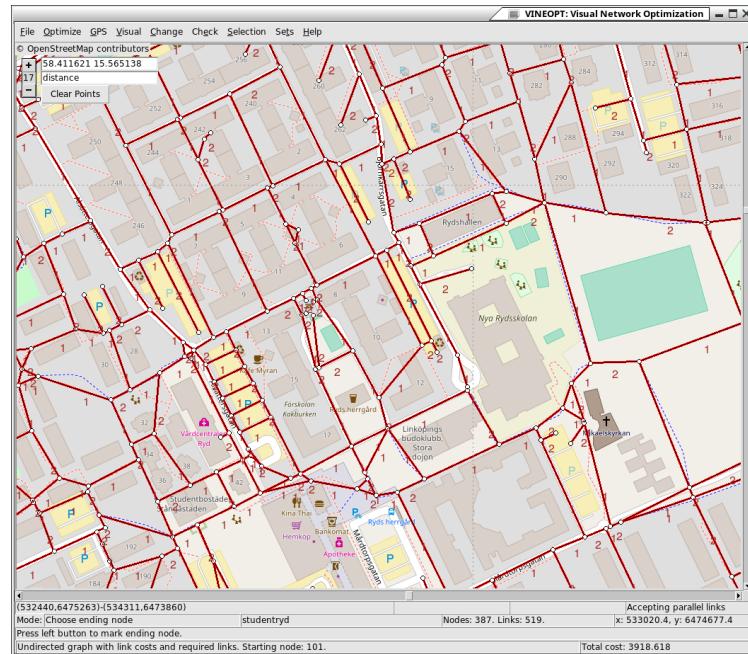
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56 / 1

Vineopt: Chinese postman in Ryd - zoom 1



Vineopt: Chinese postman in Ryd - zoom 2



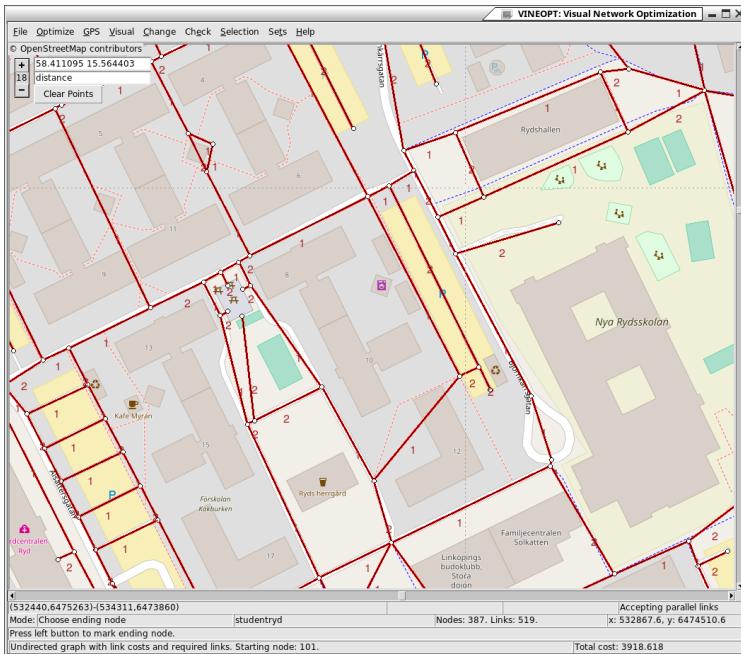
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57 / 1

Vineopt: Chinese postman in Ryd - zoom 3



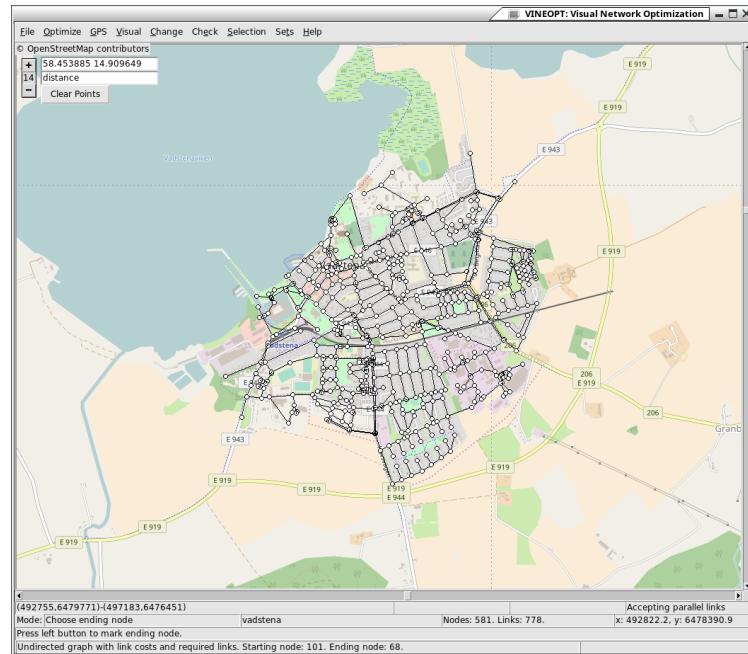
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58 / 1

Vineopt: Vadstena



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59 / 1

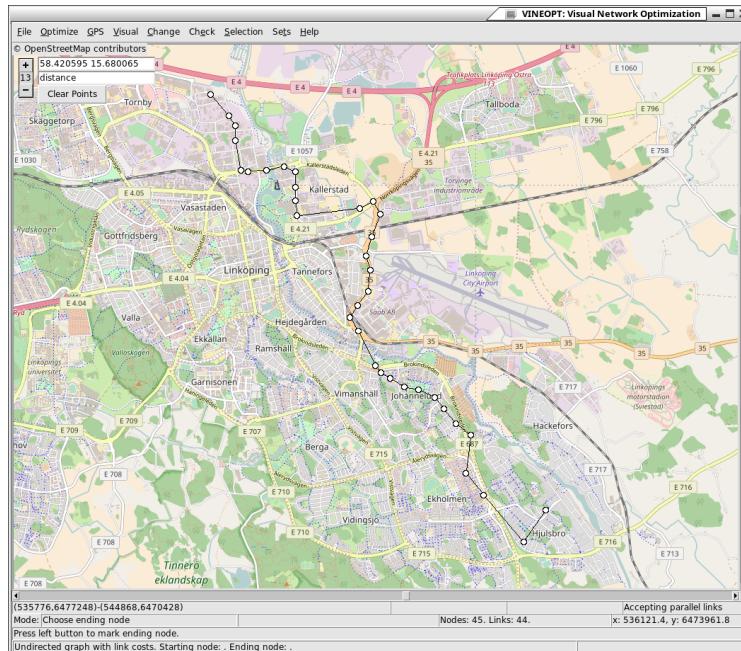
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60 / 1

Vineopt: GPS-track: home - Tornby



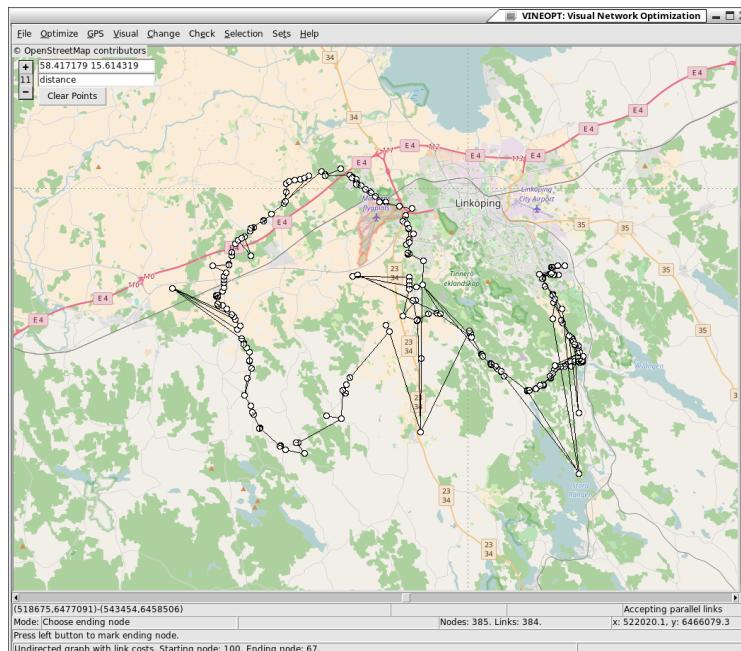
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61 / 1

Vineopt: GPS-track with few errors: round trip



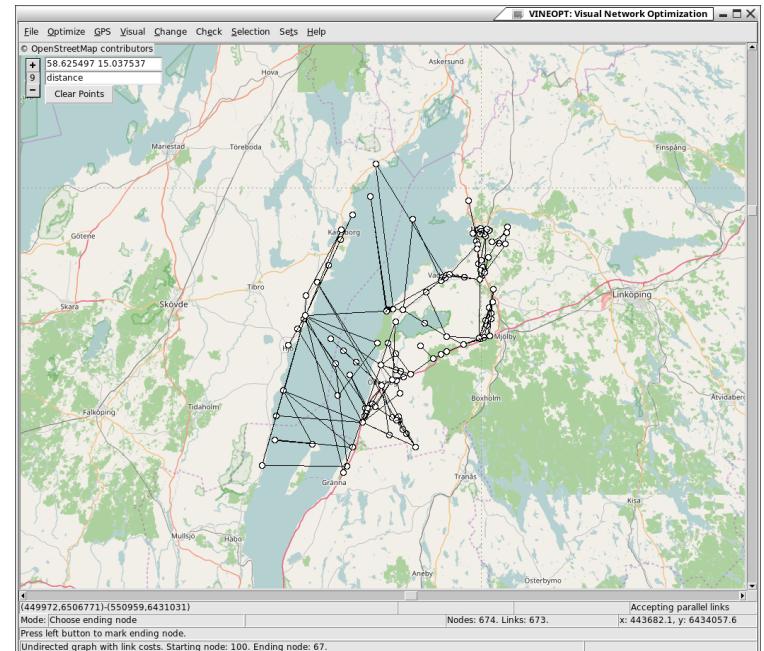
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63 / 1

Vineopt: bad GPS-track: Halvvättern



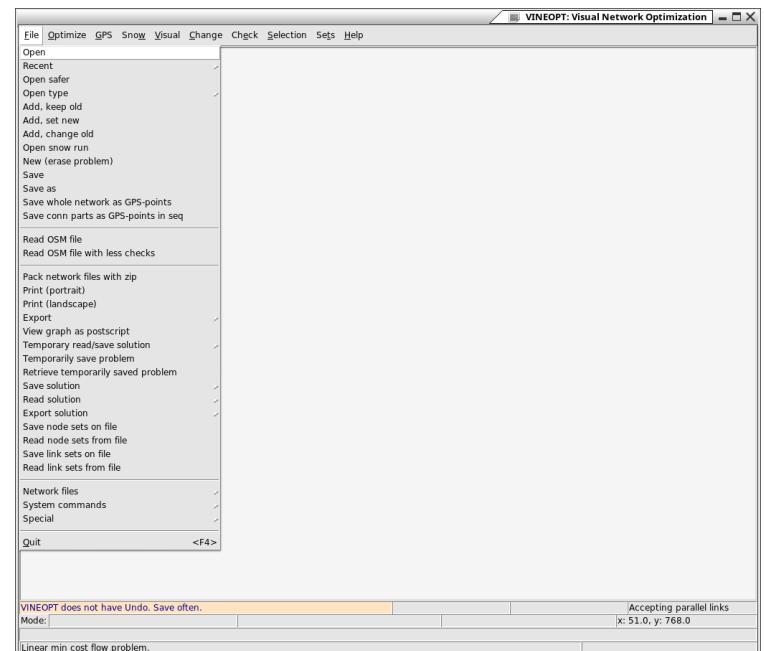
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62 / 1

Vineopt menu 1



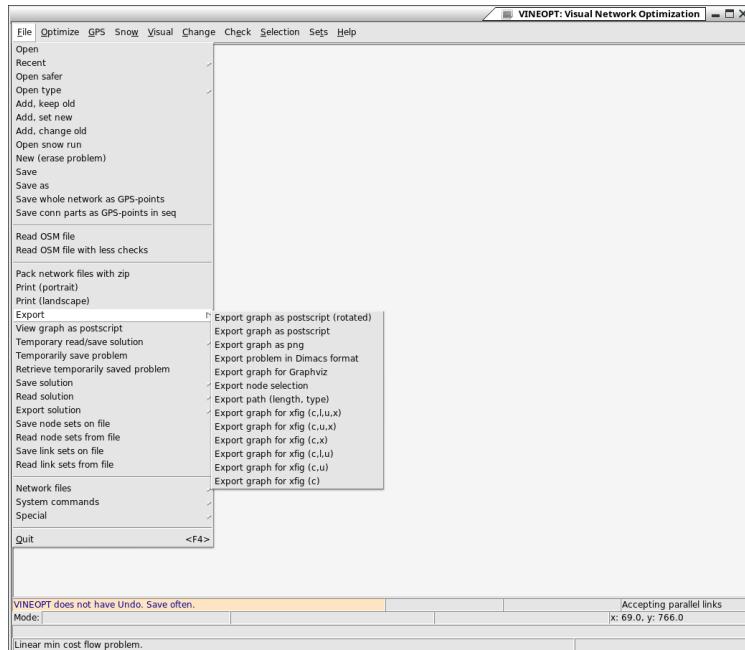
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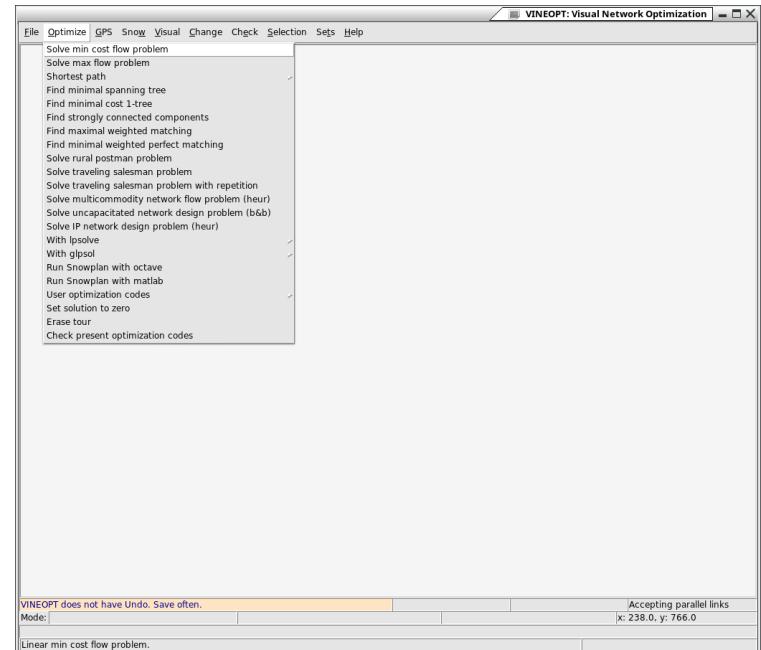
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64 / 1

Vineopt menu 1b



Vineopt menu 2



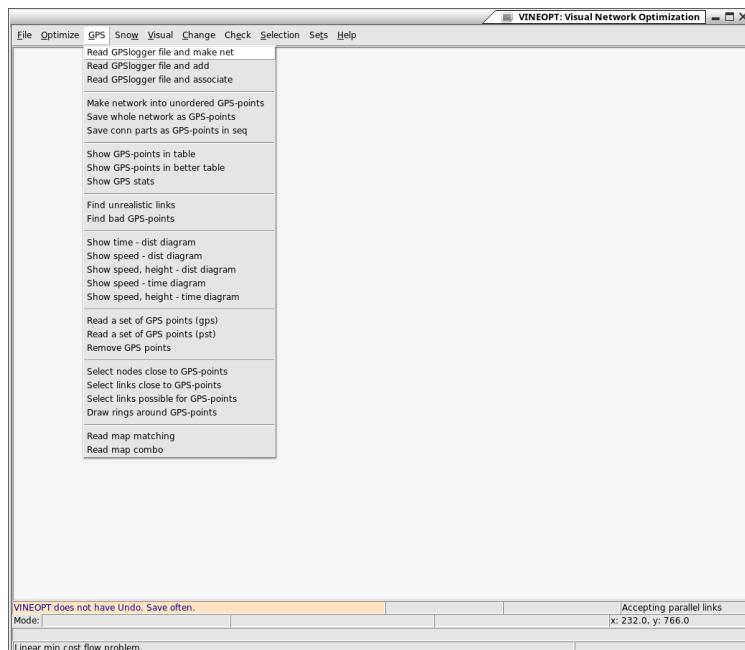
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65 / 1

Vineopt menu 3



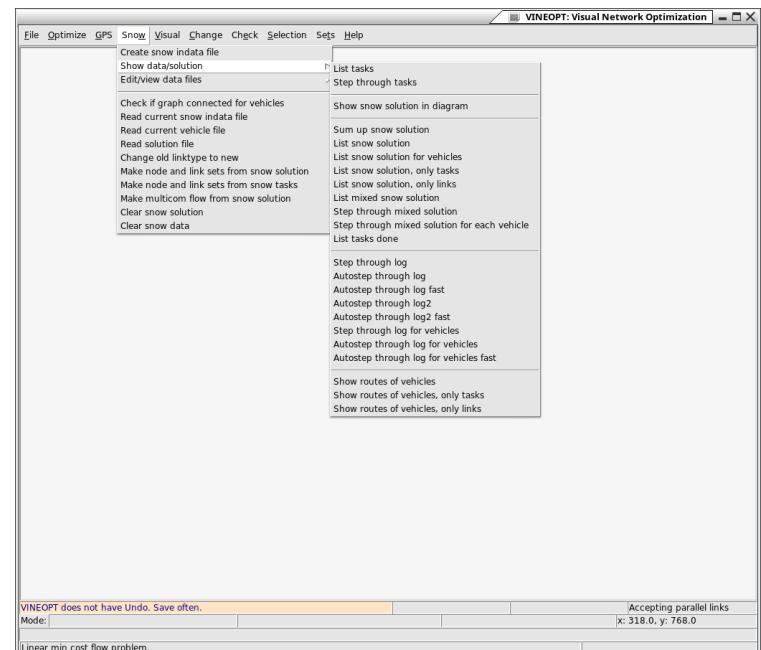
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66 / 1

Vineopt menu 4



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67 / 1

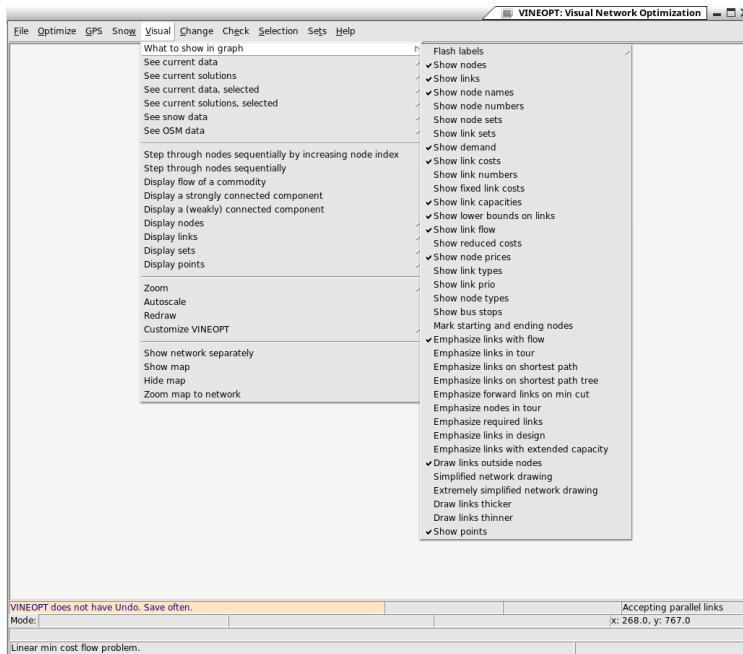
Kaj Holmberg

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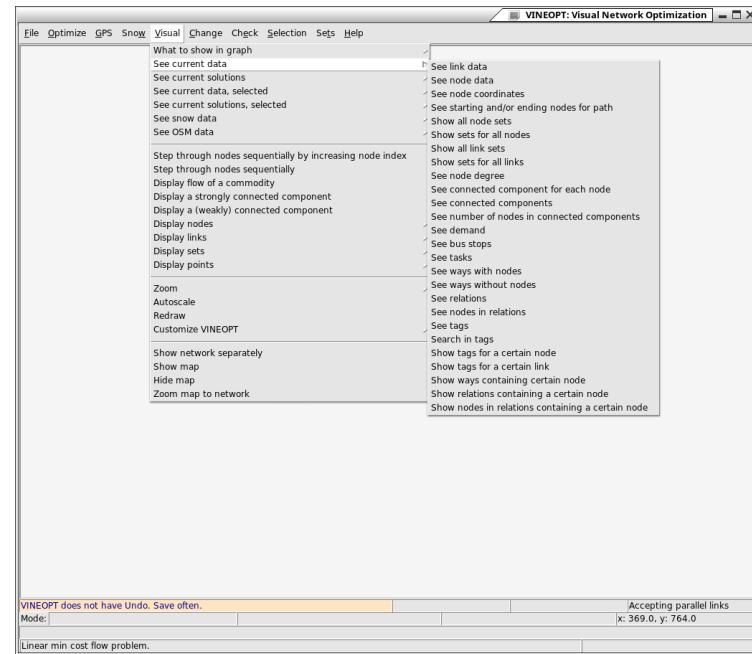
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68 / 1

Vineopt menu 5a



Vineopt menu 5b



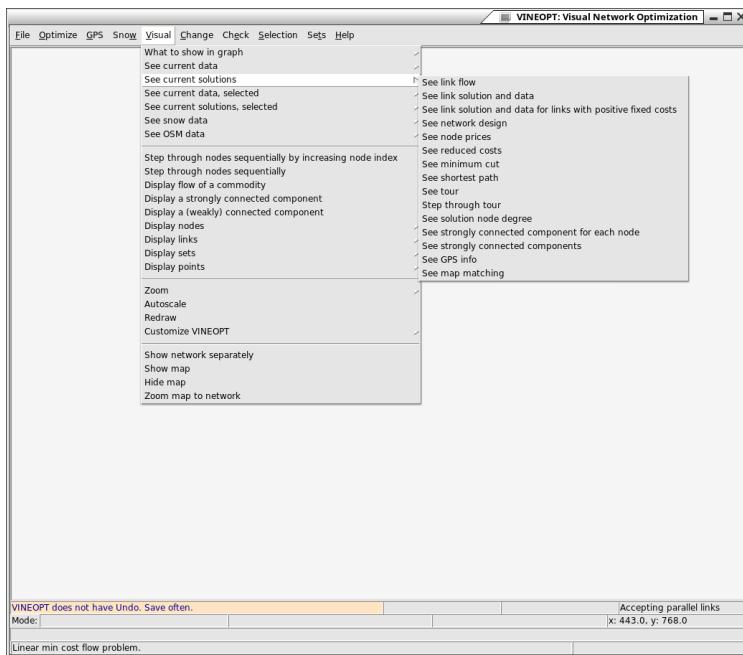
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69 / 1

Vineopt menu 5c



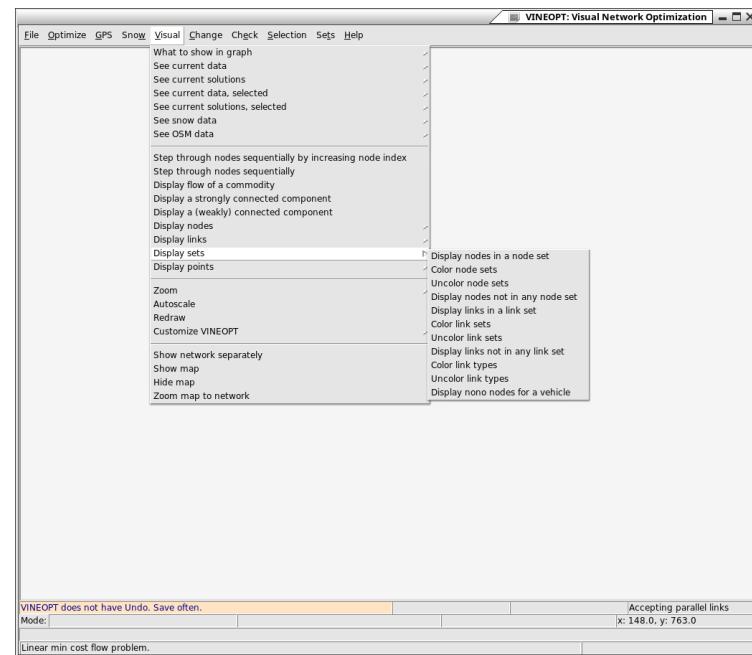
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70 / 1

Vineopt menu 5d



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71 / 1

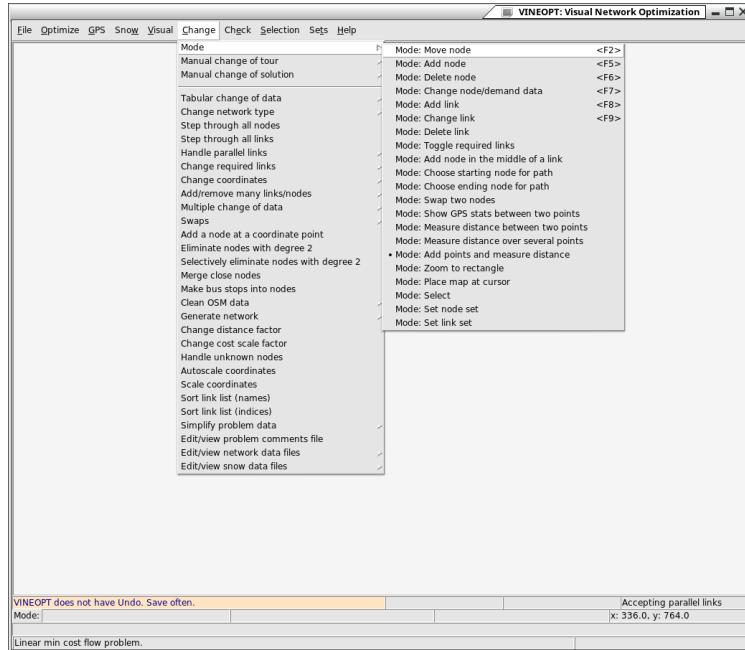
Kaj Holmberg

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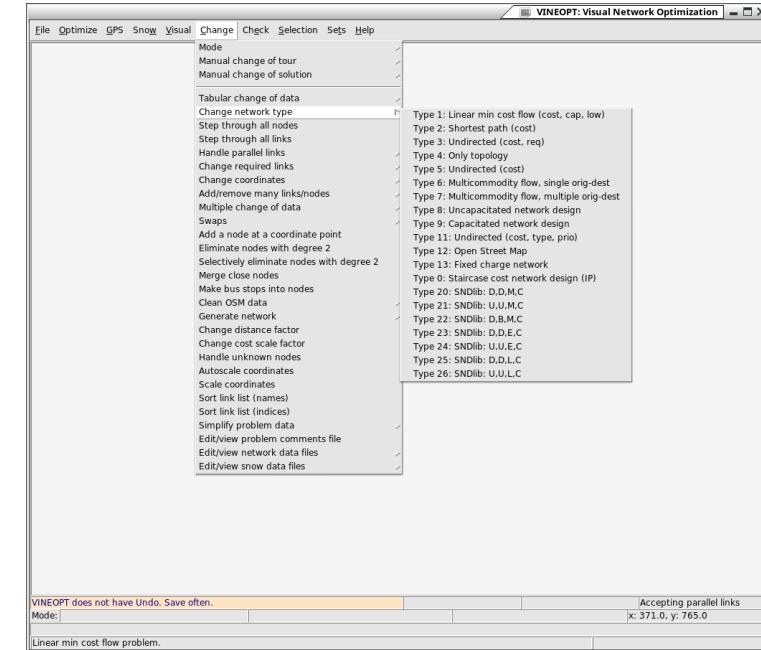
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72 / 1

Vineopt menu 6a



Vineopt menu 6b



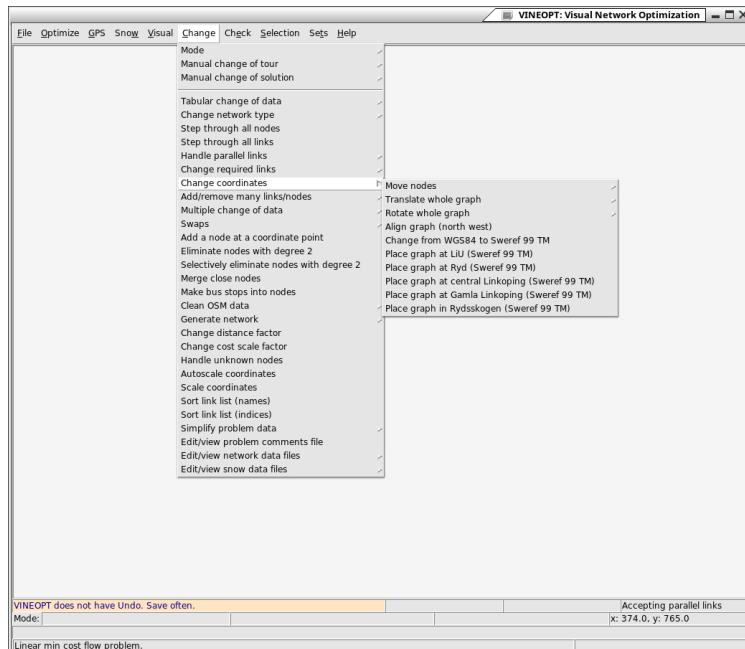
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73 / 1

Vineopt menu 6c



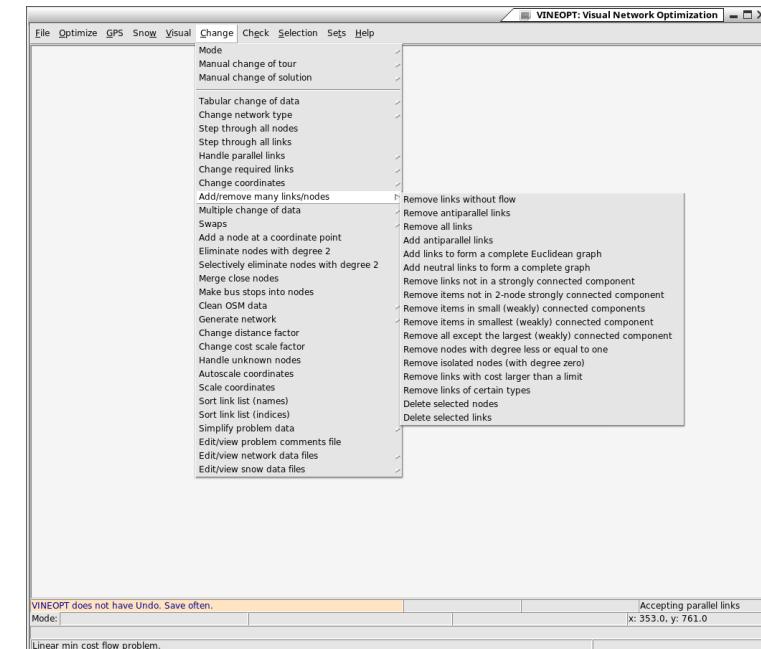
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74 / 1

Vineopt menu 6d



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75 / 1

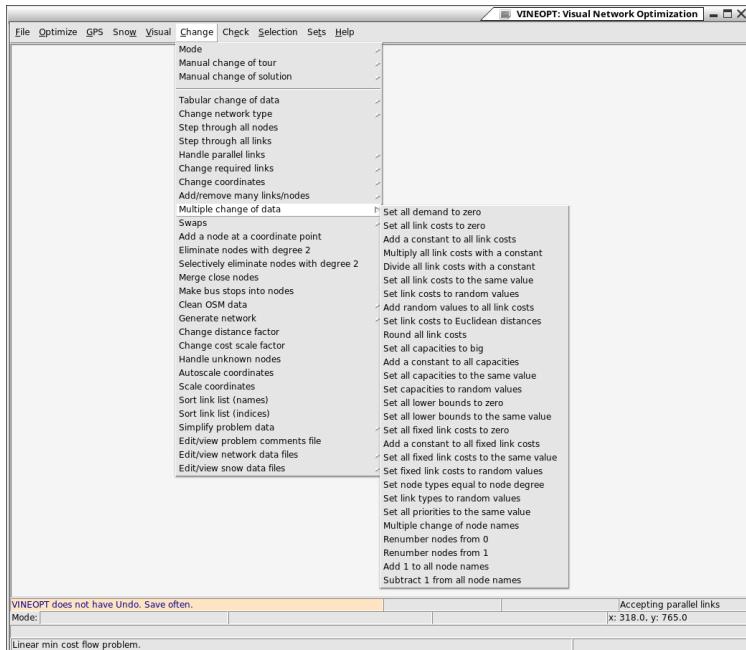
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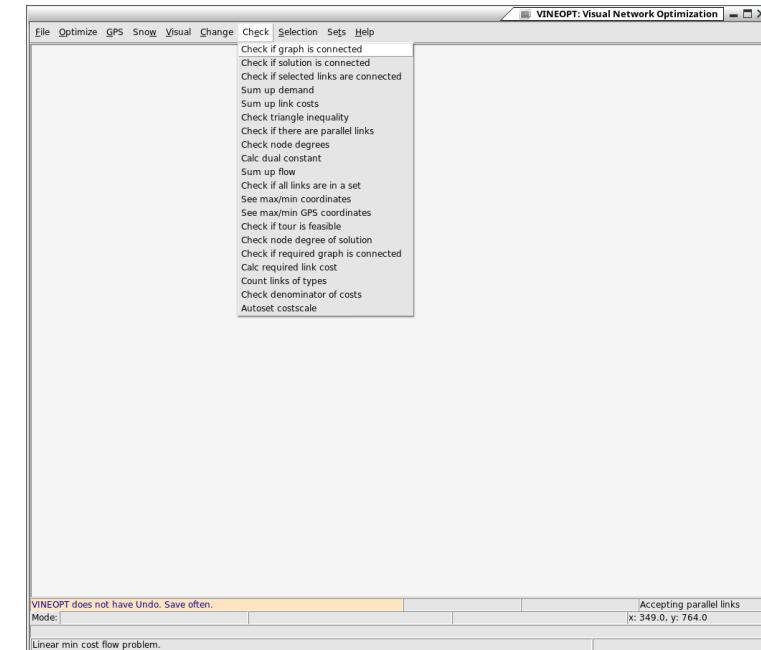
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76 / 1

Vineopt menu 6e



Vineopt menu 7



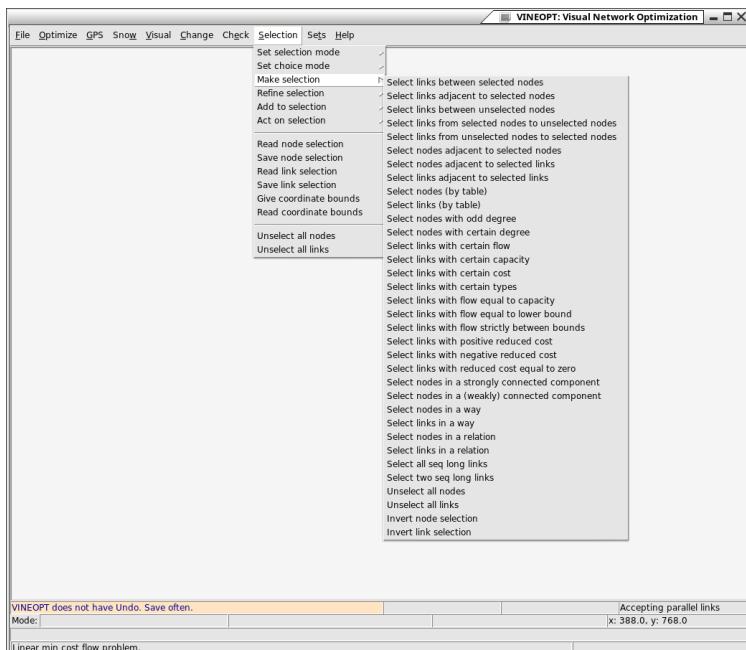
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77 / 1

Vineopt menu 8a



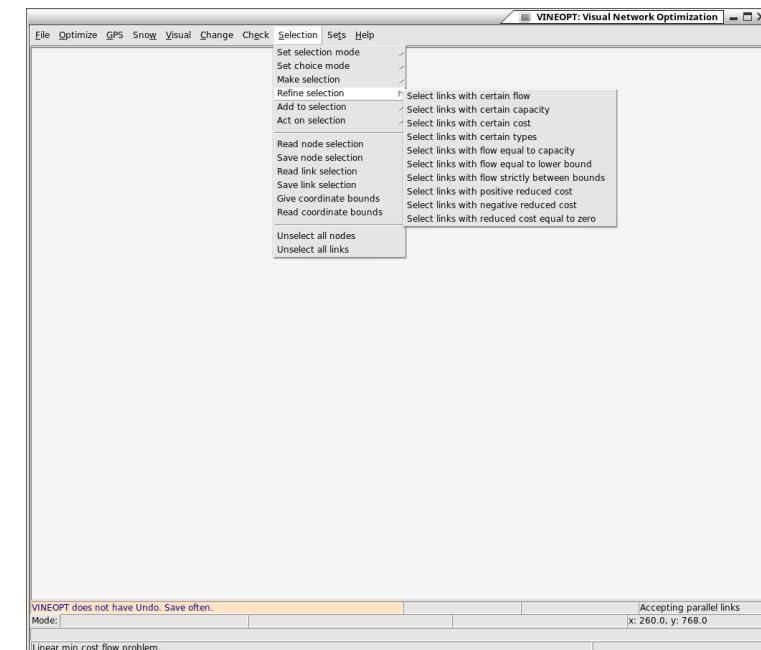
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78 / 1

Vineopt menu 8b



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79 / 1

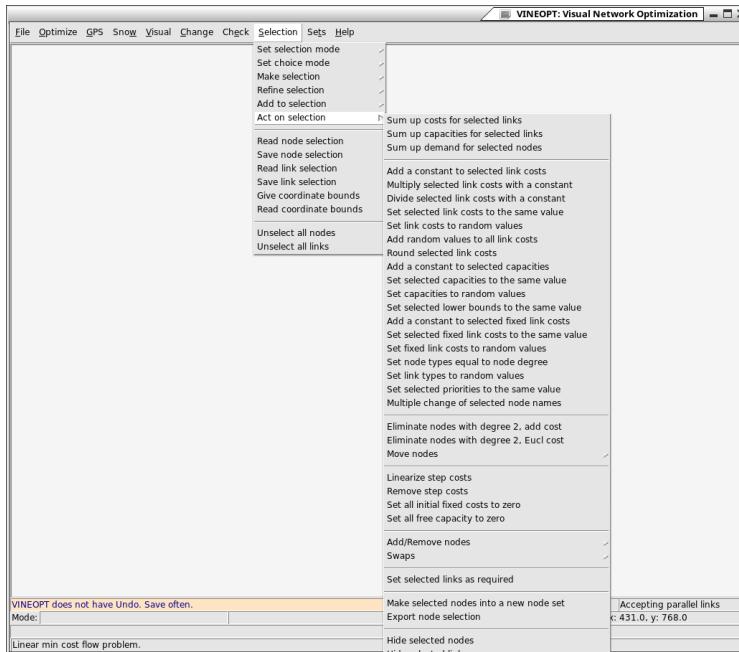
Kaj Holmberg

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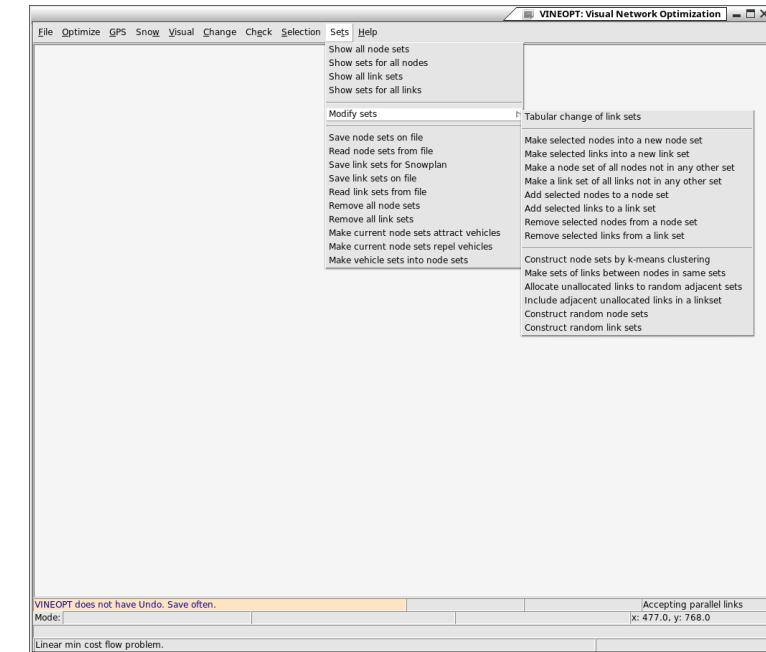
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80 / 1

Vineopt menu 8c



Vineopt menu 9



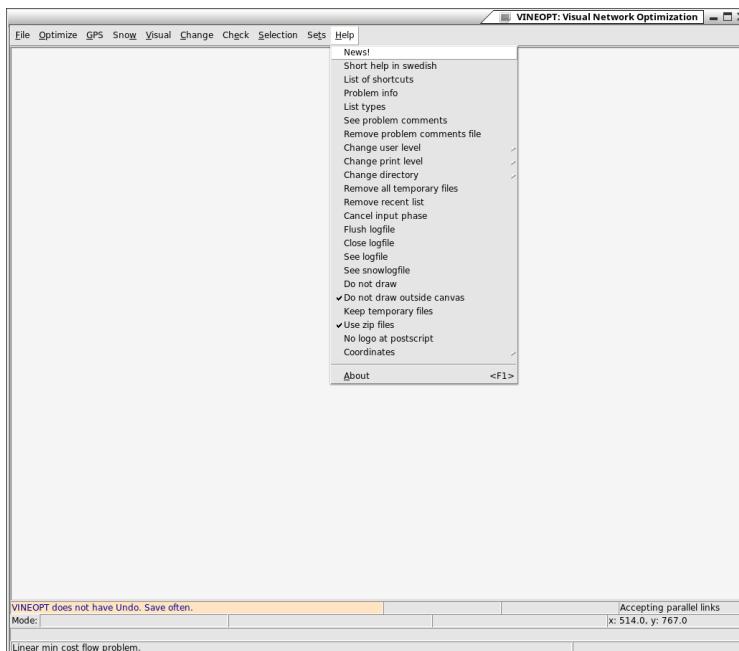
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81 / 1

Vineopt menu 10



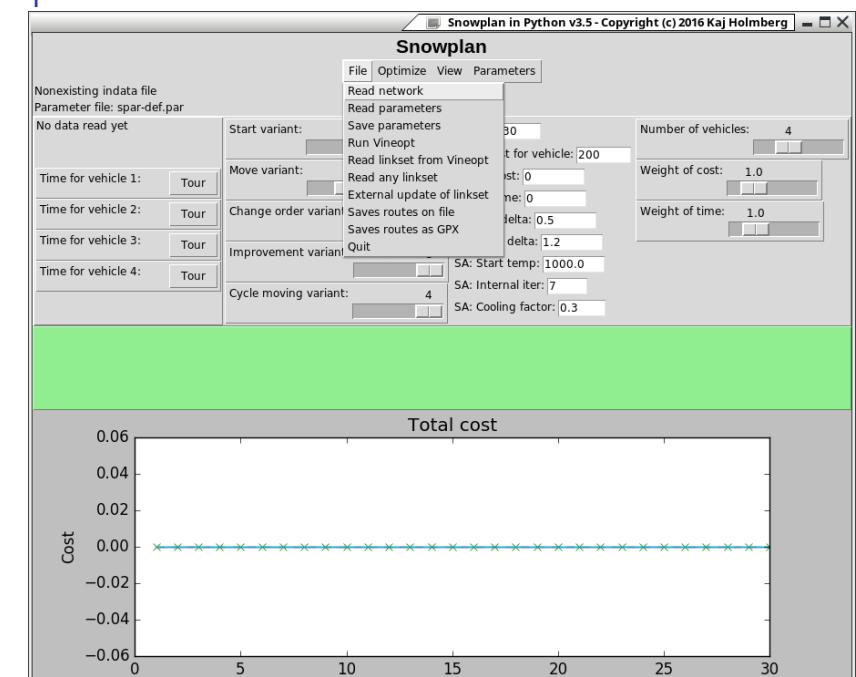
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82 / 1

Snowplan menu 1



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83 / 1

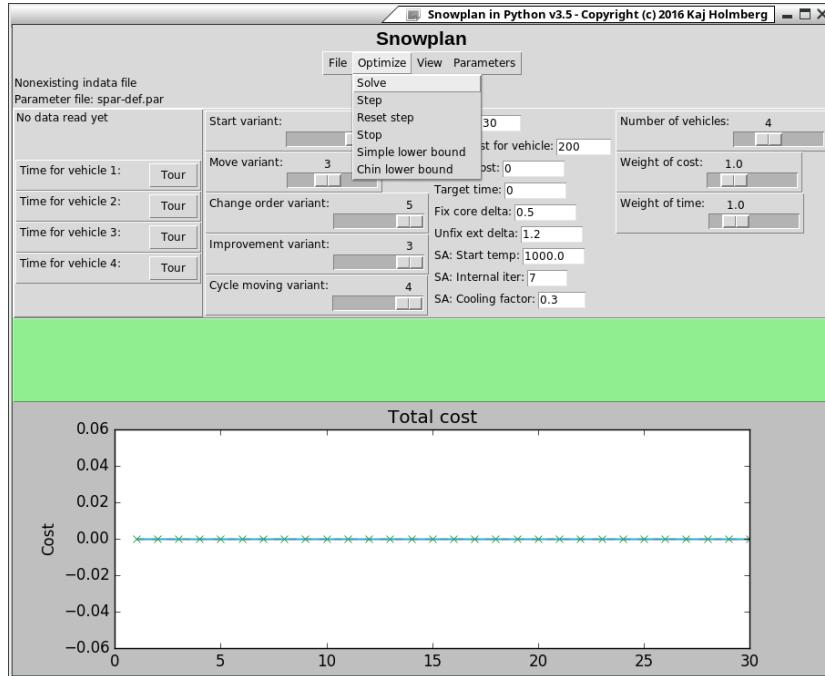
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84 / 1

Snowplan menu 2



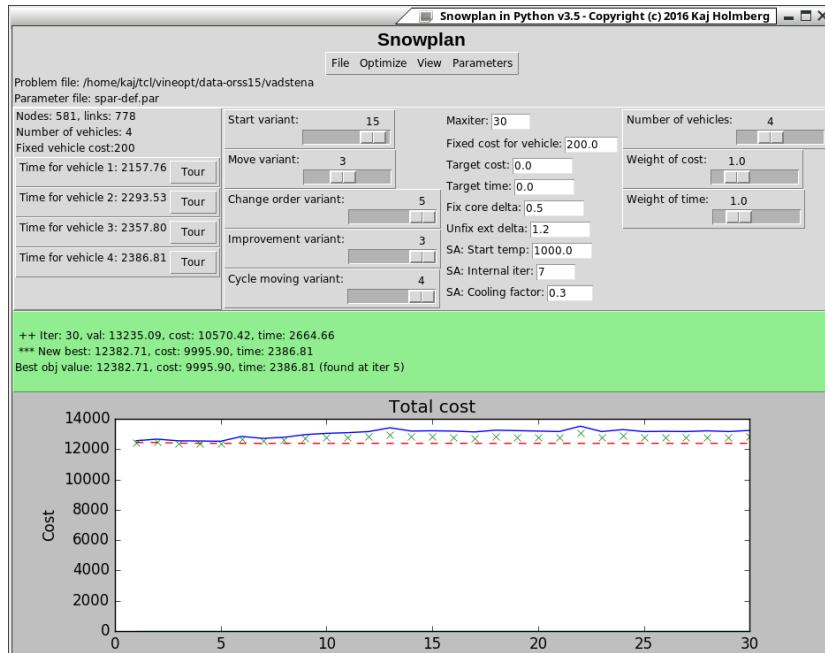
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85 / 1

Snowplan: a run - Vadstena



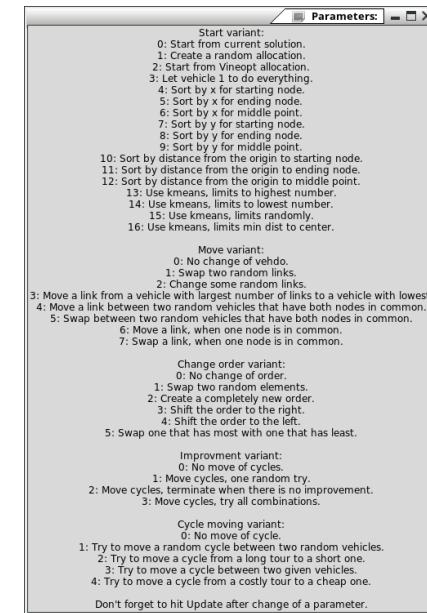
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86 / 1

Snowplan info



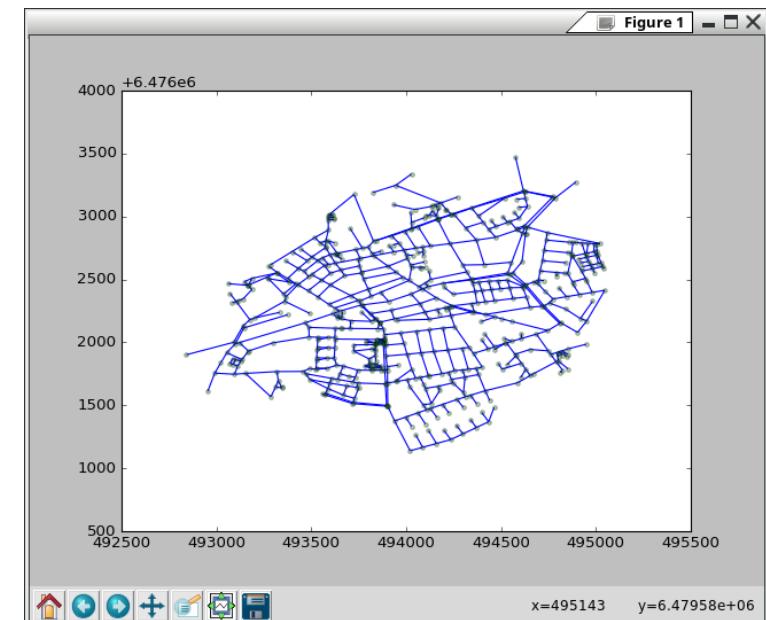
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86 / 1

Snowplan: Vadstena network



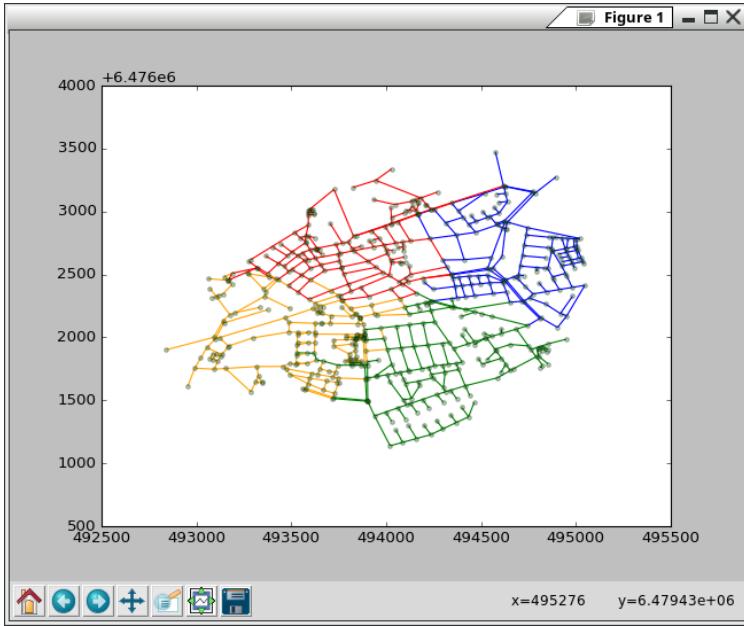
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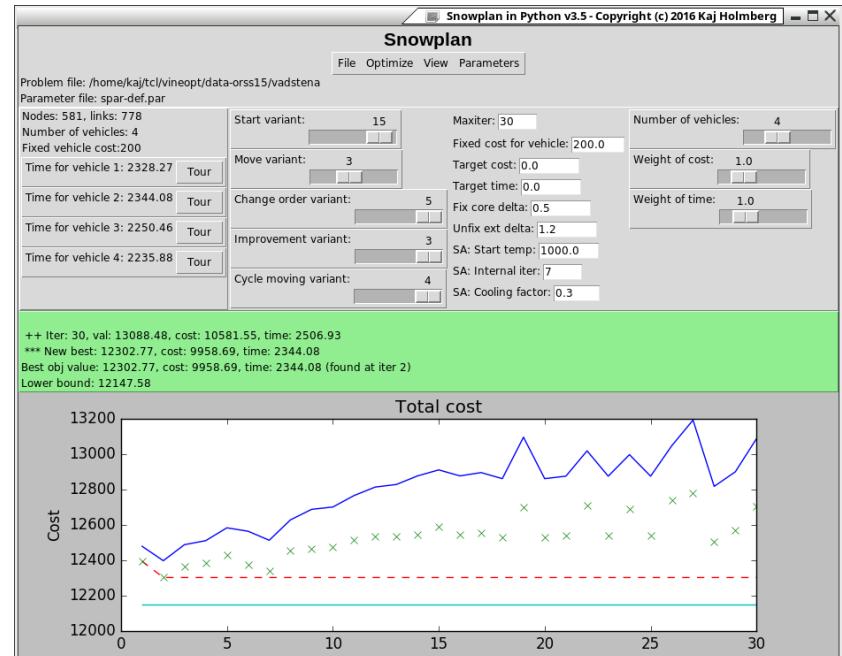
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88 / 1

Snowplan: Vadstena allocation



Snowplan: a run with lower bound - Vadstena



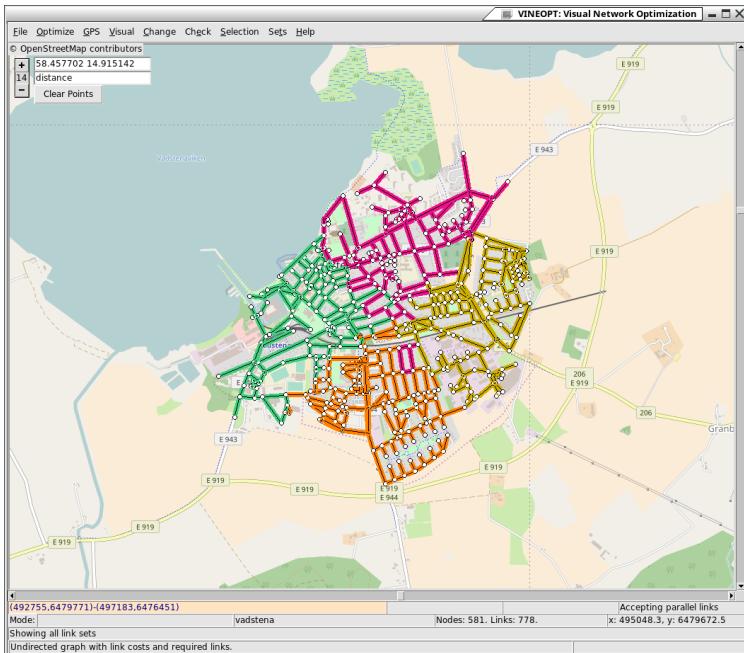
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89 / 1

Vineopt with allocation - started from Snowplan



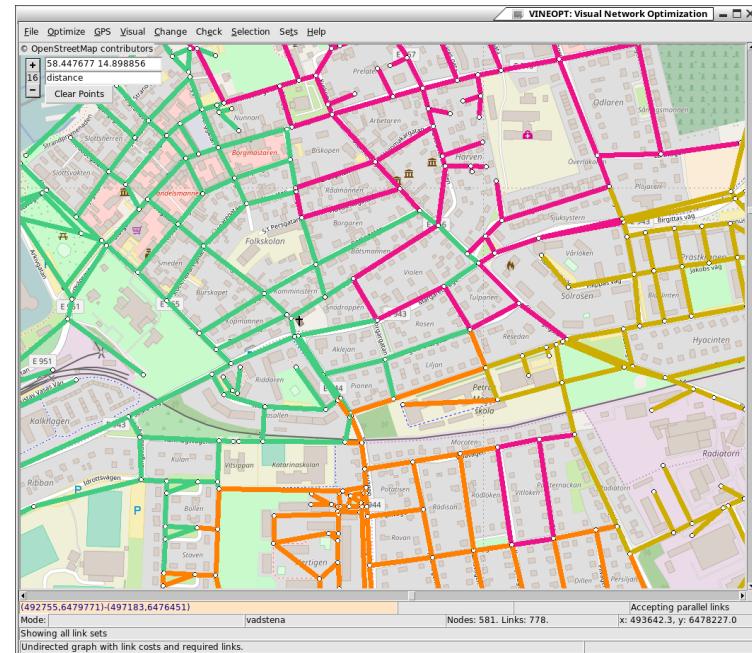
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90 / 1

Vineopt with allocation - zoom for manual change



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91 / 1

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92 / 1

Vigropt: students not allocated

Unallocated persons: 40

Persons not allocated:

AL-MUFTI SUMMIA	Use	Ed	Del
ASPGRÉN ANTON	Use	Ed	Del
BÄNGERUS SEBASTIAN	Use	Ed	Del
CLAESSEN MARTIN	Use	Ed	Del
DUFBÄCK DENNIS	Use	Ed	Del
EDHOLM LOVISA	Use	Ed	Del
EKLÖLSSON SOFIE	Use	Ed	Del
FLEMING THEODOR	Use	Ed	Del
FÖRBERG FELIX	Use	Ed	Del
GUDJONSSON KARL FREDRIK	Use	Ed	Del
HABBE LISA	Use	Ed	Del
HELLSING MATTIAS	Use	Ed	Del
HERO EK PONTUS	Use	Ed	Del
HÄKANSSON FREDRIK	Use	Ed	Del
JOHANNSON FABIAN	Use	Ed	Del
JOHANSSON CHRISTOFFER	Use	Ed	Del
KRONVIST EMMA	Use	Ed	Del
KVIST HANNA	Use	Ed	Del
LESTANDER TIM	Use	Ed	Del

Optimized group formation - Copyright (c) 2016 Kaj Holmberg

Choose group for AL-MUFTI SUMMIA (asp: 99.0 1.0 92.0) prev groups: 0 0 0 0 2
Suggested group: 1

Group 1 Group 2 Group 3 Group 4 Group 5 Group 6

Number of persons: 0
Sum of asp 1: 0.00
Sum of asp 2: 0.00 Sum of asp 2: 0.00 Sum of asp 2: 0.00 Sum of asp 2: 0.00 Sum of asp 2: 0.00 Sum of asp 2: 0.00
Sum of asp 3: 0.00 Sum of asp 3: 0.00 Sum of asp 3: 0.00 Sum of asp 3: 0.00 Sum of asp 3: 0.00 Sum of asp 3: 0.00
Sum of repetition: 0.00 Sum of repetition: 0.00 Sum of repetition: 0.00 Sum of repetition: 0.00 Sum of repetition: 0.00 Sum of repetition: 0.00
Total penalty: 211.00
Total cost: 0.00 Pers: 40. In group: min: 6, max: 7. Date: 2017-05-30

Neighborhood: Move Swap Update

Weight of number: 10 Weight of Aspect 1 1 Number of groups: 6
Weight of prev groups: 100 Weight of Aspect 2 10
Weight of Aspect 3 1

Read data from file/home/kaj/tcl/basg/vt-ut/vt6-vt16.dat

Vigropt: students allocated by heuristic

Optimized group formation - Copyright (c) 2016 Kaj Holmberg

Choose group for AL-MUFTI SUMMIA (asp: 99.0 1.0 92.0) prev groups: 0 0 0 0 2
Suggested group: 1

Group 1 Group 2 Group 3 Group 4 Group 5 Group 6

Number of persons: 6 Number of persons: 7 Number of persons: 7 Number of persons: 6 Number of persons: 6 Number of persons: 6
Sum of asp 1: 1.64 00 Sum of asp 1: 1.760 00 Sum of asp 1: 1.760 00 Sum of asp 1: 1.669 00 Sum of asp 1: 1.669 00 Sum of asp 1: 1.669 00
Sum of asp 2: 0.50
Sum of asp 3: 0.477 00
Sum of repetition: 35666.67
Total penalty: 356.67
Total cost: 5226.33 Pers: 40. In group: min: 6, max: 7. Date: 2017-05-30

Neighborhood: Move Swap Update

Weight of number: 10 Weight of Aspect 1 1 Number of groups: 6
Weight of prev groups: 100 Weight of Aspect 2 10
Weight of Aspect 3 1

Read data from file/home/kaj/tcl/basg/vt-ut/vt6-vt16.dat

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93 / 1

Viseopt

Filled in

1	2	3	4	5	6	7	8	9
1		4	8					
2	7	9			5			
3	6	1				2		
4				5	9			
5	8	1						
6	2			6	7			
7		5	7		6			
8				9				
9	1	4		3	9			

Num: None 1 2 3 4 5 6 7 8 9 :
Row: None 1 2 3 4 5 6 7 8 9 :
Col: None 1 2 3 4 5 6 7 8 9 :
SqCol: None 1 2 3 : SqRow: None 1 2 3 :

Filled: 23 (of 81) Checking indata feasibility: Indata feasible

Do one row Do one col Do one sq Do one num Do one Do all Do two test Do ext test
Get numbers Read Save Count Clear Quit Run GLPK Check Info Alt disp

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94 / 1

Viseopt: one step

Filled in

1	2	3	4	5	6	7	8	9
1		4	8			7		
2	7	9			5			
3	6	1				2		
4	1			5	9			
5	8	1						
6	2			6	7			
7		5	7		6			
8				9		5		
9	1	4		3	9			

Num: None 1 2 3 4 5 6 7 8 9 :
Row: None 1 2 3 4 5 6 7 8 9 :
Col: None 1 2 3 4 5 6 7 8 9 :
SqCol: None 1 2 3 : SqRow: None 1 2 3 :

Filled: 26 (of 81) Do a one pass col fixation: Fixed position (1,9) to 7

Do one row Do one col Do one sq Do one num Do one Do all Do two test Do ext test
Get numbers Read Save Count Clear Quit Run GLPK Check Info Alt disp

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95 / 1

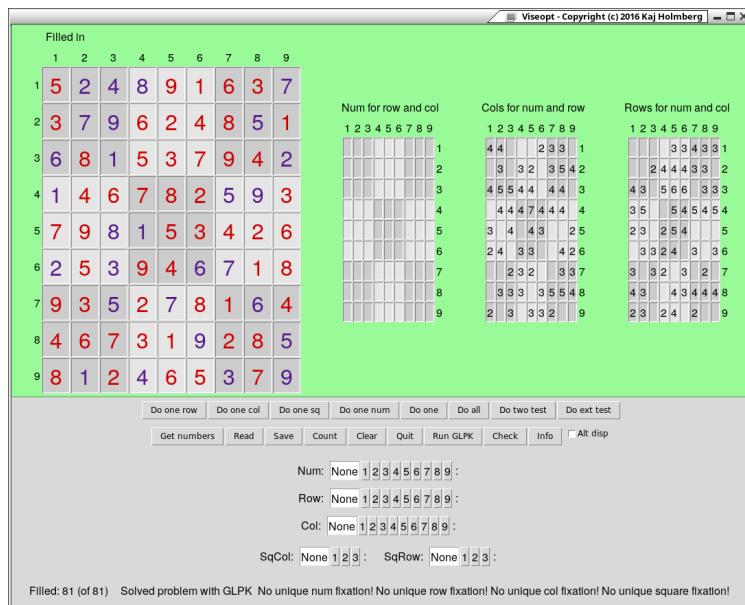
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96 / 1

Viseopt: full solution by GLPK



Vineopt homepage

The screenshot shows a linear programming solver interface. It includes a menu bar with "File", "Optimization", "Visualization", "Changes", and "Help". Below the menu is a table for "Visual Linear Programming" with columns for Bas, z, x1, x2, x3, x4, x5, and b. The table has several rows of data. A "Pivot" button is below the table. To the right, there's a "Vineopt and friends" section with news items and a "News" sidebar.

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97 / 1

Vineopt homepage

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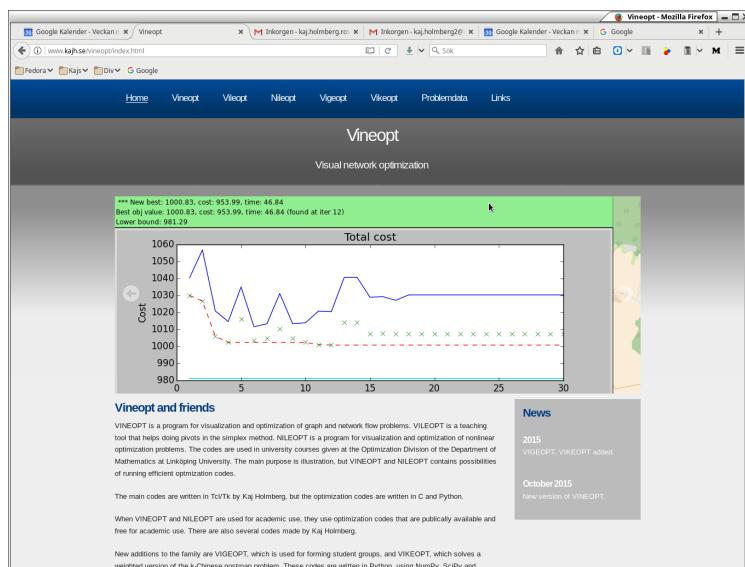
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98 / 1

The end

Questions?

kaj.holmberg@liu.se



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7 juni 2017

99 / 1

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7 juni 2017

100 / 1