



Bonus Workshop

Солверы

○ Constraint Programming:

CHOCO - java library, open source

Gecode - c++, free

FICO Express - binary, free with academic license

JACOP - java , open source

CPLEX – binary, free with academic license

MiniZinc / G12 - binary, free for students

or-tools - C++ , open source, APIs - Java,

Python, and .NET

SAS OR – binary, free with academic license

○ Local Search:

Local Solver - binary, free with academic license

OptaPlanner - java, open source

CPLEX – binary, free with academic license

SAS OR – binary, free with academic license

○ Mixed Integer Programming:

BCP - c++, open source

CBC - c++, open source

CPlex - binary, free with academic license

GLPK - c, open source

gurobi - binary, free with academic license

LPSolve - c, open source

MIP – binary, open source

SCIP - binary, free for academic use

SAS OR - binary, free with academic license

○ Non-Linear Optimization:

Artelis Knitro – binary, free with academic license

CPLEX – binary, free with academic license

SAS OR – binary, free with academic license

...

Пакеты для Python, часть 1

MINLP+MIQP+MILP +NLP+IP+LP	
Package	Link
gekko	Official
knitro	Official
lindo	Official
midaco	Official
naginterfaces	Official
octeract	Official
pydrake	Official
pygmo	Official
pyomo	Official
pyscipopt	Official
xpress	Official

MIQP+MILP+IP +LP	
Package	Link
copt	Official
cplex	Official
docplex	Official
gurobipy	Official
highs	Official
localsolver	Official
mosek	Official
optlang	Official
sasoptpy	Official

MILP+IP+LP	
Package	Link
cvxopt	Official
cvxpy	Official
cylp	Official
flowty	Official
lpsolve55	Official
Mindoptpy	Official
Mip	Official
Ortools	Official
picos	Official
pulp	Official
pymprog	Official
swiglpk	Official

NLP+LP	
Package	Link
iminuit	Official
nlopt	Official
openmdao	Official
pyopt	Official
scipy	Official
worhp	Official
cyipopt	Official

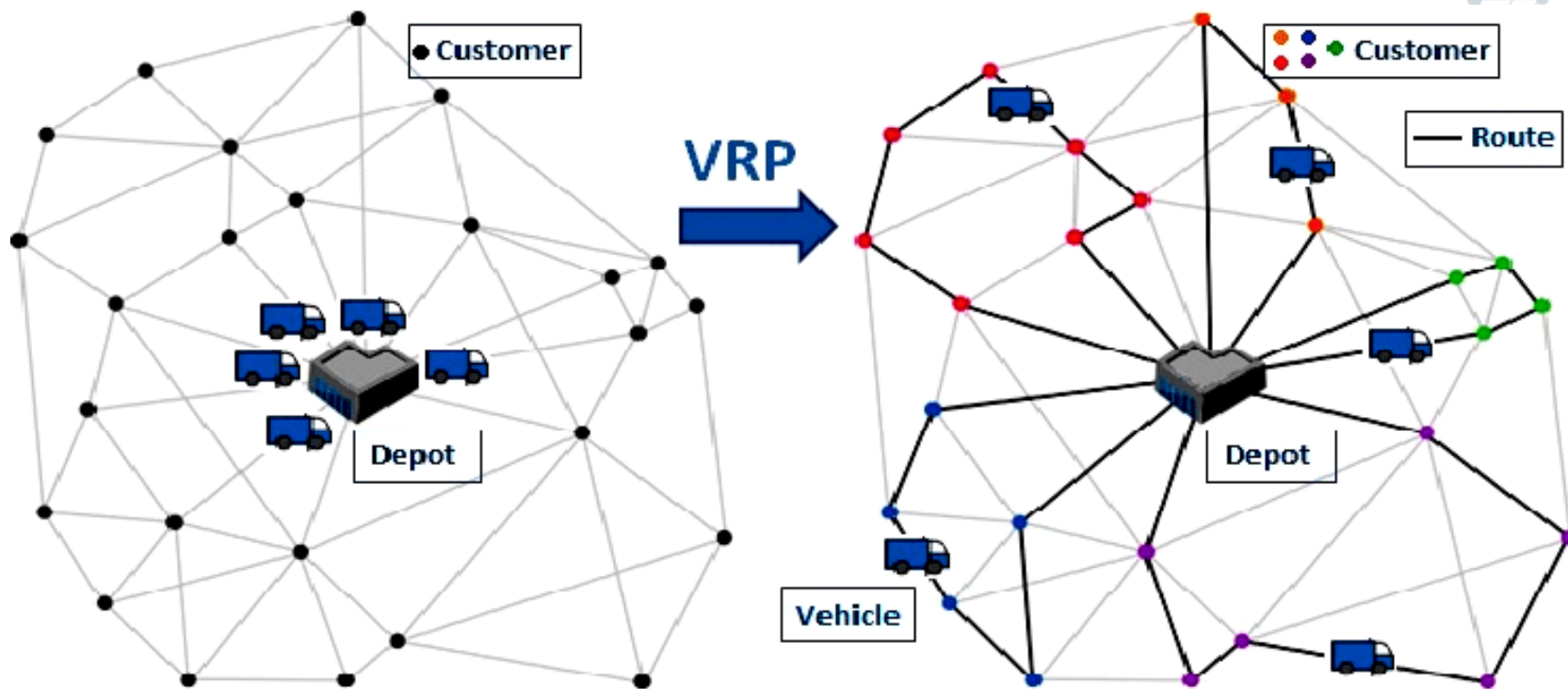
CP	
Package	Link
cplex	Official
cmpy	Official
gecode-python	Official
kalis	Official
minizinc	Official
optapy	Official
ortools	Official
z3-solver	Official

Пакеты для Python, часть 2

GPP

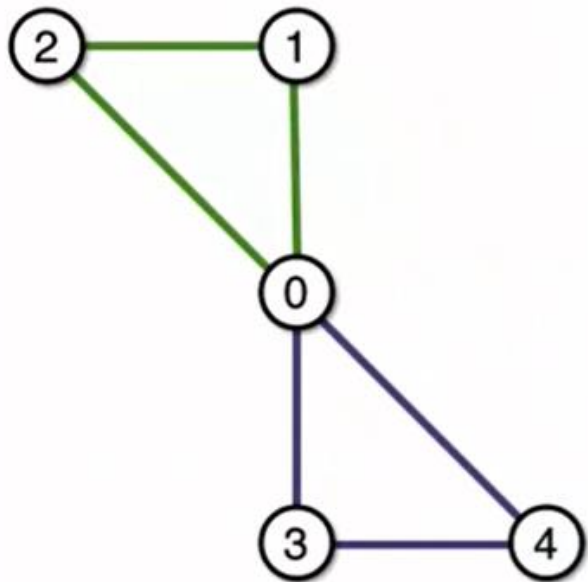
Package	Link								
arm-mango	Official	evology	Official	oasis	Official	pysmac	Official	swarmlib	Official
ax	Official	freelunch	Official	optuna	Official	pysot	Official	swarmpack	Official
bayesian-optimization	Official	gaft	Official	optuner	Official	pyswarms	Official	agepy	Official
bayesianevolution	Official	geneticalgorithm	Official	optimizer	Official	rapids-NeurIPS	Official	tgo	Official
bayeso	Official	gyopt	Official	pagmo	Official	ray	Official	turbo-NeurIPS	Official
bayesopt	Official	hebo	Official	pdfo	Official	rbfopt	Official	turbo	Official
bolbib	Official	heuristic_optimization	Official	platypus	Official	scikit-optimize	Official	ultraopt	GitHub
cma	Official	hpbanner	Official	proxmin	Official	simanneal	Official	yabox	GitHub
cmaes	Official	hyperopt	Official	py-bobyqa	Official	simple	Official	zoopt	GitHub
cuopt	Official	inspyred	Official	pydogs	Official	solidpy	Official		
deap	Official	mealpy	Official	pygpgo	Official	spearmin	Official		
dfoalgorithms	Official	mipengo	Official	pymoo	Official	spotpy	Official		
dfogn	Official	mystic	Official	pyopus	Official	ssb-optimize	Official		
dlib	Official	nevergrad	Official	pypesto	Official				
		niapy	Official	pyriad	Official				

Маршрутизация транспорта



Маршрутизация транспорта

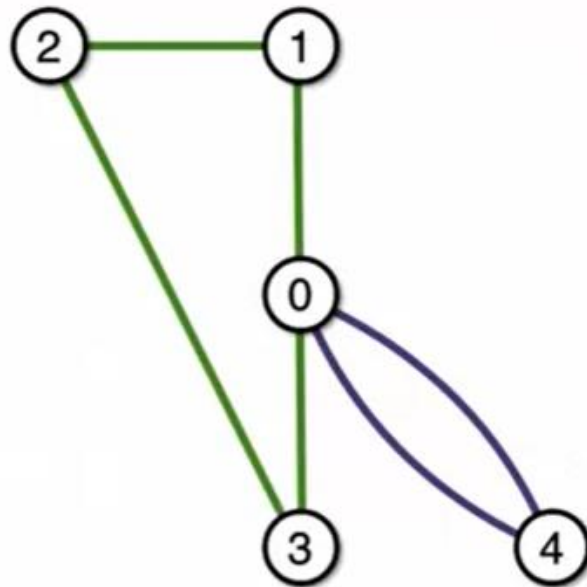
Затраты = 68.3



1 машина

2 машина

Затраты = 80.6



1 машина

2 машина

Маршрутизация транспорта

- n локаций, v машин
- Для каждой локации есть спрос v_i и координаты x_i, y_i
- c – значение вместимости для каждой машины
- Последовательность доставок машины i, T_i

Minimize $\sum_{i \in V} (dist(0, T_{i,0}) + \sum_{\langle j,k \rangle \in T_i} dist(j, k) + dist(T_{i,|T_i|-1}, 0))$

При этом, $\sum_{j \in T_i} d_j \leq c \ (i \in V)$

$$\sum_{i \in V} (j \in T_i) = 1 \ (j \in N \setminus \{0\})$$

Задание

Minimize $\sum_{i \in V} (\text{dist}(0, T_{i,0}) + \sum_{\langle j,k \rangle \in T_i} \text{dist}(j,k) + \text{dist}(T_{i,|T_i|-1}, 0))$

При этом $\sum_{j \in T_i} d_j \leq c \ (i \in V)$

$$\sum_{i \in V} (j \in T_i) = 1 \ (j \in N \setminus \{0\})$$

Вход

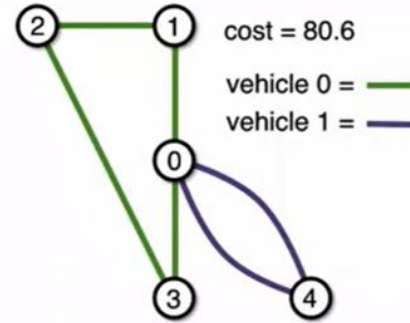
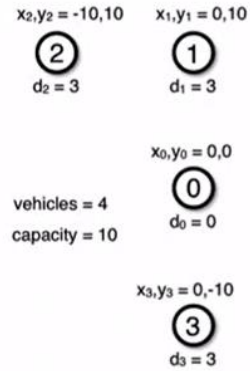
N	V	c
0	x_0	y_0
d_1	x_1	y_1
...
d_ N -1	x_ N -1	y_ N -1

Выход

Целевая функция	Оптимальность

v_0	0	t_0_1	t_0_2	...	0
...					
v_ V -1	0	t_ V -1_1	t_ V -1_2	...	0

Задание



Вход

5	4	10
0	0	0
3	0	10
3	-10	10
3	0	-10
3	10	-10

Выход

Целевая функция	Оптимальность
80.6	0

v_0	0	1	2	3	0
v_1	0	4	0		
v_2	0	0			
v_3	0	0			

Задание

2	vrp_16_3_1	278.72
3	vrp_26_8_1	607.65
4	vrp_51_5_1	524
5	vrp_101_10_1	838.64
5	vrp_421_41_1	2014.2
7		