Relatório — Fluxo em Redes (Caminho Mínimo)

Gerado em 2026-01-20T18:36:57.083663Z

Resumo executivo

sim_id	sim_name	n	m	neg_edges	runtime_s	dist_reachable	dist_mean	dist_max
1	Bellman	10	22	7	1.960061490535736e-05	10	-6.3	39.0
1	Bellman	100	1307	462	0.0003893999382853	100	-126.24	50.0
2	Dijkstra	10	25	0	2.180039882659912e-05	10	24.0	53.0
2	Dijkstra	100	2549	0	0.0002614995464682	100	6.7	12.0
3	Floyd	10	32	9	0.0013953000307083	10	24.6	50.0
3	Floyd	100	2499	564	0.764173099771142	100	0.77	20.0

Simulação 1 — Bellman recursivo em DAG

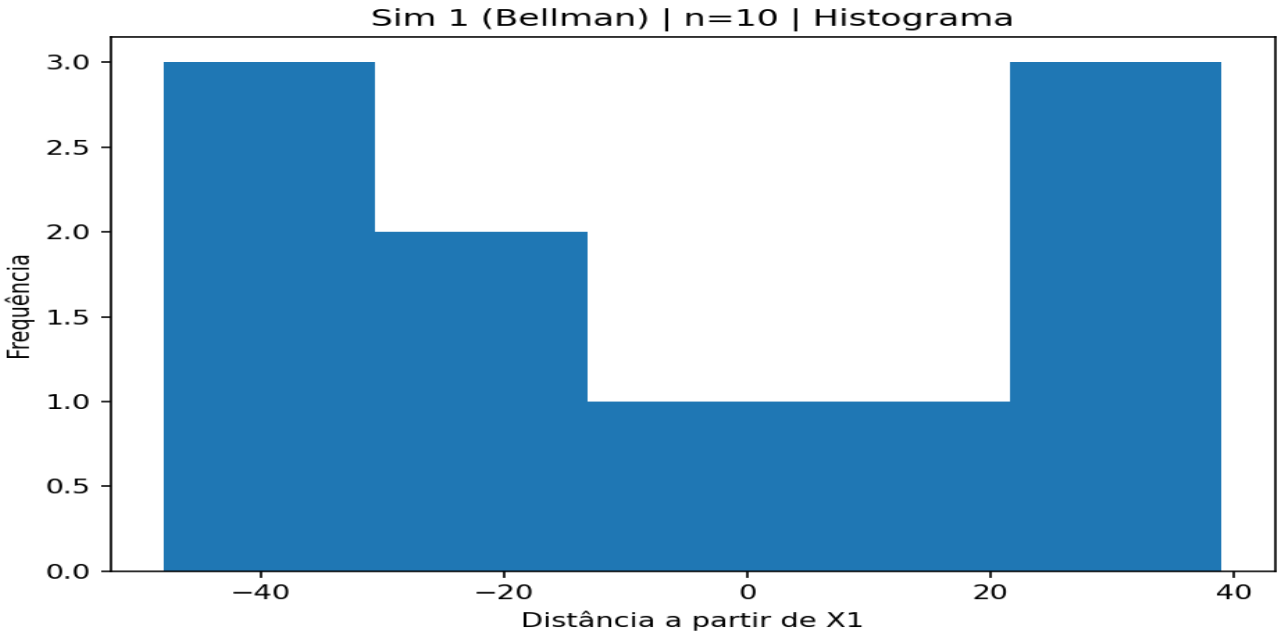
n	m	neg_edges	runtime_s	dist_mean	dist_std
10	22	7	1.960061490535736e-05	-6.3	33.556072475782976
100	1307	462	0.0003893999382853	-126.24	90.15133055035848

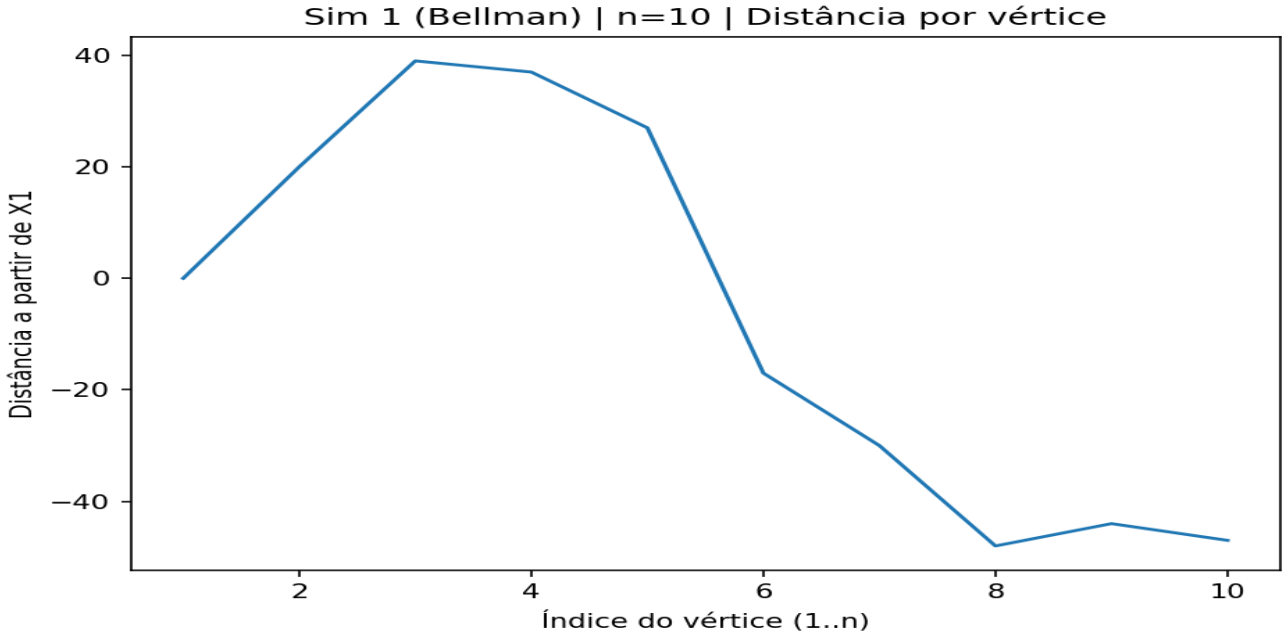
Execução n=10

Arestas m=22 (densidade efetiva 0.244), arestas negativas=7. Alcançáveis=10/10. Tempo=0.000020s.

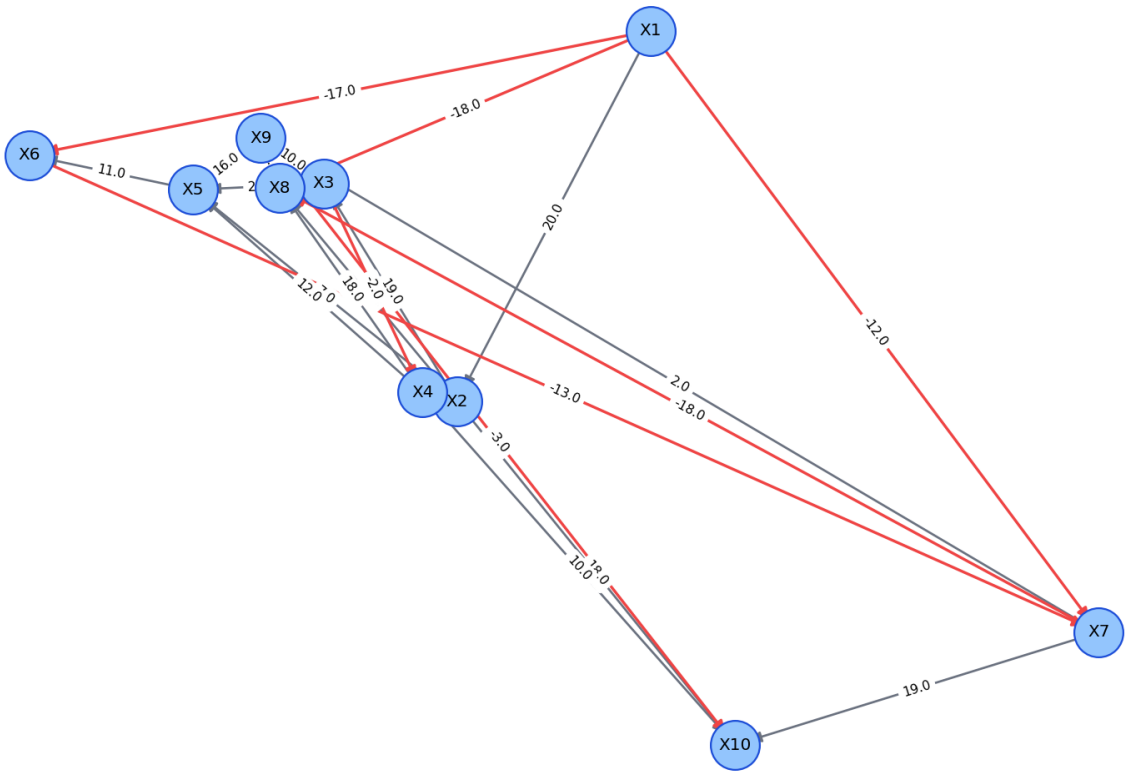
Ranking de distância (mais perto → mais longe)

label	distance	path
X8	-48.0	X1 -> X6 -> X7 -> X8
X10	-47.0	X1 -> X6 -> X7 -> X8 -> X9 -> X10
X9	-44.0	X1 -> X6 -> X7 -> X8 -> X9
X7	-30.0	X1 -> X6 -> X7
X6	-17.0	X1 -> X6
X1	0.0	X1
X2	20.0	X1 -> X2
X5	27.0	X1 -> X2 -> X5
X4	37.0	X1 -> X2 -> X3 -> X4
X3	39.0	X1 -> X2 -> X3





Simulação 1 — Bellman | n=10



Execução n=100

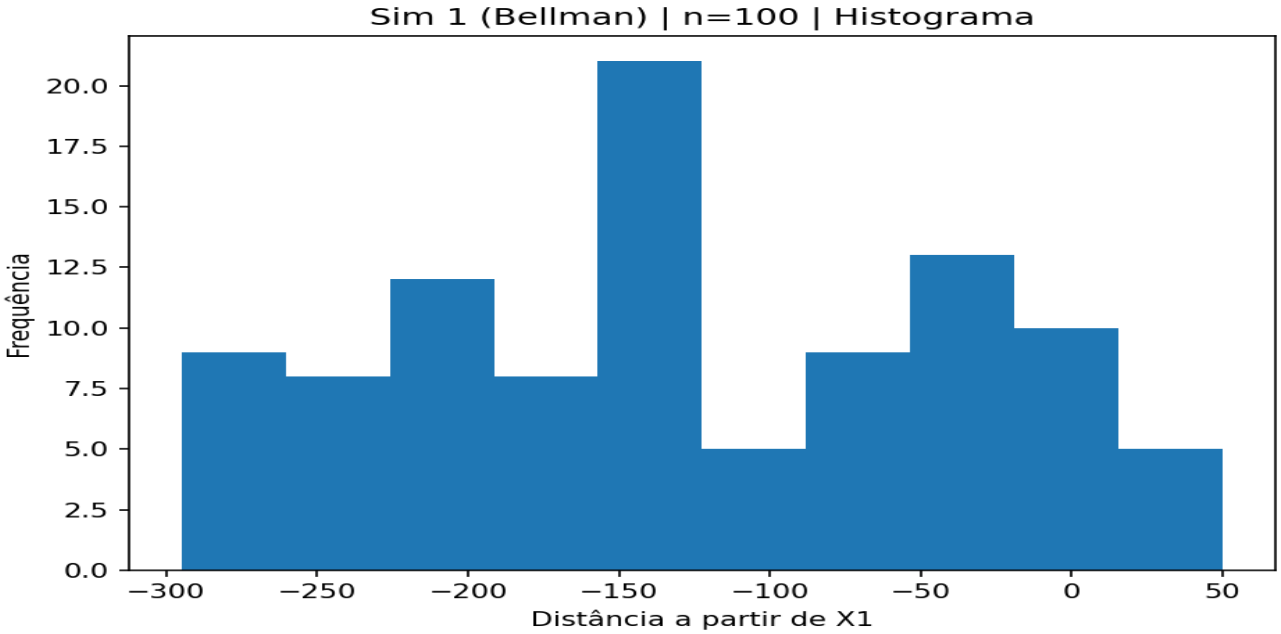
Arestas m=1307 (densidade efetiva 0.132), arestas negativas=462. Alcançáveis=100/100. Tempo=0.000389s.

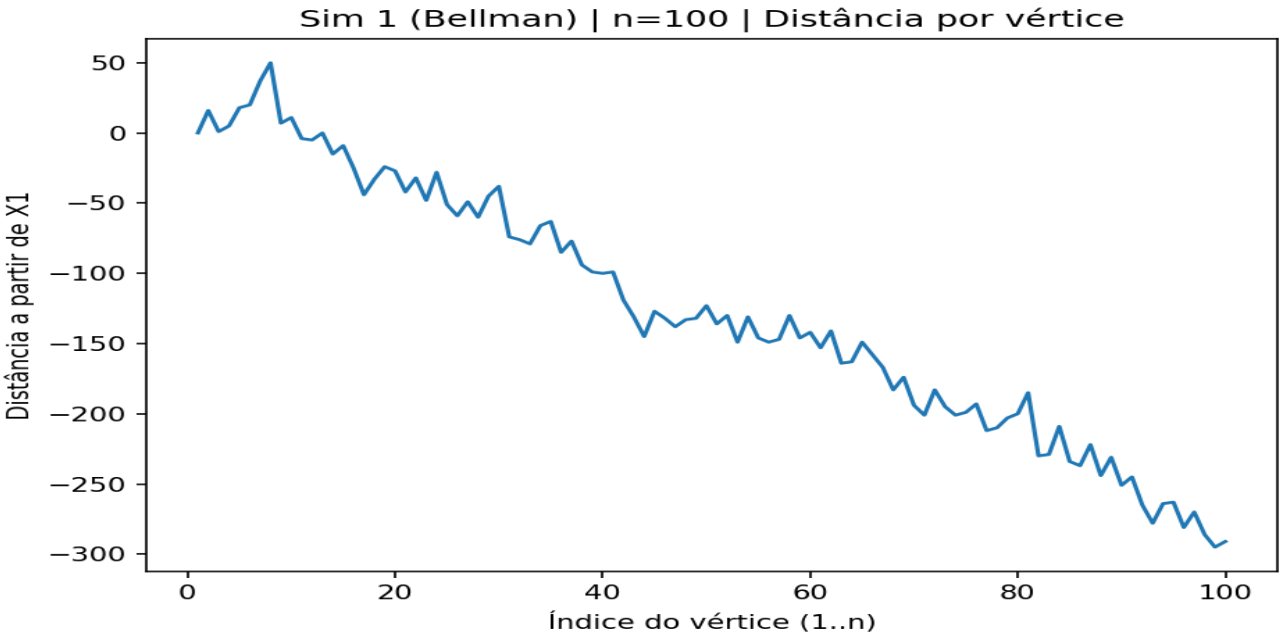
Top 10 mais distantes

label	distance	path
X8	50.0	X1 -> X2 -> X3 -> X4 -> X6 -> X7 -> X8
X7	37.0	X1 -> X2 -> X3 -> X4 -> X6 -> X7
X6	20.0	X1 -> X2 -> X3 -> X4 -> X6
X5	18.0	X1 -> X2 -> X3 -> X4 -> X5
X2	16.0	X1 -> X2
X10	11.0	X1 -> X2 -> X3 -> X9 -> X10
X9	7.0	X1 -> X2 -> X3 -> X9
X4	5.0	X1 -> X2 -> X3 -> X4
X3	1.0	X1 -> X2 -> X3
X1	0.0	X1

Top 10 mais próximos

label	distance	path
X99	-295.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X100	-291.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X98	-286.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X96	-281.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X93	-278.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X97	-270.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X92	-265.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X94	-264.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X95	-263.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -
X90	-251.0	X1 -> X2 -> X3 -> X4 -> X15 -> X16 -> X17 -> X20 -> X21 -> X25 -> X26 -> X33 -> X38 -> X39 -> X40 -> X41 -> X42 -> X43 -> X44 -> X61 -> X67 -> X68 -> X69 -> X70 -


Sim 1 (Bellman) | n=100 | Histograma
Frequência
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
−300
−250
−200
−150
−100
−50
0
50
Distância a partir de X1


Sim 1 (Bellman) | n=100 | Distância por vértice
Distância a partir de X1
50
0
−50
−100
−150
−200
−250
−300
0
20
40
60
80
100
Índice do vértice (1..n)

Simulação 2 — Dijkstra com Heap (Best-First)

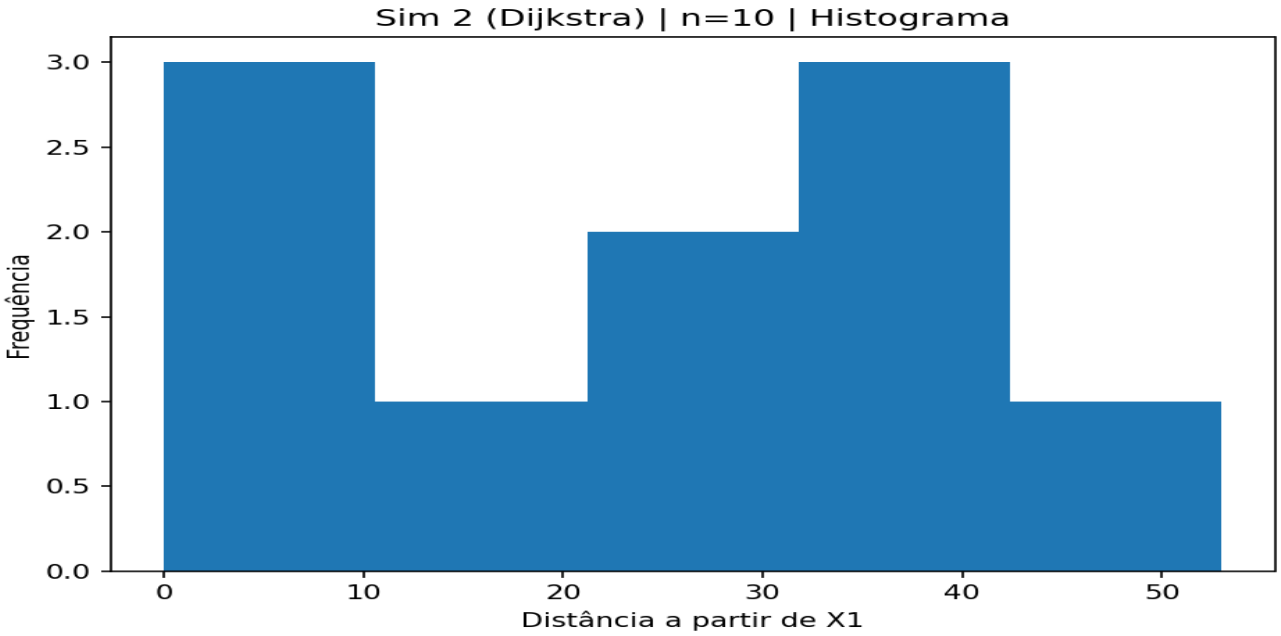
n	m	neg_edges	runtime_s	dist_mean	dist_std
10	25	0	2.180039882659912e-05	24.0	17.894133116750865
100	2549	0	0.0002614995464682	6.7	2.418677324489565

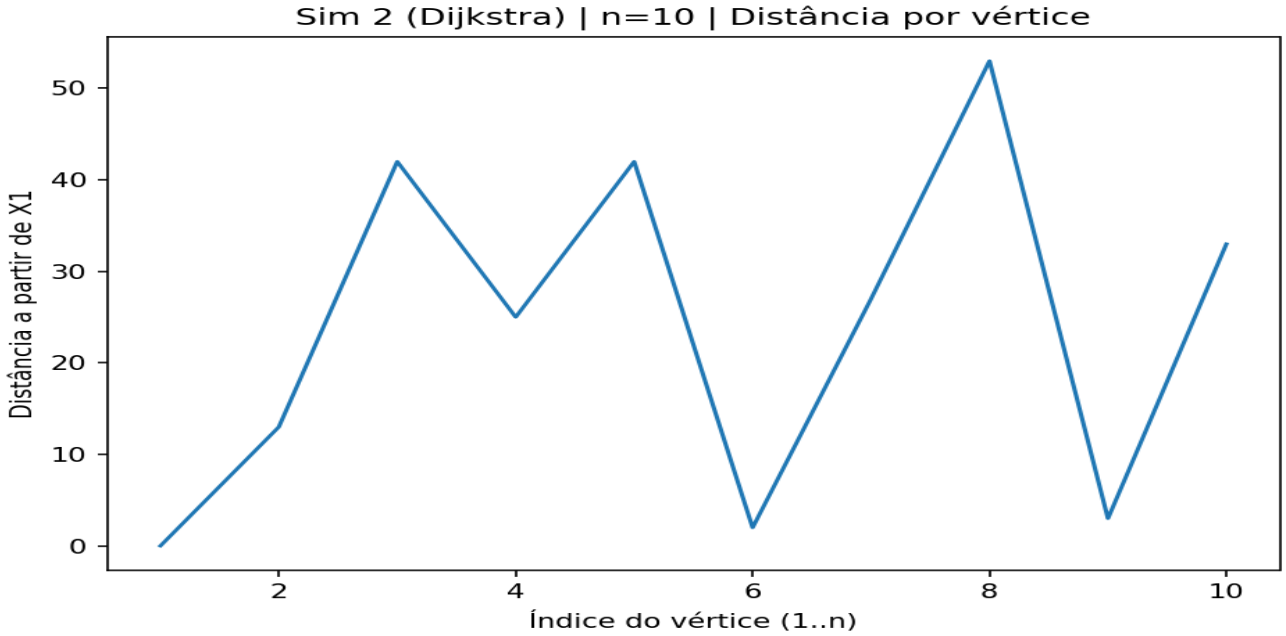
Execução n=10

Arestas m=25 (densidade efetiva 0.278), arestas negativas=0. Alcançáveis=10/10. Tempo=0.000022s.

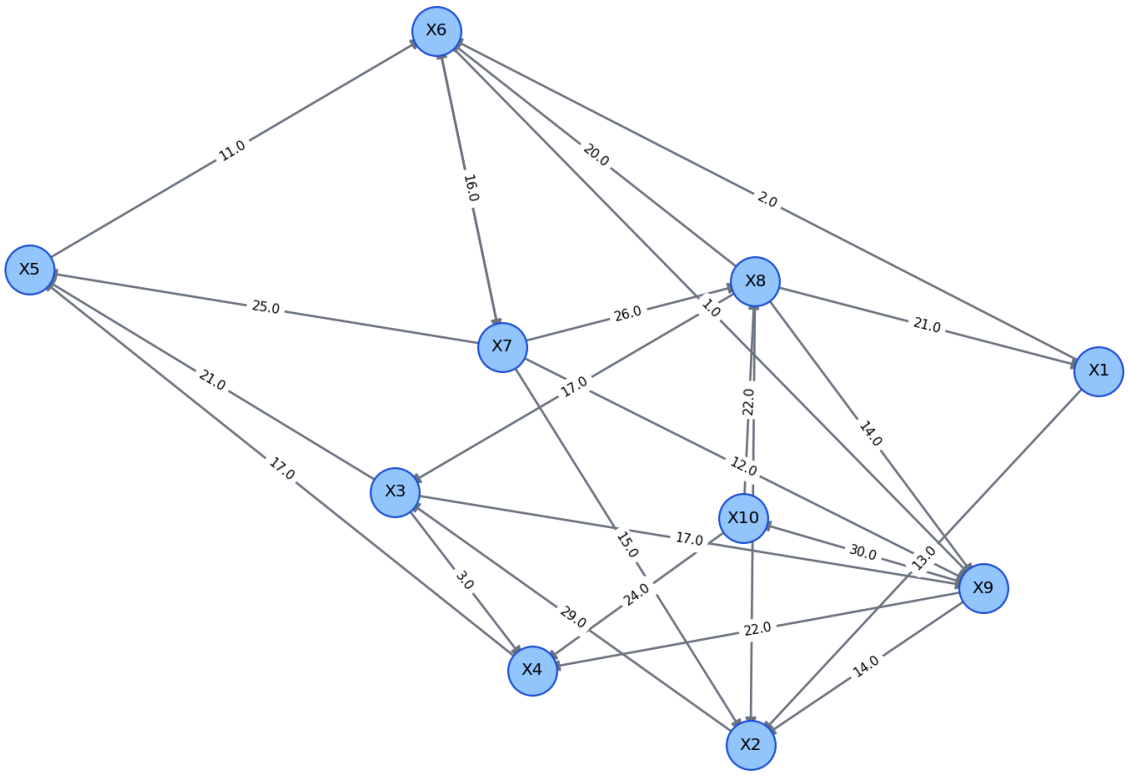
Ranking de distância (mais perto → mais longe)

label	distance	path
X1	0.0	X1
X6	2.0	X1 -> X6
X9	3.0	X1 -> X6 -> X9
X2	13.0	X1 -> X2
X4	25.0	X1 -> X6 -> X9 -> X4
X7	27.0	X1 -> X6 -> X7
X10	33.0	X1 -> X6 -> X9 -> X10
X3	42.0	X1 -> X2 -> X3
X5	42.0	X1 -> X6 -> X9 -> X4 -> X5
X8	53.0	X1 -> X6 -> X7 -> X8





Simulação 2 — Dijkstra | n=10



Execução n=100

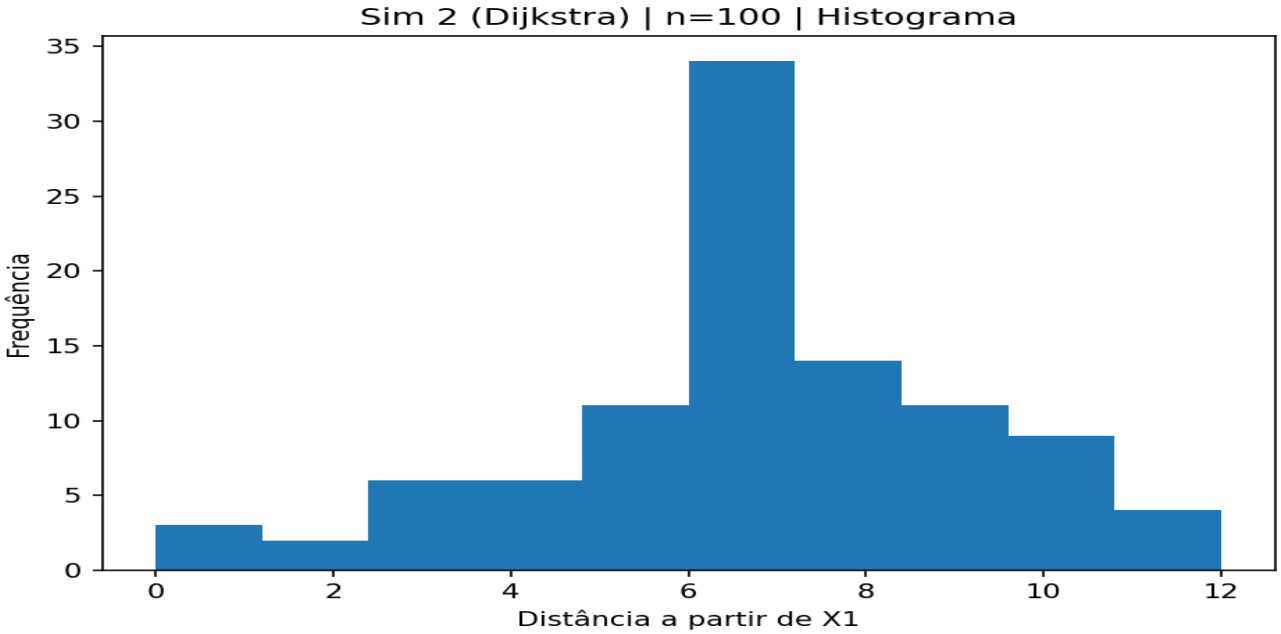
Arestas m=2549 (densidade efetiva 0.257), arestas negativas=0. Alcançáveis=100/100. Tempo=0.000261s.

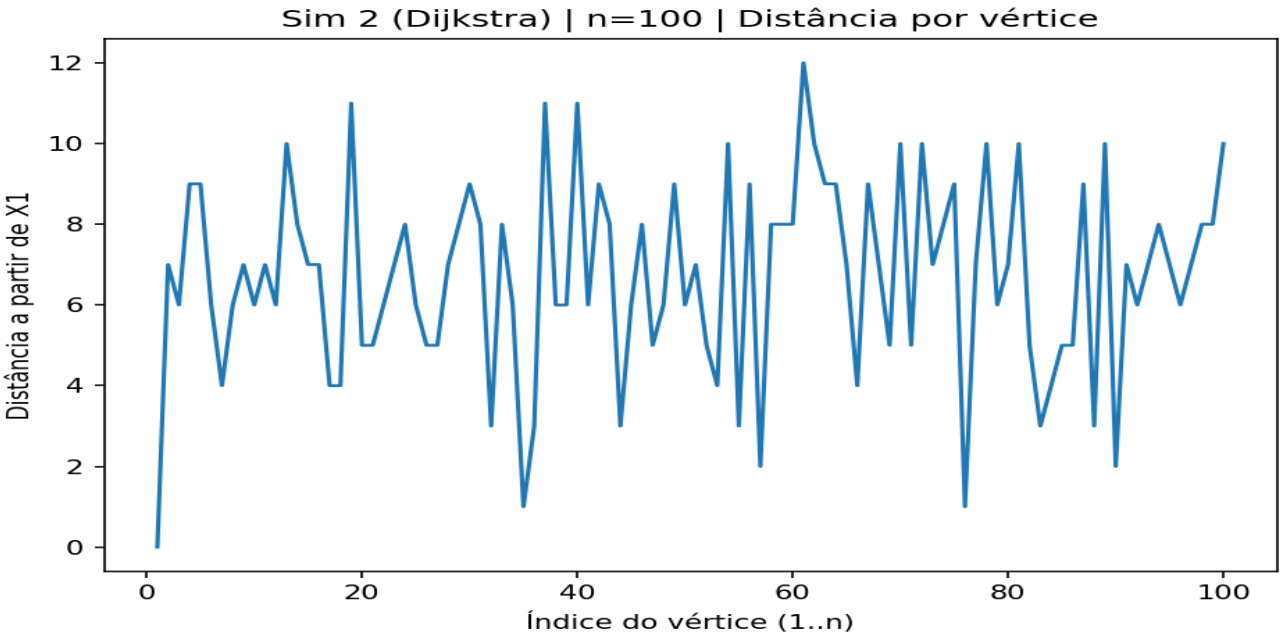
Top 10 mais distantes

label	distance	path
X61	12.0	X1 -> X32 -> X38 -> X23 -> X59 -> X4 -> X61
X37	11.0	X1 -> X76 -> X57 -> X36 -> X71 -> X6 -> X37
X19	11.0	X1 -> X76 -> X57 -> X55 -> X19
X40	11.0	X1 -> X32 -> X86 -> X14 -> X40
X70	10.0	X1 -> X70
X81	10.0	X1 -> X76 -> X57 -> X52 -> X68 -> X81
X72	10.0	X1 -> X76 -> X57 -> X84 -> X34 -> X60 -> X72
X100	10.0	X1 -> X32 -> X95 -> X100
X89	10.0	X1 -> X76 -> X57 -> X55 -> X85 -> X15 -> X89
X62	10.0	X1 -> X27 -> X62

Top 10 mais próximos

label	distance	path
X1	0.0	X1
X35	1.0	X1 -> X35
X76	1.0	X1 -> X76
X57	2.0	X1 -> X76 -> X57
X90	2.0	X1 -> X35 -> X90
X44	3.0	X1 -> X76 -> X57 -> X44
X36	3.0	X1 -> X76 -> X57 -> X36
X32	3.0	X1 -> X32
X88	3.0	X1 -> X76 -> X88
X83	3.0	X1 -> X83


Sim 2 (Dijkstra) | n=100 | Histograma
Frequência
Distância a partir de X1
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12


Sim 2 (Dijkstra) | n=100 | Distância por vértice
Distância a partir de X1
Índice do vértice (1..n)
0
2
4
6
8
10
12
0
20
40
60
80
100

Simulação 3 — Floyd-Warshall (matriz de custos)

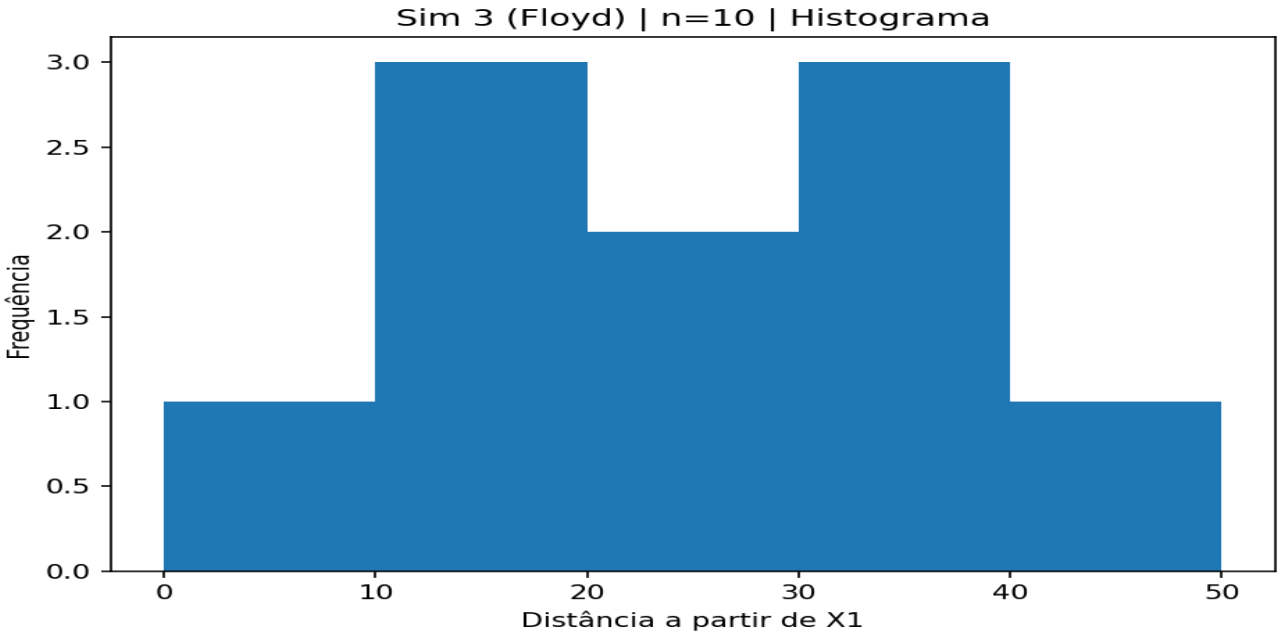
n	m	neg_edges	runtime_s	dist_mean	dist_std
10	32	9	0.0013953000307083	24.6	13.965672200076874
100	2499	564	0.764173099771142	0.77	11.333009309093503

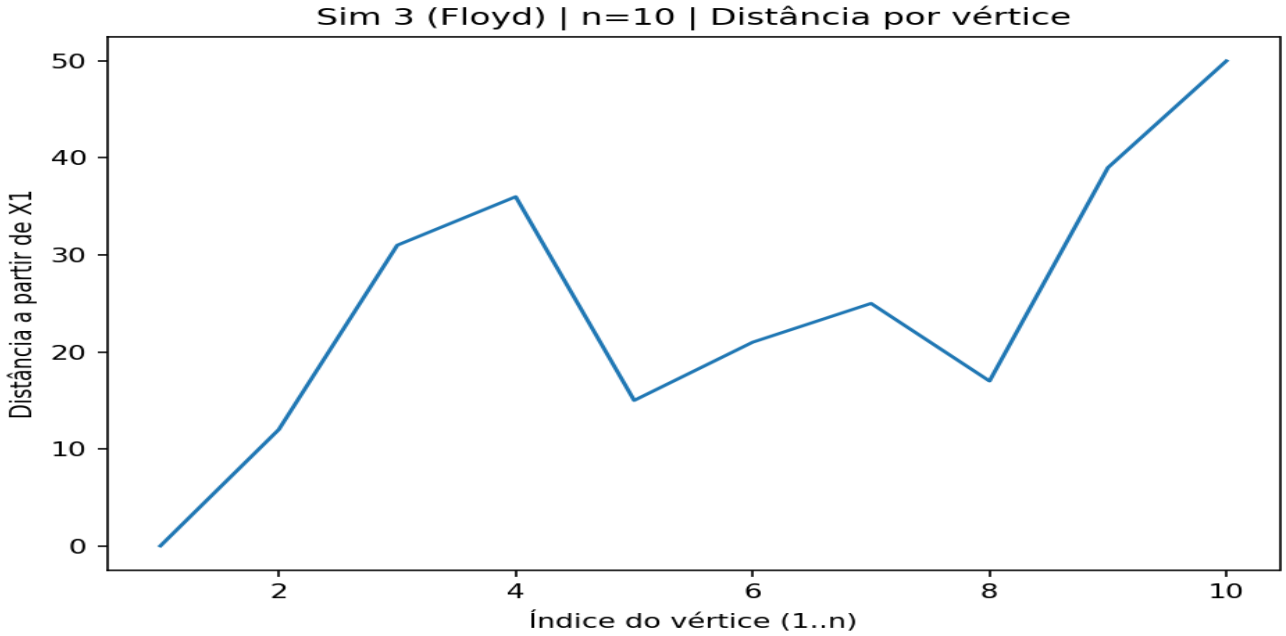
Execução n=10

Arestas m=32 (densidade efetiva 0.356), arestas negativas=9. Alcançáveis=10/10. Tempo=0.001395s.

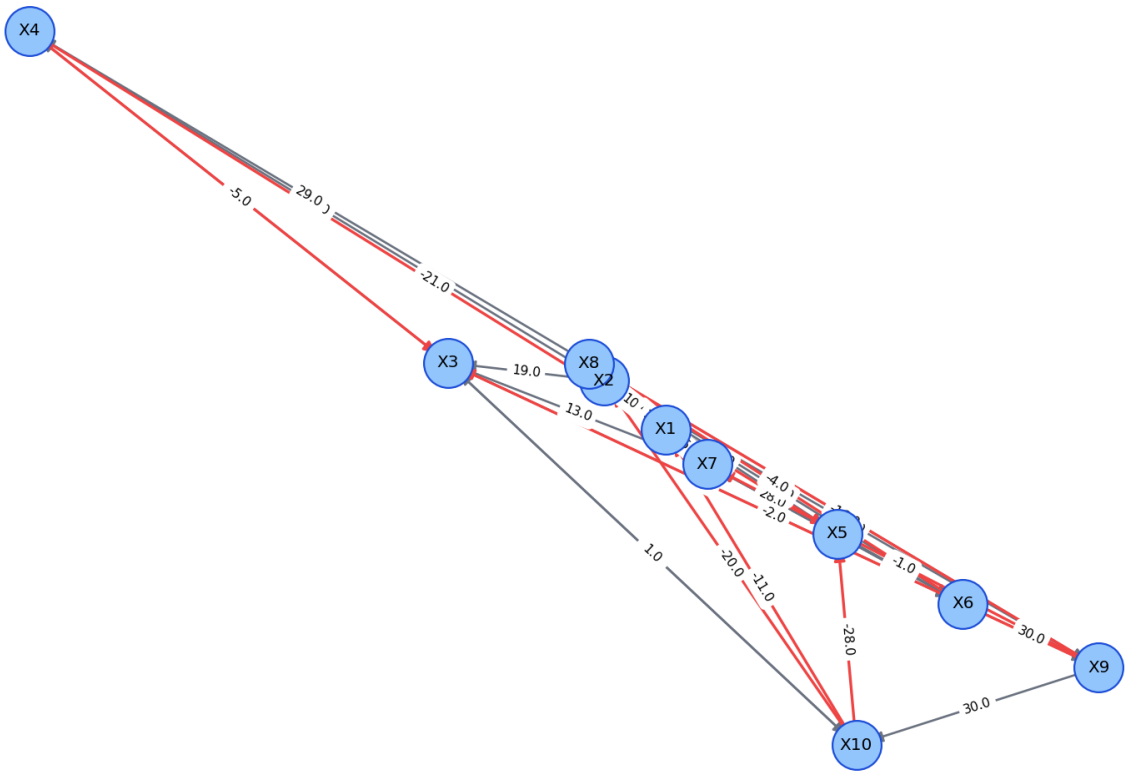
Ranking de distância (mais perto → mais longe)

label	distance	path
X1	0.0	X1
X2	12.0	X1 -> X2
X5	15.0	X1 -> X2 -> X4 -> X5
X8	17.0	X1 -> X2 -> X6 -> X8
X6	21.0	X1 -> X2 -> X6
X7	25.0	X1 -> X7
X3	31.0	X1 -> X2 -> X3
X4	36.0	X1 -> X2 -> X4
X9	39.0	X1 -> X2 -> X9
X10	50.0	X1 -> X2 -> X3 -> X10





Simulação 3 — Floyd | n=10



Execução n=100

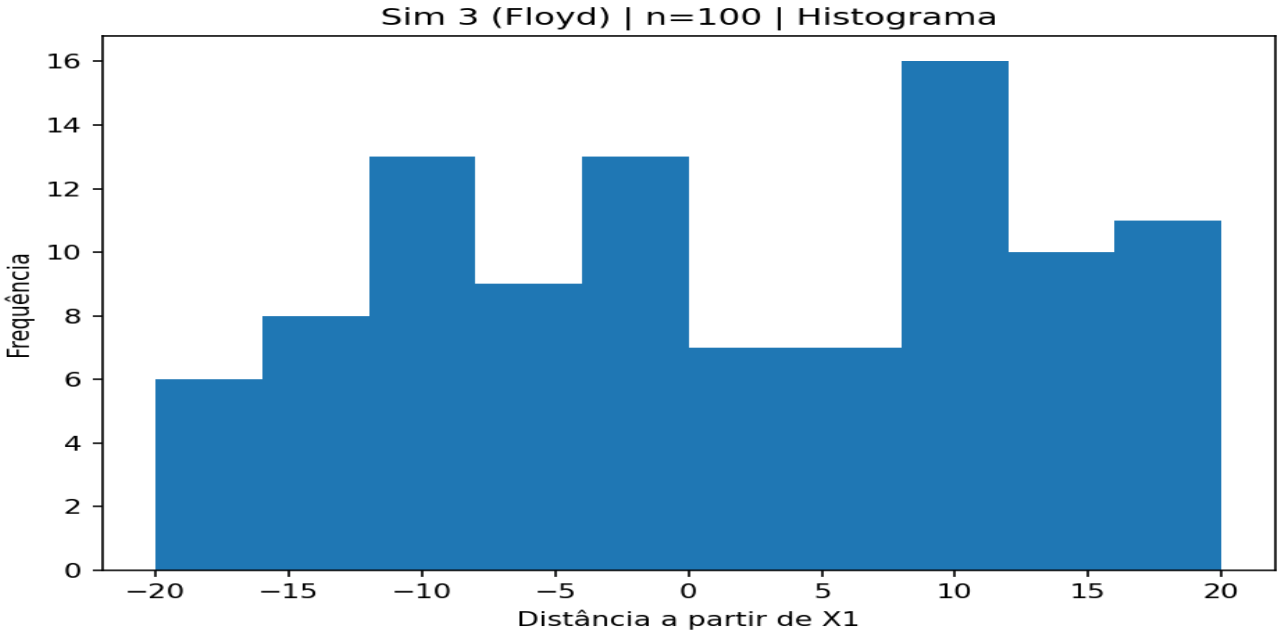
Arestas m=2499 (densidade efetiva 0.252), arestas negativas=564. Alcançáveis=100/100. Tempo=0.764173s.

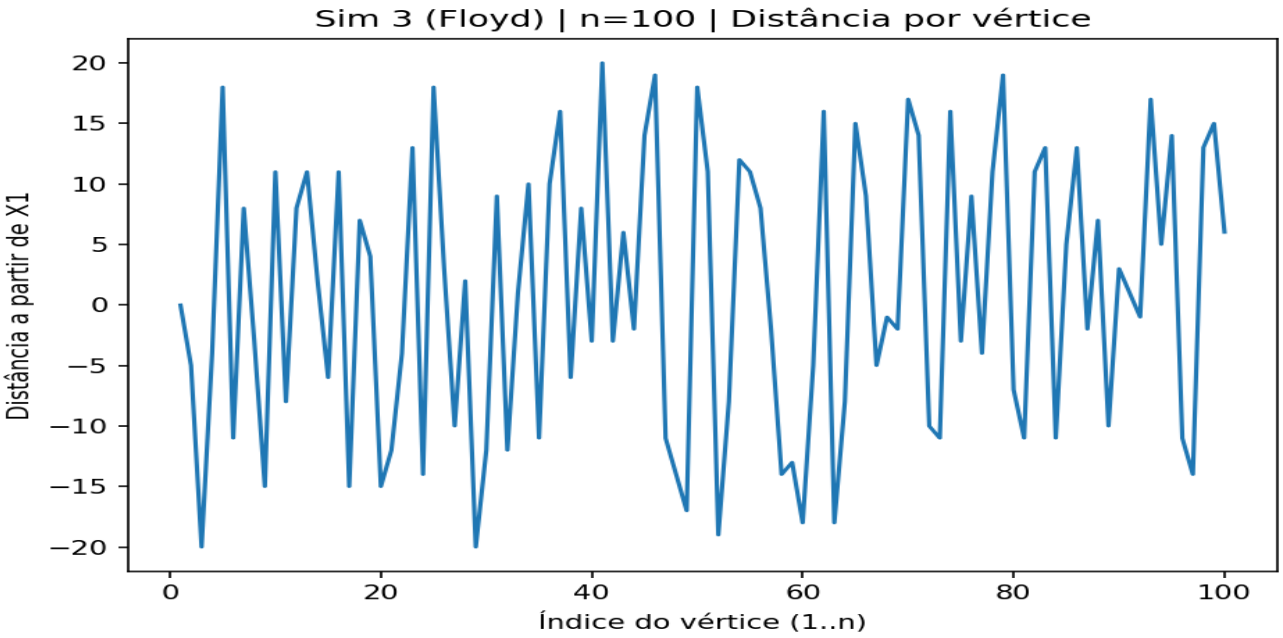
Top 10 mais distantes

label	distance	path
X41	20.0	X1 -> X12 -> X41
X46	19.0	X1 -> X47 -> X87 -> X83 -> X46
X79	19.0	X1 -> X47 -> X87 -> X90 -> X79
X25	18.0	X1 -> X47 -> X87 -> X90 -> X79 -> X25
X5	18.0	X1 -> X29 -> X5
X50	18.0	X1 -> X58 -> X64 -> X37 -> X95 -> X50
X93	17.0	X1 -> X93
X70	17.0	X1 -> X47 -> X87 -> X70
X62	16.0	X1 -> X47 -> X72 -> X84 -> X62
X74	16.0	X1 -> X12 -> X74

Top 10 mais próximos

label	distance	path
X3	-20.0	X1 -> X47 -> X72 -> X60 -> X3
X29	-20.0	X1 -> X29
X52	-19.0	X1 -> X47 -> X72 -> X84 -> X52
X60	-18.0	X1 -> X47 -> X72 -> X60
X63	-18.0	X1 -> X47 -> X72 -> X84 -> X88 -> X63
X49	-17.0	X1 -> X47 -> X15 -> X49
X17	-15.0	X1 -> X47 -> X72 -> X84 -> X88 -> X89 -> X16 -> X55 -> X17
X9	-15.0	X1 -> X29 -> X66 -> X9
X20	-15.0	X1 -> X58 -> X20
X24	-14.0	X1 -> X47 -> X72 -> X84 -> X31 -> X24


Sim 3 (Floyd) | n=100 | Histograma
Frequência
Distância a partir de X1
0
2
4
6
8
10
12
14
16
−20
−15
−10
−5
0
5
10
15
20


Sim 3 (Floyd) | n=100 | Distância por vértice
Distância a partir de X1
Índice do vértice (1..n)
−20
−15
−10
−5
0
5
10
15
20
0
20
40
60
80
100