Modern intelligent IT
Lab 3 (09.04.2016)
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TASK: Traveling Salesperson Problem (TSP)

Assume a salesperson, starting from his/her city, should visit 25 cities, all of them but only once, and then return to the city he/she started. The problem is to look for the minimum length of such tour.

TSP with 25 cities of a fixed location

1. Assume 25 cities as shown in the next page (start from Z and return to Z).
2. Calcurate distance matrix (25×25).
3. Apply GA and evolve chromosomes to be the tours of minimum length.
4. Also show
(5) The graph of fitness vs generation.
(6) The minimum tour in the 1st, two intermediate, and the final generation.

Map of 25 cities

(6,6)

A (1,5)	B (2,5) (3,5)	C (4,5)	D (5,5)	E
F (1,4)	G (2,4) (3,4)	H (4,4)	I (5,4)	J
K (1,3)	L (2,3) (3,3)	Z (4,3)	M (5,3)	N
O (1,2)	P (2,2) (3,2)	Q (4,2)	R (5,2)	S
T (1,1)	U (2,1) (3,1)	V (4,1)	W (5,1)	X

(0,0)
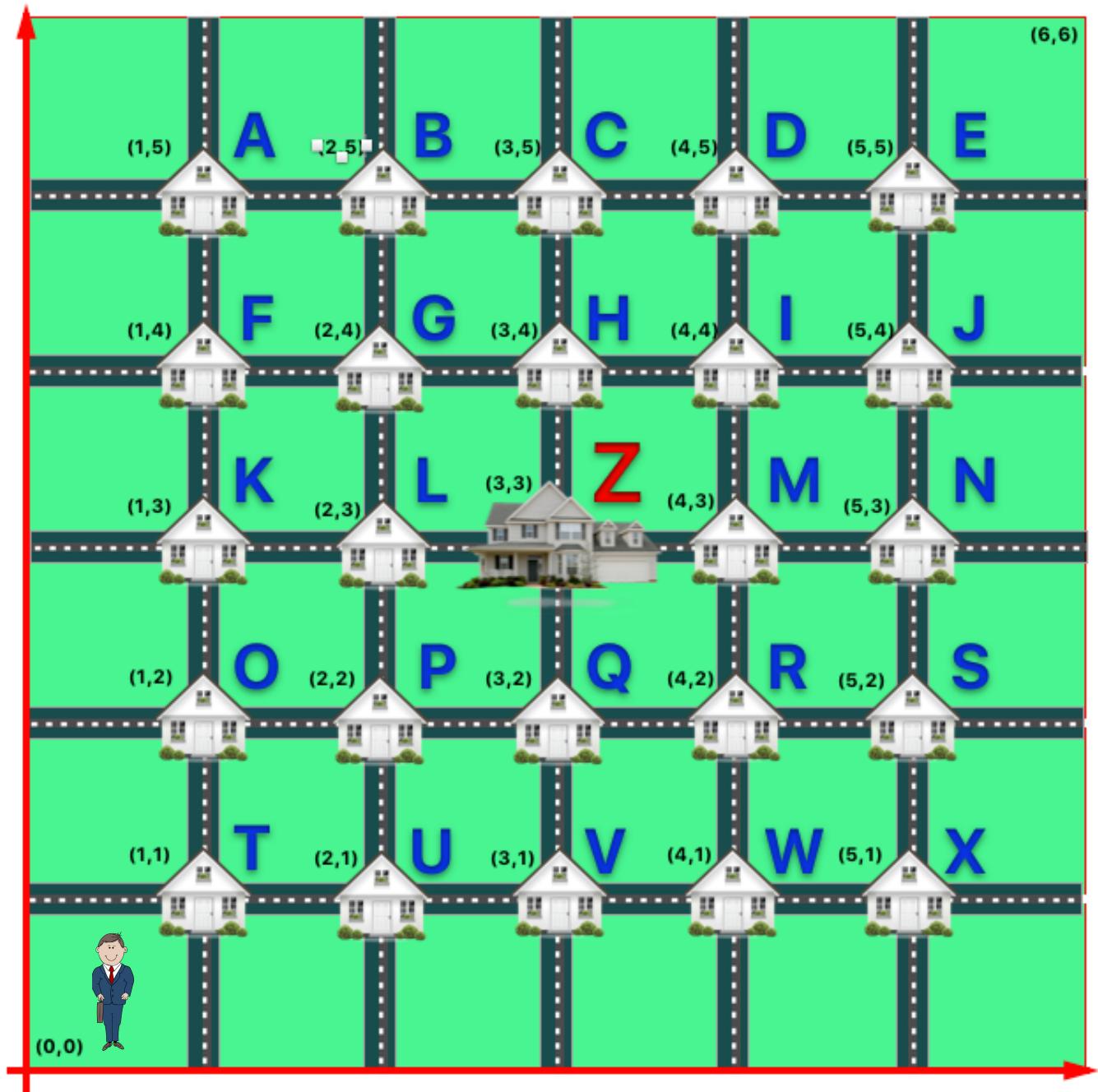
All possible tours

	A	B	C	D	E	F	G	H	I	J	K	Z	L	M	N	O	P	Q	R	S	T	U	V	W	X
A	0,0000	1,0000	2,0000	3,0000	4,0000	1,0000	1,4142	2,2361	3,1623	4,1231	2,0000	2,2361	2,8284	3,6056	4,4721	3,0000	3,1623	3,6056	4,2426	5,0000	4,0000	4,1231	4,4721	5,0000	5,6569
B	1,0000	0,0000	1,0000	2,0000	3,0000	1,4142	1,0000	1,4142	2,2361	3,1623	2,2361	2,0000	2,2361	2,8284	3,6056	3,1623	3,0000	3,1623	3,6056	4,2426	4,1231	4,0000	4,1231	4,4721	5,0000
C	2,0000	1,0000	0,0000	1,0000	2,0000	2,2361	1,4142	1,0000	1,4142	2,2361	2,8284	2,2361	2,0000	2,2361	2,8284	3,6056	3,1623	3,0000	3,1623	3,6056	4,4721	4,1231	4,0000	4,1231	4,4721
D	3,0000	2,0000	1,0000	0,0000	1,0000	3,1623	2,2361	1,4142	1,0000	1,4142	3,6056	2,8284	2,2361	2,0000	2,2361	4,2426	3,6056	3,1623	3,0000	3,1623	5,0000	4,4721	4,1231	4,0000	4,1231
E	4,0000	3,0000	2,0000	1,0000	0,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,4721	3,6056	2,8284	2,2361	2,0000	5,0000	4,2426	3,6056	3,1623	3,0000	5,6569	5,0000	4,4721	4,1231	4,0000
F	1,0000	1,4142	2,2361	3,1623	4,1231	0,0000	1,0000	2,0000	3,0000	4,0000	1,0000	1,4142	2,2361	3,1623	4,1231	2,0000	2,2361	2,8284	3,6056	4,4721	3,0000	3,1623	3,6056	4,2426	5,0000
G	1,4142	1,0000	1,4142	2,2361	3,1623	1,0000	0,0000	1,0000	2,0000	3,0000	1,4142	1,0000	1,4142	2,2361	3,1623	2,2361	2,0000	2,2361	2,8284	3,6056	3,1623	3,0000	3,1623	3,6056	4,2426
H	2,2361	1,4142	1,0000	1,4142	2,2361	2,0000	1,0000	0,0000	1,0000	2,0000	2,2361	1,4142	1,0000	1,4142	2,2361	2,8284	2,2361	2,0000	2,2361	2,8284	3,6056	3,1623	3,0000	3,1623	3,6056
I	3,1623	2,2361	1,4142	1,0000	1,4142	3,0000	2,0000	1,0000	0,0000	1,0000	3,1623	2,2361	1,4142	1,0000	1,4142	3,6056	2,8284	2,2361	2,0000	2,2361	4,2426	3,6056	3,1623	3,0000	3,1623
J	4,1231	3,1623	2,2361	1,4142	1,0000	4,0000	3,0000	2,0000	1,0000	0,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,4721	3,6056	2,8284	2,2361	2,0000	5,0000	4,2426	3,6056	3,1623	3,0000
K	2,0000	2,2361	2,8284	3,6056	4,4721	1,0000	1,4142	2,2361	3,1623	4,1231	0,0000	1,0000	2,0000	3,0000	4,0000	1,0000	1,4142	2,2361	3,1623	4,1231	2,0000	2,2361	2,8284	3,6056	4,4721
Z	2,2361	2,0000	2,2361	2,8284	3,6056	1,4142	1,0000	1,4142	2,2361	3,1623	1,0000	0,0000	1,0000	2,0000	3,0000	1,4142	1,0000	1,4142	2,2361	3,1623	2,2361	2,0000	2,2361	2,8284	3,6056
L	2,8284	2,2361	2,0000	2,2361	2,8284	2,2361	1,4142	1,0000	1,4142	2,2361	2,0000	1,0000	0,0000	1,0000	2,0000	2,2361	1,4142	1,0000	1,4142	2,2361	2,8284	2,2361	2,0000	2,2361	2,8284
M	3,6056	2,8284	2,2361	2,0000	2,2361	3,1623	2,2361	1,4142	1,0000	1,4142	3,0000	2,0000	1,0000	0,0000	1,0000	3,1623	2,2361	1,4142	1,0000	1,4142	3,6056	2,8284	2,2361	2,0000	2,2361
N	4,4721	3,6056	2,8284	2,2361	2,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,0000	3,0000	2,0000	1,0000	0,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,4721	3,6056	2,8284	2,2361	2,0000
O	3,0000	3,1623	3,6056	4,2426	5,0000	2,0000	2,2361	2,8284	3,6056	4,4721	1,0000	1,4142	2,2361	3,1623	4,1231	0,0000	1,0000	2,0000	3,0000	4,0000	1,0000	1,4142	2,2361	3,1623	4,1231
P	3,1623	3,0000	3,1623	3,6056	4,2426	2,2361	2,0000	2,2361	2,8284	3,6056	1,4142	1,0000	1,4142	2,2361	3,1623	1,0000	0,0000	1,0000	2,0000	3,0000	1,4142	1,0000	1,4142	2,2361	3,1623
Q	3,6056	3,1623	3,0000	3,1623	3,6056	2,8284	2,2361	2,0000	2,2361	2,8284	2,2361	1,4142	1,0000	1,4142	2,2361	2,0000	1,0000	0,0000	1,0000	2,0000	2,2361	1,4142	1,0000	1,4142	2,2361
R	4,2426	3,6056	3,1623	3,0000	3,1623	3,6056	2,8284	2,2361	2,0000	2,2361	3,1623	2,2361	1,4142	1,0000	1,4142	3,0000	2,0000	1,0000	0,0000	1,0000	3,1623	2,2361	1,4142	1,0000	1,4142
S	5,0000	4,2426	3,6056	3,1623	3,0000	4,4721	3,6056	2,8284	2,2361	2,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,0000	3,0000	2,0000	1,0000	0,0000	4,1231	3,1623	2,2361	1,4142	1,0000
T	4,0000	4,1231	4,4721	5,0000	5,6569	3,0000	3,1623	3,6056	4,2426	5,0000	2,0000	2,2361	2,8284	3,6056	4,4721	1,0000	1,4142	2,2361	3,1623	4,1231	0,0000	1,0000	2,0000	3,0000	4,0000
U	4,1231	4,0000	4,1231	4,4721	5,0000	3,1623	3,0000	3,1623	3,6056	4,2426	2,2361	2,0000	2,2361	2,8284	3,6056	1,4142	1,0000	1,4142	2,2361	3,1623	1,0000	0,0000	1,0000	2,0000	3,0000
V	4,4721	4,1231	4,0000	4,1231	4,4721	3,6056	3,1623	3,0000	3,1623	3,6056	2,8284	2,2361	2,0000	2,2361	2,8284	2,2361	1,4142	1,0000	1,4142	2,2361	2,0000	1,0000	0,0000	1,0000	2,0000
W	5,0000	4,4721	4,1231	4,0000	4,1231	4,2426	3,6056	3,1623	3,0000	3,1623	3,6056	2,8284	2,2361	2,0000	2,2361	3,1623	2,2361	1,4142	1,0000	1,4142	3,0000	2,0000	1,0000	0,0000	1,0000
X	5,6569	5,0000	4,4721	4,1231	4,0000	5,0000	4,2426	3,6056	3,1623	3,0000	4,4721	3,6056	2,8284	2,2361	2,0000	4,1231	3,1623	2,2361	1,4142	1,0000	4,0000	3,0000	2,0000	1,0000	0,0000

Graph of fitness vs generation

1ˢᵗ path
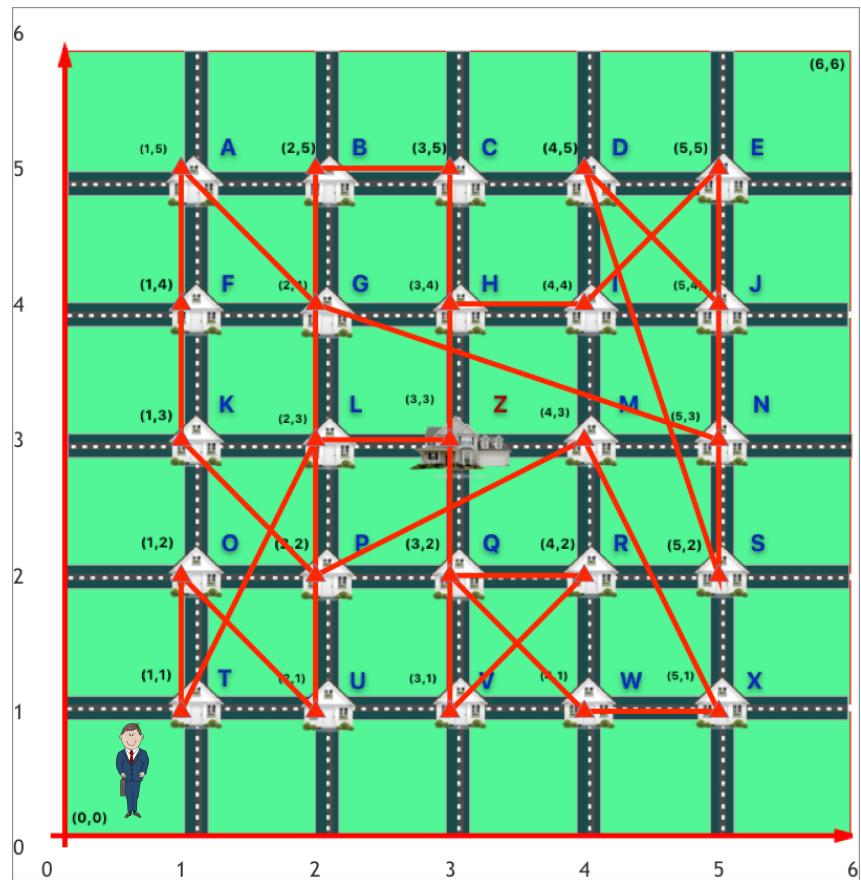
2ⁿᵈ path
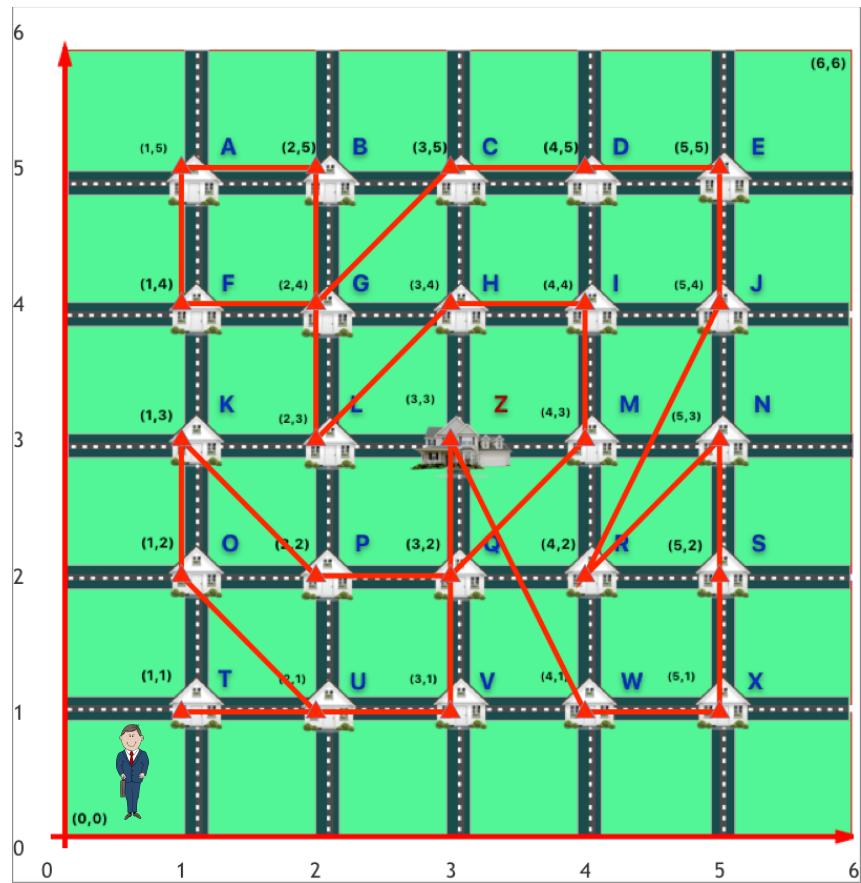
**3rd path**
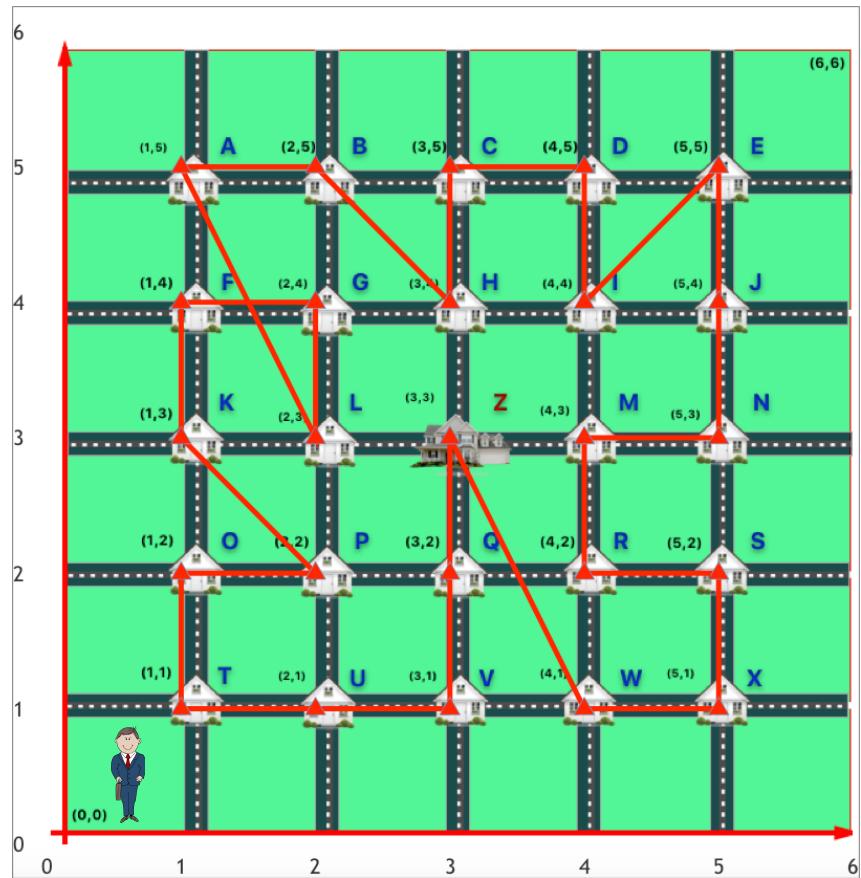
4th path
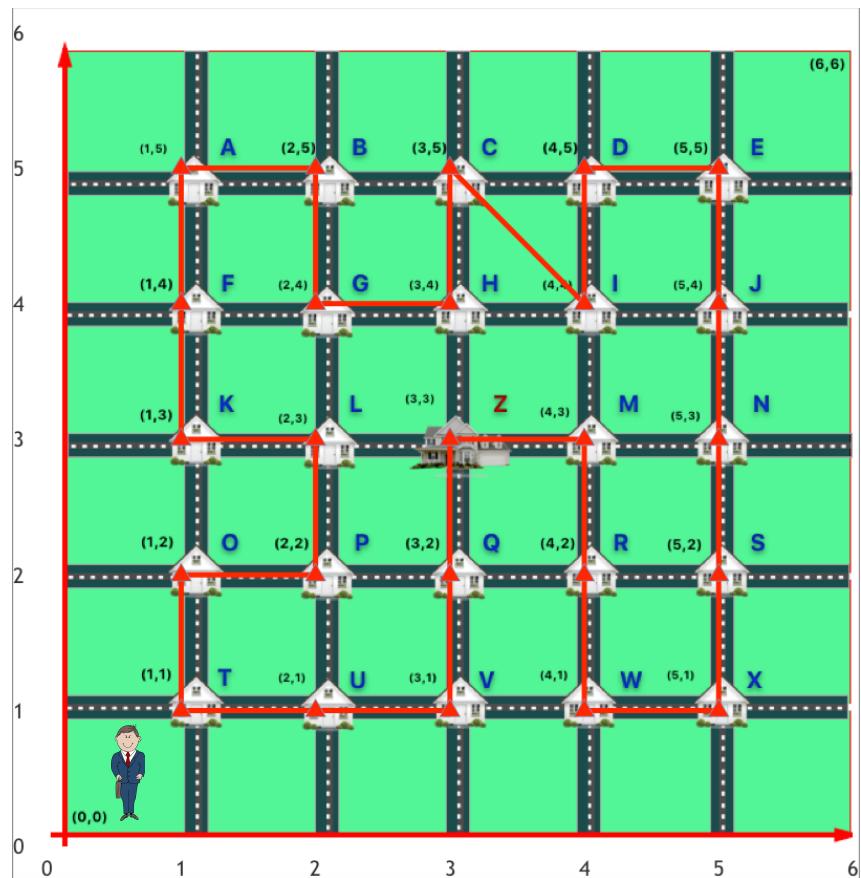
Last (best) path
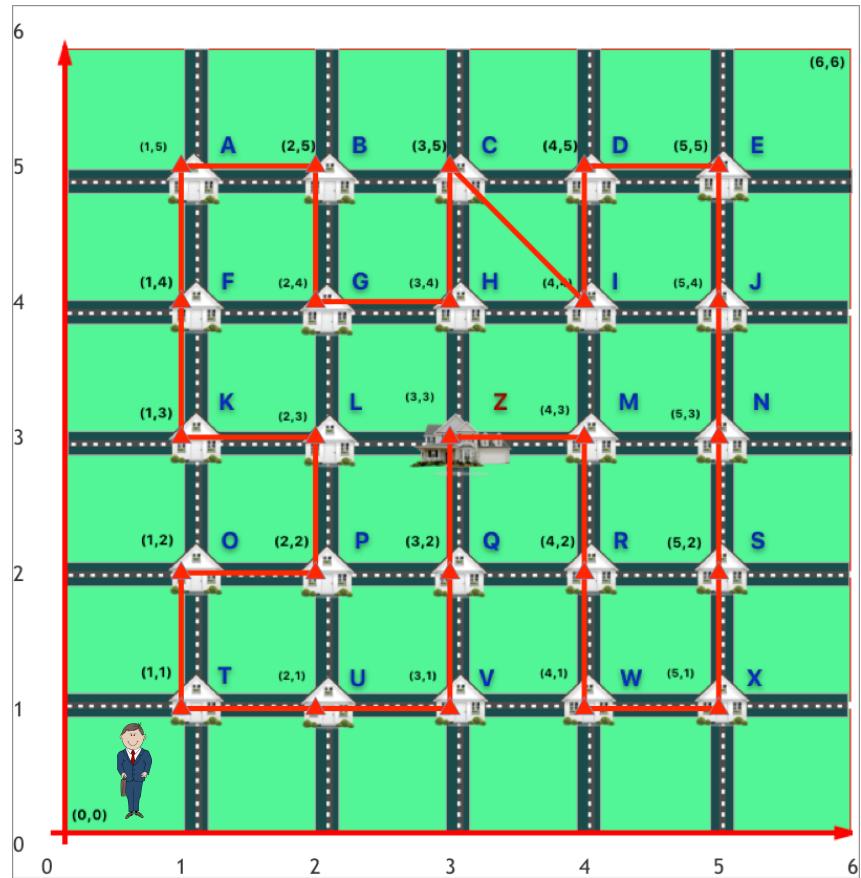
Last (best) path (without images)