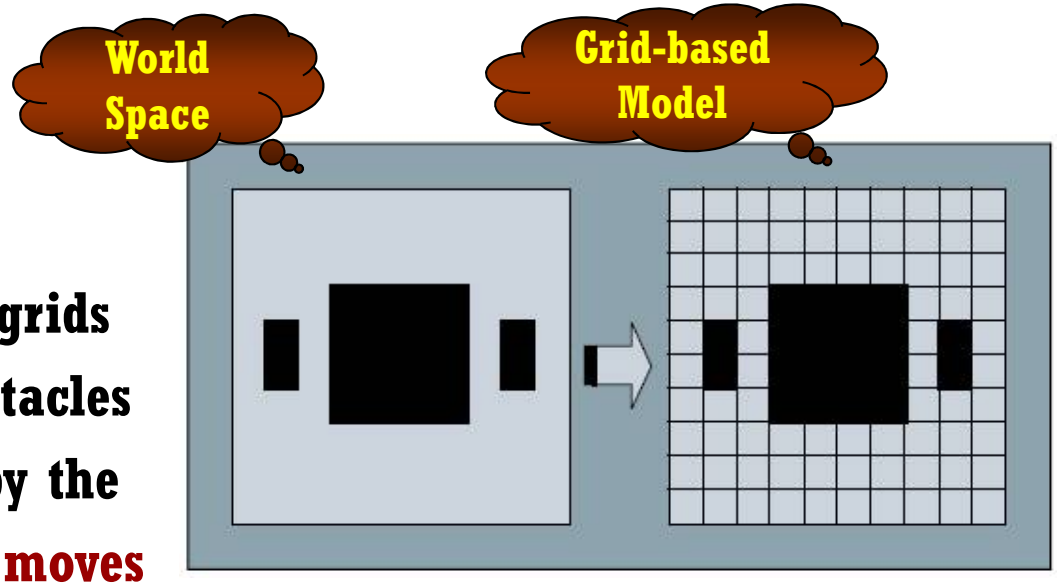
Robot Navigation (1)

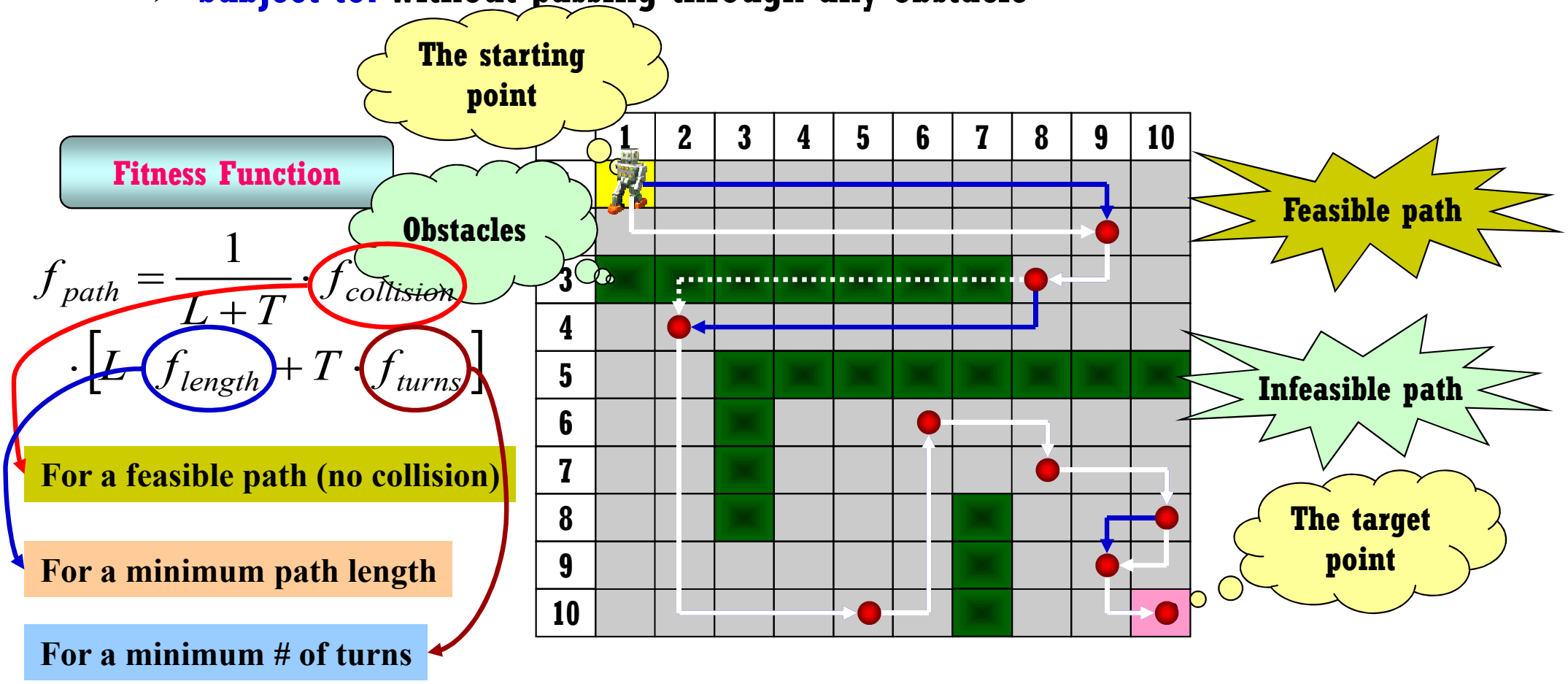
- **Autonomous Robot Navigation**
  - Allow a robot explore an environment independent of human intervention
  - Require Sensors to detect obstacles in the environment
  - Require Machine Intelligence to plan a path around obstacles
    - ✓ A modern example: the use of genetic algorithms

- **System Environment**
  - A grid-based model is used
  - The grid is viewed as square
  - An obstacle may occupy one or more grids
  - Squares, fully or partly blocked by obstacles
  - The robot can move on all free cells by the combination of vertical & horizontal moves

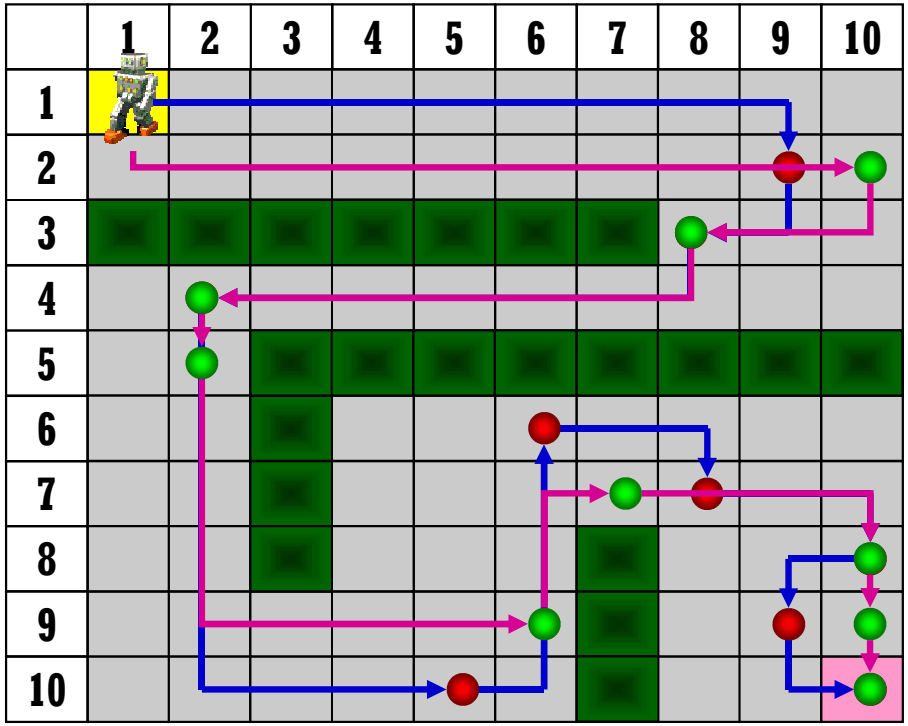


Robot Navigation (2)

- **Problem Formulation**
  - **Objective:** Find a **(feasible) path** from the starting and the target points, which minimizes the number of turns and its length
  - **Subject to:** without passing through any obstacle



Robot Navigation (3)



Encoding: Row- and Column-wise Movement

	4	6								
	1	2	3	4	5	6	7	8	9	10
Path Location	1	9	8	2	10	6	8	10	9	10
Path Direction	0	1	1	1	0	0	0	0	1	-

Path Switching Points

Row-wise Movement

Vertical direction first

Crossover

Offspring 1:

1	9	8	2	10	6	8	10	9	10
0	1	1	1	0	0	0	0	1	-

4 6

Crossover does not apply to the switching points!

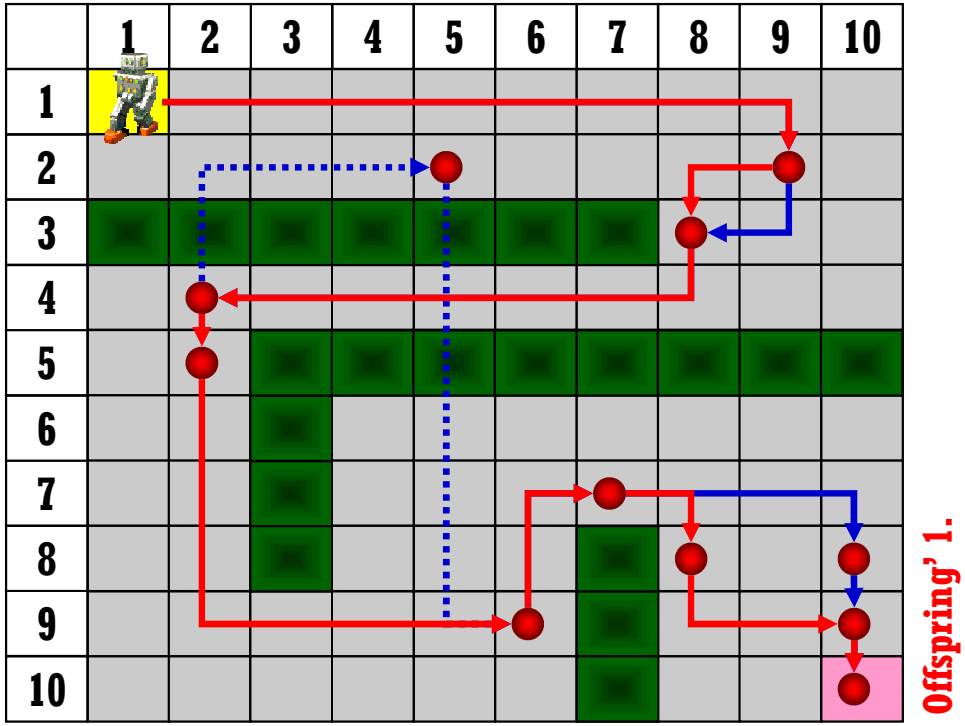
Offspring 2:

1	10	8	2	2	9	7	10	10	10
1	1	1	1	1	1	0	1	1	-

5 7

Robot Navigation (4)

Offspring 1.



Offspring' 1.

Mutation

With small probability

Offspring' 1.

1	9	8	2	2	9	7	8	10	10
0	0	1	1	1	1	0	1	1	-

5	6

Crossover

Offspring 1.

1	9	8	2	2	9	7	10	10	10
0	1	1	1	1	1	0	1	1	-

4	6

Offspring 2.

1	10	8	2	10	6	8	10	9	10
1	1	1	1	0	0	0	0	1	-

5	7