Recursive Backtracking

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Solving a Maze

A journey of a thousand miles begins with a single step.
—Confucius, 5th century B.C.E.

- The example most often used to illustrate recursive backtracking is the problem of solving a maze, which has a long history in its own right.
- The most famous maze in history is the labyrinth of Daedalus in Greek mythology where Theseus slays the Minotaur.
- There are passing references to this story in Homer, but the best known account comes from Ovid in *Metamorphoses*.

Metamorphoses
—Ovid, 1 A.C.E.

. . . When Minos, willing to conceal the shame
That sprung from the reports of tatling Fame,
Resolves a dark inclosure to provide,
And, far from sight, the two-form'd creature hide.

Great Daedalus of Athens was the man
That made the draught, and form'd the wondrous plan;
Where rooms within themselves encircled lye,
With various windings, to deceive the eye. . . .
Such was the work, so intricate the place,
That scarce the workman all its turns cou'd trace;
And Daedalus was puzzled how to find
The secret ways of what himself design'd.

These private walls the Minotaur include,
Who twice was glutted with Athenian blood:
But the third tribute more successful prov'd,
Slew the foul monster, and the plague remov'd.
When Theseus, aided by the virgin's art,
Had trac'd the guiding thread thro' ev'ry part,
He took the gentle maid, that set him free,
And, bound for Dias, cut the briny sea.
There, quickly cloy'd, ungrateful, and unkind,
Left his fair consort in the isle behind . . .

The Right-Hand Rule

- The most widely known strategy for solving a maze is called the ***right-hand rule***, in which you put your right hand on the wall and keep it there until you find an exit.
- If Theseus applies the right-hand rule in this maze, the solution path looks like this.
- Unfortunately, the right-hand rule doesn't work if there are loops in the maze that surround either the starting position or the goal.
- In this maze, the right-hand rule sends Theseus into an infinite loop.