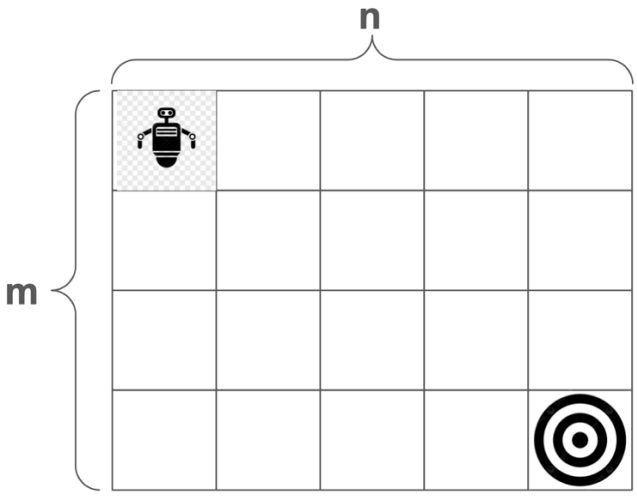
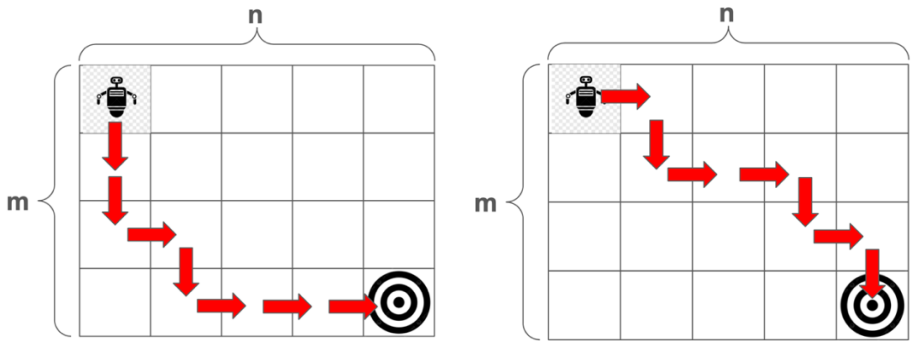
Robots on Grids



Let's consider a robot on an *m x n* grid of squares (that is, *m* rows and *n* columns). The robot starts in the top-left square, and its target is at the bottom-right. The robot has two moves available to it - it can move one square to the right, or one square down – so it must make a combination of rightward and downward moves to reach its target. It follows that the robot will take *(m + n – 2)* steps to reach its target.

Here are two such paths it could take:



Your task is to write code that counts the number of possible paths for the robot, given an *m* and *n*.

1. Write a function *num_paths(m, n)* that recursively computes the number of paths from the top-left to bottom-right square of an *m x n* grid **without memoization**.
2. Write a function *num_paths_memo(m, n)* that does the same, but memoizes the smaller subproblem solutions.
3. The provided sample/driver code will do the runtime calculation for you. Take a screenshot of the output and submit it along with your python script.

Example code:

A sample source code file has been attached (hw2.py), please start writing your solution using this template. You need to complete the #TODO sections only.

Expected Output

- *The expected result for m=15, n=14 is 20058300.*
- *The elapsed time / runtime can vary from system to system.*

Comments Required!

Please add a few comments in your Python script to explain the functionality and logic of your code. Ensure that the comments are concise and meaningful.

Grading Breakdown

Task	Description	Points
1	Implementation of num_paths() function	30
2	Implementation of num_paths_memo() function	50
3	Output screenshot (to report the runtimes)	10
4	Comments	10

Submission Instructions

(Please follow the instructions carefully and submit accordingly.)

- Name your source code file as "FULL_NAME_HW2.py"
- Submit this **file** and **output screenshot** in iCollege folder '**Homework2**'
- Due date: Wed, 10/15/2025 11:59 PM
- Late submission will be accepted until: Sat, 10/18/2025 11:59 PM

The late submissions penalty will be determined based on the following formula:

PENALTY = 0.4 * NUMBER_OF_HOURS_LATE

Examples:

If your submission is 2 hours late, PENALTY = 0.8%
If your submission is 24 hours late, PENALTY = 9.6%
If your submission is 72 hours late, PENALTY = 28.8%

Note:
- Only late submissions that are <= 3 days late will be considered for grading.
-All submissions must be made through iCollege. No email submission will be accepted.