UNIVERSITY OF SCIENCE
FALCUTY OF INFORMATION TECHNOLOGY

SUBJECT: INTRODUCTION TO AI

LAB 01 – THE KNIGHT'S TOUR
CLASS 20CLC11

Student's name: Mai Quý Trung
Student ID: 20127370

Lecturers: **NGUYỄN NGỌC THẢO, NGUYỄN THÀNH AN, LÊ NGỌC THÀNH**

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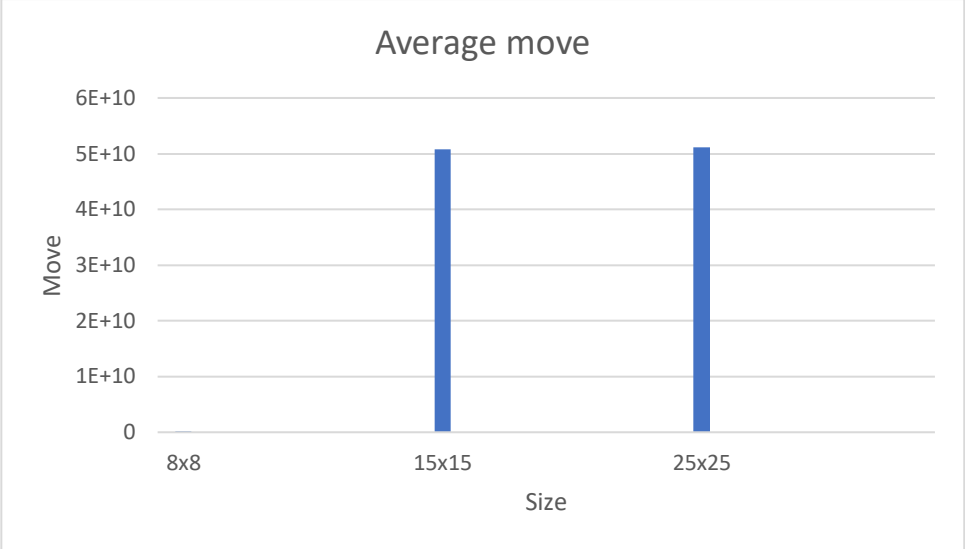
I) Checklist

STT	Criteria	Done	Not done
1	Manipulate the input and output	**X**	
2	Implement the backtracking	**X**	
3	Implement the Warnsdorff's Heuristic	**X**	
4	Provide valid results for the backtracking strategy	**X**	
5	Provide valid results for the Warnsdorff's Heuristic	**X**	
6	Provide all evidential files in the OUTPUT folder	**X**	
7	Report sufficient information in the document	**X**	

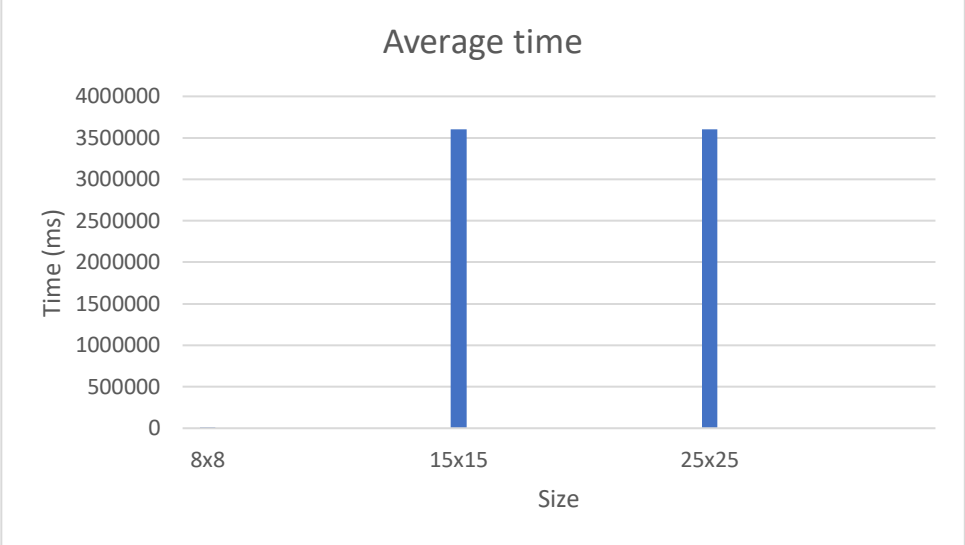
II) Statistical report

1. Backtracking's Algorithm

SIZE	POSITION	MOVES	RUNNING TIME (ms)	**AVERAGE MOVES**	**AVERAGE TIME (ms)**
8x8	(1, 1)	8250733	526.819	~ 150121277.8	~ 9749.9316
	(5, 1)	9152986	613.815		
	(8, 1)	3242065	288.334		
	(5, 3)	108524012	6938.09		
	(8, 2)	621436593	40382.6		
15x15	(1, 1)	> 46000000000	3600000	~ 50800000000	~ 3600000
	(5, 1)	> 49000000000	3600000		
	(4, 6)	> 52000000000	3600000		
	(5, 3)	> 61000000000	3600000		
	(4, 3)	> 46000000000	3600000		
25x25	(1, 1)	> 62000000000	3600000	~ 51200000000	~ 3600000
	(8, 1)	> 50000000000	3600000		
	(5, 3)	> 47000000000	3600000		
	(4, 6)	> 51000000000	3600000		
	(4, 2)	> 46000000000	3600000		



(The graph shows the average moves using backtracking algorithm)



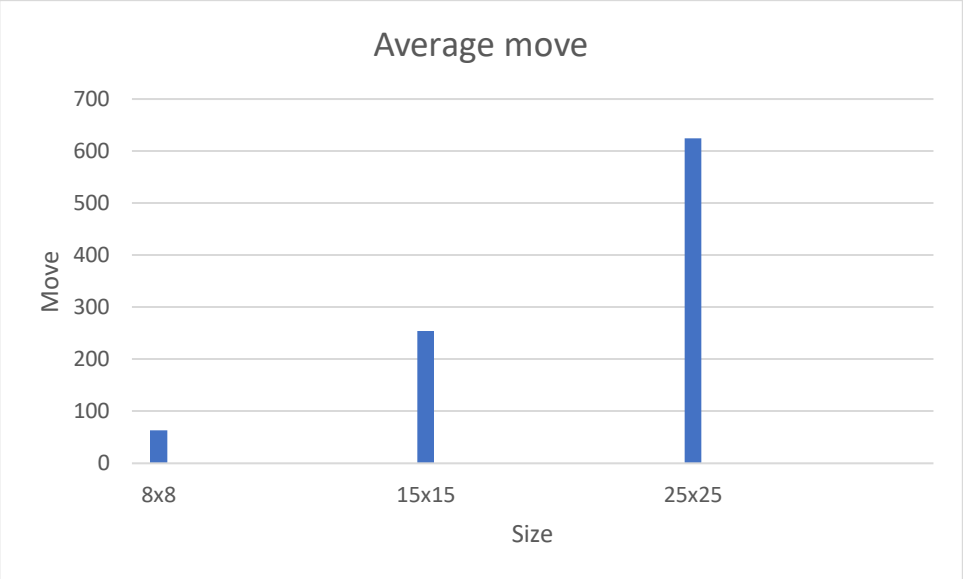
(The graph shows the average time using backtracking algorithm)

Discussion:

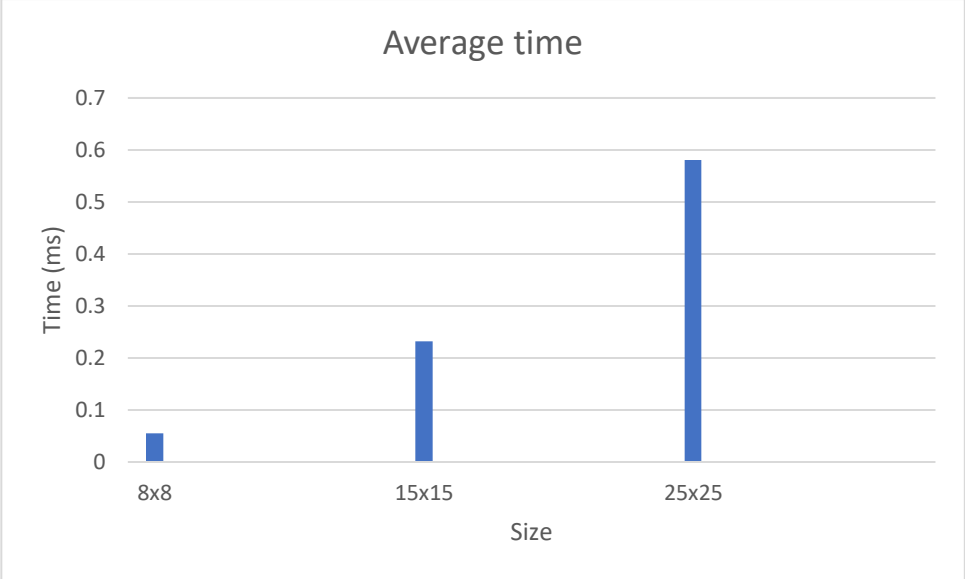
- Most of the coordinates on the board like -px 1 -py 5 with size 8x8, backtracking algorithm solves in a very long time that normal computers can't process.
- With board size 8x8, only some specific coordinates such as (1, 1), (5,1), (5,3), the program can give faster outputs. Either with board size 15x15 and 25x25.

2. Warnsdorff's Algorithm

SIZE	POSITION	MOVES	RUNNING TIME (ms)	AVERAGE MOVES	AVERAGE TIME (ms)
8x8	(1, 1)	64	0.056	~ 64	0.0552
	(5, 1)	64	0.056		
	(8, 1)	64	0.054		
	(8, 2)	64	0.057		
	(4, 3)	64	0.053		
15x15	(2, 6)	225	0.215	~ 254	0.2324
	(5, 1)	225	0.193		
	(5, 3)	225	0.279		
	(1, 8)	222	0.272		
	(4, 1)	224	0.203		
25x25	(1, 1)	625	0.529	~ 625	0.5802
	(5, 1)	625	0.614		
	(8, 8)	625	0.666		
	(4, 6)	625	0.546		
	(2, 7)	624	0.546		



(The graph shows the average moves using Warnsdorff's heuristic algorithm)



(The graph shows the average time using Warnsdorff's heuristic algorithm)

Discussion:

- Heuristic algorithm in some cases does not provide the correct solution to solve the board. Since it uses heuristic functions to declare the next move with smallest moveable steps.
- Therefore, with cases that cannot reach all cells in the board, steps will be counted respectively and the statistics will output the problability of success knight tours.

III) Reference

1. Wikipedia The Knight's Tour: https://en.wikipedia.org/wiki/Knight%27s_tour
2. GeeksForGeeks Backtracking's Algorithm: https://www.geeksforgeeks.org/the-knights-tour-problem-backtracking-1/
3. GeeksForGeeks Warnsdorff's Algorithm: https://www.geeksforgeeks.org/warnsdorffs-algorithm-knights-tour-problem/