**PROJECT PLANNING REPORT**

My name is Roja Kamble and I am doing this project together with Meenasree Ananthavelu.

Researching on the topic, understanding algorithms, finding the base of the problem and identifying the efforts and cons are the contributions I made for this project. Meena contributed by sharing different ideas on implementation and by documenting for the project planning report.

**Topic and Motivation:**

The topic that we chose for the project is **“Knight’s Travails”.** The idea is to find the shortest path between two squares on a chess board as travelled by a knight. The knight cannot traverse through the same cell again and it cannot move outside the board. There are few applications like board game and backtracking for the same.

**Board game:** In chess board we have 64 cells, we should be able to fill all the cells, such that we got to move the knight. It uses uniform cost search that is similar to BFS (Breadth First Search) with each move on chess board being having an equal cost, so the shortest path will always have the least number of moves.

**Backtracking:** The knight traverses in every possible combination of the N x N matrix to find a solution. We use backtracking in solving various puzzles like Crosswords, Sudoku, Peg Solitaire etc. We also use this to find all the Hamiltonian Paths present in the graph which is a special case for Knight’s tour problem.

**Background:**

We found this problem interesting, a regular known board game having mathematical background which is followed by certain data structures and algorithms.

The key research that are in line to be performed to improve the algorithm are:

* Starting the position of the knight somewhere in the middle of the board and optimizing the traversal path to reach the maximum cells.
* To explore the existing algorithm and come up with drawbacks and then implement our own algorithm.

**Implementation and Evaluation Plan:**

The key activities for our project:

* Algorithm to be used: Breadth First Search [BFS], Dijkstra’s.
* Data structures to be used: Graphs, Matrices, Linked list, Queue.
* Data sets –

1. The chess board data set starting with 5x5 board size and may go up to 8x8 size having the Knight’s in multiple start and end positions.
2. Other data sets depending on the time availability and our implementation we will also use Sudoku or crossword datasets.

* Design of experiment – Try for optimized path from different positions of the knight and minimize the time complexity to travel with less time.

Time Complexity: O(8^(NN)), as there are NN cells in the board/matrix.

Space Complexity: O(N\*N), N is the size of the board.

* Code deployment – Based on our implementation, if we create our own algorithm, we will deploy the code to any cloud service (AWS/Azure/GitHub) for implementation & testing.

Calendar

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Description automatically generated with medium confidence

**Tentative Timeline for the project:**

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| **Activity** | **Expected time frame** |
| Explore the Algorithm | Sept week 3 - 4 |
| Explore the Data structure | Oct week 1 - 2 |
| Design the Experiment | Oct week 3 |
| Code Implementation & Testing | Oct week 4 – Nov week 2 |
| Find Different Datasets and Test our code | Nov week 3 - 4 |
| Project report | Dec week 1 |

**Improvements:**

* Minimize the time to travel every cell [or]
* Maximize the reachability to different cells from various positions.

**References:**

* [https://en.wikipedia.org/wiki/Knight%27s\_tour](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FKnight%2527s_tour&data=04%7C01%7CRojaKamble%40my.unt.edu%7Cf7a7846967ec4381bf2e08d97ba0ad7c%7C70de199207c6480fa318a1afcba03983%7C0%7C0%7C637676752290387275%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=dQ5sCfYZm%2BJmlMHD5FlNoLT1qDsYgst0a1DBo1s9PKw%3D&reserved=0)
* [https://en.wikipedia.org/wiki/Backtracking#:~:text=Backtracking%20is%20a%20general%20algorithm,completed%20to%20a%20valid%20solution](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FBacktracking%23%3A~%3Atext%3DBacktracking%2520is%2520a%2520general%2520algorithm%2Ccompleted%2520to%2520a%2520valid%2520solution&data=04%7C01%7CRojaKamble%40my.unt.edu%7Cf7a7846967ec4381bf2e08d97ba0ad7c%7C70de199207c6480fa318a1afcba03983%7C0%7C0%7C637676752290397272%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=PrbnDt8RXJWgkkwBuuUxKy9wE0XBfBQBAExzNC8AlOo%3D&reserved=0)