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Assignment 09 Analysis Doc

**1. Who is your programming partner? Which of you submitted the source code of your program?**

My programming partner was Ella Moskun, uid 0897252. My partner submitted the Source code for this assignment.

**2. Evaluate your programming partner.**

We were able to complete this assignment very quickly because we split who would focus on what part of the code allowing for us to have all planned once we met. This means that as a pair we completed the code efficiently and in little time. My partner was very efficient in coding knowledge and requires very little assistance for coding.

**3. Does the straight-line distance (the absolute distance, ignoring any walls) from the start point to the goal point affect the running time of your algorithm?**

The straight-line distance will affect the runtime however this is not a set change. Generally the runtime will increase because with walls being considered there are more nodes that can be checked on the way to the goal. However the runtime may be shorter if distance to the goal is short for example SXG will cause a decrease in runtime as the goal is only 2 nodes away from the start.

**4. Explain the difference between the straight-line distance and the actual solution path length. Give an example of a situation in which they differ greatly. How do each of them affect the running time of your algorithm? Which one is a more accurate indicator of run-time?**

The difference in runtime when considering walls or not depends on the distance the goal is from the start.

For example

```
XXXXXXXXXX A
X          X
X      X   X
X      X   X
X      X   X
X      X   X
X      X   X
X      X   X
X      X   X
X      SXG  X
XXXXXXXXXX
```

```
XXXXXXXXXX B
X      XG X
X      X   X
X      X   X
X      X   X
X      X   X
X      X   X
XXXXXXXXXX
X      S   X
XXXXXXXXXX
```

A is an example of a maze that will have a shorter runtime without walls while B is an example that will have a longer runtime without walls. A will have a shorter runtime without walls than B but B will have a shorter runtime with walls. Bs runtime will increase without walls as more nodes must be considered before reaching the goal while in A.

Without considering walls runtime can be neatly seen with an upward curve as the goal is farther from the start and more nodes are in the queue.

**5. Assuming that the input maze is square (height and width are the same), consider the problem size,  $N$  to be the length of one side of the maze. What is the worst-case performance of your algorithm in Big-O notation? Your analysis should take in to account the density of the maze (how many wall segments there are in the field). For example, a completely open field with no walls other than the perimeter is not dense at all, as opposed to the example maze given "bigMaze.txt", which is very dense. There is no one correct answer to this since solutions may vary, but you must provide an analysis that shows you are thinking about the problem in a meaningful way related to your solution.**

The worst case performance of a maze can be  $N^2$  this would be in an open maze where all nodes are checked before the goal is found or if there is no solution and all the nodes are checked. This is less in a dense maze as some of the nodes are replaced with walls meaning that less nodes are needed to be checked.

|                     |   |                               |   |
|---------------------|---|-------------------------------|---|
| X X X X X X X X     | A | X X X X X X X X X X           | B |
| X                GX |   | X    X                X       |   |
| X                X  |   | X    X    X            X      |   |
| X                X  |   | X    X    X            X      |   |
| X                X  |   | X    X    X            X      |   |
| X                X  |   | X    X    X            G X    |   |
| X                X  |   | X    X    X            X      |   |
| X                X  |   | X    X    X            X      |   |
| X S             X   |   | X S                X        X |   |
| X X X X X X X X     |   | X X X X X X X X X X           |   |

Graph a will have a longer runtime than graph B as all the nodes need to be checked while in graph B only a couple of nodes are being checked at a time.

**6. How many hours did you spend on this assignment?**

We spent about 5 hours on this assignment.