maze design

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1 Project Structure

Project structure breakdown:

```
.
/data
   invalid_bfs.txt
   invalid_graph.txt
   invalid_map.txt
   map_vis.txt
   valid_map2.txt
   valid_map.txt
/doc
   design.tex
   writeup.pdf
   writeup.tex
/include
   io_helper.h
   llist.h
   matrix.h
   p_queue.h
 Makefile
README.md
/src
   driver.c
   io_helper.c
   llist.c
   matrix.c
   p_queue.c
/test
   test_all.c
   test_io_helper.c
   test_matrix.c
```

data - various .txt maps for testing the project.
doc - documentation for the project, design plan, writeup, man page, and test

plan.
include - custom header files for C source code files.
src - C source code files for project.
test - C source code files for unit testing.

2 Data Structures Needed

This project will rely on five main data structures. Three structs to hold the matrix, information about it, and its member variables, and a linked list with stack-like behavior and priority queue for implementing Dijkstra's Algorithm. The three structs are:

```
typedef struct vertex_t {
        struct vertex_t *parent;
        struct edge_t *neighbors;
        int value;
        int weight;
        char letter;
        int level;
        int num_children;
} vertex_t;

typedef struct edge_t {
        vertex_t *destination;
        struct edge_t *next;
} edge_t;

typedef struct graph_t {
        vertex_t **matrix;
        vertex_t *start;
        vertex_t *end;
        uint16_t rows;
        uint16_t cols;
        uint16_t size;
} graph_t;
```

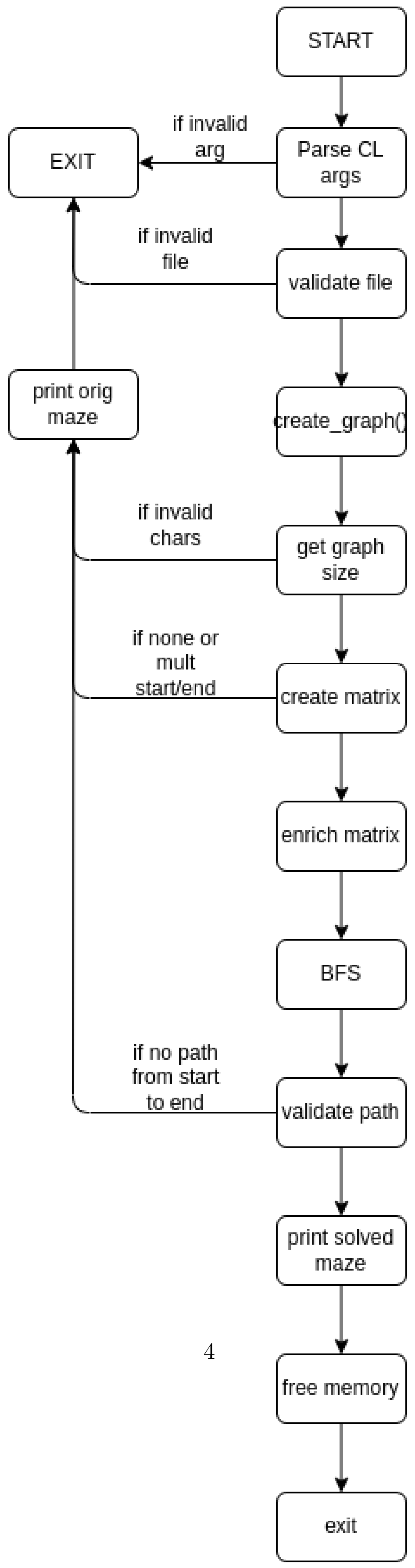
3 Functions Needed

The basic functions needed are:

```
/*
 Callocs space for graph_t and returns pointer to the struct.
 */
graph_t *graph_create(void);
```

```
/*
 free() memory allocated for graph and its members
 */
void matrix_destroy(graph_t * graph);

/*
 Iterates over the maze file and calculates number of rows and max number of colu
 */
int get_set_graph_size(FILE * fp, graph_t * graph);

/*
 Iterates over the maze file, and initializes and sets the values in the matrix
 */
int matrix_graph_create(FILE * fp, graph_t * graph);

/*
 Iterates over the graph, enriching each vertex with neighbors.
 */
int matrix_enrich(graph_t * graph);

/*
 Prints un-modified graph if map invalid, or no route exists.
 */
void print_graph(graph_t * graph);

/*
 Conducts a BFS against a valid map.
 */
int bfs(graph_t * graph);

/*
 If all map validation conditions are met, prints the original map, with route r
 */
void print_solved(graph_t * graph);
```

4 Project Flow


START
Parse CL args
if invalid arg
EXIT
if invalid file
validate file
print orig maze
create_graph()
if invalid chars
get graph size
if none or mult start/end
create matrix
enrich matrix
BFS
if no path from start to end
validate path
print solved maze
free memory
exit