5/1/2016

Project 1

Minesweeper

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Introduction

For our project I chose to write up a program that allows the user to play Minesweeper. The game is played in the command prompt using the standard row and column grid or a an “X’ and “Y” coordinate plane. The game randomly places mines on the game board that the user will define before playing. The goal is simple, navigate around the board without revealing mines as you go, and you accomplish this by using clues given about surrounding mines from your previous choice. This is done when you select one potential clear zone it will denote a number that will tells you how many mines are located from that position selected. The numbers can range from zero to eight.

This project is considered important because it allowed for a smoother transition in to utilizing classes. This is due to the fact that I was able utilize some of the same declaration and using a structure. By learning a few of the syntax for structure manipulation it allowed for me to prepare for some of the similar syntax used by classes, thus allowing for me to come into classes a bit more prepared.

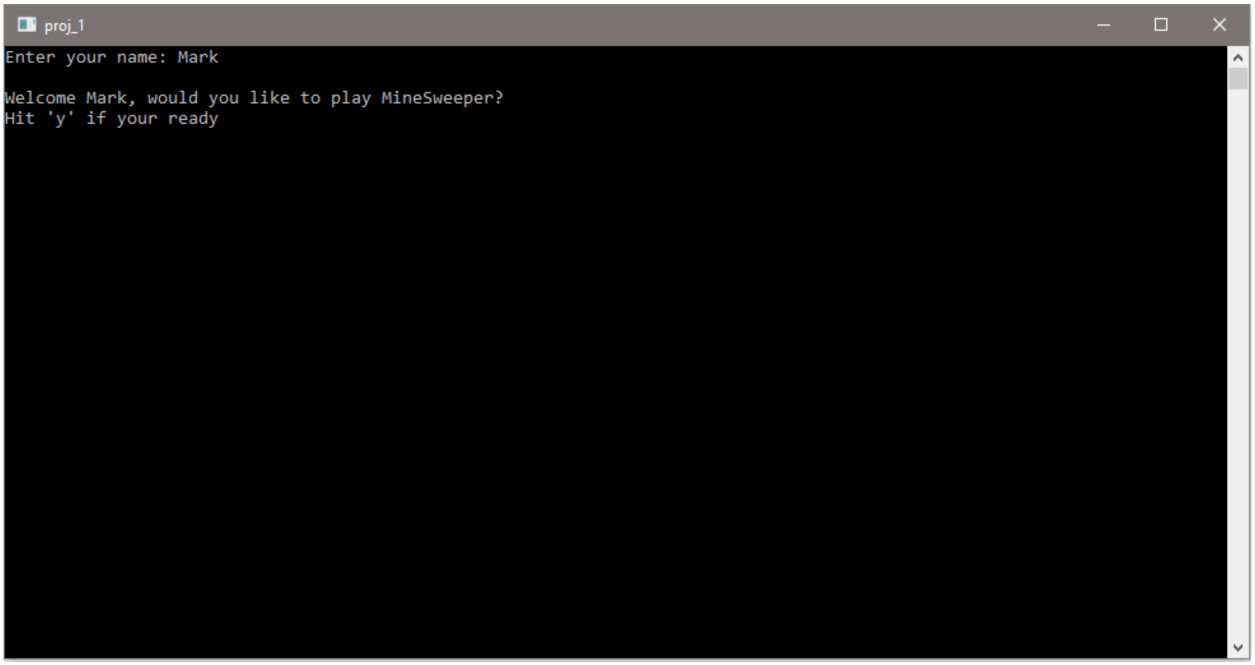
Summary

This project came in about a total length of 489 lines excluding blank lines and comments, and 599 in total. In the program I utilized dynamic memory allocation when asking for the user’s name and for the playing field. In addition, functions with structures were used with the creation of the playing field and many other areas. Pointers were used for the name and for passing information to functions. Character and string arrays were used. Reading and writing to a binary file was a bit more difficult and is the area that I am not a hundred percent as I receive an action, but I am not sure if that is what I truly wanted. The project was not to difficult just time consuming I believe I spend about three days cumulative over the course of a few weeks alongside my regular course work.

Description

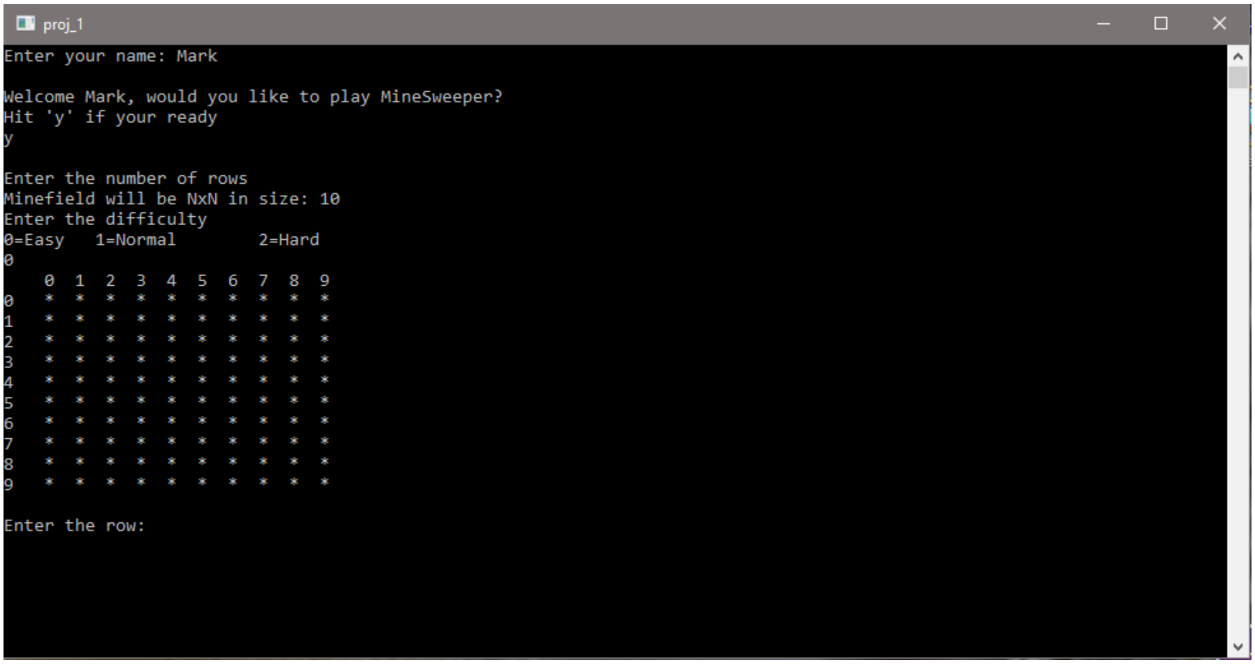
The project was written to be built dynamically as the user provides data that was asked of them i.e. name, rows in order to construct the grid in a row times row format, and their selection for the following picture the descriptions will come before each instance.

For example, if you provide It first with any name such as Mark it will retain that name in order to congratulate you, or comfort you depending if you win or lose the round.



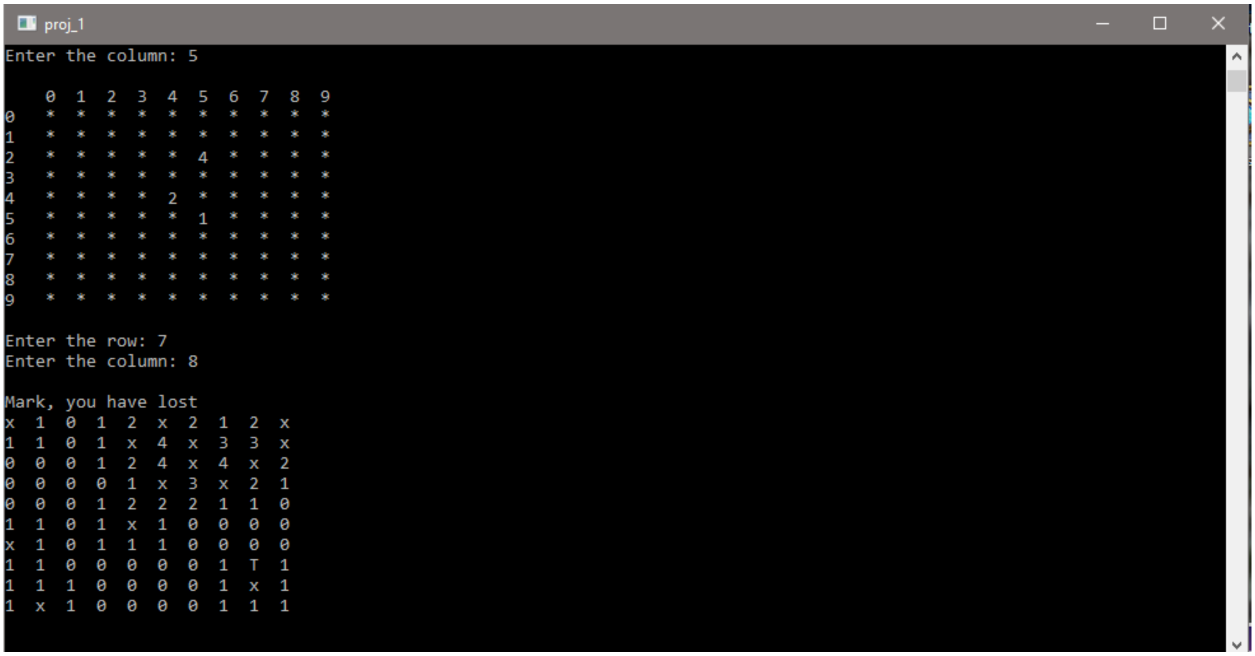
```
Enter your name: Mark

Welcome Mark, would you like to play MineSweeper?
Hit 'y' if your ready
```

Then it will ask for you to input your choice if you would like to play or exit the program. Followed by asking for a valid size for the array of units, and prevents you from continuing on i.e. a ten by ten grid and for the difficulty which determines how many mine will be placed on the board.



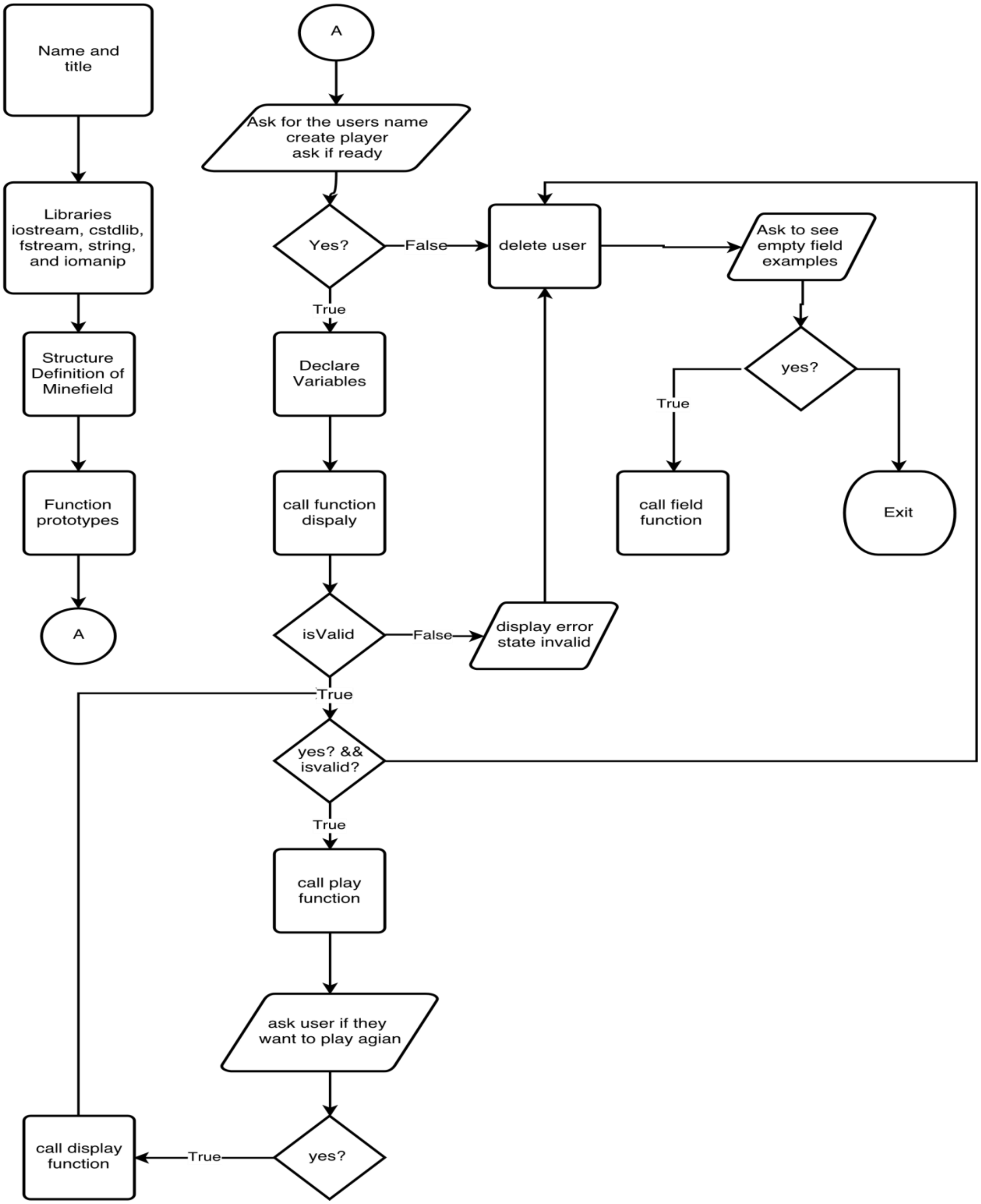
```
Enter your name: Mark

Welcome Mark, would you like to play MineSweeper?
Hit 'y' if your ready
y

Enter the number of rows
Minefield will be NxN in size: 10
Enter the difficulty
0=Easy   1=Normal        2=Hard
0
    0  1  2  3  4  5  6  7  8  9
0   *  *  *  *  *  *  *  *  *  *
1   *  *  *  *  *  *  *  *  *  *
2   *  *  *  *  *  *  *  *  *  *
3   *  *  *  *  *  *  *  *  *  *
4   *  *  *  *  *  *  *  *  *  *
5   *  *  *  *  *  *  *  *  *  *
6   *  *  *  *  *  *  *  *  *  *
7   *  *  *  *  *  *  *  *  *  *
8   *  *  *  *  *  *  *  *  *  *
9   *  *  *  *  *  *  *  *  *  *

Enter the row:
```

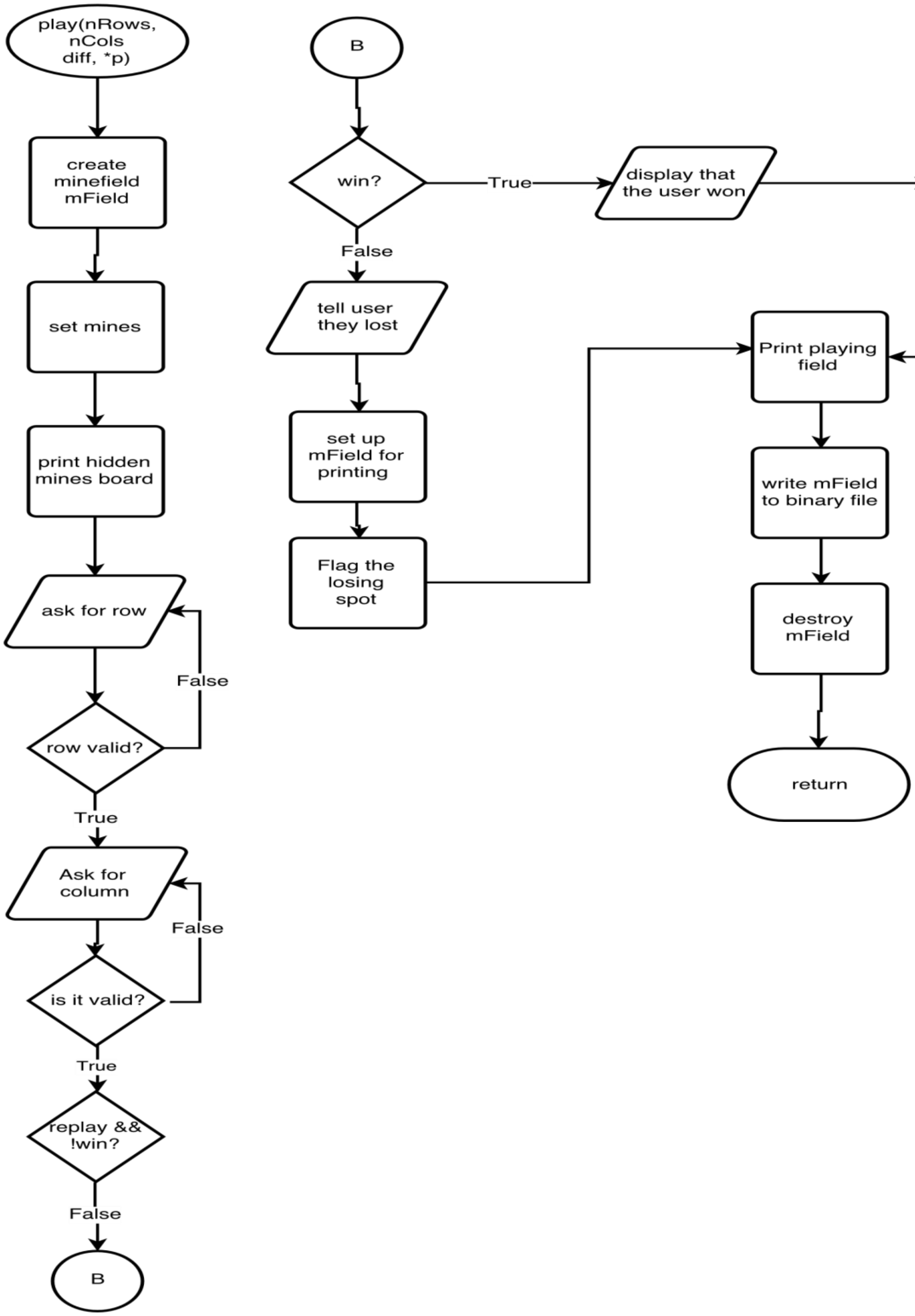
Furthermore. It will ask you for your choice in where you want to reveal followed by displaying an updated game board. For the picture I used I lost, I'm not a patient man when I comes to playing minesweeper I prefer the speed random selection method, but in doing so it demonstrates that it will reveal the board and shows you your last move made by flagging it as a "T".



```
Enter the column: 5

    0  1  2  3  4  5  6  7  8  9
0   *  *  *  *  *  *  *  *  *  *
1   *  *  *  *  *  *  *  *  *  *
2   *  *  *  *  *  4  *  *  *  *
3   *  *  *  *  *  *  *  *  *  *
4   *  *  *  *  2  *  *  *  *  *
5   *  *  *  *  *  1  *  *  *  *
6   *  *  *  *  *  *  *  *  *  *
7   *  *  *  *  *  *  *  *  *  *
8   *  *  *  *  *  *  *  *  *  *
9   *  *  *  *  *  *  *  *  *  *

Enter the row: 7
Enter the column: 8

Mark, you have lost
x  1  0  1  2  x  2  1  2  x
1  1  0  1  x  4  x  3  3  x
0  0  0  1  2  4  x  4  x  2
0  0  0  0  1  x  3  x  2  1
0  0  0  1  2  2  2  1  1  0
1  1  0  1  x  1  0  0  0  0
x  1  0  1  1  1  0  0  0  0
1  1  0  0  0  0  0  1  T  1
1  1  1  0  0  0  0  1  x  1
1  x  1  0  0  0  0  1  1  1
```

Flow Chart


Name and title
Libraries iostream, cstdlib, fstream, string, and iomanip
Structure Definition of Minefield
Function prototypes
A
A
Ask for the users name create player ask if ready
Yes?
False
True
delete user
Ask to see empty field examples
yes?
True
call field function
Exit
Declare Variables
call function dispaly
isValid
False
display error state invalid
True
yes? && isvalid?
True
call play function
ask user if they want to play agian
yes?
True
call display function


play(nRows, nCols diff, *p)
create minefield mField
set mines
print hidden mines board
ask for row
False
row valid?
True
Ask for column
False
is it valid?
True
replay && !win?
False
B
B
win?
True
display that the user won
set up mField for print
False
tell user they lost
set up mField for printing
Flag the losing spot
Print playing field
write mField to binary file
destroy mField
return

Pseudo Code

```
I.    Ask user for their name.
II.   Create the player using their name.
III.  Ask if the user is ready to play the game.
IV.   If they choose yes.
        a. Begin playing the game.
        b. Continue until it is calculated that the player has won or lost.
        c. If the game is over, ask if they want to play again.
             i. If yes re run steps I to IV c.
            ii. If no exit game.
V.    If no delete the user and exit the game.
VI.   Ask if you want to see previous results of last game.
        a. If yes read from binary file.
        b. If no continue to step VII.
VII.  Ask if they want to see examples of random mine field.
VIII. If no, then exit program
        a. Else display fields.
```

Major Variables

Type	Variable Name	Description	Location
short	**board	Holds the game board data.	Line 36 in MineField structure.
short	row	Holds the number of rows.	Line 38 in MineField structure
short	column	Hold the number of columns.	Line 40 in MineField structure
short	mines	Holds the mines data	Line 42 in MineField structure
enum	flags	Holds the status condition of the spaces on the field.	Line 34 in MineField structure
enum	difficulty	Determines how many mines to set.	Line 32 in MineField structure
char*	name	Holds the name of the user.	Line 74 in main ()

Concept From Chapter’s

Chapter	Concept	Description	Location
9.2	Pointer Variables	Used to hold memory addresses, and allows for indirect data manipulation.	Lines 64, 74, 161, 162, 205, 216, 222, 224, 261, 271…etc.
9.7	Passing pointers to functions	Passing a pointer gives the function access to the original argument	Lines 64 and 66 (functions). Lines 158 - 201 (play()) and 205 - 218(*name())
10	Working with char	Using and manipulation of char arrays	Lines 205 - 218
11	structures	ADT’s created to have their own domain of data and accessing structures to create objects.	Linea 30 – 42 Minefield struct. Lines 86, 159 – 163, 222 – 239.
12	Writing and reading to binary file	Use fstream library to write/read data to file	Lines 573 - 598

Reference

I used a video on YouTube to get me started:

Writing MineSweeper in 10 minutes

By Anton Te

https://www.youtube.com/watch?v=vqJQoangCSw

Code

```
/*
 *
 * Author: Diaz, Alfredo - Project 1
 * Project Minesweeper
 *
 */

///System Libraries
#include <cstdlib>
#include <iostream>
#include <fstream>
#include <string>
#include <iomanip>

using namespace std;

///User Libraries

///Global Constants

/***************************************************
 *
 *                 Structure
 *
 **************************************************/
/// Structure that holds the minefield, and
/// the associated flags that occur when
/// the user selects a square.

struct MineField {
    ///Difficulty
    enum Difficulty {EASY, NORMAL, HARD};
    ///Flags for various possibilities
    enum flags {EMPTY=10, MINE, CLEAR, LOSS};
    ///Game board
    short **board;
    ///Number of rows on board
    short row;
    ///Number of columns on the board
    short column;
    ///Number of mines on the playing field
    short mines;
};

///Function Prototypes

MineField *create(short,short);
void destroyBoard(MineField *);
void printClear(MineField *);
void print(MineField *);
MineField::Difficulty shortToDiff(short);
bool isValid(short, short, MineField::Difficulty);
bool isClear(MineField *, short, short);
short numMines(MineField::Difficulty);
void placeMines(MineField *);
void placeFlags(MineField *);
short adjacent(MineField *, short, short, short = MineField::MINE);
void clearArea(MineField *, short, short);
void perimeter(MineField *);
void zero(MineField *, short, short);
bool win(MineField *);
void field();
bool replay(MineField *, short, short);
void play(short, short, MineField::Difficulty, char*);
void display(short&, MineField::Difficulty&);
char *name();
void writeBin(MineField *, string);
void readBin(string);

///Execution Begins Here!
int main(int argc, char** argv) {

    /// Obtain user's name
    char *user = name();

    /// Determine if the player wishes to play a game
    cout << "\nWelcome " << user << ", would you like to play
MineSweeper?\n"
         << "Hit 'y' if your ready\n";
    char choice;
    cin >> choice;

    if(choice == 'y'){

        /// creation of game board
        short nRows;
        MineField::Difficulty difficult;

        /// Set game parameters from user input
        display(nRows, difficult);

        /// determine validity
        if(isValid(nRows, nRows, difficult)){
            while(choice == 'y' && isValid(nRows, nRows, difficult)){
                play(nRows, nRows, difficult, user);
                cout << endl;
                cout << user << ", Would you like to play agian?" << endl;
                cout << "Input 'y' for yes or anything else for no\n";
                cin >> choice;
                cout << endl;
                /// recreate board if yes
                if(choice == 'y' ) display(nRows,difficult);
            }
        }
        /// if data is not valid
        else
            cout << "Board too small.";
    }
    cout << "\nGame over.\n";

    cout << "\nGoodbye, " << user << endl;

    /// clean us used memory
    delete user;

    readBin("result");

    cout << "Would you like to see some empty mine fields "
            "stored in a structure?\n"
            "Hit 'y' for yes: ";
    cin >> choice;

    if (choice == 'y'){
        field();
    }
    cout << endl;

    return 0;
}

/***************************************************************
 *
 *              Function definitions
 *
 ***************************************************************/

void display(short &rows, MineField::Difficulty &d) {
    cout << "\nEnter the number of rows\n"
            "Minefield will be NxN in size: ";
    cin >> rows;

    short diff;
    cout << "Enter the difficulty\n"
            "0=Easy\t 1=Normal\t 2=Hard\n";
    cin >> diff;
    d = shortToDiff(diff);
}

/// Function while return true if input chosen was valid
bool isValid(short rows, short cols, MineField::Difficulty diff) {
    /// check to make sure number of mines does not exceed the number of
spots
    /// available
    return (rows * cols) > numMines(diff);

}
```

```
/// Play a game of minesweeper
/// User inputs how many rows and columns and the difficulty
void play(short nRows, short nCols,
    MineField::Difficulty diff, char *p) {
    srand(static_cast<unsigned int>(time(0)));
    MineField *mField = create(nRows, nCols);
    MineField *result;
    mField->mines = numMines(diff);
    placeMines(mField);
    print(mField);
    short row, col;
    do {
        /// Select the row
        do {
            cout << "Enter the row: ";
            cin >> row;
            /// check bounds
        } while (row < 0 || row >= mField->row);
        do {
            cout << "Enter the column: ";
            cin >> col;
            /// check bounds
        } while (col < 0 || col >= mField->column);
        cout << endl;
    } while (replay(mField, row, col) && !win(mField));

    /// Prepare to print completed minefield
    if (win(mField)) {
        cout << p << ", You win\n";
        placeFlags(mField);
    }
    else{
        cout << p << ", you have lost\n";
        placeFlags(mField);
        mField->board[row][col]= MineField::LOSS;
    }

    /// Print the complete minefield
    printClear(mField);

    /// write result to binary file
    writeBin(mField, "result");

    /// deallocate the game area
    destroyBoard(mField);
}

/// Function gets the user name as a string converts it to a char array
/// for the 1d dynamic array requirement
char *name() {
    cout << "Enter your name: ";
    string in;
    cin >> in;
    short size = in.size();
    /// make room for '\0'
    char *name = new char[size+1];
    for (short i = 0; i != size; ++i) {
        *(name+i) = in[i];
    }
    *(name+size+1) = '\0';

    return name;
}

/// Function that creates the grid on which game will be played
MineField* create(short rows, short cols) {
    /// dynamically create a minefield
    MineField *out = new MineField;
    out->row=rows;
    out->column = cols;

    /// Create the 2D game minefield
    out->board = new short *[rows];

    /// Create each row
    for (short row = 0; row != rows; ++row)
        out->board[row] = new short [cols];

    /// Make sure each square is empty
    for (short i = 0; i != rows; ++i)
        for (short j = 0; j != rows; ++j)
            out->board[i][j] = MineField::EMPTY;
    return out;
}

/// Function return the MineField::Difficulty type from
/// the short variable
MineField::Difficulty shortToDiff(short choice) {
    switch (choice) {
        case (0):
            return MineField::Difficulty::EASY;
            break;
        case (1):
            return MineField::Difficulty::NORMAL;
            break;
        case (2):
            return MineField::Difficulty::HARD;
        default:
            return MineField::Difficulty::EASY;
            break;
    }
}

/// Function deallocates memory
void destroyBoard(MineField *mField) {
    /// delete each dynamically allocated row
    for (short i = 0; i != mField->row; ++i)
```

```
        delete[] mField->board[i];
    /// delete the dynamically allocated structure
    delete mField;
}

/// Functions prints the minefield with all the squares revealed.
/// used mostly after player loses
void printClear(MineField* mField) {
    for (short row = 0; row != mField->row; ++row){
        for (short col = 0; col != mField->column; ++col) {
            if ( *(*(mField->board+row) + col) == MineField::LOSS)
                cout << "T  ";
            else if (*(*(mField->board+row) + col) == MineField::MINE)
                cout << "x  ";
            else if (!isClear(mField, row, col))
                     cout << adjacent(mField, row, col) << "  ";
            else
                cout << "0  ";
        }
        cout << endl;
    }
    cout << endl;
}

/// Function prints the minefield with spaces hidden
void print(MineField* mField) {
    /// Print the column index
    for (short i = 0; i != mField->column; ++i){
        /// Pad initial output of column indicator
        if (i==0)
            cout << "  ";
        cout << setw(3) << i;
    }
    cout << endl;
    for (short row = 0; row != mField->row; ++row){
        for (short col = 0; col != mField->column; ++col){
            if(col == 0 && row < 10) cout << row << "  ";
            if (col == 0 && row >= 10) cout << row << " ";
            /// KEEP EMPTY spaces and MINEs hidden
            if (mField->board[row][col] == MineField::EMPTY ||
                mField->board[row][col] == MineField::MINE)
                cout << setw(3) << right  << "* ";
            /// print out the CLEARed area
            else if (mField->board[row][col] == MineField::CLEAR)
                cout << setw(2)<< 0 << " ";
            /// Print out the actual value of the square
            else
                cout << setw(2)<< mField->board[row][col] << " ";
        }
        cout << endl;
    }
    cout << endl;
}
```

```
/// Function returns the number of mines to set based on Difficulty
short numMines(MineField::Difficulty d) {
    if (d==MineField::EASY)
        return 15;
    else if (d==MineField::NORMAL)
        return 30;
    else
         return 45;
}

/// Function places mines in grid
void placeMines(MineField *mField) {
    /// holds how many mines will be used
    short mines = mField->mines;

    /// keep looping through minefield until all mines are set
    while (mines) {
        for (short i = 0; i != mField->row; ++i) {
            for (short j = 0; j != mField->column; ++j) {
                /// place mines if result of rand()%15 == 0
                if ((rand() % 100) % 10 == 0){
                    ///only place mines if mines are still available
                    /// and current is empty
                    if (mines && mField->board[i][j] == MineField::EMPTY)
{
                        /// set the mine
                        mField->board[i][j] = MineField::MINE;
                        --mines;
                    }
                }
            }
        }
    }
}

/// Function returns how  many 'flag' elements surround a given square
short adjacent(MineField *mField, short row, short col, short FLAG) {
    short nAd=0;              /// the number of adjacent mines

    /// not on first or last row or first or last column
    /// most of the searches take place in this area
    if ( row > 0 && col > 0 && row < mField->row-1 && col < mField-
>column-1) {
        /// search the 3x3 grid surrounding a cell
        for (short i = row-1; i <= row+1; ++i) {
            for (short j = col-1; j <= col+1; ++j)
                if (mField->board[i][j] == FLAG)
                    ++nAd;
        }
    }
    /// on the first row, not on first or last column
    else if ( row == 0 && col > 0 && col < mField->column - 1) {
        for (short i = row; i <= row+1; ++i) {
            for (short j = col-1; j <= col+1; ++j)
```

```
                if (mField->board[i][j] == MineField::MINE)
                    ++nAd;
        }
    }
    /// on the last row, not on first or last column
    else if ( row == mField->row-1 && col > 0 && col < mField->column - 1)
{
        for (short i = row-1; i <= row; ++i) {
            for (short j = col-1; j <= col+1; ++j)
                if (mField->board[i][j] == MineField::MINE)
                    ++nAd;
        }
    }
    /// on the first column, not on first or last row
    /// search to the right
    else if ( col == 0 && row > 0 && row < mField->row - 1) {
        for (short i = row-1; i <= row+1; ++i) {
            for (short j = col; j <= col+1; ++j)
                if (mField->board[i][j] == MineField::MINE)
                    ++nAd;
        }
    }
    /// on the last column, not on first or last row
    /// search to the left
    else if ( col == mField->column-1 && row > 0 && row < mField->row - 1)
{
        for (short i = row-1; i <= row+1; ++i) {
            for (short j = col-1; j <= col; ++j)
                if (mField->board[i][j] == MineField::MINE)
                    ++nAd;
        }
    }
    /// top left corner
    else if (row == 0 && col == 0) {
        if (mField->board[row][col+1] == MineField::MINE) ++nAd;
        if (mField->board[row+1][col] == MineField::MINE) ++nAd;
        if (mField->board[row+1][col+1] == MineField::MINE) ++nAd;
    }
    /// top right corner
    else if (row == 0 && col == mField->column-1) {
        if (mField->board[row][col-1] == MineField::MINE) ++nAd;
        if (mField->board[row+1][col] == MineField::MINE) ++nAd;
        if (mField->board[row+1][col-1] == MineField::MINE) ++nAd;
    }
    /// bottom left corner
    else if (row == mField->row-1 && col == 0) {
        if (mField->board[row-1][col] == MineField::MINE) ++nAd;
        if (mField->board[row-1][col+1] == MineField::MINE) ++nAd;
        if (mField->board[row][col+1] == MineField::MINE) ++nAd;
    }
    /// bottom right corner
    else if (row == mField->row-1 && col == mField->column-1) {
        if (mField->board[row-1][col-1] == MineField::MINE) ++nAd;
        if (mField->board[row-1][col] == MineField::MINE) ++nAd;
        if (mField->board[row][col-1] == MineField::MINE) ++nAd;
    }
    /// return number of mines from appropriate if statement
    return nAd;
}

/// Function is true if there 0 land mines adjacent to
/// selected square
bool isClear(MineField * mField, short row, short col) {
    if (adjacent(mField, row, col))
        return false;            /// there was at least one mine adjacent
    return true;                 /// area was clear
}

/// Clear an area whose values are clear
/// i.e 0 adjacent  mines
void zero(MineField *mField, short row, short col) {
    /// check bounds
    if ( row >= mField->row || row < 0 || col >= mField->column || col <
0)
        return;
    if (isClear(mField, row, col) && mField->board[row][col] !=
MineField::CLEAR){
        mField->board[row][col] = MineField::CLEAR;
        /// go up one row
        zero(mField, row+1, col);
        /// go down one row
        zero(mField, row-1, col);
        /// go right one col
        zero(mField, row, col+1);
        /// go left one col
        zero(mField, row, col-1);
    }
    /// space was not clear or already shown
    else
        return;
}

/// Function shows how many mines are adjacent to selected square
/// for the entire minefield
void placeFlags(MineField *mField) {
    for (short i = 0; i != mField->row; ++i)
        for (short j = 0; j != mField->column; ++j)
            /// don't look for adjacent mines in areas where
            /// mine is already located
            if (mField->board[i][j] != MineField::MINE)
                mField->board[i][j] = adjacent(mField, i, j);
}

/// Function reveals what is underneath the square that the user has
selected
/// and whether to continue based on what is revealed
/// i.e selecting a mine means you lost, game over
bool replay(MineField * mField, short row, short col) {
    /// check if user selected a losing square
    if (mField->board[row][col] == MineField::MINE)
        return false;

    /// Square is a zero, clear the surrounding area if necessary
    else if (isClear(mField, row, col) ){
        zero(mField, row, col); /// show cleared area
        perimeter(mField);
        print(mField);
        return true;
    }
    /// Square had adjacent mine
    /// reveal the number to the user
    else {
        mField->board[row][col] = adjacent(mField, row, col);
        print(mField);
        return true;
    }
}

/// Function checks whether the player has won
bool win(MineField *mField) {
        for (short i = 0; i != mField->row; ++i)
            for (short j = 0; j != mField->column; ++j)
                /// if there are empty spaces player has not won
                if (mField->board[i][j] == MineField::EMPTY)
                    return false;
        /// there were no empty spaces left. Player has won
        return true;
    }

/// Function find the perimeter of the cleared areas
void perimeter(MineField *mField) {
    for (short row = 0; row != mField->row; ++row ) {
        /// avoid search at left and right edge of array
        for (short col = 0; col != mField->column; ++col) {
            /// when you're not on the bounds of the array
            if (row > 0 && row < mField->row-1
                && col > 0 &&  col <mField->column-1)
                if (mField->board[row][col] == MineField::CLEAR) {
                    /// check that the previous number has mines adjacent
                    if (mField->board[row][col-1] != MineField::CLEAR)
                        mField->board[row][col-1] = adjacent(mField, row,
col-1);
                    /// check if the next number has mines adjacent
                    if (mField->board[row][col+1] != MineField::CLEAR)
                        mField->board[row][col+1] = adjacent(mField,row,
col+1);
                    if (mField->board[row-1][col] != MineField::CLEAR)
                        mField->board[row-1][col] = adjacent(mField, row-
1, col);
                    /// check if the next number has mines adjacent
                    if (mField->board[row+1][col] != MineField::CLEAR)
```

```
                        mField->board[row+1][col] = adjacent(mField,row+1,
col);
                    /// check the adjacent corners
                    if (mField->board[row+1][col-1] != MineField::CLEAR)
                        mField->board[row-1][col-1] = adjacent(mField,row-
1, col-1);
                    if (mField->board[row-1][col+1] != MineField::CLEAR)
                        mField->board[row-1][col+1] = adjacent(mField,row-
1, col+1);
                    if (mField->board[row+1][col-1] != MineField::CLEAR)
                        mField->board[row+1][col-1] =
adjacent(mField,row+1, col-1);
                    if (mField->board[row+1][col+1] != MineField::CLEAR)
                        mField->board[row+1][col+1] =
adjacent(mField,row+1, col+1);
                }
        }
    }
}

/// This function creates an array of the Minefield structure
/// as part of the requirement's to be able to write to and read
/// from an array of structures
void field() {
    cout << "How many mine fields do you want to see: ";
    int n;
    cin >> n;

    MineField **mField = new MineField*[n];
    const int row = 10;
    const int col = 10;
    /// create the fields
    for (int i = 0; i != n; ++i) {
        /// Create each field
        mField[i] = create(row, col);
        /// get number of mines
        mField[i]->mines = numMines(MineField::EASY);
        /// set the mines
        placeMines(*(mField+i));
        /// set the flags
        placeFlags(*(mField+i));
        /// print the field
        printClear(*(mField+i));
        cout << endl;
    }
    cout << endl;

    /// deallocate memory
    for (int i = 0; i != n; ++i) {
        destroyBoard(*(mField+i));
    }
    delete []mField;
}
```

```
/// Function writes the minefield structure to a binary file
void writeBin(MineField *mField, string fileName) {
    /// Write the result to a binary file
    fstream out(fileName.c_str(), ios::out | ios::binary);    /// open the
file
    out.write(reinterpret_cast<char *>(&mField),sizeof(*mField)); ///
write to the file
    out.close();
}

/// Function prints the data variable from the Minefield structure
/// written to a binary file
void readBin(string fileName) {
    /// Ask user if they want to see the result of the last game
    char response;
    cout << "Would you like to see the result of the last game as "
    "read from a binary file?\n"
    "Hit 'y' if yes: ";
    cin >> response;
    if (response == 'y') {
        cout << "\nResult of your last game:\n";
        /// Create space to hold the file read
        MineField *result;
        fstream in(fileName.c_str(), ios::in | ios::binary);
        in.read(reinterpret_cast<char *>(&result), sizeof(*result));
        printClear(result);
        in.close();
    }
}
```