a. One notable obstacle I had to overcome was how to have my program print out that a

command string has incorrect syntax even if it had a previous command that plotted off

the grid. My program originally printed out that it could not execute a command if that

command that plotted off the grid occurred before my program finished checking for

syntax errors. After a days of trying to figure out a solution, I finally came to a conclusion

that I could create an int variable holding the position of the bad command and a bool

variable to check after my program had finished running through the commandString and

checked for syntax errors. if plotLine failed, I would just set bool to be true, and after

running through the commandString, I would check this bool which would indicate a

failed plotLine command. This proved to be a simple and effective solution.

Another notable obstacle I had to overcome was how to keep track of the current

position after executing a part of the command string, because originally, after each

command, my position would reset to (1,1). I fixed this by initializing two variables to hold

the current position and after executing each command, I would change the variables

holding the current position.

b. Pseudocode

plotLine Function:

Check for correct parameters when plotLine is called

Returns false if one of parameters is invalid

Check if distance is negative or positive

Program will split into positive or negative distance

Check if mode is foreground or background

Program will split into foreground or background

Check if direction is horizontal or vertical

Loop through grid for given distance and direction

Call setChar to plot the character at current position

Increment or decrement position

Function returns true after finished plotting

executeCommands Function:

Repeatedly:

Reset to default position (1,1)

Check every character of the command string

If there is a ‘c’ or ‘C’

Clear the grid and set default parameters

If there is an ‘f’ or ‘F’

Change mode to foreground

And change the plotChar character

Return 1 if there is an incorrect character

If there is a ‘b’ or ‘B’

Change mode to background

And change the plotChar character

Return 1 if there is an incorrect character

If there is an ‘h’ or ‘H’

Read the digits to find distance

Return 1 if there are no digits for distance

Call plotLine to plot horizontally

Return false if plotting exceeds bounds

Keep the position of the bad command that plotted off grid

If there is a ‘v’ or ‘V’

Read the digits to find distance

Return if there are no digits for distance

Call plotLine to plot vertically

Return false if plotting exceeds bounds

Keep the position of the bad command that plotted off grid

Check if there is an invalid character for instructions

Return with position of invalid instruction

If finished reading command string with no syntactical errors

Check if there was a command that plotted off the grid

Check which error occurred first

Set position to position of the first bad command

Return 2

Otherwise, program finished running with no error and returns 0 to draw

c. Test Cases:

1. H0 ensure plotLine will only modify the current position for horizontal
2. h0 ensure capital and lowercase do the same thing
3. V0 ensure plotLine will only modify the current position for vertical
4. v0 ensure capital and lowercase do the same thing
5. C ensure this clears the grid and sets to default parameters
6. h29v19 ensure we are at the last row and column
7. h30 ensure syntactically correct command but cannot execute command
8. V20 ensure syntactically correct command but cannot execute command
9. H10f ensure program prints syntax error at position 5
10. h10f@h-10 ensure foreground modifies plotChar and plots over existing plots
11. h10b#h19 ensure background does not modify characters other than spaces
12. h10v10h19v9 ensure program can execute multiple commands
13. Qh3 ensure program prints syntax error at position 1
14. FFh10 ensures program sets plotChar to F
15. FFfbh10 ensures program sets plotChar to b
16. h10H-20 ensures program prints cannot execute command at position 4
17. h10v19Cf@h3 ensures program cleared grid and changes plotChar correctly
18. H10f h-10 ensures program sets plotChar to space char and modifies existing chars
19. F’\t’h10 ensures program prints syntax error at position 2 since tab char != isprint
20. v2b h12fHh1fiH0 ensures program can handle multiple commands that modify

plotChar and calls plotLine

1. h10v10f8h10@f ensures program prints syntax error at position 12
2. “ “ ensures program terminates if an empty string is entered
3. b$h10b-10 ensures program prints syntax error at position 8
4. F b f v10 ensures program handle spaces as plotChar correctly
5. Ffffffffffbbbbh10 ensures program handles setting plotChar to correct character
6. H-10 valid syntax but program should say cannot execute command at position 1
7. H30h30v30 ensures program returns with position of the first error at position 1
8. H10v10v10 ensures program returns with position of the first error at position 7
9. H10v20f ensures program returns syntax error at position 8