Homework V
Assigned in Laboratory VII
Due Start of Laboratory IX

Please perform the following activities. This assignment is unpledged. You may work with one other person. You are allowed to talk with others, but your work must be your own.

Objective

We continue to develop our skills at taking a program specification and realizing a program. This assignment reinforces the skills of taking a problem and decomposing it into simpler problems.

Problem

The Department of Energy (DOE) is in the process of developing a robot that can be used in hazardous environments. The robot, HERO (Hazardous Environment Robot Observer), is controlled by simple commands. HERO understands the following commands:

Command	Action
U or u	Move up
D or d	Move down
L or l	Move left
R or r	Move right
S or s n	Set speed to n
M or m n	Set movement distance to n tenths of a centimeter

When HERO executes a movement command (U, D, L, or R) it moves in that direction. It moves a distance that is specified by the last set movement distance command (M) executed. The speed command (S) tells HERO how fast to execute commands. The argument for the speed command is milliseconds. HERO delays n milliseconds before reading and executing the next command. Both the arguments to the speed and movement commands are integers.

To help DOE develop HERO, you have been asked to write a program that displays the actions of HERO. Your program reads a file of HERO commands and displays HERO's action in a display window. Since HERO's intended purpose is to find hazardous materials, the program should indicate when HERO encounters hazardous material. Whenever HERO crosses a region with hazardous material that region should be highlighted on the screen.

A HERO command file has the following format:

```
20.0 20.0
9.0 9.0 2.0 2.0
0.0 0.0
S 100
M 10
D
D
D
D
D
D
L
```

This first line is the width and height in centimeters of the display window. The second line is the coordinates of the hazardous waste region and the size (width and height) of the waste region. The third line is the starting coordinates of HERO. Following these three lines (which must be present in a HERO command file) are HERO commands.

Your program should open the command file `hero.dat`, create a display window of the indicated size, draw the hazardous waste region (which should be yellow), and draw HERO at its starting coordinates. To represent HERO on the display use a 1.0 centimeter by 1.0 centimeter blue square. The program should read HERO commands and update the display to simulate the movements of HERO. The program should terminate when the last command is executed.

When HERO enters the hazardous waste region, the region should be displayed as red. When HERO exits the hazardous waste region its color should be returned to yellow.

If HERO attempts to move beyond the boundary of the left edge of the display window, HERO should appear at the right edge of the display window. Similarly, if HERO attempts to move beyond the boundary of the right edge of the display window, HERO should appear at the left edge of the display window. When HERO is at the top or bottom edge of the display window, the action is similar. If HERO attempts to move beyond the top edge of the display window, it should appear at the bottom of the display window. If HERO attempts to move beyond the bottom edge of the display window, it should appear at the top of the display window.

Notes

To simulate the movement of HERO, we can do the following. Erase HERO at its current location by drawing a white rectangle of the same size, then draw HERO at its new position. Because `RectangleShape` objects have frames around them, when a white rectangle is drawn, a black frame will remain on the screen. This will be acceptable as it will indicate HERO's track which may be useful in catching any bugs in its behavior.

To implement a delay function for the speed, you will need to use the `GetMilliseconds()` library function which is part of your EzWindows API. See page 739 of your textbook for the prototype of this function.

The argument to the movement command, *n*, must not be greater than 100. The initial value for movement is 10. Thus, if no movement command has been executed, HERO moves 0.1 centimeter on each command.

The argument to the speed command, *n*, must not be greater than 2000. The initial value for the speed is 100.

The length and width of the display window should not be greater than 30 centimeters.

Your program should validate all input as it is read. If it encounters an invalid command or illegal data values, the program should output an error message. The error message should identify the line number of the command file that has an error and what the error is. The erroneous command should be ignored and the rest of the data file should be processed normally.

Please submit your program electronically before the beginning of Laboratory IX. See your handout for how to do this. You should call your file `hw05.cpp` when you copy it to the CS1 server. Do not copy the project file.

You should also turn in a hard copy (print out) at the beginning of your laboratory when the program is due.

See the 101 Web page for the grading criteria for this assignment. The URL is:

```
http://www.cs.virginia.edu/cs101/
```