ECS 175 Fall 2019 - Assignment 1 Manual

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1 Run

Put data file at `test_scene` in current working directory. Then use `./Project1` to run the project.

2 Menu

2.A Introduction

There is a right-click menu in the system, also all functions can be invoked using keyboard. For example, `a` means just pressing key "A" and `A` means press "Shift + A". The `stdout` at the terminal will show important instructions and information.

2.B Bresenham / DDA

Right click menu's first option allows switching the line drawing algorithm between Bresenham and DDA. Also use keyboard `b` or `d`.

2.C Fill / Draw

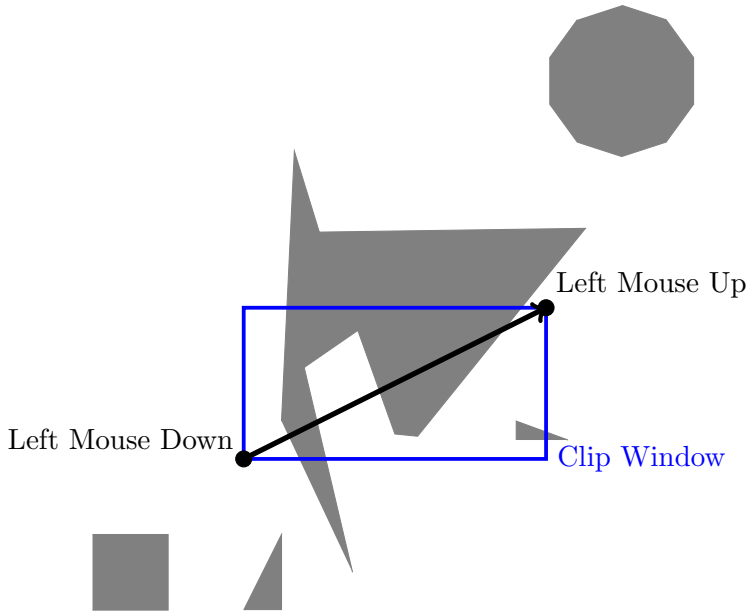
Right click menu's second option allows switching between filling (with interior of polygon) and drawing (only drawing edges). Also use keyboard `f`.

2.D Clipping

Right click menu's third option enables clipping. Please follow these steps.

1. Click on menu's "Clip" or press keyboard `c`.
2. Go to a corner of the clipping window, press and hold the left mouse button.
3. Drag the mouse to the other corner of the clipping window, then release left mouse button.

Right click menu's fourth option "No Clip" disables clipping. Also use keyboard `C` (Shift + C). See the figure below.



2.E Hide / Show

Right click menu's fifth option allows hiding / showing a polygon using its ID. ID starts with 0. Also use keyboard `0` for polygon 0, `1` for polygon 1, etc.

2.F Linear Transformation

Right click menu's 6th, 7th, and 8th option allows doing linear transformation. selecting the option, use mouse (like in "Clipping") to provide two points on the point to indicate translation vector, rotation angle, or scaling factor.

For convenience, after a specific polygon is selected, it will be colored red.

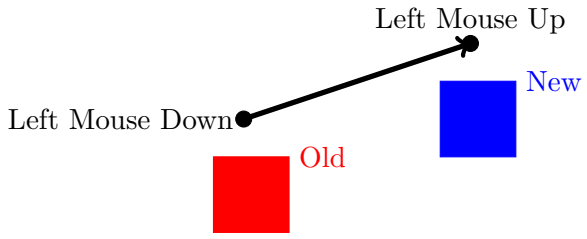
After each transformation, the file `test_scene` will be automatically overwritten with the new scene.

2.F.1 Translation

For example, suppose we want to translate polygon 3.

1. Select "Translation → Translate 3" on menu bar OR press `t` and then `3` on keyboard.
2. Drag the mouse from point a to point b on the screen. The translation vector will be $b - a$;

See the figure below.

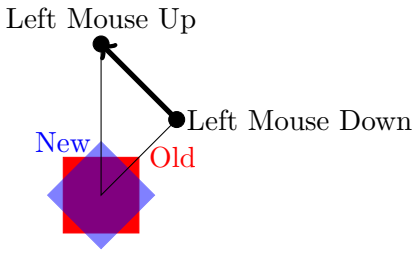


2.F.2 Rotation

For example, suppose we want to rotate polygon 4.

1. Select "Rotation → Rotate 4" on menu bar OR press `r` and then `4` on keyboard.
2. Drag the mouse from point a to point b on the screen. Suppose the centroid of polygon 4 is c, then the rotation angle will be the angle between vector $a - c$ and $b - c$.

See the figure below.



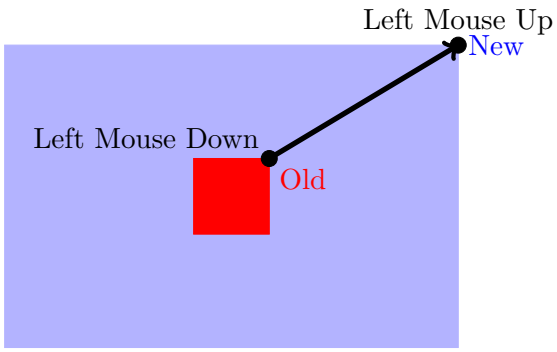
2.F.3 Scaling

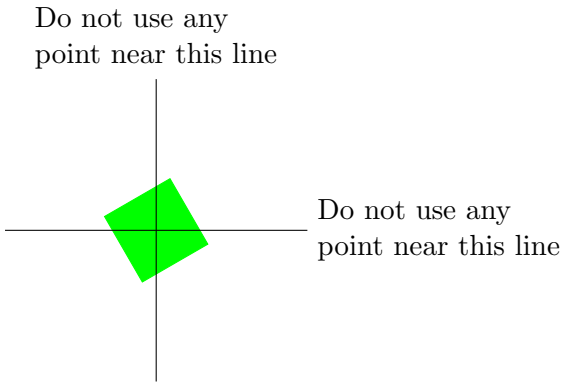
For example, suppose we want to scale polygon 2.

1. Select "Scaling → Scale 2" on menu bar OR press `r` and then `2` on keyboard.
2. Drag the mouse from point $a = (x_a, y_a)$ to point $b = (x_b, y_b)$ on the screen. Suppose the centroid of polygon 2 is $c = (x_c, y_c)$, then the x scaling factor will be $\frac{x_b - x_c}{x_a - x_c}$ and the y scaling factor will be $\frac{y_b - y_c}{y_a - y_c}$.

Note: try not to click on points that have close x or y values to the centroid, as this may make the polygon really big or small.

See the figure below.





2.G Quitting

Select "Quit" or press `q` to quit.

3 Extra Features

If you press `K` (Shift + K) on keyboard, everything will rotate. This is just for fun. Press `K` (Shift + K) again to stop this behavior.

In my program, the `draw_pix()` function is passed into DDA and Bresenham through a function pointer of type `void (*)(int, int)`. This gives the user more flexibility when using my library, and it allows me to highlight the polygon that is selected to be transformed.

To implement the interactive rotation, there is conversion between α and $\sin(\alpha)$ and $\cos(\alpha)$ implemented. See program output when a rotation is completed. Sample output: "Rotate cos = 0.670286; sin = -0.742103; angle = -47.910835 deg"

4 Keyboard Summary

Key choices	Function
b / d / B / D	Bresenham / DDA
f / F	Fill / Draw
c	Enable clip (select region using mouse)
C	Disable clip
t / T	Translation (specify vector using mouse)
r / R	Rotation (specify angle using mouse)
s / S	Scaling (specify factor using mouse)
K	Automatically rotate (extra)
q / Q	Quit
0	Hide / show polygon 0 OR Select polygon 0 for transformation
1	Hide / show polygon 1 OR Select polygon 1 for transformation
2	Hide / show polygon 2 OR Select polygon 2 for transformation
3	Hide / show polygon 3 OR Select polygon 3 for transformation
4	Hide / show polygon 4 OR Select polygon 4 for transformation
5	Hide / show polygon 5 OR Select polygon 5 for transformation
6	Hide / show polygon 6 OR Select polygon 6 for transformation
7	Hide / show polygon 7 OR Select polygon 7 for transformation
8	Hide / show polygon 8 OR Select polygon 8 for transformation
9	Hide / show polygon 9 OR Select polygon 9 for transformation