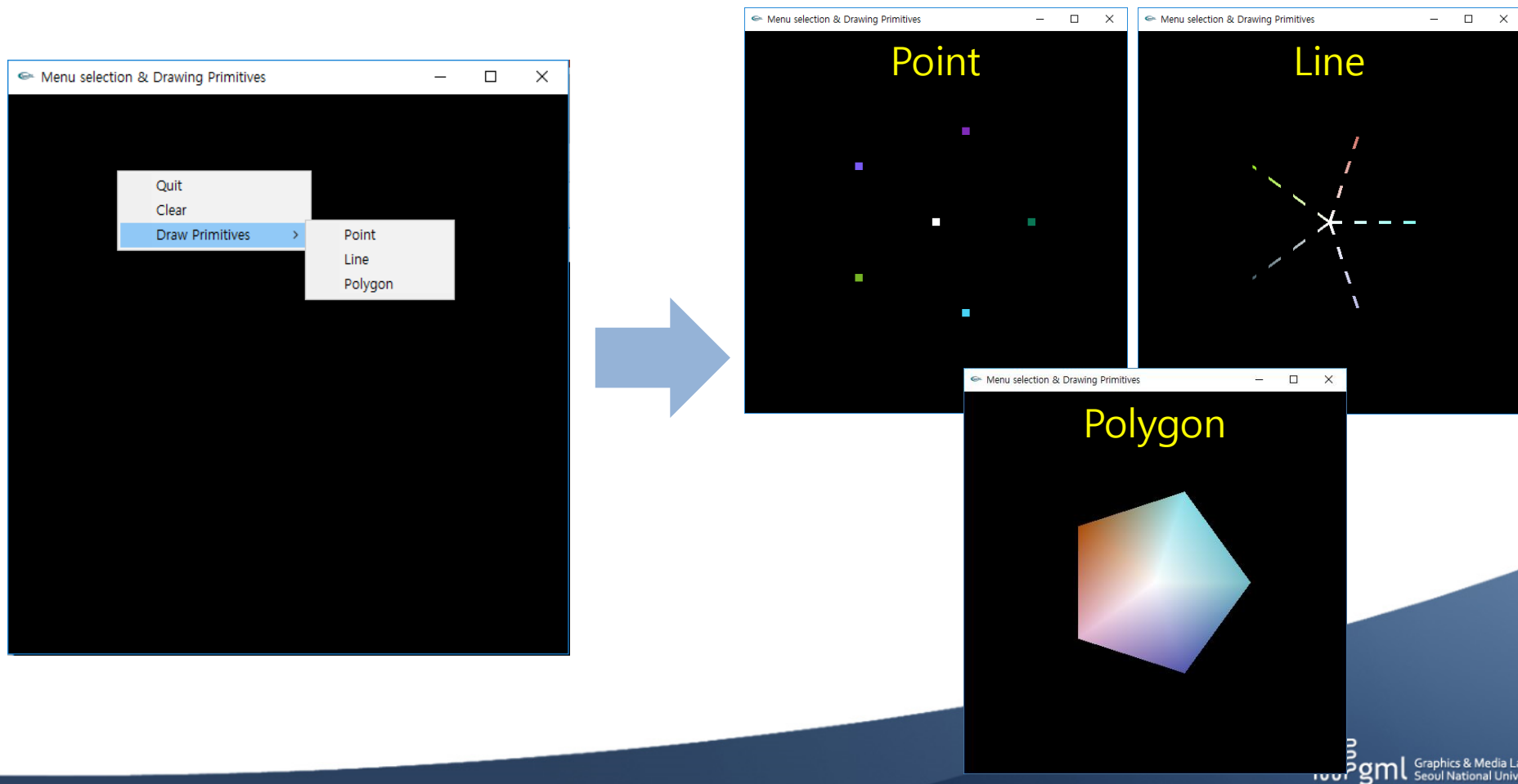# LAB I
Week 03

Seoul National University
Graphics & Media Lab
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Today's Mission

- Read data.txt including Center position & Radius
- Draw Primitives using Popup menu
- Move Primitives & Change Center Color using Callback functions

Callback functions

- glutDisplayFunc(…)
- glutKeyboardFunc(…)
- glutSpecialFunc(…)
- glutMouseFunc(…)
- glutMotionFunc(…)
- glutIdleFunc(…)

glutDisplayFunc(renderScene)

```
void renderScene(void) {
    glClearColor(0, 0, 0, 0);

    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

    drawPolygon();

    glutSwapBuffers();
    // glFlush();
    // glFinish();
}
```

glutKeyboardFunc(processNormalKeys)

```c
void processNormalKeys(unsigned char key, int x, int y) {
    printf("You pressed %c\n", key);
    if (key == 27 || key == 'q')
        exit(0);
    …
}
```

- key: ASCII code
- x, y: current mouse position

glutKeyboardFunc(processNormalKeys)

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	–	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C		
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

glutSpecialFunc(processSpecialKeys)

```c
void processSpecialKeys(int key, int x, int y) {
    printf("You pressed %c at (%d, %d)\n", key, x, y);
    switch (key) {
    case GLUT_KEY_F1:
        ...
        break;
    case GLUT_KEY_UP:
        ...
        break;
    case GLUT_KEY_HOME:
        ...
        break;
    case GLUT_KEY_INSERT:
        ...
        break;
    }
}
```

glutSpecialFunc(processSpecialKeys)

GLUT_KEY_F1
⋮
GLUT_KEY_F12

GLUT_KEY_LEFT
GLUT_KEY_RIGHT
GLUT_KEY_UP
GLUT_KEY_DOWN

GLUT_KEY_PAGE_UP
GLUT_KEY_PAGE_DOWN
GLUT_KEY_HOME
GLUT_KEY_END
GLUT_KEY_INSERT

glutMouseFunc(processMouse)

```c
void processMouse(int button, int state, int x, int y) {
    printf("Mouse button is clicked! (%d, %d, %d, %d)\n", button, state, x, y);
    if (button == GLUT_LEFT_BUTTON) {
        …
    }
    if (state == GLUT_UP) {
        …
    }
}
```

- button
  - GLUT_LEFT_BUTTON
  - GLUT_MIDDLE_BUTTON
  - GLUT_RIGHT_BUTTON
- state
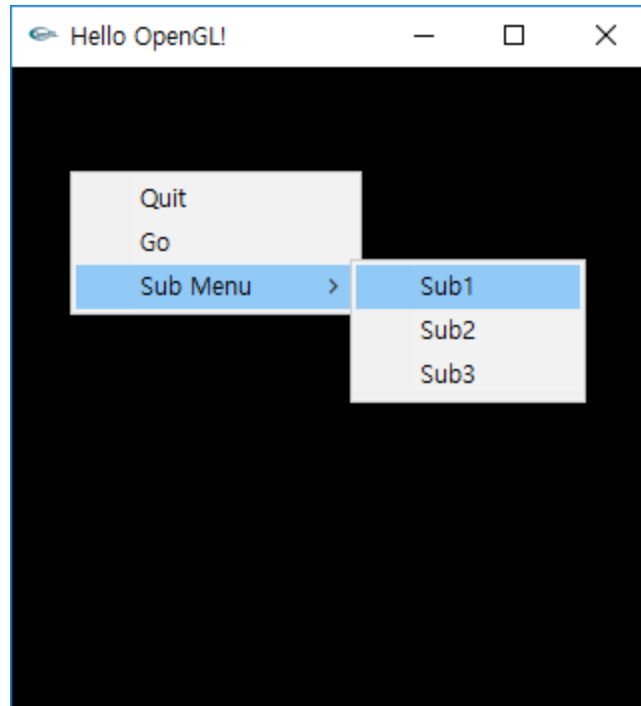 - GLUT_DOWN
  - GLUT_UP
- x, y: current mouse position

Popup menu

```
void main(int argc, char **argv) {
    …
    glutCreateWindow("Hello OpenGL!");

    // Popup menu
    int mainmenu, submenu;

    submenu = glutCreateMenu(sub_menu_function);
    glutAddMenuEntry("Sub1", 1);
    glutAddMenuEntry("Sub2", 2);
    glutAddMenuEntry("Sub3", 3);

    mainmenu = glutCreateMenu(main_menu_function);
    glutAddMenuEntry("Quit", 999);
    glutAddMenuEntry("Go", 0);
    glutAddSubMenu("Sub Menu", submenu);
    glutAttachMenu(GLUT_RIGHT_BUTTON);

    …
    glutMainLoop();
}
```

Popup menu

```c
void sub_menu_function(int option) {
    printf("Sub menu %d has been selected\n", option);
    ...
}

void main_menu_function(int option) {
    printf("Main menu %d has been selected\n", option);
    if (option == 999)
        exit(0);
    ...
}
```
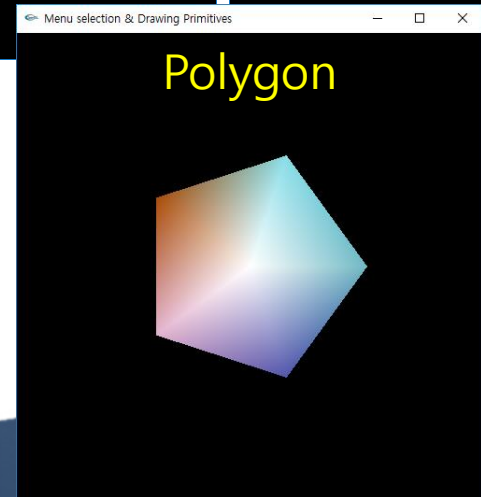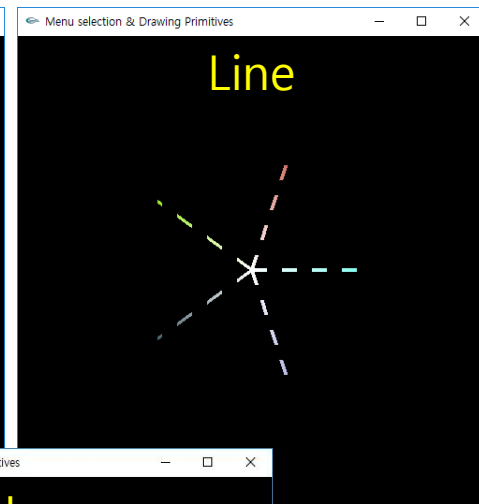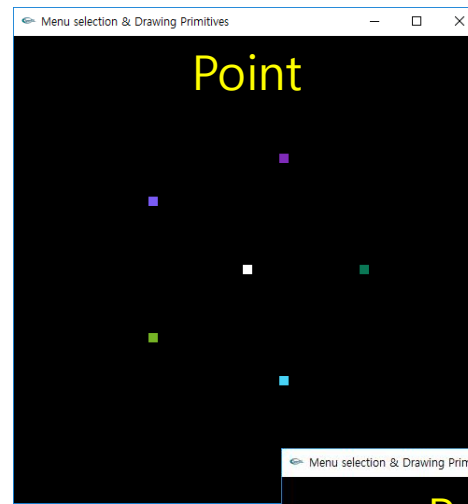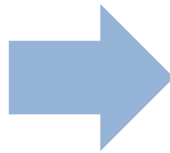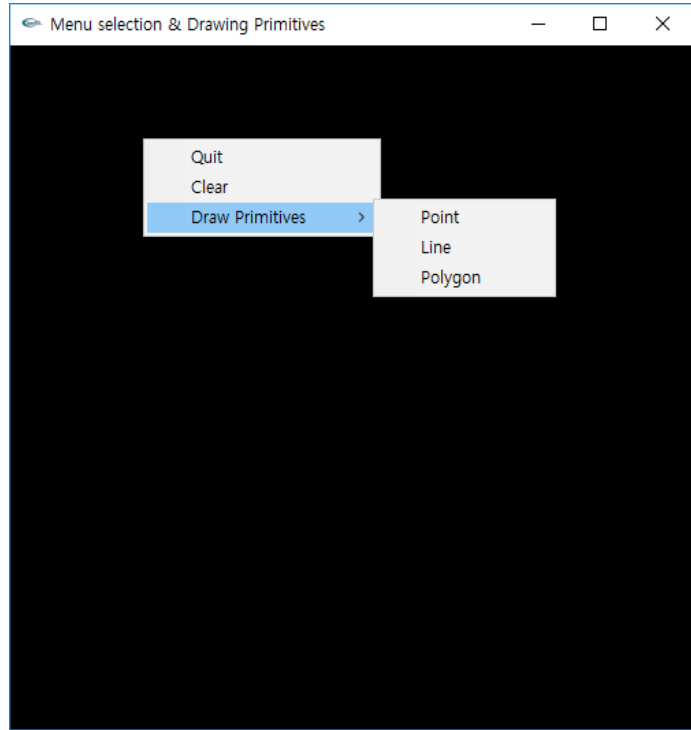
Popup menu

glutPostRedisplay()

- marks the current window as needing to be redisplayed.

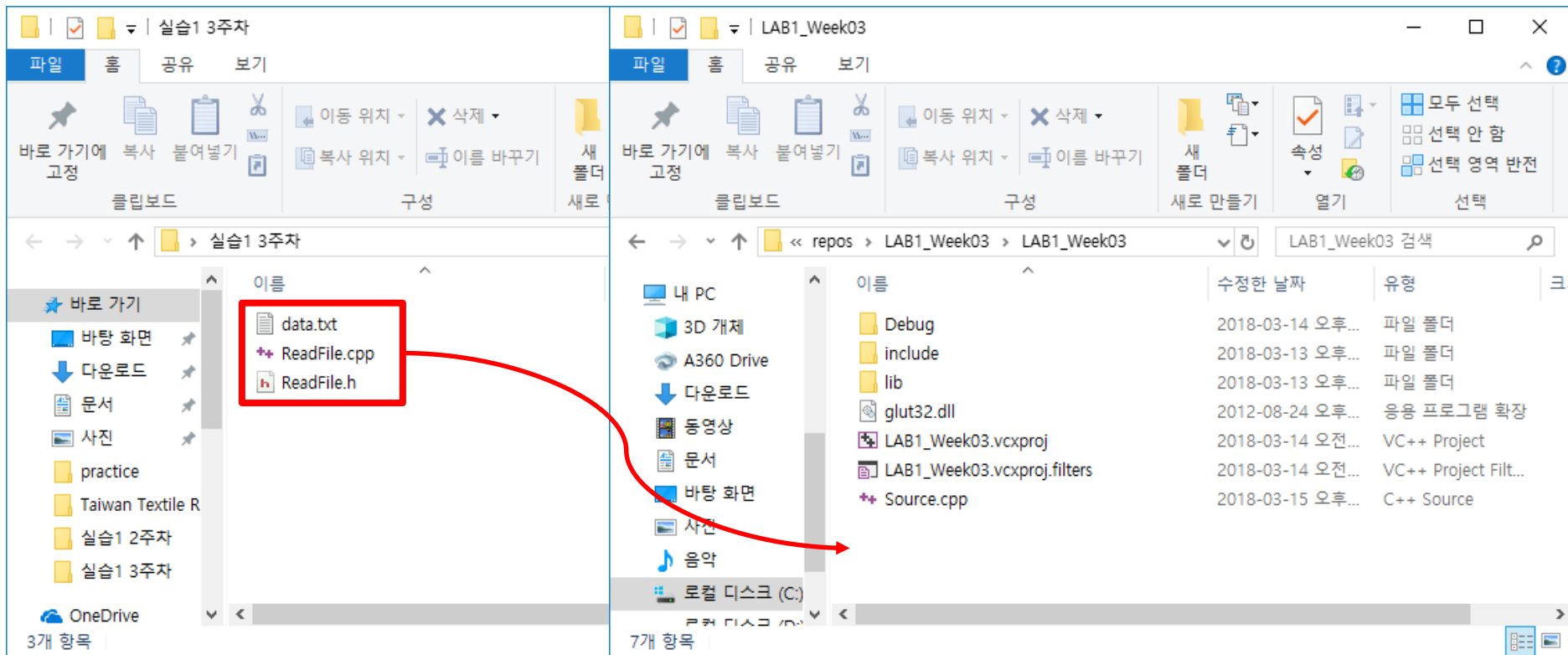```
void func() {
    ...
    glutPostRedisplay();
}
```

# Today's Mission

- Read data.txt including Center position & Radius
- Draw Primitives using Popup menu
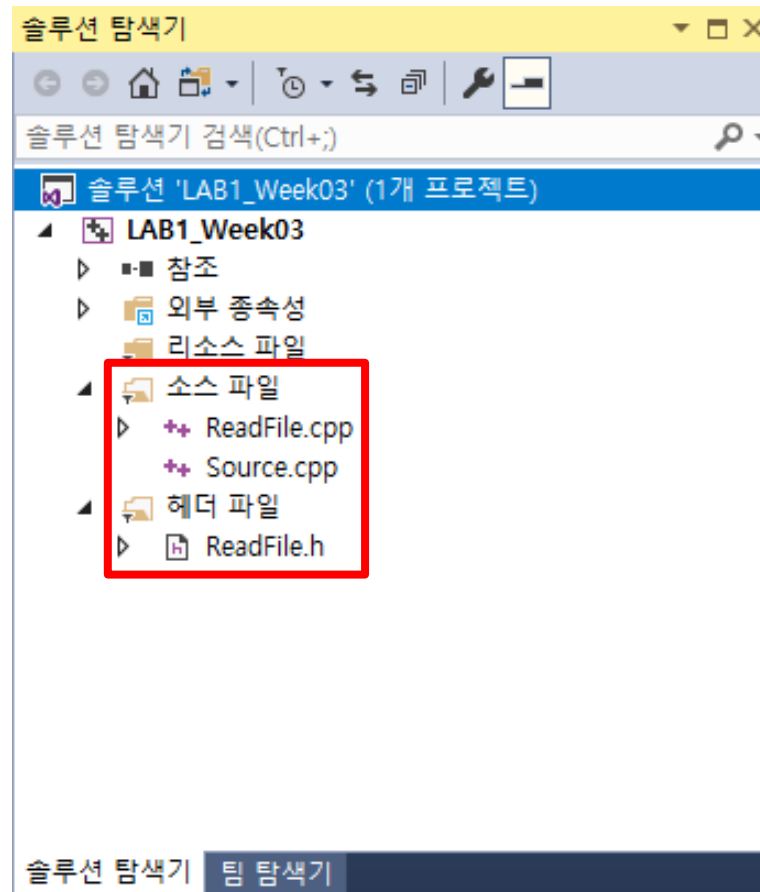- Move Primitives & Change Center Color using Callback functions

# Today's Mission

- Copy 'data.txt', 'ReadFile.cpp', and 'ReadFile.h' to your project folder.
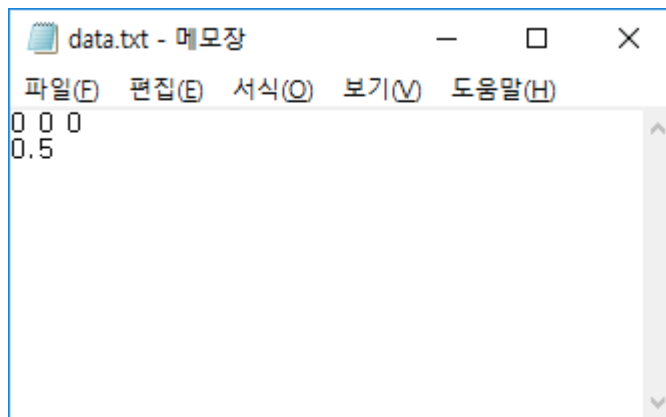
# Today's Mission

- Open 'ReadFile.cpp' and 'ReadFile.h'.

# Today's Mission

- Given
  - Circumference of circle ($\pi$)
  - Number of sides of Polygon(Point , Line): Initial input
  - Main_menu_function (quit & clear)
  - data.txt (center & radius)
  - ReadFile.h
  - ReadFile.cpp: needs to be implemented

# Today's Mission

- Implementation
  - Register Callback function
  - Draw Polygon
    - Modify your last week's code
  - Draw Point
    - Size: 10.0
  - Draw Line
    - Width: 5.0
    - Stipple: choose any factor & pattern
  - GLUT Keyboard Input
    - Button '1', '2', '3', or '4': Center color is R, G, B, or white immediately.
  - GLUT Special Keyboard Input
    - Up, Down, Right or Left arrow: Point is moved by 0.1 in each direction.
  - Popup menu
    - Pop menu up using right mouse button
  - Read data.txt (center & Radius) within ReadFile.cpp