1. Sample GLUT program.

```
#undef SIMPLE_1
  ⟨ Header 5 ⟩
  ⟨ Global data 12 ⟩
#if defined (SIMPLE_1)
  ⟨ Simple display function for the main window 4 ⟩
  ⟨ First GLUT main program 3 ⟩
#elif defined (SIMPLE_2)
  ⟨ Simple display function for the main window 4 ⟩
  ⟨ The simple menu function 9 ⟩⟨ Second GLUT main program 7 ⟩
#elif (SIMPLE_3)
  ⟨ Draw with the display function for the main window 13 ⟩
  ⟨ Resize of the window 16 ⟩
  ⟨ Mouse function 17 ⟩
  ⟨ The longer menu function 15 ⟩
  ⟨ Mouse enters/exits window 18 ⟩
  ⟨ Simple idle function 19 ⟩
  ⟨ Third GLUT main program 11 ⟩
#else
  ⟨ Resize of animation window 21 ⟩
  ⟨ The animation function 25 ⟩
  ⟨ Animation menu function 24 ⟩
  ⟨ The ball motion 26 ⟩
  ⟨ Fourth GLUT main program 20 ⟩
#endif
```

2. Simple GLUT program.

3. ⟨ First GLUT main program 3 ⟩ ≡

```
int main(int argc, char *argv[])
{
  glutInit(&argc, argv);
  glutInitDisplayMode(GLUT_RGB | GLUT_DOUBLE | GLUT_DEPTH);
  glutCreateWindow("GLUT␣Sample␣1");
  glutDisplayFunc(MainDisplay);
  glutMainLoop( );
  return 0;
}
```

This code is used in section 1.

4. ⟨ Simple display function for the main window 4 ⟩ ≡

```
void MainDisplay(void)
{
  glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
  glutSwapBuffers( );
}
```

This code is used in section 1.

5. ⟨ Header 5 ⟩ ≡

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#include <GL/gl.h>
#include <GL/glu.h>
#include <GL/glut.h>
```

This code is used in section 1.

6. GLUT with menu.

7. ⟨ Second GLUT main program 7 ⟩ ≡

```
int main(int argc, char *argv[])
{
  glutInit(&argc, argv);
  glutInitDisplayMode(GLUT_RGB | GLUT_DOUBLE | GLUT_DEPTH);
  glutCreateWindow("GLUT Sample 2");
  glutDisplayFunc(MainDisplay);
  ⟨ Make simple menu 8 ⟩
  glutMainLoop( );
  return 0;
}
```

This code is used in section 1.

8. `#define ID_QUIT 666`

⟨ Make simple menu 8 ⟩ ≡

```
glutCreateMenu(SimpleMenu);
glutAddMenuEntry("Quit", ID_QUIT);
glutAttachMenu(GLUT_RIGHT_BUTTON);
```

This code is used in section 7.

9. ⟨ The simple menu function 9 ⟩ ≡

```
void SimpleMenu(int selection)
{
  switch (selection) {
  case ID_QUIT: exit(0);
  }
}
```

This code is used in section 1.

10. GLUT with a longer menu.

11. ⟨ Third GLUT main program 11 ⟩ ≡

```
int main(int argc, char *argv[])
{
  glutInit(&argc, argv);
  glutInitDisplayMode(GLUT_RGB | GLUT_DOUBLE | GLUT_DEPTH);
  glutCreateWindow("GLUT Sample 3");
  glutDisplayFunc(MainDisplay3);
  glutReshapeFunc(ResizeWindow);
  glutMouseFunc(Mouse);
  glutEntryFunc(MouseInWindow);
  glutIdleFunc(MyIdleFunction);
  ⟨ Make a longer menu 14 ⟩
  glutMainLoop( );
  return 0;
}
```

This code is used in section 1.

12.

```
#define BLACK_BG 0
#define RED_BG 1
#define GREEN_BG 2
#define BLUE_BG 3
#define WHITE_BG 4
```

⟨ Global data 12 ⟩ ≡

```
static int BGColor = 0;
static double XPosition = 0.0, YPosition = 0.0;
static unsigned long IdleCount = 0L;
```

See also section 23.

This code is used in section 1.

13. ⟨ Draw with the display function for the main window 13 ⟩ ≡

```
void MainDisplay3(void)
{
  printf("Background␣color␣%d\n", BGColor);
  switch (BGColor) {
  case RED_BG: glClearColor(1.F, 0.F, 0.F, 1.0F);
    glColor3f(0.F, 1.F, 1.F);
    break;
  case GREEN_BG: glClearColor(0.F, 1.F, 0.F, 1.0F);
    glColor3f(1.F, 0.F, 1.F);
    break;
  case BLUE_BG: glClearColor(0.F, 0.F, 1.F, 1.0F);
    glColor3f(1.F, 1.F, 0.F);
    break;
  case WHITE_BG: glClearColor(1.F, 1.F, 1.F, 1.0F);
    glColor3f(0.F, 0.F, 0.F);
    break;
  default: glClearColor(0.F, 0.F, 0.F, 1.0F);
    glColor3f(1.F, 1.F, 1.F);
    break;
  }
  glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
  glutSwapBuffers( );
}
```

This code is used in section 1.

14.

```
#define ID_BLACK 1000
#define ID_RED 1001
#define ID_GREEN 1002
#define ID_BLUE 1003
#define ID_WHITE 1004
```

⟨ Make a longer menu 14 ⟩ ≡

```
glutCreateMenu(SimpleMenu3);
glutAddMenuEntry("Black␣BG", ID_BLACK);
glutAddMenuEntry("Red␣BG", ID_RED);
glutAddMenuEntry("Green␣BG", ID_GREEN);
glutAddMenuEntry("Blue␣BG", ID_BLUE);
glutAddMenuEntry("White␣BG", ID_WHITE);
glutAddMenuEntry("Quit", ID_QUIT);
glutAttachMenu(GLUT_RIGHT_BUTTON);
```

This code is used in section 11.

15. ⟨ The longer menu function 15 ⟩ ≡

```
void SimpleMenu3(int selection)
{
  switch (selection) {
  case ID_BLACK: case ID_RED: case ID_GREEN: case ID_BLUE: case ID_WHITE:
    BGColor = selection − 1000;
    break;
  case ID_QUIT: exit(0);
  }
  glutPostRedisplay( );
}
```

This code is used in section 1.

16. ⟨ Resize of the window 16 ⟩ ≡

```
void ResizeWindow(int width, int height)
{
  printf("New␣window␣size␣{%d,␣%d}\n", width, height);
  glViewport(0, 0, (GLsizei)width, (GLsizei)height);
}
```

This code is used in section 1.

17. ⟨ Mouse function 17 ⟩ ≡

```
void Mouse(int button, int state, int x, int y)
{
  XPosition = (double) x/glutGet(GLUT_WINDOW_WIDTH);
  YPosition = 1.0 − (double) y/glutGet(GLUT_WINDOW_HEIGHT);
  if (GLUT_LEFT_BUTTON ≡ button ∧ GLUT_DOWN ≡ state) {
    printf("{MousePosition->{%d,␣%d},␣"
        "MouseWorldPosition->{%lg,␣%lg}}\n", x, y, XPosition, YPosition);
    printf("IdleCount->␣%u\n", IdleCount);
  }
}
```

This code is used in section 1.

18. ⟨ Mouse enters/exits window 18 ⟩ ≡

```
void MouseInWindow(int state)
{
  switch (state) {
  case GLUT_ENTERED: printf("Enter␣Window.\n");
    break;
  case GLUT_LEFT: printf("Leave␣Window.\n");
    break;
  }
}
```

This code is used in section 1.

19. ⟨ Simple idle function 19 ⟩ ≡

```
void MyIdleFunction(void)
{
  IdleCount++;
}
```

This code is used in section 1.

20. A simple animation.

```
⟨ Fourth GLUT main program 20 ⟩ ≡
  int main(int argc, char *argv[])
  {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_RGB | GLUT_DOUBLE | GLUT_DEPTH);
    glutCreateWindow("GLUT␣Sample␣4");
    glutDisplayFunc(AnimateDisplay);
    glutReshapeFunc(ResizeWindow2D);
    ⟨ Make the animation menu 22 ⟩
    glutIdleFunc(Animate);
    glutMainLoop( );
    return 0;
  }
```

This code is used in section 1.

21.

```
⟨ Resize of animation window 21 ⟩ ≡
  void ResizeWindow2D(int width, int height)
  {
    glViewport(0, 0, (GLsizei)width, (GLsizei)height);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity( );
    glOrtho(0.0, 1.0, 0.0, 1.0, −1.0, 1.0);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity( );
    screenR = sqrt(width * width + height * height);
  }
```

This code is used in section 1.

22.

```
#define ID_RUN 1000
#define ID_STOP 1001
⟨ Make the animation menu 22 ⟩ ≡
  glutCreateMenu(AnimationMenu);
  glutAddMenuEntry("Run", ID_RUN);
  glutAddMenuEntry("Stop", ID_STOP);
  glutAddMenuEntry("Quit", ID_QUIT);
  glutAttachMenu(GLUT_RIGHT_BUTTON);
```

This code is used in section 20.

23.

```
⟨ Global data 12 ⟩ +≡
  int RunAnimation = GL_TRUE;
  double x = 0.5, y = 0.5;
  double vx = 0.5, vy = 0.333;
  double r = 0.1;
  double screenR = 300;
```

24. ⟨ Animation menu function 24 ⟩ ≡

```
void AnimationMenu(int id)
{
  switch (id) {
  case ID_RUN: RunAnimation = GL_TRUE;
    break;
  case ID_STOP: RunAnimation = GL_FALSE;
    break;
  case ID_QUIT: exit(0);
  }
  glutPostRedisplay( );
}
```

This code is used in section 1.

25. ⟨ The animation function 25 ⟩ ≡

```
void AnimateDisplay(void)
{
  glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
  glEnable(GL_POINT_SMOOTH);
  glColor3f(1.F, 0.F, 0.F);
  glPointSize(r * screenR);
  glBegin(GL_POINTS);
  glVertex2d(x, y);
  glEnd( );
  glutSwapBuffers( );
}
```

This code is used in section 1.

26. ⟨ The ball motion 26 ⟩ ≡

```
void Animate(void)
{
  if (¬RunAnimation) return;
  x += vx * 0.02;
  y += vy * 0.02;
  if (x > 1.0) {
    vx *= −1.0;
    x = 2.0 − x;
  }
  else if (x < 0.0) {
    vx *= −1.0;
    x *= −1.0;
  }
  if (y > 1.0) {
    vy *= −1.0;
    y = 2.0 − y;
  }
  else if (y < 0.0) {
    vy *= −1.0;
    y *= −1.0;
  }
  glutPostRedisplay( );
}
```

This code is used in section 1.

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SKELETON

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