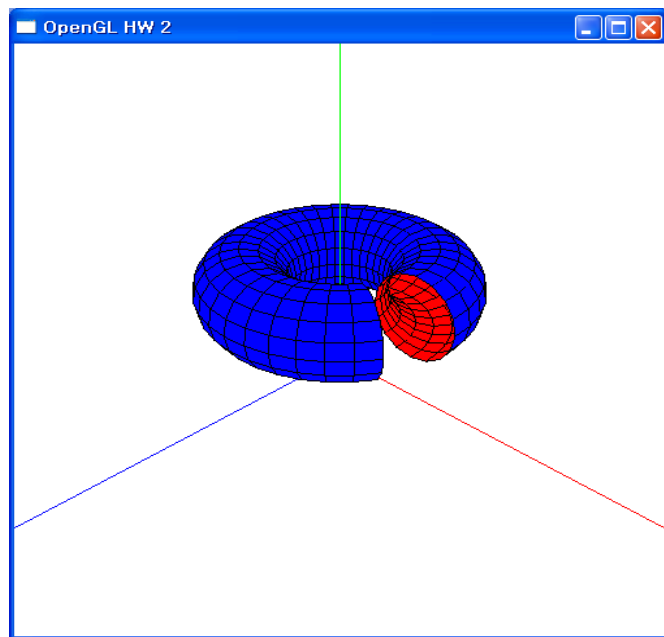


# Drawing Torus

---



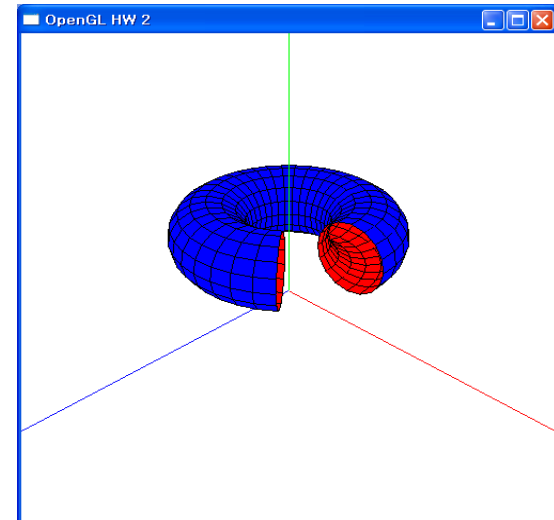
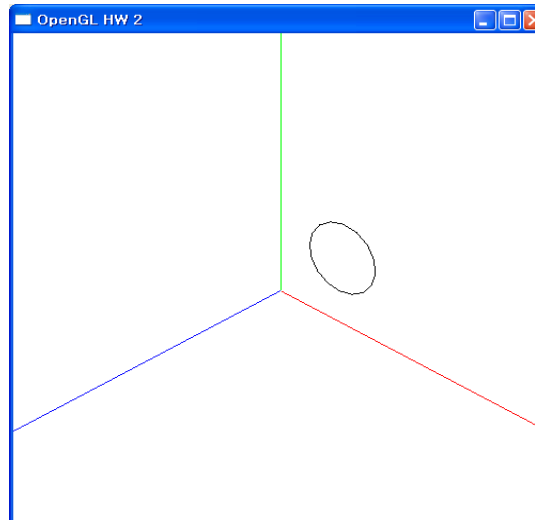
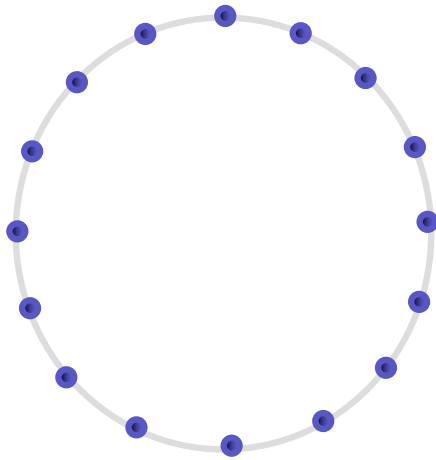
**Min Gyu Choi**

**Kwangwoon University**

# Data Points for Torus

---

- ❑ **Generate torus by revolving a circle around the y-axis**
  - position `p[36][18];`
  - 18 curve points for the circle
  - 36 steps for sweeping around the y-axis



# Drawing Torus

---

- ☐ Use 'GL\_POINTS' to draw 36 x 18 points

# Drawing Torus

---

- ❑ **Use 'GL\_QUADS' to draw all the quads**
  - ❑ **Turn on wireframe mode**
    - `glPolygonMode(GL_FRONT_AND_BACK, GL_LINE)`
    - The color of the wireframe is black.
  - ❑ **Turn off wireframe mode**
    - `glPolygonMode(GL_FRONT_AND_BACK, GL_FILL)`
    - The color of the quads is blue.
  - ❑ **Draw the torus with the quads and wireframe**
    - Offsetting is required.
-

# Drawing Torus

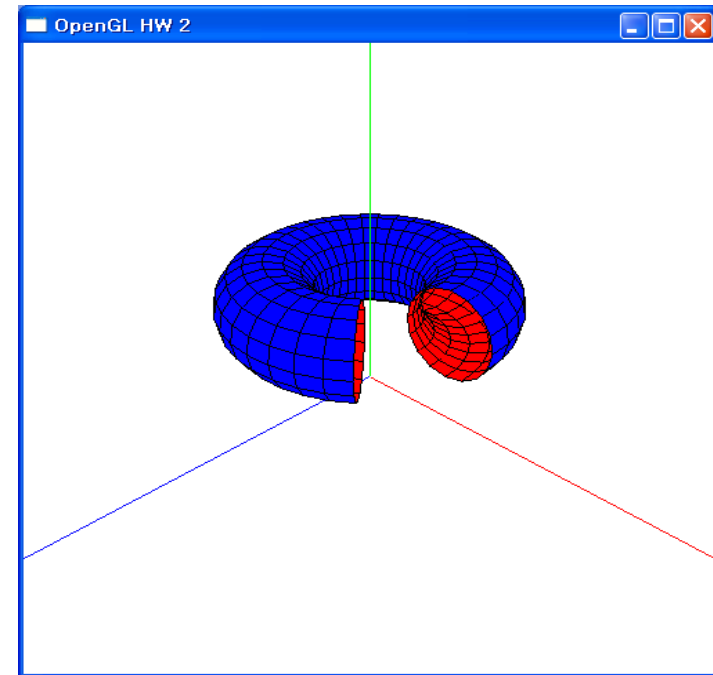
---

## ☐ Two-sided constant shading

- **Blue** for outside
- **Red** for inside

## ☐ How?

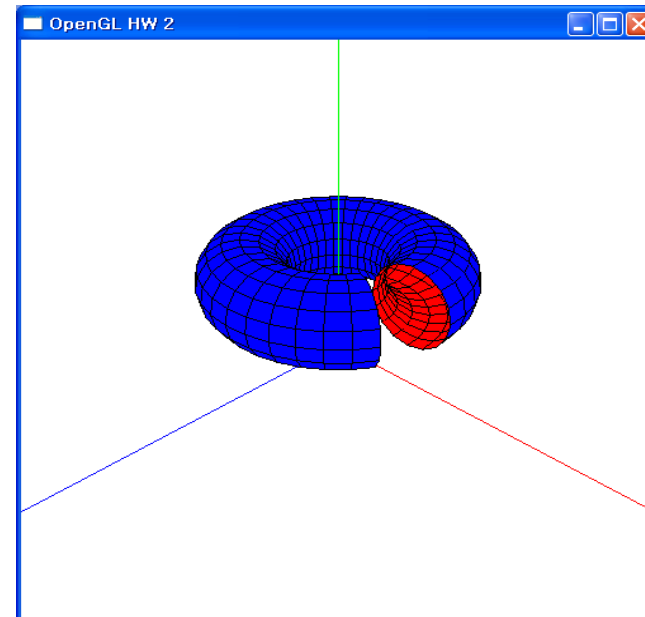
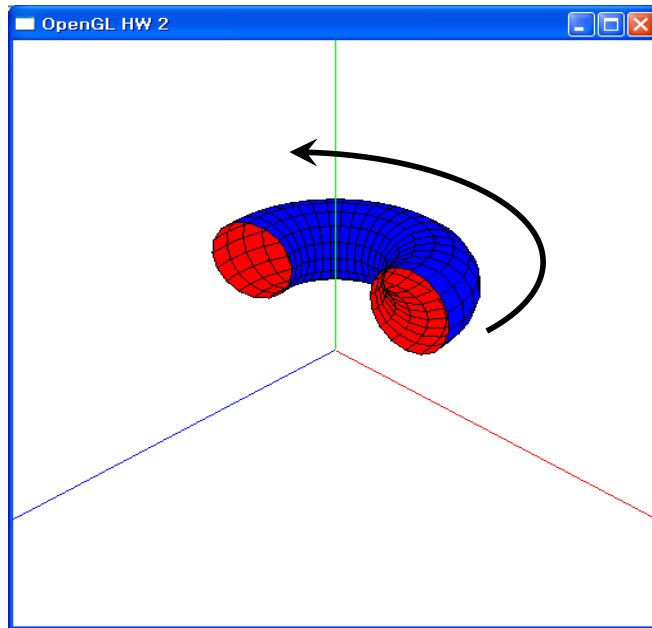
- **n**: normal vector at each polygon
- **v**: vector from the center of a polygon to COP
- What is  $(\mathbf{n} \cdot \mathbf{v})$ ?



# Drawing Torus

---

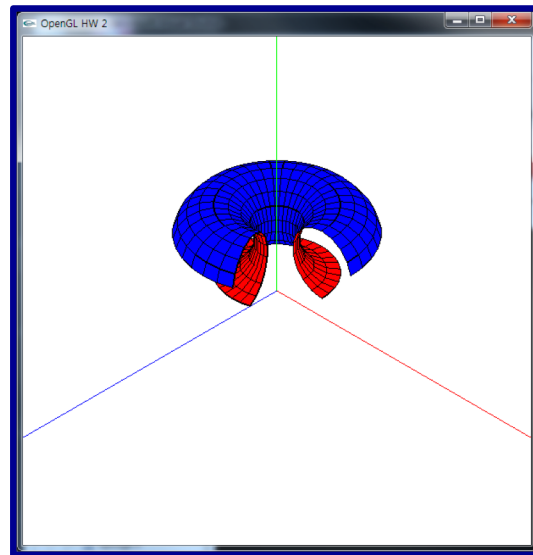
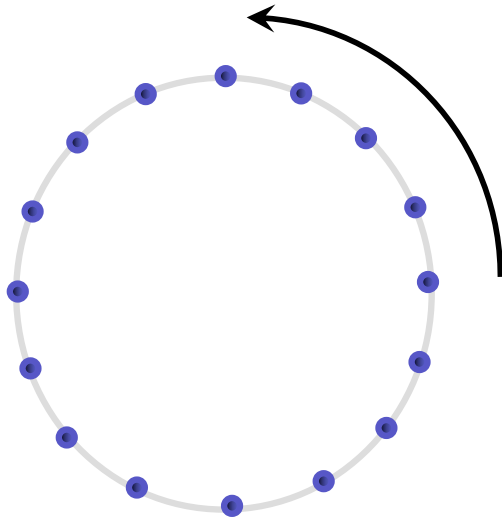
- ❑ The program should be able to control the sweep angle using keyboard inputs.
  - 'a' key: increase the sweep angle by  $10^\circ$  around the y-axis
  - 's' key: decrease the sweep angle by  $-10^\circ$  around the y-axis



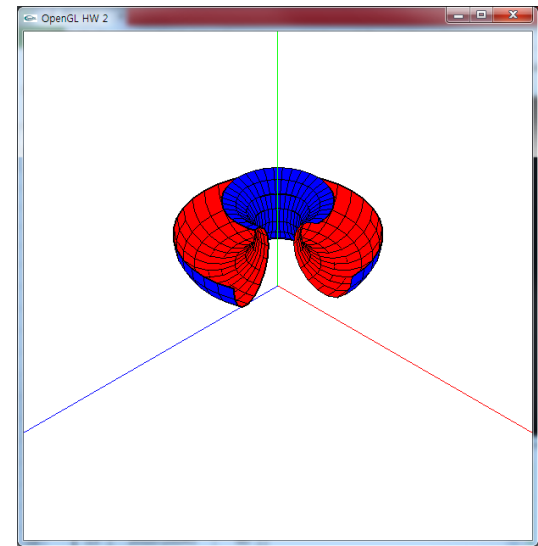
# Drawing Torus

---

- ❑ The program should be able to control the sweep angle using keyboard inputs.
  - 'j' key: increase the sweep angle by  $20^\circ$  around the z-axis
  - 'k' key: increase the sweep angle by  $-20^\circ$  around the z-axis



Clockwise



Counterclockwise

# Requirements

---

## ☐ Drawing the torus

- Draw 36x18 data points using 'GL\_POINTS': '1' key
- Draw the normal vectors of the polygons: toggle with '6' key
- Draw the normal vectors of the points: toggle with '7' key
- Draw the wireframe only: '2' key
- Draw the quads only: '3' key
- Draw the quads and the wireframe: '4' key

## ☐ Two-sided constant shading

- Two-sided constant shading with the wireframe: '5' key

## ☐ Sweep angle control around 2 different axes

- Around the y-axis with the 'a', 's' keys
  - Around the z-axis with the 'j', 'k' keys
-