

Homework #2:

WebGL Basics and Modelling

Assigned: 20.03.2023 Due: 02.04.2023

1. Objective

The main objective of this homework assignment is to practice the basics of WebGL programming and learn how to model simple geometric objects.

2. Specification

Task 1 – Modelling and rendering a ring shape

Model the geometry of a ring shape, centered at the origin, as explained in Figure 1. In the top-right figure, \mathbf{O} is the center of the WebGL canvas, \mathbf{r} is the radius of the inner circle, \mathbf{w} is the width of the ring, and \mathbf{a} is the step angle to take sample points on the ring borders. Using polar coordinates, vertex coordinates can be defined as follows:

$$v_0 = (r * \cos 0, r * \sin 0)$$

$$v_2 = (r * \cos a, r * \sin a)$$

$$v_4 = (r * \cos 2a, r * \sin 2a)$$

...

Generate the vertices in the given order ($v_0, v_1, v_2, \dots, v_n$), send the data to GPU and tell to render using triangle strips. You should design your program parametrically. The parameters that you will use are explained below. Define them as global variables in your code.

Parameters:

- **r:** Radius of the inner circle. (You can also use different x- and y- radii to obtain an elliptic shape.)
- **w:** Width of the ring.
- **a:** Step angle that determines the smoothness and resolution of the shape. As it gets smaller, more points will be sampled, and the borders will be smoother.
- **Color:** Define the uniform color of the ring as a global variable and send it to the fragment shader as a uniform variable.
- **Scaling factor:** Send this value to the vertex shader as a uniform variable to scale the shape.

See [this video](#) to observe the effects of the parameters. You don't have to use input controls as in the video since we have not covered the input handling topic in the class yet. But you can get bonus points if you perform input handling.

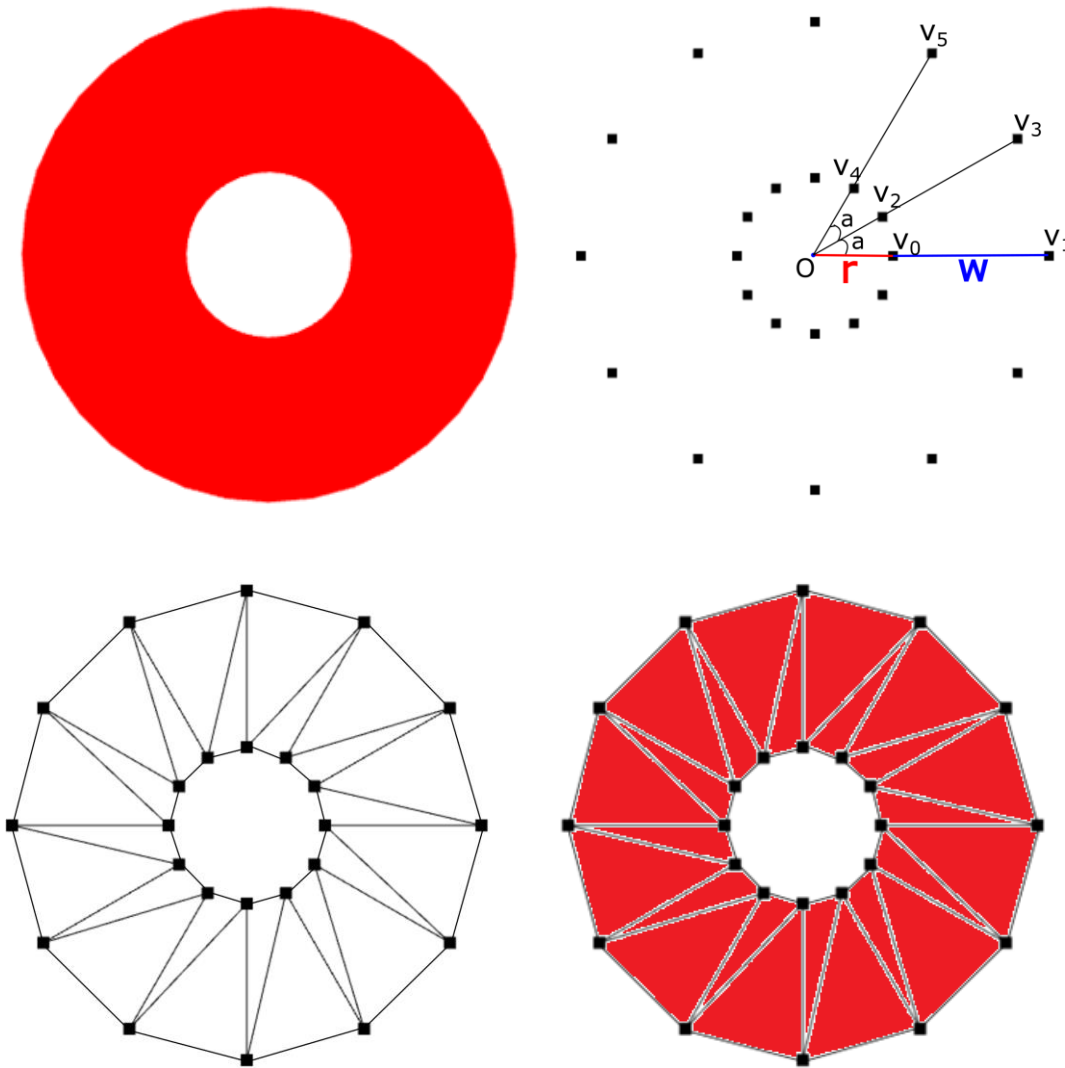


Figure 1 – Top-left: A sample ring shape. **Top-right:** Generating the vertices of the ring. **Bottom-left:** Lines of the corresponding triangle strip. **Bottom-right:** Filled version of the triangle strip. (Note that the lines and points are shown for reference, they will not exist in the final rendered shape. The final shape will look like the one in the top-left image.)

Task 2 – Report

You must also prepare a report which includes the following:

- Your names and IDs
- Your source code (only your codes, not the codes in the Common directory)
- The output of your program
- A conclusion section that explains what you have learnt and the difficulties you have faced.

3. Submission

- This homework can be done individually or in pairs.
- Place all your source files (.html and .js, including the Common directory) and your report in a zip archive with the name **HW2_StudentID1_Surname1_Name1_StudentID2_Surname2_Name2.zip** and submit through MS Teams.
- Single submission from one of the group members is required.
- If you have further questions, you can ask me via Teams.

Late Submission Policy

The deadline for homework submissions is **23:59** on the specified date. For each additional day, a **25% cut-off** will be applied.

4. Academic Honesty Policy

Do not copy the codes of any others (or from the Internet). You can borrow ideas and use partial codes from elsewhere only if you give proper citations.

5. Grading

Grading will be done according to the following scheme:

- Drawing the shape (30 pts)
- Ring parameters (25 pts)
- Color (10 pts)
- Scale (10 pts)
- Report (25 pts)
- Bonus points for additional features shown in the video (input handling etc.)

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