

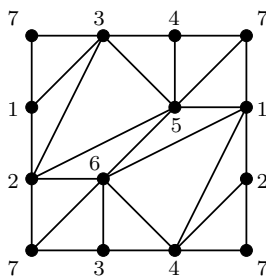
Exercise Sheet 2

Out: 26.10.2015

Due: 04.11.2015

You should work in groups of two. Don't forget to put your names and student ID numbers on the solution you hand in!

The Császár-Torus is a 2-dimensional simplicial complex, having 7 vertices, 14 triangles and their edges. It is the minimal configuration of a simplicial triangulation necessary to triangulate a torus. Its complex structure is shown in the figure below, with opposite edges glued together.



Exercise 2.1 (Stars and Links, 4 Points). Answer the following questions:

1. Describe the Star of vertex 5 and the star of the edge with vertices 3 and 4.
2. Describe the Link of vertex 7 and the link of the edge with vertices 1 and 2.

Exercise 2.2 (Modelling Császár, 4 Points). Use `JavaView` to visualize the Császár-Torus. Given the coordinates $2 = (0, 6, 0)$, $3 = (0, 0, 1)$, $4 = (6, 6, 1)$, $5 = (4, 5, 3)$, $6 = (2, 1, 3)$ and $7 = (3, 3, 15)$, find the coordinate of vertex 1 in such a way that the torus is realized without self-intersection.

Save your solution as both a geometry and a `.gif`-image (see below) and send both files to your tutor by email in the following format:

`name1_name2_uebung1_ex2.jvx/.gif`.

Hint: Start with `File`→`New`→`Geometry`→`Surfaces`→`ElementSet`. Then, use the *InfoPanel* (`Inspector`→`Geometry`→`Info` or `CTRL+I`) for setting the connectivity and the vertex positions (each number that you enter or change should be validated by *Enter*). To find an appropriate position of vertex 1, you can interactively move this vertex by hitting and holding down "P" and moving it on the display.

In order to save your work, you may want to save it as...

- a geometry file (`.jvx`): Go to `File`→`Save`→`JVX`;
- a compressed image (`.gif`): Go to `File`→`Save`→`GIF`;

- a raw image (.ppm): Go to File→Save→PPM.

Exercise 2.3 (Computing the Euler Char, 4 Points). Write a project in JavaView called `EulerCharacteristic`, which takes a geometry without boundary as input `.obj`, `.jvx`, `.byu`, ... and prints the number of vertices, edges and faces together with the Euler characteristic using `PsDebug.message()`. To compute the number of edges, use only the connectivity array `PgElementSet.getElements()` and the relation between simplices for closed surfaces.

Your program should have the following structure:

```
PaEulerCharacteristic
PjEulerCharacteristic_IP
PjEulerCharacteristic
```

When your program is running correctly, export it to a runnable jar as described on the web page with the usual file naming convention `name1_name2_eulerchar.jar`.

Hint: Take an example program in `vgp.tutor` which you understand and modify it, e.g. `vgp.tutor.firstProject`.