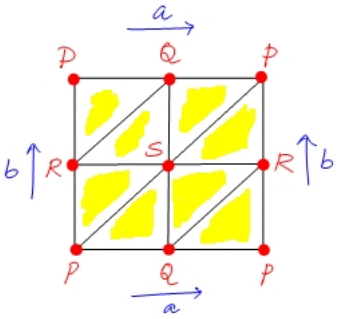
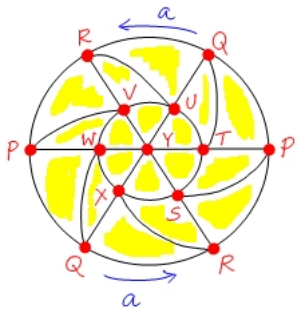
Computational Topology (Spring 2026): Homework 2

- You **must email your submission** as a **PDF file** to kbala@wsu.edu. You could write answers by hand, and scan or take photos of the writings. Put all the images in a PDF file, though.
- Your file name should identify you in the following manner. If you are Napoleon Dynamite, you should **name your submission NapoleonDynamite_Hw2.pdf**. If you want to add more bits to the title, e.g., Math529, you could name it NapoleonDynamite_Math529_Hw2.pdf, for instance. But you should **start the file name with NapoleonDynamite. And please avoid white spaces in the file name**.
- **Begin the SUBJECT of your email submission with the same `FirstnameLastname`, expression, e.g., "NapoleonDynamite Hw2 submission".**
- **This homework is due by 10:00 PM on Tuesday, February 10**.

1. (35) List all the ways in which the sides of a rectangle can be identified in pairs. In each case, indicate which of the surfaces introduced in class (in Lecture 4) if any, does the resulting object represent (we saw the 2-sphere ($\mathbb{S}^2$), torus ($\mathbb{T}^2$), Möbius strip, projective plane ($\mathbb{R}P^2$), and the Klein Bottle ($\mathbb{K}^2$).

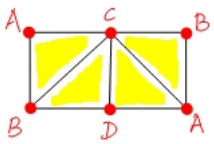
2. (20) The following are *potential* triangulations of the torus $\mathbb{T}^2$ and the real projective plane $\mathbb{R}P^2$, respectively. Decide if they are indeed correct triangulations of the two spaces. Justify your answers.



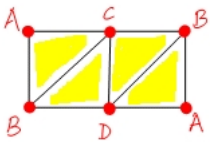


3. (30) Describe the space represented by each of the following three triangulations. Also calculate the Euler characteristic χ in each case, and compare it to the χ values of standard 2-manifolds we discussed in class ($\mathbb{S}^2$, $\mathbb{T}^2$, etc.).

(a)



(b)



(c)