

Computational Topology (Spring 2018) — Homework 6

- You **must email your submission** as a **PDF file** to bkrishna@math.wsu.edu. You are welcome to write answers by hand, and scan or take photos of the writings. Put all the images on a PDF file, though.
- Your file name should identify you. For instance, if you are Stan Jarsh, you should name your submission StanJarsh_Hw6.pdf. **Please start your name in this format. If you want to add more bits to the title, e.g., Math574, you could name it Stan-Jarsh_Math574_Hw6.pdf, for instance. Also, please avoid white spaces in the file name :-).**
- **This homework is due before midnight on Thursday, April 19.**

1. (30) Let K be the simplicial complex made of a tetrahedron and its faces. Apply the matrix reduction algorithm to the filtration of K that adds simplices in the order of their dimensions. For the three diagrams you get (in the three relevant dimensions), do any of them depend on the way you order simplices of the same dimension?
2. (35) The main step in the matrix reduction implementation of the persistence algorithm (discussed in Lecture 23 and Lecture 24) was the following.

```
while  $\exists j' < j$  with  $low(j') = low(j)$  do
  add column  $j'$  to column  $j$ 
```

Consider a variant of the matrix reduction implementation of the persistence algorithm where you add columns **to the right** of column j instead of from the left. The condition will be

```
while  $\exists j_0 > j$  with  $low(j_0) = low(j)$  do
  add column  $j$  to column  $j_0$ 
```

- (a) Show that this implementation generates the same lowest 1's as the original implementation.
- (b) Give an example complex where the two implementations give different reduced matrices R .