University of Utah
School of Computing

CS 6170 Quiz #2 Solution   Spring 2017   Lecturer: Prof. Bei Wang

Name ______________________

UID ______________________

Due Feb 23, 2017 at the end of the class.

The quiz is open-book, open-notes, but close-internet. In particular, no laptops, calculators, cell phones, or other electronic devices are allowed.

The point value of each question is clearly marked, so allocate your time wisely. The quiz is worth a total of 10 points.

You must complete all work in 10 minutes, there are no exceptions.

This quiz constitutes 10% of your final grade.

Total ______________________ (out of 10 points)

Question 1 (Computing persistent homology by matrix reduction 10 points). Given a filtration derived from the following simplicial complex, compute the points in the persistence diagram via matrix reduction.

You get 1 point for every correct point reported in the persistence diagram. You loose 1 point (up to 2 points) for every mistake you make during the matrix reduction.

In Fig. 1, vertices 1, 2, 3, and 4 comes in at time 1, 2, 3 and 4, respectively; edge 5 (connecting vertices {1,2}) comes in at time 5, edge 6 (connecting vertices {1,3}) comes in at time 6, edge 7 (connecting vertices {2,3}) comes in at time 7, edge 8 (connecting vertices {2,4}) comes in at time 8, edge 9 (connecting vertices {3,4}) comes in at time 9, edge 10 (connecting vertices {1,4}) comes in at time 10; triangle 11 (connecting vertices {1,2, 3}) comes in at time 11; triangle 12 (connecting vertices {2, 3, 4}) comes in at time 12; triangle 13 (connecting vertices {1,2, 4}) comes in at time 13; triangle 14 (connecting vertices {1, 3, 4}) comes in at time 14.

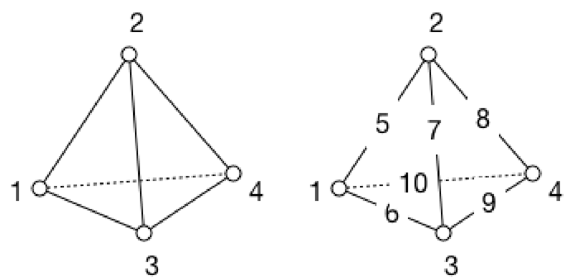

Figure 1: Simplicial complex that contains 4 vertices, 6 edges and 3 triangles. Left: vertices are labeled by the time they appear. Right: edges are labeled by the time they appear.

The boundary matrix is already given as follows, please perform matrix reduction on top of the boundary matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1					1	1				1				
2					1		1	1						
3						1	1		1					
4								1	1	1				
5											1		1	
6											1			1
7											1	1		
8												1	1	
9												1		1
10													1	1
11														
12														
13														
14														

Table 1: Boundary matrix for persistent homology computation.

Now, please report the points in the persistence diagram:

Points in 0-dimensional persistence diagram (hint: 4 points): (2,5), (3,6), (4,8), $(1, \infty)$
Points in 1-dimensional persistence diagram (hint: 3 points): (7,11), (9,12), (10,13)
Points in 2-dimensional persistence diagram (hint: 1 points): $(14, \infty)$