Math 3900 Midterm

March 5, 2015 **SHOW ALL WORK and SIMPLIFY your answers**

1. Circle T for True and F for False:

[3] 1a.) The boundary of a 2-dimensional face is a 1-dimensional cycle. T .

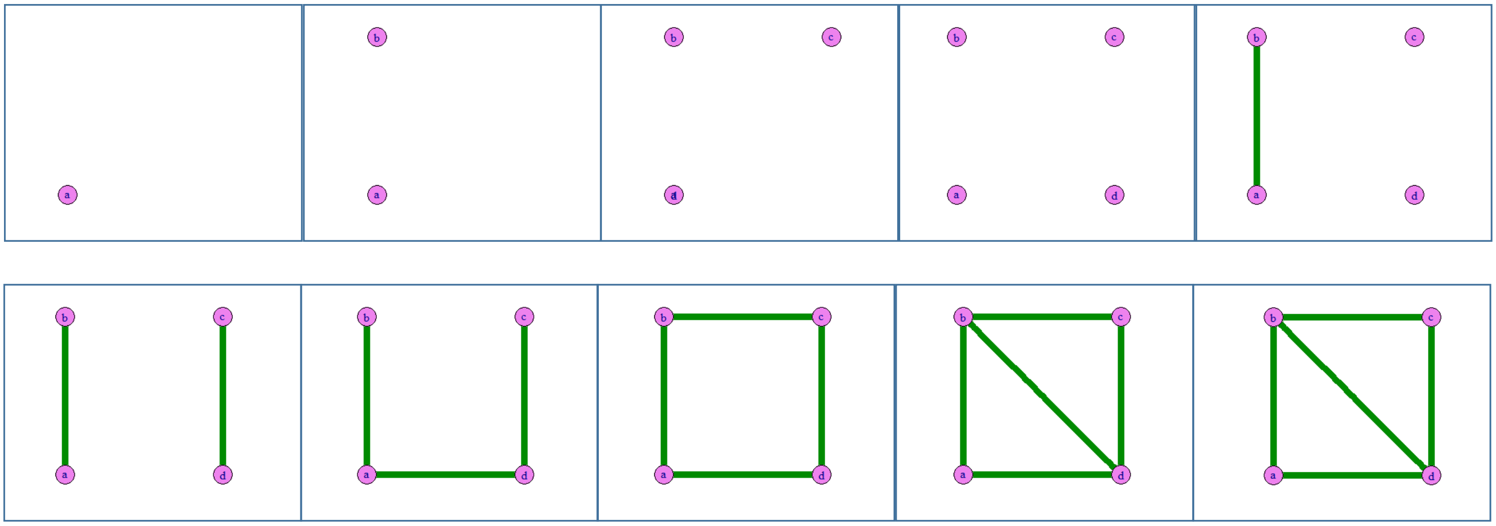
[3] 1b.) A circular disk is topologically equivalent to a triangle. T .

[3] 2.) Circle the correct answer. Suppose the first row of a csv file contains the names of your columns using characters while the remaining rows contain only numbers. Which command can you use to correctly read in this csv file so that your data set consists of only numbers.

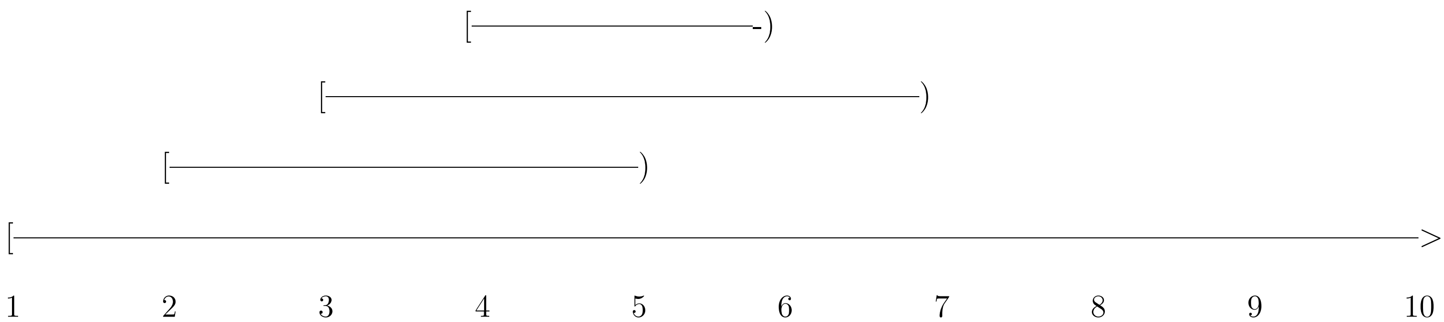
(A.) data <– read.csv("Book1.csv", header = TRUE)

[3] 3.) What command do you need to enter into Rstudio to access the help page for the function read.table

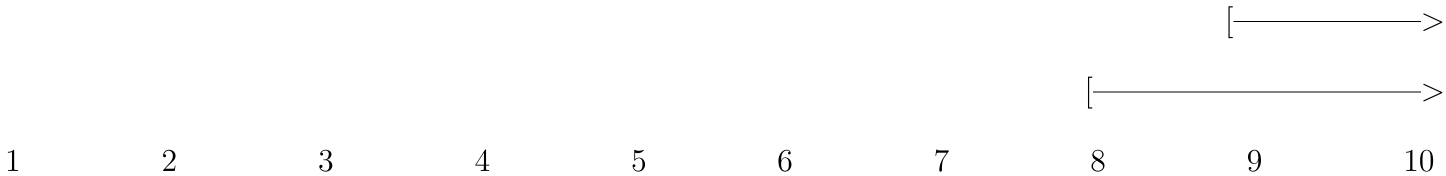
?read.table or help(read.table)



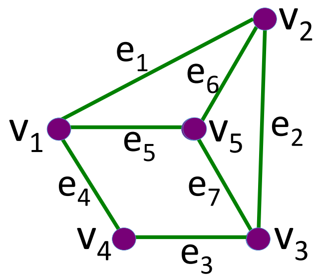
[12] 4a.) Find the barcode for H_0 for the above filtration (you do not need to show work)



[12] 4b.) Find the barcode for H_1 for the above filtration (you do not need to show work)



[60] 5.) Let C be the simplicial complex:



Find the following:

(a.) $C_0 =$ $\underline{Z_2[v_1, v_2, v_3, v_4, v_5] \text{ or equivalently } < v_1, v_2, v_3, v_4, v_5 >}$

(b.) $C_1 =$ $\underline{Z_2[e_1, e_2, e_3, e_4, e_5, e_6, e_7] \text{ or equivalently } < e_1, e_2, e_3, e_4, e_5, e_6, e_7 >}$

(c.) $C_2 =$ $\underline{\{0\}}$

(d.) $\partial_1(e_1 + e_4 + e_5) =$ $\underline{v_1 + v_2 + v_4 + v_5}$

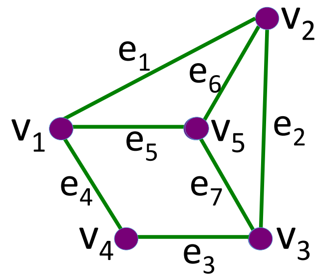
$$v_1 + v_2 + v_1 + v_4 + v_1 + v_5 = 3v_1 + v_2 + v_4 + v_5 = v_1 + v_2 + v_4 + v_5$$

(e.) $e_1 + e_4 + e_5$ is in C_n where $n =$ $\underline{1}$

(f.) $\partial(e_1 + e_4 + e_5)$ is in C_k where $n =$ $\underline{0}$

(g.) The matrix for $\partial_1 : C_1 \to C_0 =$
$$\begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{array} \begin{array}{c} \begin{array}{ccccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & e_7 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix} \end{array}$$

$$\begin{array}{cccccccc} & e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & e_7 \\ v_1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ v_2 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ v_3 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ v_4 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ v_5 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{array} \longrightarrow$$



$$\begin{array}{cccccccc} & e_1 & e_2 & e_3 & e_3+e_4+e_5+e_7 & e_5 & e_6 & e_7 \\ v_1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ v_2 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ v_3 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ v_4 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ v_5 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \end{array} \longrightarrow$$

$$\begin{array}{cccccccc} & e_1 & e_2 & e_3 & e_3+e_4+e_5+e_7 & e_5 & e_6 & e_2+e_6+e_7 \\ v_1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ v_2 & 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ v_3 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ v_4 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ v_5 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{array} \longrightarrow$$

$$\begin{array}{cccccccc} & e_1 & e_2 & e_3 & e_3+e_4+e_5+e_7 & e_5 & e_1+e_5+e_6 & e_2+e_6+e_7 \\ v_1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ v_2 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ v_3 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ v_4 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ v_5 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{array} \longrightarrow$$

(h.) $Z_1 =$ $Z_2[e_3+e_4+e_5+e_7, e_1+e_5+e_6, e_2+e_6+e_7]$

or equivalently $< e_3+e_4+e_5+e_7, e_1+e_5+e_6, e_2+e_6+e_7 >$

(i.) $B_1 = \{0\}$

(j.) $H_1 =$ $Z_2[e_3+e_4+e_5+e_7, e_1+e_5+e_6, e_2+e_6+e_7]$

or equivalently $< e_3+e_4+e_5+e_7, e_1+e_5+e_6, e_2+e_6+e_7 >$