

DSCI 369

Problem Set 1, 50 points

Instructor: Jake Kettinger

Due: January 29

1. [7 points] Using Matlab/Matlab Live Script, perform the following:

- Define a matrix

$$\mathbf{M} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

- Define a (row) vector

$$\vec{x} = (1 \quad 1 \quad 1 \quad 1)$$

- Change the bottom row of \mathbf{M} to equal \vec{x} .

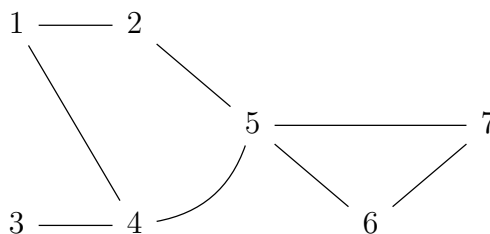
Hint: You only need 3 commands to perform the above tasks.

2. Let

$$\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 6 & 7 & 8 & 9 \\ 7 & 8 & 10 & 12 & 14 \\ 0 & 1 & 6 & 1 & 9 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 6 & 7 & 8 & 9 \\ 7 & 8 & 10 & 12 & 14 \\ 2 & 5 & 2 & 0 & 1 \end{pmatrix}$$

- [5 points] Explicitly give (i.e., write down the numeral not just a formula) $A_{2,3}$.
- [5 points] Is \mathbf{A} a 5×4 matrix? Explain your answer.
- [5 points] Are \mathbf{A} and \mathbf{B} (mathematically) equal? Explain your answer.

3. [10 points] Consider the graph/network plotted below.



Explicitly give (i.e., write down all of the entries) the adjacency matrix \mathbf{A} of the graph.

4. [10 points] Using Matlab/Matlab Live Script, perform the following:
 - Generate three different random row vectors with 4 entries, \vec{a} , \vec{b} , and \vec{c} .
 - Set $\vec{d} = \vec{a} + \vec{b} + \vec{c}$.
 - Set $\vec{e} = \vec{b} + \vec{c} + \vec{a}$.
 - Test if \vec{d} and \vec{e} are the same up to uncertainty in floating point arithmetic. (Sometimes, but not always, they will be exactly the same, but you cannot count on that.)
5. [5 points] Give an example of a data tensor with valence 3.
6. [3 points] Write at least one *complete sentence* about something you learned or are still unsure about in this week's lecture notes.

BELOW ARE UNGRADED PROBLEMS FOR EXTRA PRACTICE:

1. Given the following set

$$X = \{3, -9, 27, -81\} \quad \text{and} \quad Y = \{1, 2, 3\},$$

explicitly give (e.g., write down the sets with numerical entries) of the outputs of the following requested set operations:

- (a) $X \cup Y$
- (b) $X \cap Y$
- (c) $X \setminus (X \cap Y)$

(You don't need to write written explanations for the set problems.)

2. Given the function $f : X \rightarrow Y$ (with X and Y as above) defined as

$$f(2) = 2, \quad f(4) = 1, \quad f(6) = 3, \quad f(8) = 2,$$

answer the following questions. Justify your answers.

- (a) Is f injective?
- (b) Is f surjective?
- (c) Is f bijective?

3. Numeration:

- (a) What is numeration?
- (b) Give an example of coding in the context of numeration.

4. Suppose we wanted to understand on what type of device students accessed Canvas: phone, tablet, laptop, desktop. Devise a one-hot encoding scheme for this classification.