TMATH 308 QUINN AUTUMN 2021

Oral Midterm

Preparation

Use any resources available to prepare including your classmates, the TLC, internet, or me. You should plan, discuss, and debate answers with anyone that is willing to engage. **You are required to cite your sources and collaborators.**

- Sign up for a 25 minute interview slot at `https://calendly.com/jjquinn/oral-midterm-interview` at your earliest convenience.
- The assessment is **closed book** and **closed notes**.
- Supporting materials as explicitly mentioned in question # 1 are allowed.
- IN PERSON
  - I am looking to book a private space in the TLC for the interviews. More soon. If that doesn't work, interviews will be in my office MDS 306D. Please arrive 5 minutes early and get your materials prepared so that we can start promptly. You will have a maximum of 25 minutes to present your solutions.
- REMOTE
  - For your interview, please sign in to classroom zoom coordinates at least 5 minutes before your selected time. Have your working surface clear of clutter with only the allowed materials, blank paper, computer/tablet/phone.
  - You need a working camera to give a tour of your space. I would appreciate being able to see your face during the interview but that is not required.
  - You will have a maximum of 25 minutes to include a brief tour of your space and discussion/solutions to three questions.
  - You are required to share your screen when asked. Failure to comply will result in a 0.

Grading Rubric

The exam consists of two questions (worth 20 points each) from the next page and one mystery augmented matrix in reduced to row echelon form for you to determine the solution set (worth 10 points). Questions will be graded according to the following rubric:

A	95%	Well-executed. Thorough discussion. All points are well supported. Two or fewer minor errors. No nontrivial errors.
B	85 %	Generally well-executed. Several minor errors; or a nontrivial mathematical error that gets corrected when identified.
C	75%	Uncorrected nontrivial error; or several nontrivial errors that get corrected when identified; or error in fundamental understanding. that gets corrected when identified.
D	60%	Error in understanding of fundamental concept that does not get corrected.
0	0	No evidence of preparation or understanding. Did not comply when requested to view contents of screen.

- *(19 points)* The first question will be **your choice.**
- *(19 points)* I choose the second question from the ones remaining.
  - You may pass on my choice once for a 4 point penalty. If the pass is used, I select another problem.
- *(9.5 points)* A randomly selected augmented matrix in row echelon form for you to determine the solution set.
- *(2.5 points)* You can earn and additional 2.5 points by completing the assessment reflection after your interview.

Prof. Quinn's Oral Exam Questions

1. Write 5 true/false questions to assess five *different* concepts from Sections 1.1-1.5, 2.1, 2.2, and 3.2 that you might put on this exam if you were teaching the class. Then explain the answers, explain why you chose these particular questions and what concepts they are testing. *You are allowed to prepare a document containing your typed questions (only the questions) and bring that to the interview.*

2. A student submitted the following proof.

   Let A and B be $n \times n$ matrices. Since matrix multiplication is not commutative, we know

   $$AB \neq BA.$$

   Applying the determinant function to both sides, we conclude $\det(AB) \neq \det(BA)$.

   Grade the proof on clarity (scale between 0 and 3) and accuracy/correctness (scale between 0 and 4). Fully justify your scores.

3. There has been lots of vocabulary in this course so far. It is important to understand the relationship between the definitions by combining words and constructing examples. Be able to give and explain matrix examples that satisfy randomly selected characteristics, one from column A and one from B (or say why one doesn't exist.) (3x)

Column A	Column B
1) consistent	a) singular (for the coefficient matrix)
2) inconsistent	b) nonsingular (for the coefficient matrix)
3) homogeneous	c) overdetermined
4) nonhomogeneous	d) underdetermined

4. Elementary matrices are important enough to merit their own section in the textbook. Discuss why they are so important. What is your favorite application of elementary matrices so far?

5. Given an $m \times n$ matrix A, define a subset of $\mathbb{R}^m$ by

   $$S = \{\mathbf{v} \in \mathbb{R}^m \quad | \quad \mathbf{v}^T \cdot A = \mathbf{0}\}.$$

   Show that S is a subspace.

6. Clearly explain the difference between two matrices being (row) **equivalent** versus being **equal**? Be prepared to illustrate your discussion with examples of each concept.

Your final question will ask you to find the solution set of a linear system that is given in row echelon form. I am not giving these out in advance but as examples, consider:

$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{array}\right] \qquad \left[\begin{array}{cccccc|c} 1 & -1 & 2 & 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 & -1 & 0 & 2 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \end{array}\right]$$