MAS 3105 Oct 3, 2019
Quiz 3 Prof. S. Hudson

1) [25 pt] Suppose A is singular. What can you say about the product A adj A ? Explain.

2) [15 pt] Describe the MATLAB output from the command $A =$ **round** (8∗**rand**(5)). (Is it a scalar, a column vector, a 2x3 matrix, etc ? Can you predict any number(s) in the output, or at least the type of number(s)?)

3) [30 pt] Use Cramer's Rule to find the third column of A^{-1} by solving $A\mathbf{x} = \mathbf{e_3}$.

$$A = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 2 & 3 \end{pmatrix}$$

4) [30 pt] Choose one proof; circle it. You may continue on the back. Include *words* !

a) Part A of Thm 3.3.2. If span $L = V$ and L is Lin. Ind. then every $\mathbf{v} \in V$ is a *unique* Lin. Comb. of the vectors in L.

b) Thm 3.2.1. If $L \subset V$ then span L is a subspace of V. Mention all 4 parts of the definition of subspace, and prove the last two carefully.

c) Suppose A, $B \in R^{n\times n}$ and AB is singular. Show that A or B is singular.

Remarks, Scales, Answers: Problems 1, 3 and 4c are exercises from the book. The average on Quiz 3 was approx 65 out of 100 based on the top 23 scores. This is much lower than Quizzes 1 and 2, but fairly normal for a Quiz 3. The material gets harder after Ch 1 or 2. The high scores were 84 and 81. Here is an advisory scale for Quiz 3:

A's 73 to 100
B's 63 to 72
C's 53 to 62
D's 43 to 52

I have also computed your average for the 3 quizzes to estimate your semester grade so far, and wrote it on the upper right corner of your quiz. This does not yet include your HW and MHW scores. The average of these averages is approx 80, with a high of 92 and two 88's. Here is a scale for that statistic.

A's 87 to 100
B's 77 to 86
C's 67 to 76
D's 57 to 66

1) Since A is singular, det $A = 0$. So from a Ch.2.3 theorem, A adj$A$ = det$A$ $I = O$, the zero matrix. Some people wrote A adj$A$ = det$A = 0$ suggesting that the answer is the

scalar 0. You can clarify that your answer is a matrix with a large cursive O, or with a comment. Comments that adj$A$ and A adj$A$ are singular do not help much.

2) It produces a 5x5 matrix with random integer entries from 0 to 8. Include some explanation, as usual. Some wrote 'multiples of 8', but to me that means numbers like 16, etc, which is wrong.

It is debatable how random the numbers are, but I didn't expect you to go into that.

3) $[x_1\ x_2\ x_3]^T = [1\ \ -1\ \ 1]^T$. For example, $x_1 = \det A_1 / \det A = \frac{1}{1} = 1$.

I gave partial credit for other methods, such as $A^{-1} = (\det A)^{-1} \mathrm{adj} A$. But that is not Cramer's Rule.

4ab) See the text or lectures.

4c) This is an exercise in Ch 2. Since AB is singular, det $AB = 0$. So, by the main thm, det A det $B = 0$. By simple algebra, either det A or det B is 0. So, either A or B is singular.