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Birzeit University

Mathematics Department

Math 234

First Hour Exam **First semester 2013/2014**

Student name: [redacted] "5" **Student no:** [redacted]

Question #1 (24%): Which of the following statements is true and which is false:

False 1- If A is an nxn matrix and the system AX=0 has a nontrivial solution then A is nonsingular

True 2- If A and B are nxn matrices and AB is nonsingular then both A and B are nonsingular.

False 3-If A is 4x4 matrix then $|-A|=-|A|$

False 4- If A is 3x3 matrix and $A=[-A^T]$ then A is singular

False 5- The product of two symmetric nxn matrices is symmetric

True 6-If A is a nonsingular matrix then the matrix A^T is nonsingular also.

False 7- Any non homogenous system of linear equations that has a nontrivial solution must have infinite number of solutions.

False 8- If A, B, C are 2x2 matrices with AB=AC then B=C.

False 9- If A and B are 2x2 matrices such that A.B=0 then A=0 or B=0.

True 10- If $A=\begin{pmatrix}1&0&0\\0&1&0\\5&0&1\end{pmatrix}$ then $A^{-1}=\begin{pmatrix}1&0&0\\0&1&0\\-5&0&1\end{pmatrix}$

True 11- If A, B are 3x3 matrices with $|A|=4$, $|B|=5$ then $|2A^{-1}B|=10$

True 12- If $A=\begin{pmatrix}2&5&7\\1&3&4\\2&1&6\end{pmatrix}$ then the (2, 3) entry of A^{-1} is $\frac{1}{3}$

$$A^{-1}_{32}=\frac{A_{32}}{|A|}=\frac{1}{3}$$

True 13-If the coefficient matrix of the system AX=b is $A=\begin{pmatrix}1 & 2 & 3\\ 0 & -1 & 1\\ 0 & 4 & 1\end{pmatrix}$

Then the system must have a unique solution

True 14- Any nonsingular matrix can be written as a product of elementary matrices.

false 15-The product of two elementary matrices is elementary

True 16- $|AB|=|BA|$ for any two nxn matrices A and B

$|A|\,|B| = |B|\,|A|$

Question #2(30%): Circle the correct answer:

1- If $A=\begin{bmatrix}a & b & c\\ d & e & f\\ g & h & i\end{bmatrix}$, and $|A|=6$, and $B=\begin{bmatrix}2a & 2b & 2c\\ 4g & 4h & 4i\\ -d & -e & -f\end{bmatrix}$ then $|B|=$

$-1 * 2 * -1 * 4 = 8\,|A| = 86 = 48$

a) 48 b) -48

c) -24 d) 24

2- If A, B are two $n\times n$ matrices then

a) $\det(AB^T)=\det(AB)$ → $|A||B^T| = |A||B|$

b) $\det(\alpha A)=\alpha\det(A)$ × $\alpha^n|A|$

c) $\det(A+B)=\det(A)+\det(B)$ X

3- If AX=b has no solution where A is an nxn matrix and b is an nx1 matrix then:

a- A is row equvalent to I_n b- A is nonsingular .

c- A is a product of elementary matrices d- $AX=0$ has infinitely many solutions,

4- The conditions on a,b such that the system $\begin{array}{l} ax + y = 1 \\ 2x + y = b \end{array}$ has infinite number of solution is

a) a=2 and b=1 b) $a\neq 2$ and b=1

c) a=2 and $b\neq 1$ d) $a\neq 2$ and $b\neq 1$

$\left[\begin{array}{cc|c} a/a & 1/a & 1/a \\ 2 & 1 & b \end{array}\right] \to \left[\begin{array}{cc|c} 2/2 & 1/2 & b/2 \\ a & 1 & 1 \end{array}\right]$

$\left[\begin{array}{cc|c} 1 & 1/2 & b/2 \\ 0 & 1-\frac{a}{2} & 1- \end{array}\right]$

5- If A and B are $n\times n$ nonsingular matrices then :

a- $(AB)^T=A^TB^T$ B^TA^T b- $(A+B)^T=A^T+B^T$

c- $(AB)^{-1}=A^{-1}B^{-1}$ X $B^{-1}A^{-1}$ d- $|\alpha A|=\alpha^n|A|$ X

$1-\frac{a}{2}=0$ | $1-\frac{ab}{2}$

$1=\frac{a}{2}$ | $1=\frac{ab}{2}$

$a=2$ | $2=ab$

$a=2,\ b=1$

Mathematics Department
Math 234

...st Exam Summer 2010

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Question 1 (39 points). Mark each of the following by True of False

(1) (T) An $n \times n$-matrix A is nonsingular if and only if A is a product of elementary matrices.

(2) (F) Any two $n \times n$-singular matrices are row equivalent.

(3) (T) If A is a singular matrix and U is the row echelon form of A, then $\det(U) = 0$.

(4) (T) If A is a 3×3-matrix and the system $Ax = \begin{pmatrix} 5 \\ 1 \\ 3 \end{pmatrix}$ has a unique solution, then the system $Ax = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$ has only the zero solution.

(5) (T) If an $n \times n$-matrix A is nonsingular, then Cramer's rule can be used to solve the system $Ax = b$.

$m > n$

(6) (T) Let A be a 4×3-matrix with $a_2 = a_3$. If $b = a_1 + a_2 + a_3$, where a_j is the jth column of A, then the system $Ax = b$ will have infinitely many solutions.

(7) (T) If y, z are solutions to the system $Ax = 0$, then any linear combination of y, z is also a solution to $Ax = 0$.

(8) (T) If A is a singular and B a nonsingular $n \times n$-matrices, then AB is singular.

(9) (F) If a matrix B is obtained from A by multiplying a row of A by a real number c, then $|A| = c|B|$.

(10) (T) If A, B are $n \times n$-matrices, $|A| = 3$ and $|B| = -2$, then $|A^{-1}B^T| = \frac{-2}{3}$ $|B| = c|A|$

(11) (T) If A is a singular matrix, then $A\,\mathrm{adj}(A) = 0$. $\det A^{-1}$ $\det B^T$

(12) (T) $S = \{ \begin{pmatrix} a \\ b \\ 0 \end{pmatrix} : a, b \in \mathbf{R}\}$ is a subspace of $\mathbf{R}^3$. $\frac{\det B}{\det A} = \frac{-2}{3}$

(13) (F) If A is row equivalent to B, then $\det(A) = \det(B)$.

(14) (F) If A is a nonsingular $n \times n$-matrix and c is a nonzero real number, then $(cA)^{-1} = (\frac{1}{c})^n A^{-1}$.

(15) (F) If A is a singular $n \times n$-matrix, $b \in \mathbf{R}^n$, then the system $Ax = b$ has infinitely many solutions.

(16) (F) If A, B are 4×4-matrices and AB is the zero matrix, then $\det(A) = 0$.

$\frac{1}{\det(A)} \mathrm{adj}(A)$

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$AB = 0$

$\det(AB) = \underset{0}{\det(A)}\ \underset{0}{\det(B)}$