$\begin{pmatrix} 1 & 4 & 0 \\ 1 & 7 & 1 \\ 3 & 2 & \end{pmatrix}$

Mathematics Department
Math 234

First Exam

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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 $Ax = b$.

(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. $m > n$

(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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$AB = 0$

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