Math 630-102
Homework 2

Section 1.4

Problem 13 (a, b, d). By trial and error find examples…

> Note: this means that you are asked to guess the matrix elements, although you may easily find a more systematic way to solve this problem. You don't have to do part *c* since it's somewhat tricky.

Problem 21. Find the powers A^2, A^3 (A^2 times A), and B^2, B^3, C^2 and C^3…

> Note: the last question asks you to obtain expressions for A^k, B^k and C^k, for any k. This should be obvious once you solve the first part.

Problem 24. Which three matrices E_{21}, E_{31}, E_{32} put "A" into a triangular form "U"?...

> Recall that M is the inverse of matrix L in the LU factorization. Note that subscripts of matrices E here and elsewhere in the book indicate rows that are operated on (E_{21} indicates that this matrix adds or subtracts a multiple of row 1 from row 2). However, in class we used subscripts just to indicate the order of operations (E_1 we called our first row operation, E_2 our second operation, etc.)

Section 1.5

Problem 3. Apply elimination to produce the factors L and U for…

> Note: recall that elements of L contain the inverse coefficients of your row operations. Note also that you can always check your answer by multiplying L and U to obtain A.

Problem 5. Factor A into LU, and write down the upper triangular system $Ux = c$ which appears after elimination, for…

Problem 9, part (b) only: Solve the system $Ax=b$ starting with $Lc=b$

> Note: this is were you do the step 2 of the method described in class. In part (a) the matrix A is already decomposed into LDU. Once you obtain c, solve $DUx=c$.

Problem 11. Solve as two triangular systems, without multiplying LU to find A….

Note: again, do the step 2 of the method described in class. Recall that first you solve $Lc=b$ (where b is the right-hand side column vector), and once you know c, you can then solve $Ux=c$

Problem 15. Find the PA = LDA factorizations (and check them) for…

Note: you have to do any necessary row exchanges first (P), even though it requires you to start the factorization to see if a row exchange is indeed needed. In practice of course computer algorithms will avoid repeating the same steps twoce.

Section 1.6

Problem 1. Find the inverses (no special system is required) of…

Note: "no special system is required" means that you can guess the elements by trial and error. Hint for the last matrix: $\sin^2\theta+\cos^2\theta=1$

Problem 3. From $AB=C$ find the formula for A^{-1}. Also find A^{-1} from $PA = LU$.

Hint: use the rule for the inverse of a product, and do a simple linear algebra step.

Problem 13. If $A=\begin{bmatrix}3\\1\end{bmatrix}$ and $B = \begin{bmatrix}2\\2\end{bmatrix}$, compute A^TB, B^TA, and BA^T