# MATH 211 MAPLE ASSIGNMENT

Detailed instructions for completing this assignment will be given on a separate sheet called MAPLETIPS, and using these the assignment should take an hour or less. Only stapled assignments will be accepted, non-stapled assignments go into the garbage. Page numbers refer to the text "Linear Algebra and its Applications" by D. Lay, 3rd Edition.

## ASSIGNMENT

1. Your name on top of first page, and ID number on top of second page.

2. (a) Find $e$ and $\pi$ to 100 digits.

   (b) Determine the 100th digit of $\pi$ (the 1st is 3, 2nd 1, 3rd 4, etc.)

3. Find, to 30 digit accuracy, the zeros (roots) of the polynomial $p(x) = x^3 - 7x^2 + 5x - 12$.

   In the following questions consider the matrices

$$A = \begin{bmatrix} 1 & -2 & 2 & 3 & 0 & 4 \\ 4 & 4 & -1 & 7 & 2 & -5 \\ 2 & 3 & 5 & 9 & 1 & 2 \\ 0 & 2 & 3 & 9 & 3 & 1 \\ 7 & -6 & 0 & 15 & 4 & 6 \end{bmatrix}, \quad B = \begin{bmatrix} -2 & -1 & 3 & 0 & 4 \\ -4 & 1 & 2 & 5 & -1 \\ -2 & 0 & 7 & 2 & 0 \\ 9 & -1 & 3 & -13 & 6 \\ -11 & -1 & 3 & 0 & 13 \end{bmatrix},$$

$$C = \begin{bmatrix} 2 & 3 & 4 \\ 3 & 5 & 0 \\ 4 & 0 & -2 \end{bmatrix}.$$

4. State a property of the matrix $C$, and because of this property what can you say about the eigenvalues of $C$. [Hint : see 5.5 Exercise 24 or p.452, The Spectral Theorem (a).]

5. (a) Find $\text{rank}(A)$.

   (b) Find the RREF of $A$. How many pivots are there, and compare this with your answer in (a).

6. Find $BA$.

7. (a) Find $\det(B)$.

   (b) Is $B$ invertible? Explain your answer

   (c) If $B$ is invertible, find $B^{-1}$.

   (d) From what you already know about $B$, what must its RREF equal? Explain.

8. Find the eigenvalues of $B$, and find an eigenvector for the eigenvalue $\lambda = -13$.

9. (a) Find the eigenvalues of $C$ to 30 digit accuracy.

   (b) Your answers in (a) will be complex numbers, that is contain $I = \sqrt{-1}$. Explain why this is not in contradiction to the Spectral Theorem.

10. p.118-39 Let

$$S = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

    Compute $S^k$ for $k = 2, 3, 4, 5, 6, 7, 800$.

11. p.118-40 Describe in words what happens when you compute $A^5, A^{10}, A^{20}, A^{30}$ for

$$A = \begin{bmatrix} 1/6 & 1/2 & 1/3 \\ 1/2 & 1/4 & 1/4 \\ 1/3 & 1/4 & 5/12 \end{bmatrix}.$$