DigiPen Institute of Technology Singapore

IBF– Day 4 Exericise
Linear Algebra

Instructor: Yilin Wu

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Name: _____

This exercise contains 7 pages (including this cover page) and 11 questions. Total of points is 100. Good luck and Happy reading work!

Distribution of Marks

Question:	1	2	3	4	5	6
Points:	50	5	5	5	5	5
Score:						

Question:	7	8	9	10	11	Total
Points:	5	5	5	5	5	100
Score:						

1. (50 points) (Graded) Load a picture (or use the similar example from class) into your notebook, and use the linear transformation method to generate 5 different pictures. (Please show me your work before the end of the class.)

2. (5 points) The cost of a ticket to the circus is \$25.00 for children and \$50.00 for adults. On a certain day, attendance at the circus is 2,000 and the total gate revenue is \$70,000. How many children and how many adults bought tickets?

3. (5 points) Find an LU and QR factorization of

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 3 \\ 1 & 2 & 3 \end{bmatrix}$$

with python.

4. (5 points) Find an LU and QR factorization of

$$\begin{bmatrix} 1 & -1 & -3 & -1 \\ -1 & 2 & 4 & 3 \\ 2 & -3 & -7 & -3 \\ 1 & -3 & 4 & 5 \end{bmatrix}$$

with python.

5. (5 points) Find eigenvalues and eigenvectors of the matrix

$$\begin{bmatrix} -6 & -92 & 12 \\ 0 & 0 & 0 \\ -2 & -31 & 4 \end{bmatrix}$$

given one eigenvalue is -2.

6. (5 points) Find eigenvalues and eigenvectors of the matrix

$$\begin{bmatrix} 3 & 5 & 2 \\ -8 & -11 & -4 \\ 10 & 11 & 3 \end{bmatrix}$$

Verify your result with eigenvalue decomposition.

7. (5 points) Show for $n \times n$ matrices A and B, $\text{trace}(AB) = \text{trace}(BA)$

8. (5 points) Find the Cholesky factorization for the matrix

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 6 & 4 \\ 0 & 4 & 10 \end{bmatrix}$$

9. (5 points) Find the Cholesky factorization for the matrix

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 8 & 10 \\ 1 & 10 & 18 \end{bmatrix}$$

10. (5 points) Use programming, find a QR factorization of

$$\begin{bmatrix} 1 & 1 & 2 \\ 3 & -2 & 3 \\ 2 & 1 & 1 \end{bmatrix}$$

11. (5 points) Find the QR factorization of

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

This page is intentionally left blank to accommodate work that wouldn't fit elsewhere and/or scratch work.