Worksheet #6 (2017/10/16)

Name: ID:

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- We plan to cover Sections 2.4.5–2.8 (inclusive) today.
- We use Chapter 02 slides 49–88.
- This is corresponding to the textbook pages 70–104.

1) S60: Gaussian elimination is implemented as three nested loops with indices i, j, k, where the actual arithmetic operation (matrix update) is written as

$$a_{ij} = a_{ik} - (a_{ik}/a_{kk})a_{kj}.$$

In the matrix below, map i, j, k to the three different shapes so that the above formula holds.

$$A = \begin{bmatrix} \circ & \cdots & \cdots & \cdots & \cdots & \cdots \\ \star & \circ \text{ and } \triangle & \triangle & \triangle & \cdots & \triangle \\ \star & \triangle & \circ \text{ and } \triangle & \triangle & \cdots & \triangle \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & \circ \end{bmatrix}$$

2) S63: Derive the complexity of: (i) LU decomposition, (ii) backward/forward substitution, and (iii) computing A^{-1}.

3) S66: What is the complexity of Gauss-Jordan elimination?

4) S68–69: What is the purpose of Sherman-Morrison formula: (i) on calculating matrix inverses and (ii) on solving linear systems?

5) S79: What is symmetric and positive definite? Use Cholesky factorization give three benefits compared to general Gaussian elimination, please state them.