# CSI 35: Discrete Mathematics II. Midterm 2 review

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Much of the Midterm will be similar to the exercises listed below. All page numbers and exercises are from the textbook, Discrete Mathematics and its Applications, 8th Ed., by Kenneth H. Rosen.

Recall: Given a relation $R$ from a set $A = \{a_1, a_2, \ldots, a_m\}$ to a set $B = \{b_1, b_2, \ldots, b_n\}$, the zero-one matrix of $R$ is the array with $m$ rows and $n$ columns so that the entry at row $i$ and column $j$ is 1 if $(a_i, b_j) \in R$ and 0 otherwise.

- List the ordered pairs in the relations on $\{1, 2, 3\}$ represented by each of the following zero-one matrices. Then do the directed graph that represents each relation (that is, draw an arrow from $a$ to $b$ if $(a, b) \in R$).

  (a) $R_1 = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ (b) $R_2 = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ (c) $R_3 = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

- From the previous exercise, compute the zero-one matrix of $R_1 \circ R_1$, $R_1 \circ R_2$ and $R_2 \circ R_1$.

- List the ordered pairs in the relations on $\{1, 2, 3, 4\}$ represented by each of the following zero-one matrices. Then do the directed graph that represents each relation (that is, draw an arrow from $a$ to $b$ if $(a, b) \in R$).

  (a) $R_1 = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$ (b) $R_2 = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ (c) $R_3 = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

- From the previous exercise, compute the zero-one matrix of $R_1 \cup R_1$, $R_1 \cap R_2$ and $R_2 - R_1$.

- Do exercises 1, 2, 3, 10, 30, 32, 33 from Section 9.1.

- Do exercises 1, 2, 4, 7 from Section 9.2.

- Do exercises 1, 17, 21, 24, 26, 35, 36, 41, 47 from Section 9.5.

- Do exercises 1, 3, 7, 9, 14, 15, 16, 22, 23, 25, 32, 34 from Section 9.6.

- Memorize the definitions on the Review of Key Terms and Results (pages 665, 666). In the test, you will be asked some definitions from this list.

- Do exercises 1, 2, 3, 21 from the Supplementary Exercises (pages 667, 668).