

CISC-102 WINTER 2016

HOMEWORK 4

Please work on these problems and be prepared to share your solutions with classmates in class next Friday. Assignments will **not** be collected for grading.

READINGS

Read sections 2.1, 2.2, 2.3, 2.4, 2.6, 2.8, 2.9, 3.1, 3.2, 3.3 (in 3.3 you may skip the part on permutations) of *Schaum's Outline of Discrete Mathematics*.

Read section 2.1 again (If you did not understand things last week) of *Discrete Mathematics Elementary and Beyond*.

PROBLEMS

- (1) Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$
 - (a) What is $A \times B$?
 - (b) What is $B \times A$?
 - (c) What is $(A \times B) \cup (B \times A)$?
 - (d) What is $(A \times B) \cap (B \times A)$?
- (2) Suppose A is a set of m elements, and B is a set of n elements. How many elements are there in the product set $A \times B$? How many elements are there in the product set $B \times A$?
- (3) Consider the following relations on the set $A = \{1, 2, 3\}$:
 - $R = \{(1, 1), (1, 2), (1, 3), (3, 3)\}$,
 - $S = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3)\}$,
 - $T = \{(1, 1), (1, 2), (2, 2), (2, 3)\}$,
 - $A \times A$.Which of the relations above are antisymmetric?
- (4) Explain why each of the following binary relations on the set $S = \{1, 2, 3\}$ is or is not an equivalence relation on S .
 - (a) $R = \{(1, 1), (1, 2), (3, 2), (3, 3), (2, 3), (2, 1)\}$
 - (b) $R = \{(1, 1), (2, 2), (3, 3), (2, 1), (1, 2), (3, 2), (2, 3), (3, 1), (1, 3)\}$
 - (c) $R = \{(1, 1), (2, 2), (3, 3), (3, 1), (1, 3)\}$
- (5) Let R be a relation on the set of Natural numbers such that $(a, b) \in R$ if $a \geq b$. Show that the relation R on $\mathbb{N}$ is a partial order.
- (6) Determine whether the mappings from $\mathbb{R}$ to $\mathbb{R}$ shown below are or are not functions, and explain your decision.
 - (a) $f(x) = 1/x$
 - (b) $f(x) = \sqrt{x}$

- (c) $f(x) = 3x - 3$
- (7) Determine whether each of the following functions from $\mathbb{R}$ to $\mathbb{R}$ is a bijection, and explain your decision. HINT: Plotting these functions may help you with your decision.
- (a) $f(x) = 3x + 4$
- (b) $f(x) = -x^2 + 2$
- (c) $f(x) = x^3 - x^2$