

MAD 3105 Assignment 01 NAME: _____
Relations and Their Properties DUE: Thursday, January 14th (11:59pm EST)

Directions: Show ALL work for credit. There are 5 questions. Write on your own paper. Each part is worth 5 points, unless stated otherwise. You may type or neatly write your solutions. Make sure you write your name on all papers that you use. **Scan this page at the front of your work**, and compile as ONE .pdf file. Check that all work was saved and scanned legibly.

Save your file as: **A01xyLASTNAME.pdf**. (where "xy" is your first and middle initial)

Once completed, attach your file under "Assignment 01" on Blackboard and click "submit." Thank you!

1) For the relation $R = \{(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)\}$ on the set $A = \{1, 2, 3, 4\}$, explain/show whether or not the relation is the following: (For any credit, be sure to give a reason why for each).

- (a) reflexive,
- (b) symmetric,
- (c) antisymmetric,
- (d) transitive.

2) Let the sets be relations on the real numbers: $R_1 = \{(a, b) \in \mathbb{R}^2 \mid a \geq b\}$, the "greater than or equal to" relation and let $R_2 = \{(a, b) \in \mathbb{R}^2 \mid a \neq b\}$, the "unequal to" relation. Find: **(10 pts each)**

- (a) $R_1 \cap R_2$ (write out the relation in the set notation, as R_1 and R_2 were written)
- (b) $R_1 - R_2$ (write out the relation in the set notation, as R_1 and R_2 were written)
- (c) $R_1 \oplus R_2$ (write out the relation in the set notation, as R_1 and R_2 were written)

3)(a) How many relations are on the set $\{a, b, c\}$?

(b) If $R = \{(1, 1), (1, 2), (2, 4), (3, 1), (3, 0)\}$ & $S = \{(1, 2), (2, 0), (3, 1), (0, 0), (4, 3)\}$ find $S \circ R$

4) R is the relation represented by the matrix $M_R = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, find the matrix for:

- (a) R^{-1}
- (b) \overline{R}
- (c) $R \circ R$ (i.e. R^2)

5) (a) The relation R is on $\{1, 2, 3\}$. Represent the relation **(10 points)**

$R = \{(1, 1), (2, 1), (2, 2), (2, 3), (3, 2)\}$ with a matrix.

(b) By looking at the matrix, is the relation R reflexive? Why or why not? **(5 points)**

(c) Draw the directed graph that represents the relation R . **(10 points)**