## MAD 3105-6

## REVIEW

1. Let R be the relation on the set  $\mathbb{Z}$  of all integers, where aRb means that  $ab \leq 0$ . Is R an equivalence relation?

2. Let  $\mathbb{R}^2$  be the set of all ordered pairs of real numbers; that is,  $\mathbb{R}^2 = \{(x, y) : x, y \in \mathbb{R}\}$ . Define a relation R on  $\mathbb{R}^2$ , where  $(x_1, y_1)R(x_2, y_2)$  means that  $x_1 + y_2 = x_2 + y_1$ .

- (a) Prove that R is an equivalence relation.
- (b) Find the equivalence class [(1,2)].

3. Let R be the relation on the set Z of all integers, where aRb means that  $a^2 = b^2$ . Determine whether R is reflexive, symmetric, antisymmetric, transitive.

4. Find the matrix that represents the given relations, where the elements are ordered as indicated.

- (a) R on  $\{1, 2, 3, 4, 6, 12\}$ , where aRb means a|b.
- (b)  $R^2$ , where R is the relation on the set  $\{w, x, y, z\}$  given by

$$R = \{(w, w), (w, x), (x, w), (x, x), (x, z), (y, y), (z, y), (z, z)\}$$

5. Determine whether the relation on the set  $\{a, b, c, d\}$  defined by the matrix  $M_R$  below (elements are ordered as indicated) is reflexive, symmetric, antisymmetric, transitive.

$$M_R = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{bmatrix}$$

6. Draw the Hasse diagram of the relation R on the set  $A = \{2, 3, 4, 6, 10, 12, 16\}$ , where  $(a, b) \in R$  means that a|b.

7. Find the matrix of the transitive closure of the relation R on the set  $\{a_1, a_2, a_3\}$  whose matrix in the given order is

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}.$$