

The instructors will select four of these problems to grade, with each problem worth 5 points. Clear and complete justification is required for full credit. You are welcome to discuss these problems with anyone and everyone, but must write up your own final submission without reference to any sources other than the textbook and instructor. Submissions must be on clean paper with no ragged edges.

For each of the relations specified below:

- a) Pick an element  $t$  of the set in question and find three other elements of the set which are related to it.
- b) For your element  $t$  from part a, find three other elements of the set which are not related to it.
- c) Determine whether the relation is reflexive, symmetric, or transitive.

1. Let  $\approx$  be the relation on  $\mathbb{Z} \times \mathbb{N}^+$  defined by  $(a, b) \approx (c, d)$  iff  $ab = cd$ .
2. Let  $\sim$  be the relation on  $\mathbb{Z} \times \mathbb{N}^+$  defined by  $(a, b) \sim (c, d)$  iff  $ad = bc$ .
3. Consider the set  $A = \{1, 2, 3, 4\}$  and the relation  $R = \{(1,1), (1,3), (2,2), (2,4), (3, 1), (3,3), (4,2), (4,4)\}$ . Write the partition  $\mathcal{P}$  corresponding to  $R$ .
4. Consider the set  $A = \{1, 2, 3, 4\}$  and the partition  $\mathcal{P} = \{\{1\}, \{2, 3\}, \{4\}\}$  on  $A$ . Write the relation corresponding to  $\mathcal{P}$ .
5. Express the definition of the sum of two functions in terms of ordered pairs.
6. Express the definition of the composition of two functions in terms of ordered pairs.

