

You will receive 1/4 point for any question on which you answer 'E' for "I don't know".

Problem 1. Which of the following are relations on the integers? Answer A for "Yes" and B for "No".

- (i) $\mathbb{N} \times \mathbb{N}$
- (ii) $\{p \in \mathbb{Z} : p \text{ is prime}\}$
- (iii) $\{(1, 1/2)\}$
- (iv) \emptyset

Problem 2. Is $\{(1, 2), 4\}$ a relation?

- A) Yes B) No C) On what?

Problem 3. The relation $\{(x, y) \in \mathbb{Z} \times \mathbb{Z} : y - x \in \mathbb{N}\}$ is the same as which of the following relations?

- A) $|$ B) $=$ C) \leq D) \geq

Problem 4. For each of the following relations on a set S , determine if it is anti-symmetric, irreflexive, reflexive, symmetric, or transitive.

- (i) ($S = \mathbb{Z}$) Say that $x \equiv y \pmod{n}$ if $x - y$ is divisible by n .
- (ii) ($S = \mathbb{Z}$) Say that $x \nmid y$ if y is *not* divisible by x
- (iii) ($S = \mathbb{Z}$) Say that $x \wr y$ if $x|y^2$
- (iv) ($S = \mathbb{Z}$) Let

$$R = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : xy \text{ is even}\}$$

- (v) Let S be the set of polygons (in the plane). Declare that polygons P and Q are *congruent*, and write $P \equiv Q$, if it is possible to move P to Q by a combination of rotations and shifts.