EE2302 Foundations of Information and Data Engineering

Assignment 3 **Due: 11 pm, Sep 23**

Full mark: 21 points

1. Let R be the relation on Z defined by

$$mRn \text{ if and only if } mn > 0 \text{ or } m = n = 0.$$

   a) (3 points) Prove that R is an equivalence relation.

   b) (3 points) How many distinct equivalence classes are there? What are they?

2. (3 points) Let $a \equiv b \pmod{n}$ and $c \equiv d \pmod{n}$. Prove that $ac \equiv bd \pmod{n}$.

3. (3 points) Let $A = \{a, b\}$. Describe all partial order relations on A.

4. Consider the following two relations defined on $\boldsymbol{R}$, where $\boldsymbol{R}$ is the set of real numbers:
   - For all $x, y \in \boldsymbol{R}$, $x\ S\ y$ if and only if $x \geq y$.
   - For all $x, y \in \boldsymbol{R}$, $x\ T\ y$ if and only if $x - y$ is an integer.

   a) (2 marks) Which one is not an equivalence relation? Justify your answer.

   b) (3 marks) Prove that the other one is an equivalence relation.

   c) (4 marks) Describe its distinct equivalence classes.