Discrete Structures

Fight for Survival

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August 27, 2026

P1

Given $f : A \to B$, where $A = \{a, b, c, d\}$ and $B = \{1, 2, 3\}$ such that $f(a) = 3$, $f(b) = 2$, $f(c) = 1$, $f(d) = 3$ Is f a function, onto/surjective, one-to-one/injective, bijective?

P2

Can there be two subsets of real numbers, say P and Q, such that their Cartesian product $P \times Q$ is a subset of $S = \mathbb{R}^2$ given by $P \times Q = \{f(p, q) \mid p^2 + q^2 \leq 1\}$? If such P and Q exist, find them; otherwise, show that such two sets do not exist.

P3

Let $R = (P(\mathbb{R}), \subseteq)$[a], i.e, R is a subset Relation (R) on the subsets of real numbers. For two subsets of real numbers, $A, B \subseteq \mathbb{R}$, we have $(A, B) \in R$, whenever, $A \subseteq B$.

1. "Is R an Equivalence relation?"
2. "Is R a Partially Ordered relation?"

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[a] $P(\mathbb{R})$ is the power set of the set of real numbers.

P4

In a school there are 25 teachers who teach Engineering or Management. Of these, 15 teachers teach Engineering, and 6 teachers teach both Engineering and Management. How many teachers teach only Management? Also, draw its Venn diagram.

P5

Construct a Relation on a set of four elements which is "Reflexive and Symmetric but not Transitive"

P6

Show that $\mathbb{Z}^+$ with relation $|$ is a POSET. Draw a Hasse Diagram for $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ with relation $|$.

P7

Short Answers:

1. Create a partition of the set $\mathbb{Z} \times \mathbb{Z}$ into three sets.
2. What is $(A \oplus B) \oplus (B \oplus B)$ for two sets A, B.
3. Give example of a relation that is NOT a function if there is one.
4. Give example of a function that is NOT a relation if there is one.