



PES UNIVERSITY, Bangalore

(Established under Karnataka Act No. 16 of 2013)

Department of Computer Science & Engineering

Automata Formal Languages & Logic

Question Bank - Functions and Relations

- 1) Diagram the following functions and mention whether they are one-to-one, onto or bijective:

a) $f : \{a, b, c, d\} \rightarrow \{1, 2, 3, 4\}$

$$f(a) = 1$$

$$f(b) = 2$$

$$f(c) = 3$$

$$f(d) = 4$$

b) $g : \{a, b, c, d\} \rightarrow \{1, 2, 3, 4\}$

$$g(a) = 1$$

$$g(b) = 1$$

$$g(c) = 4$$

$$g(d) = 4$$

- 2) Let $A = \{1, 2, 3, 4\}$ and $B = \{0, 3, 6, 8, 12, 15\}$. Consider a rule $f(x) = x^2 - 1, x \in A$, then

- show that f is a mapping from A to B .
- draw the arrow diagram to represent the mapping.
- represent the mapping in the roster form.
- write the domain and range of the mapping.

- 3) Find all real values of x such that $f(x) = g(x)$ where f and g are functions given by $f(x) = 3x + \sqrt{x}$ and $g(x) = 2x + 6$.

4) Identify if each of the following is one to one function ,onto function or both.

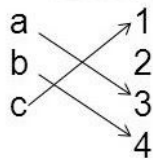


Fig 1

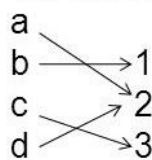


Fig 2

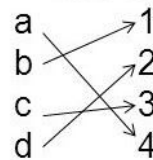


Fig 3

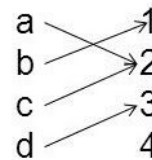


Fig 4

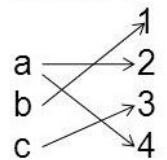


Fig 5

5) For the set $A = \{1, 2, 3, 4\}$, show the matrix and digraph representation of the relation $R = \{(1, 1), (1, 3), (2, 1), (2, 3), (2, 4), (3, 1), (3, 2), (4, 1)\}$.

6) Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{a, b, c, d\}$. Which of the following arrow diagram(s) defines onto functions? Explain.

Diagram 1

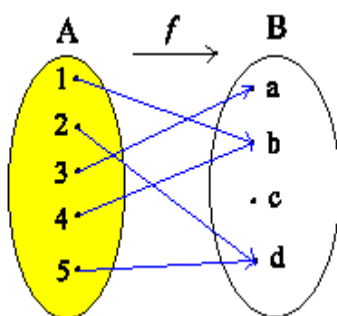


Diagram 2

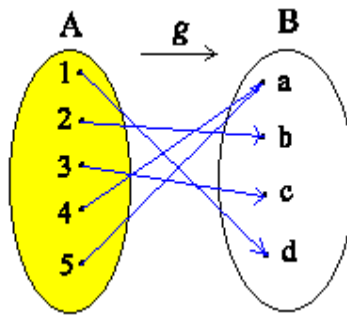
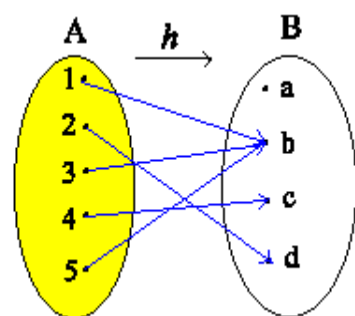


Diagram 3





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- 7) Define functions f from \mathbf{Z} to \mathbf{Z} and g from \mathbf{R} to \mathbf{R} by the formulas: for all $y \in \mathbf{Z}$ and $x \in \mathbf{R}$,

$$f(y) = y^2 \quad \text{and} \quad g(x) = 2x + 1$$

a. Is f onto? Prove or disprove by giving a counter example.

b. Is g onto? Prove or disprove by giving a counter example.

- 8) Given relations on the set $A = \{1, 2, 3\}$ identify if each of the relations is reflexive, symmetric, and transitive.

a) $R_1 = \{(1, 1), (2, 2), (3, 3)\}$

b) $R_2 = \{(2, 2), (2, 3), (3, 2)\}$

c) $R_3 = \{(2, 3), (3, 2)\}$

d) $R_4 = \{(1, 2), (1, 3), (2, 3)\}$

- 9) Let R be a relation on the set of real numbers such that aRb iff $a-b$ is an integer. Prove whether R is an equivalence relation.

- 10) Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 3), (3, 3), (4, 4)\}$ be a relation on A . Verify that R is an equivalence relation.