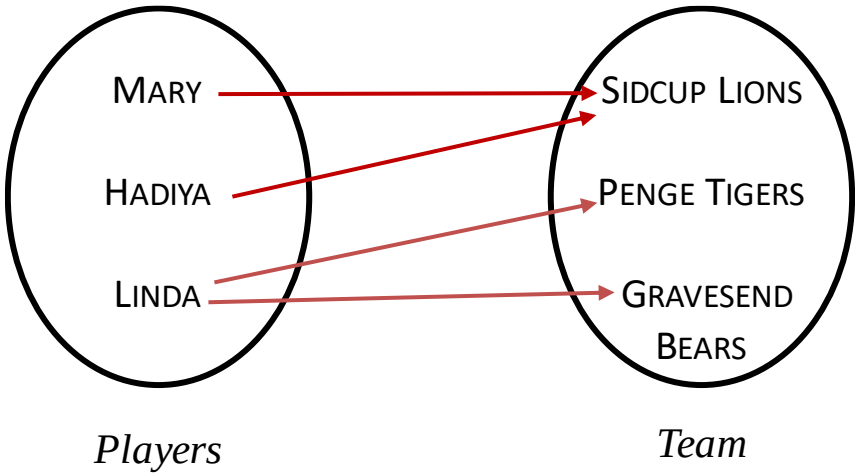
CN4004: Maths for Computing

Relations and Functions: Tutorial

1. The diagram below represents the relation "*plays for*" between the set *Players* and the set *Teams*:



   a) Represent the relation in terms of a set of ordered pairs.

   b) Write in words: MARY $\mathscr{R}$ SIDCUP LIONS

2. A and B are two sets and R is a relation from set A to set B .

$$A = \{ 1, 2, 3\}$$
$$B = \{ x, y\}$$
$$R = \{(1, x), (2, x), (3, y)\}$$

   Represent the relation R pictorially.

3. A relation R is specified as follows:

$$R = \{ (a, 2), (d, 9), (b, 4), (c, 7), (a, 1) \}$$

   Give the value of R^{-1}, the inverse of this relation.

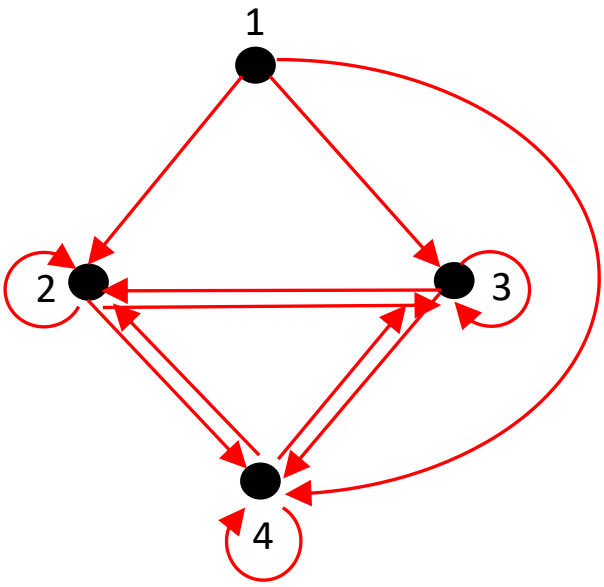
4. Consider the relation "*is less than*" on the set of integers.

Is this relation

a) symmetric
b) reflexive
c) transitive?

In each case give a reason for your answer.

5. Consider the digraph below which shows a relation on the set {1, 2, 3, 4} :

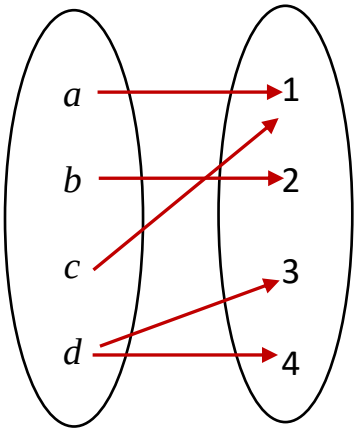


Is this relation:

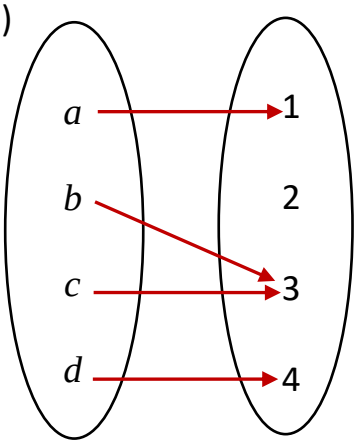
a) Reflexive? b) Symmetric c) Transitive?

6. Which of the diagrams below represents a function?

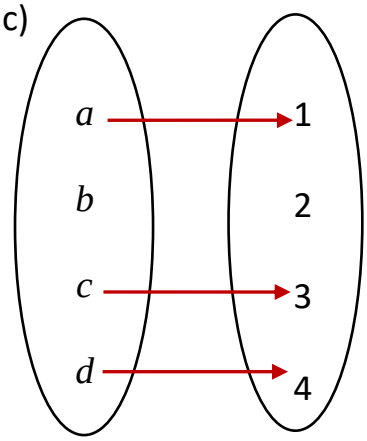
a)



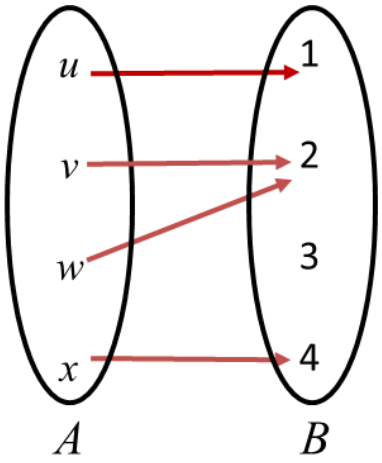
b)



c)



7. A function f, which maps from a set A to a set B, is represented pictorially below:



What is the value of the following?

a) $f(u)$ b) $f(v)$ c) $f(w)$ d) $f(x)$

8. A function f is specified as follows:

$$f : \mathbb{Z} \to \mathbb{Z}$$
$$f(x) = 4x^2 - 5$$

What is the value of the following?

a) $f(3)$ b) $f(-1)$ c) $f(0)$

9. Consider the following function:

$$f: \quad \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$$
$$f(x, y) = 2x^2 + 3y$$

State the value of:

a) $f(2, 0)$ b) $f(1, -1)$

10. $g(x) = 3x + 1$ $f(x) = x^3$

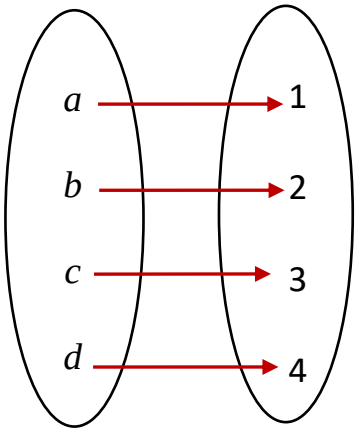
Calculate: $f(g(3))$

11. Write a complete specification (signature and behaviour) of a function that accepts two integers and outputs a number which is twice the sum of these two integers.

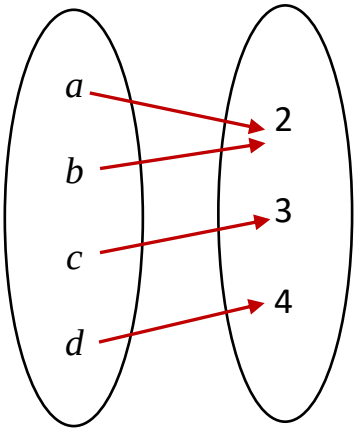
12. Write a Java method that implements the example in question 11.

13. Consider the functions below. For each one, say whether it is an onto function, a one-to-one function, neither or both.

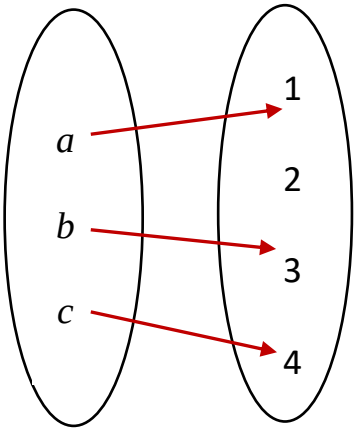
a)



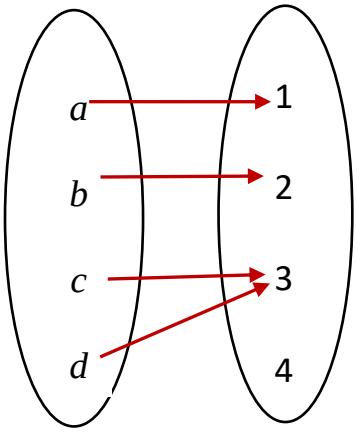
b)



c)



d)



14. Consider the following function: $f: \mathbb{R} \to \mathbb{R}$

$f(x) = x^2$

Is this function a) onto?

b) one-to-one?