4.1 Definitions, Diagrams, and Inverses

4.1.1 Function Terminology

Question 1

Given the function:

$$g : \mathbb{Z} \to \mathbb{N} \qquad \text{...with the rule...} \qquad g(x) = x^2$$

a. What is the function name? g

b. What is the domain? $\mathbb{Z}$

c. What is the codomain? $\mathbb{N}$

d. Is 2 a valid domain value? Yes

e. Is -2 a valid domain value? Yes

f. Is 4 a valid codomain value? Yes

g. Is -4 a valid codomain value? No

Question 2

a. Define a function where the inputs and outputs are integers, and the relationship is that the output is the *square* of the input provided to the function.

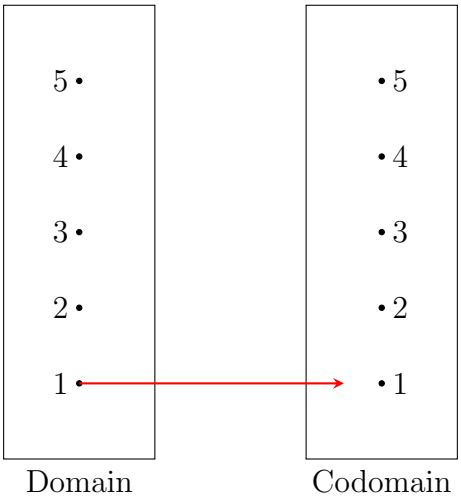
$f : \mathbb{Z} \to \mathbb{Z}$, with $f(x) = x^2$

b. Draw a diagram of the function. Include 5 values in the domain and in the co-domain.

4.1.2 Binary Relations

Question 3

Finish the arrow diagram for the following Binary Relation.
Domain: $\{1, 2, 3, 4, 5\}$
Codomain: $\{1, 2, 3, 4, 5\}$
Rule: { (1,5), (2,3), (3,3), (4,2), (5,1) }



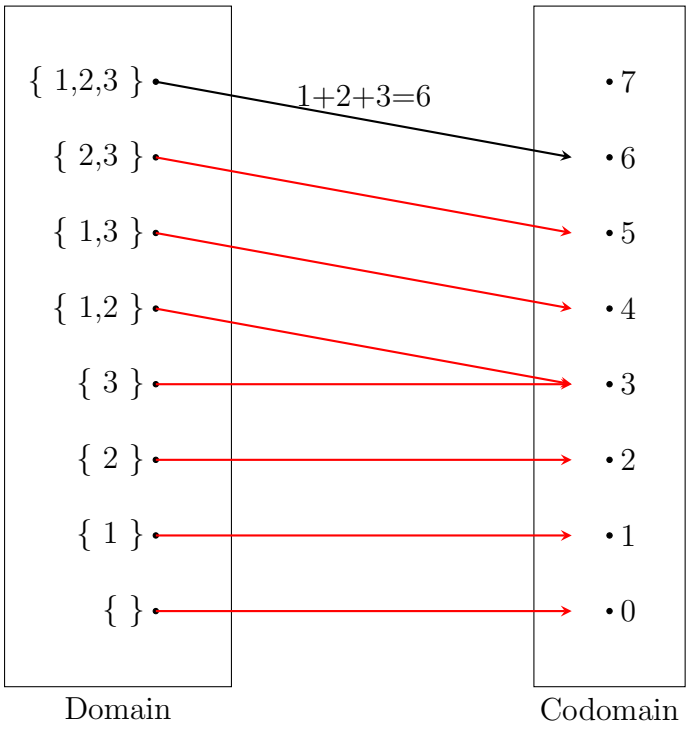
Question 4

Finish the arrow diagram for the following Binary Relation.

Domain: $\wp(\{1, 2, 3\})$, the Power Set of {1, 2, 3}.

Codomain: The set $B = \{0, 1, 2, 3, 4, 5, 6, 7\}$.

Rule: $(S, n) \in \mathbb{R}$
This means that n is the **sum** of elements in the the set S given as an input. For example, with the input set {1, 2}, the output will be $1 + 2$, or 3.



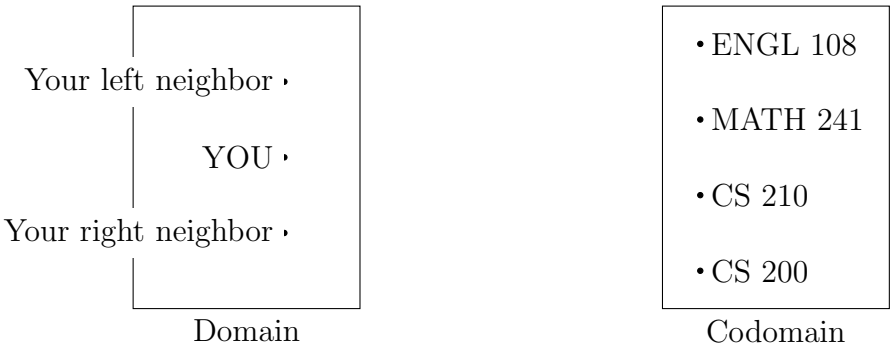
Question 5

Identify which of the following relations are also functions. Explain why not, if the relation is not a function. Also complete the diagrams given.

a. Relation R_1

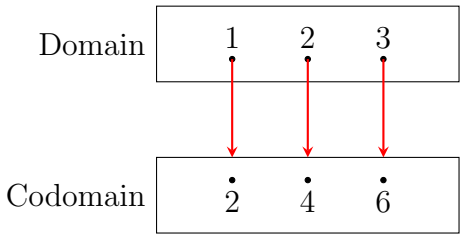
Domain: The set $\mathbb{S}$ of all students at your college this semester.
Codomain: The set $\mathbb{C}$ of all classes offered at your college this semester.
Rule: (x, y) is in R_1 if student x is enrolled in class y this semester.

Let's use a small sample set. Fill it out to help you figure out if this is a function. Not a function; a student can take more than 1 class.



b. Relation R_2

Domain: The set $A = \{1, 2, 3\}$. Codomain: The set $B = \{2, 4, 6\}$.
Rule: (x, y) is in R_2 if $2x = y$. This is a function



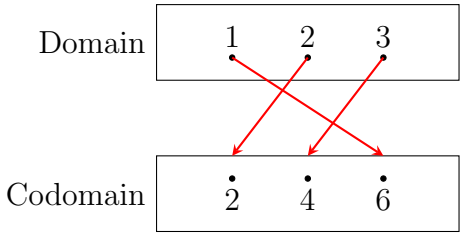
Question 6

Identify which of the following relations are also functions. Explain why not, if the relation is not a function. Also complete the diagrams given.

a. Relation R_3

Domain: The set $A = \{1, 2, 3\}$. Codomain: The set $B = \{2, 4, 6\}$.
Rule: { (1,6), (2,2), (3,4) }

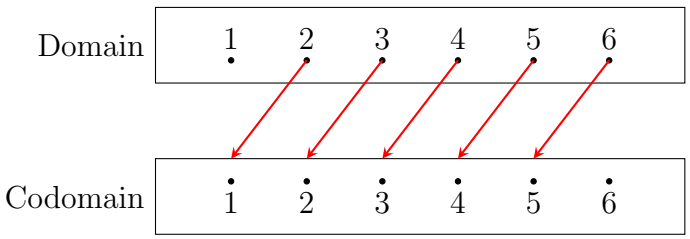
Let's use a small sample set. Fill it out to help you figure out if this is a function. This is a function.



b. Relation R_4

Domain: The set $A = \{1, 2, 3, 4, 5, 6\}$. Codomain: The same set A.

Rule: (x, y) is in R_3 if $x - 1 = y$. This is not a function; 1 doesn't point to anything, and 6 isn't pointed to by anything.

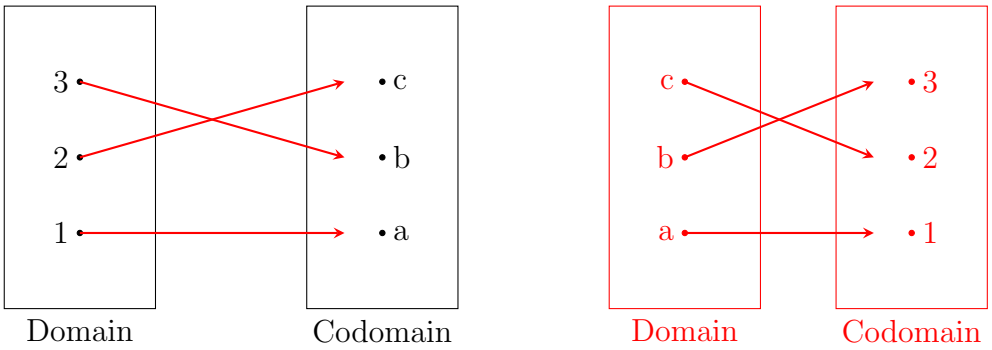


4.1.3 Inverse Relations

Question 7

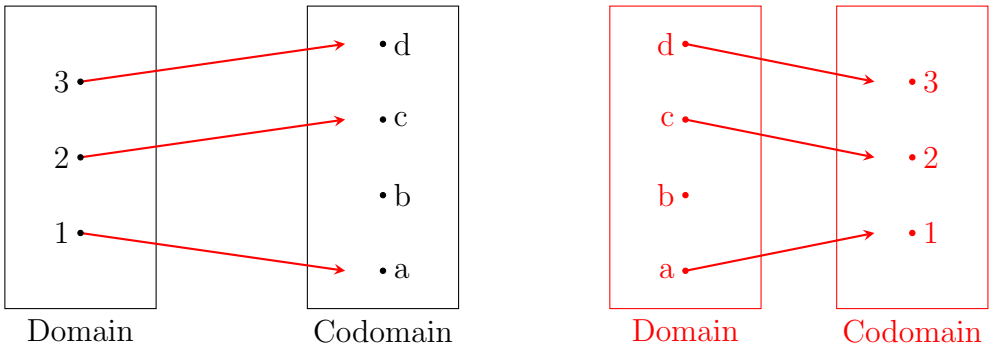
Draw the inverse of each diagram. Identify if the original, and/or the inverse, are functions.

a.



Both are functions.

b.



The original is a function, but the inverse is not a function.