# Ratings encoding

In the table below, each row represents a user's ratings of movies:  $\checkmark$  (check) indicates the person liked the movie,  $\checkmark$  (x) that they didn't, and  $\bullet$  (dot) that they didn't rate it one way or another (neutral rating or didn't watch). Can encode these ratings numerically with 1 for  $\checkmark$  (check), -1 for  $\checkmark$  (x), and 0 for  $\bullet$  (dot).

Person	Fyre	Frozen II	Picard	Ratings written as a 3-tuple
$\overline{P_1}$	Х	•	✓	
$P_2$	1	$\checkmark$	X	
$P_3$	1	✓	✓	
$P_4$	•	X	✓	

## **Definitions**

Term	Notation Example(s)	We say in English
sequence	$x_1, \ldots, x_n$	A sequence $x_1$ to $x_n$
summation	$\sum_{i=1}^{n} x_i \text{ or } \sum_{i=1}^{n} x_i$	The sum of the terms of the sequence $x_1$ to $x_n$
all reals	$\mathbb{R}$	The (set of all) real numbers (numbers on the number line)
all integers	$\mathbb{Z}$	The (set of all) integers (whole numbers including negatives, zero, and positives)
all positive integers	$\mathbb{Z}^+$	The (set of all) strictly positive integers
all natural numbers	N	The (set of all) natural numbers. <b>Note</b> : we use the convention that 0 is a natural number.
piecewise rule definition	$f(x) = \begin{cases} x & \text{if } x \ge 0 \\ -x & \text{if } x < 0 \end{cases}$	Define $f$ of $x$ to be $x$ when $x$ is nonnegative and to be $-x$ when $x$ is negative
function application	f(7) $f(z)$ $f(g(z))$	f of 7 <b>or</b> $f$ applied to 7 <b>or</b> the image of 7 under $f$ $f$ of $z$ <b>or</b> $f$ applied to $z$ <b>or</b> the image of $z$ under $f$ $f$ of $g$ of $z$ <b>or</b> $f$ applied to the result of $g$ applied to $z$
absolute value square root	$\begin{array}{c}  -3  \\ \sqrt{9} \end{array}$	The absolute value of $-3$ The non-negative square root of 9

# Data types

Term	Examples:	
	(add additional	examples from class)
set	$7 \in \{43, 7, 9\}$	$2 \notin \{43, 7, 9\}$
unordered collection of elements		
repetition doesn't matter		
Equal sets agree on membership of all elements		
n-tuple		
ordered sequence of elements with $n$ "slots" $(n > 0)$		
repetition matters, fixed length		
Equal n-tuples have corresponding components equal		

#### string

ordered finite sequence of elements each from specified set repetition matters, arbitrary finite length Equal strings have same length and corresponding characters equal

### $Special\ cases:$

When n = 2, the 2-tuple is called an **ordered pair**.

A string of length 0 is called the **empty string** and is denoted  $\lambda$ .

A set with no elements is called the **empty set** and is denoted  $\{\}$  or  $\emptyset$ .

## Defining sets

To define sets:

To define a set using **roster method**, explicitly list its elements. That is, start with { then list elements of the set separated by commas and close with }.

To define a set using **set builder definition**, either form "The set of all x from the universe U such that x is ..." by writing

$$\{x \in U \mid ...x...\}$$

or form "the collection of all outputs of some operation when the input ranges over the universe U" by writing

$$\{...x... \mid x \in U\}$$

We use the symbol  $\in$  as "is an element of" to indicate membership in a set.

**Example sets**: For each of the following, identify whether it's defined using the roster method or set builder notation and give an example element.

### Defining functions ratings

Recall our representation of Netflix users' ratings of movies as n-tuples, where n is the number of movies in the database. Each component of the n-tuple is -1 (didn't like the movie), 0 (neutral rating or didn't watch the movie), or 1 (liked the movie).

Consider the ratings  $P_1 = (-1, 0, 1), P_2 = (1, 1, -1), P_3 = (1, 1, 1), P_4 = (0, -1, 1)$ 

Which of  $P_1$ ,  $P_2$ ,  $P_3$  has movie preferences most similar to  $P_4$ ?

One approach to answer this question: use **functions** to define distance between user preferences.

For example, consider the function  $d_0$ : given by

 $d_0(((x_1, x_2, x_3), (y_1, y_2, y_3))) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + (x_3 - y_3)^2}$ 

Extra example: A new movie is released, and  $P_1$  and  $P_2$  watch it before  $P_3$ , and give it ratings;  $P_1$  gives  $\checkmark$  and  $P_2$  gives  $\checkmark$ . Should this movie be recommended to  $P_3$ ? Why or why not?

Extra example: Define a new function that could be used to compare the 4-tuples of ratings encoding movie preferences now that there are four movies in the database.