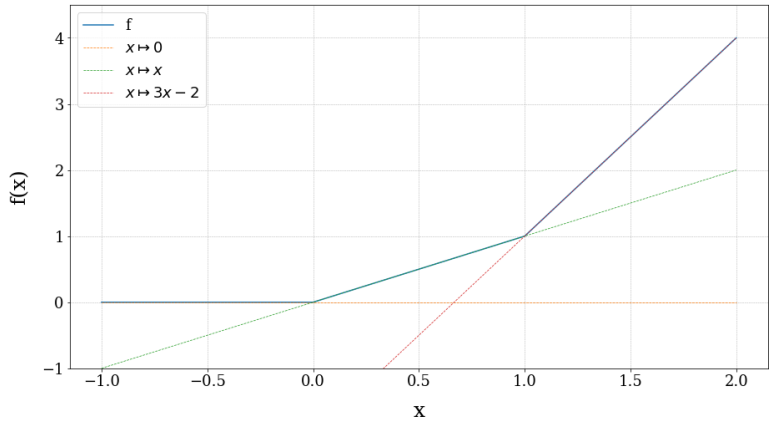
Topic 1

Consider a piecewise linear function defined by:

- f(x) = 0, if x <= 0
- f(x) = x, if 0 < x <= 1
- f(x) = 3x – 2, if 1 < x

Code a function taking as input a numpy array of floats and returning the numpy array of the element-wise application of f to this input. Offer an efficient implementation that takes advantage of vectorized operations (no for loops or maps).



Topic 2

Consider an SQL table named accelerometers containing the following columns:

- wellid, integers
- time, timestamp
- y, double precision[]

Write a query retrieving the list of unique wellid for which at least one y field had an average value lower than –0.5 over the last 12 hours.

Topic 3

Consider a canyon crossed by a bridge. 4 characters stand on one side of the canyon, each of them needs a different number of time units to cross the bridge: 1, 2, 5 and 10. They start with a torch that is necessary to cross the bridge.

No more than 2 characters can cross the bridge at once, one of them must be holding the torch during the crossing, and the slowest one sets the time required to get to the other side.

Can you propose a program determining a sequence of actions allowing all of the characters to cross in less than 17 units of time?