



## Matrices

### 1 Why

### 2 Definition

Consider two sets: the natural numbers from 1 to  $n$  and those from 1 to  $m$ . Consider a third non-empty set. A *matrix of* elements of the third set is a function from the cartesian product of the first two sets of natural numbers to the third set. We call such a function a *matrix*.

We think of the objects in the third set as arrayed in a grid or arrayed in a table. We call  $n$  and  $m$  the *dimensions* of the matrix. We call  $n$  the *height* and  $m$  the *width*. If the height of the matrix is the same as the width of the matrix then we call the matrix *square*. If the height is larger than the width, we call the matrix *tall*. If the width is larger than the height, we call the matrix *wide*.

#### 2.1 Notation

Let  $S$  be non-empty set. We denote the set  $n \times m$  over the set  $S$  by  $S^{n \times m}$ -valued matrices by  $S^{n \times m}$ . We often denote matrices by upper-case latin numbers. Let  $A \in S^{n \times m}$ . This means the same as  $A : \{1, \dots, n\} \times \{1, \dots, m\} \rightarrow S$ . We denote  $A(i, j)$  by  $A_{ij}$ .