Tableau 2D

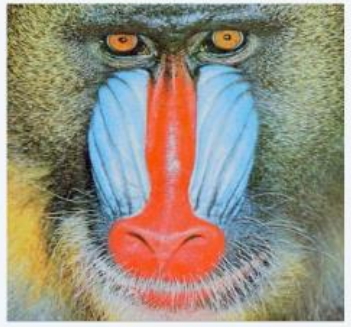
A two-dimensional array is a *doubly-indexed* sequence of values of the same type.

Examples

- Matrices in math calculations.
- Grades for students in an online class.
- Outcomes of scientific experiments.
- Transactions for bank customers.
- Pixels in a digital image.
- Geographic data
- ...

grade

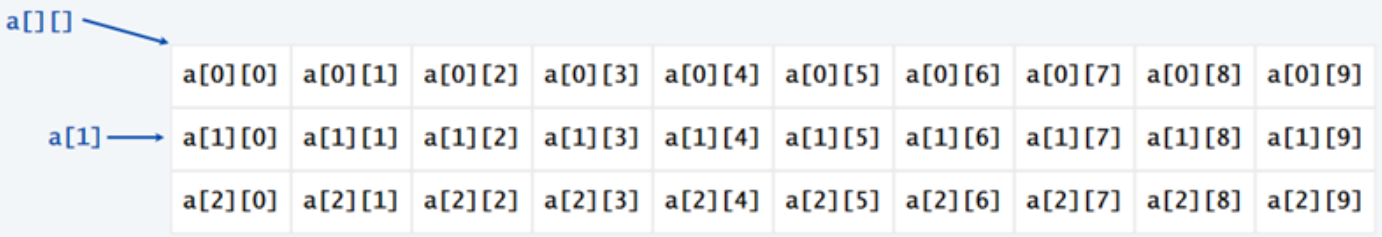
student ID	0	1	2	3	4	5	...
0	A	A	C	B	A	C	
1	B	B	B	B	A	A	
2	C	D	D	B	C	A	
3	A	A	A	A	A	A	
4	C	C	B	C	B	B	
5	A	A	A	B	A	A	
...							



Main purpose. Facilitate storage and manipulation of data.

Java language support for two-dimensional arrays (basic support)

operation	*typical code*
Declare a two-dimensional array	`double[][] a;`
Create a two-dimensional array of a given length	`a = new double[1000][1000];`
Refer to an array entry by index	`a[i][j] = b[i][j] * c[j][k];`
Refer to the number of rows	`a.length;`
Refer to the number of columns	`a[i].length;` ←
Refer to row *i*	`a[i]` ← no way to refer to column j



a 3-by-10 array

Java language support for two-dimensional arrays (initialization)

operation	*typical code*
Default initialization to 0 for numeric types	`a = new double[1000][1000];`
Declare, create and initialize in a single statement	`double[][] a = new double[1000][1000];`
Initialize to literal values	`double[][] p = { { .92, .02, .02, .02, .02 }, { .02, .92, .32, .32, .32 }, { .02, .02, .02, .92, .02 }, { .92, .02, .02, .02, .02 }, { .47, .02, .47, .02, .02 }, };`

no need to use nested loops like

```
for (int i = 0; i < 1000; i++)
   for (int j = 0; j < 1000; j++)
      a[i][j] = 0.0;
```

BUT cost of creating an array is proportional to its size.

Exercice 8

- Ecrire les méthodes suivantes:
  1) Créez un tableau M*N de valeurs aléatoires entre 10 et 100.
  2) Imprimer les valeurs du tableau.
  3) Calculez la moyenne du tableau.
  4) Calculez la moyenne pour chaque ligne du tableau .
  5) Trouvez le maximum du tableau et ses indices.
  6) Trouvez le minimum du tableau et ses indices.
  7) Trouvez le maximum pour chaque ligne du tableau.
  8) Trouvez le minimum pour chaque ligne du tableau.
  9) Trouvez la fréquence d'une valeur dans ce tableau.
  10) Mélanger les lignes d'un tableau de deux dimensions
  11) Mélanger les colonnes d'un tableau de deux dimensions

operation	*typical code*
Declare a two-dimensional array	`double[][] a;`
Create a two-dimensional array of a given length	`a = new double[1000][1000];`
Refer to an array entry by index	`a[i][j] = b[i][j] * c[j][k];`
Refer to the number of rows	`a.length;`
Refer to the number of columns	`a[i].length;` ←
Refer to row *i*	`a[i]` ← no way to refer to column j