

Abstract Data Type

Array

Marian Petruk

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What is an array?



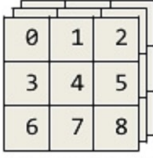
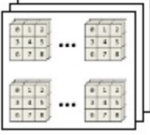
Dimensions	Example	Terminology
1		Vector
2		Matrix
3		3D Array (3 rd order Tensor)
N		ND Array

Figure 1: Visual representation of an array

1 Definition(s)

1. In computer science, **an array data structure**, or simply **an array**, is a data structure consisting of a collection of elements (values or variables), each identified by at least one array index or key. An array is stored so that the position of each element can be computed from its index tuple by a mathematical formula. The simplest type of data structure is a linear array, also called one-dimensional array. - [Wikipedia, the free encyclopedia](#).
2. **An array** keeps track of multiple pieces of information in linear order, a one-dimensional list. However, the data associated with certain systems (a digital image, a board game, etc.) lives in two dimensions. To visualize this data, we need a multi-dimensional data structure, that is, **a multi-dimensional array**. A two-dimensional array is really nothing more than an array of arrays (a three-dimensional array is an array of arrays of arrays). - [Processing.org](#)
3. **The array** is a basic abstract data type that holds an ordered collection of items accessible by an integer index. These items can be anything from primitive types such as integers to more complex types like instances of classes. Since it's an ADT, it doesn't specify an implementation, but is almost always implemented by an array (data structure) or dynamic array. - [Brilliant Math & Science Wiki](#)

2 Array1D

Data:

- Any type

Operation(s):

- `__len__` - Returns the size of the array.
- `__getitem__` - Returns the value of the element on the given index.
- `__setitem__` - Puts (sets) the value in the array's item at the given index position.
- `__clear__` - Clears the array by setting each item to the given value.
- `__str__` - Converts the adt structure of 1D array into a string.
- `__iter__` - Returns the array's iterator for traversing the items.

3 Array2D

Data:

- Any type

Operation(s):

- `num_rows` - Returns the number of rows in the 2D array.
- `num_cols` - Returns the number of columns in the 2D array.
- `clear` - Returns the number of columns in the 2D array.
- `__getitem__` - Returns the number of columns in the 2D array.
- `__setitem__` - Returns the number of columns in the 2D array.
- `__str__` - Converts the 2D array into a string.

4 Usage

In this project, ADT of the 2 dimensional array will be used. In one column there will be a data from a country (e.g. UA), and in other another country (e.g. PL). Rows will be filled with data from The World Bank. Every 2D array will consist data from one indicator.

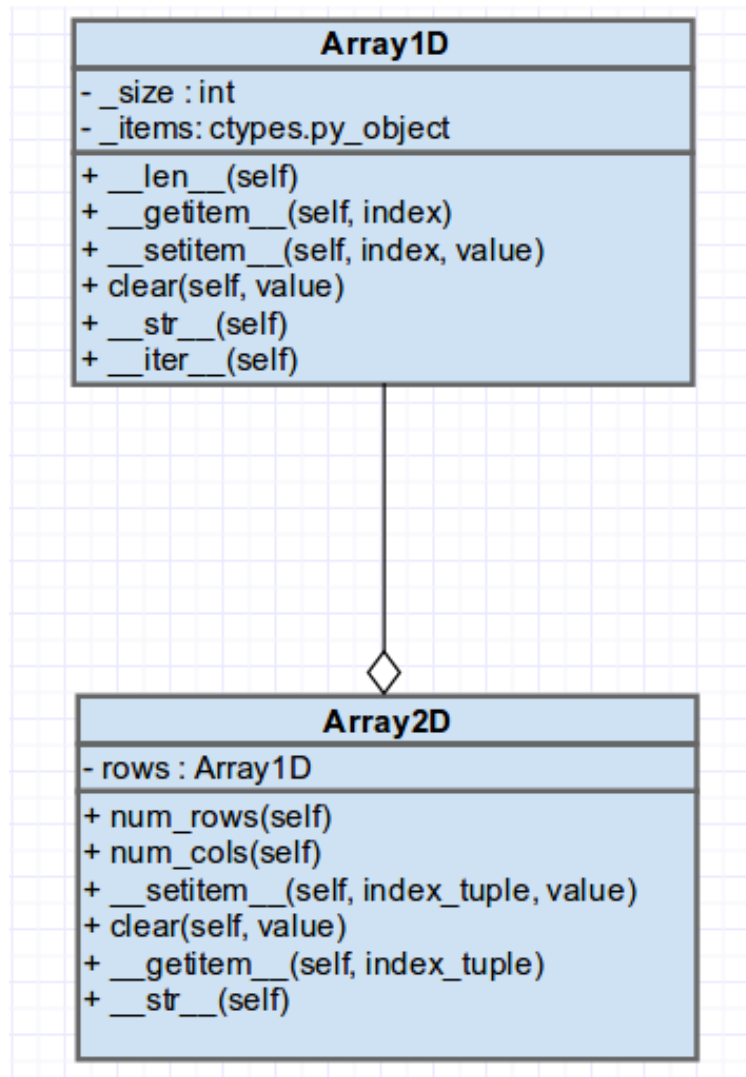


Figure 2: *UML Diagram of Array1D and Array2D classes*

5 Indicators

```
#                               Indicators                               #
# -----#
#                               Economy and growth                       #
# -----#

gdp = "NY.GDP.MKTP.CD" # GDP (current US$)
gdp_per_capita = "NY.GDP.PCAP.CD" # GDP per capita (current US$)
gross_savings = "NY.GNS.ICTR.ZS" # Gross savings (% of GDP)
inflation_gdp = "NY.GDP.DEFL.KD.ZG" # Inflation, GDP deflator (annual %)
imports = "NE.IMP.GNFS.ZS" # Imports of goods and services (% of GDP)
inflation_consumer_prices = "FP.CPI.TOTL.ZG" # Inflation, consumer prices (annual %)
gni = "NY.GNP.MKTP.PP.CD" # GNI, PPP (current international $)

# -----#
#                               Some other indicators                       #
# -----#

total_population = "SP.POP.TOTL" # total population indicator
life_expectancy = "SP.DYN.LE00.IN" # Life expectancy at birth, total (years)
high_tech_exports = "TX.VAL.TECH.CD" # High-technology exports (current US$)
science_tech_articles = "IP.JRN.ARTC.SC" # Scientific and technical journal articles
```

6 Example

Result of using data structure for total population indicator of Ukraine and Poland from 1990 to 2017 (2016):

```
>>> dataset = api.get_dataset(total_population, iso_country_codes, date="1990:2017")
>>> gdp_2d_array = Array2D(27, 2)
>>> gdp_2d_array[(0, 0)] = "UA"
>>> gdp_2d_array[(0, 1)] = "PL"
>>> for i in range(1, 27):
>>> ... gdp_2d_array[(i, 0)] = dataset.as_dict()['UA'][str(i-1+1990)]
>>> ... gdp_2d_array[(i, 1)] = dataset.as_dict()['PL'][str(i-1+1990)]
>>> print(gdp_2d_array)
UA PL
51892000.0 38110782.0
52000470.0 38246193.0
52150266.0 38363667.0
52179210.0 38461408.0
51921041.0 38542652.0
51512299.0 38594998.0
51057189.0 38624370.0
50594105.0 38649660.0
50143939.0 38663481.0
49673350.0 38660271.0
```

49175848.0 38258629.0
48683865.0 38248076.0
48202500.0 38230364.0
47812950.0 38204570.0
47451600.0 38182222.0
47105150.0 38165445.0
46787750.0 38141267.0
46509350.0 38120560.0
46258200.0 38125759.0
46053300.0 38151603.0
45870700.0 38042794.0
45706100.0 38063255.0
45593300.0 38063164.0
45489600.0 38040196.0
45271947.0 38011735.0
45154029.0 37986412.0
