Nested Loop

Loop inside another loop

Nested Loop Example

```
// in a spreadsheet

Iterate all the row {

  In each row iteration

     Iterate over each column{
       read the value of cell
     }

     }
```

Excel Sheet

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

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Nested Loop

```
//a nested for loop
for (int r = 0; r < 2; r++) {

    for (int k = 0; k < 3; k++) {

      System.out.print("|Row"+ r + "-Column"+k + "| ");

    }
     System.out.println();

}
```

Nested Loop

```
//Nested for each loop
   int[] rows = {1,2,3,4};
   int[] cols = {1,2,3};
   for (int row : rows) {

     for (int col : cols) {
       System.out.print(" |Row"+row+ "-Column"+col);
     }
     System.out.println();

   }
```

Nested Loop

```
// a nested while loop
  int i = 0 ;
while(i<5) {
    i++;
    int j = 0 ;
    while(j<3) {
      j++;
      System.out.print(" |Row"+i+"-Column"+j);
    }
    System.out.println();

}
```

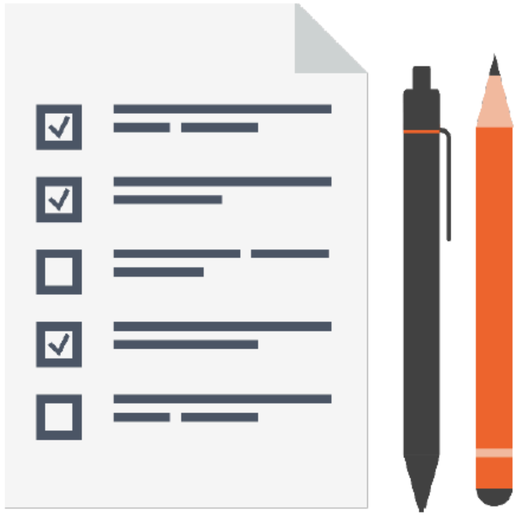
Nested Loop

```
// a nested while loop
int i1 = 0 ;
do {
  i1++;
  int j = 0 ;
     do{
       j++;
       System.out.print(" |Row"+i1+"-Column"+j);
     } while(j<3) ;

  System.out.println();

}while(i1<5);
```

Nested Loop

```
//Nested for loop and while loop
   for (int j = 0; j < 4; j++) {

     int k=0;
     while(k<3) {
       System.out.print(" |Row"+j+"-Column"+k);
       k++ ;
     }
     System.out.println();
   }
```

Java Programming
Agenda



- Understanding Java Arrays
- Sorting an Array
- Using binary-search
- Multi-Dimensional Array

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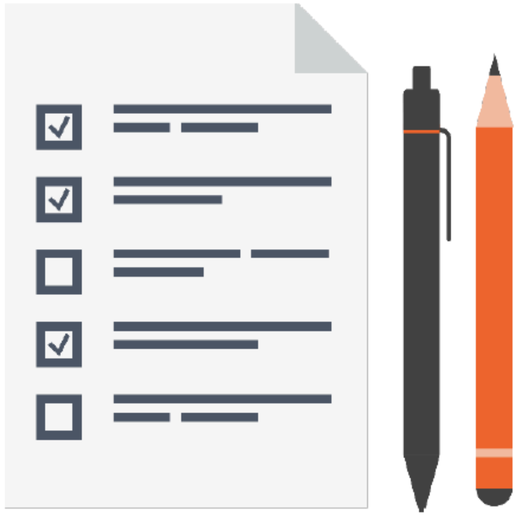
After today's session you should be able to:



- Have better understanding of Array
- Learn Arrays class to sort an Array
- Use Arrays class to binary search
- Understand and create Multi-Dimensional Array

- Create :
  Simple program using Arrays

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Array

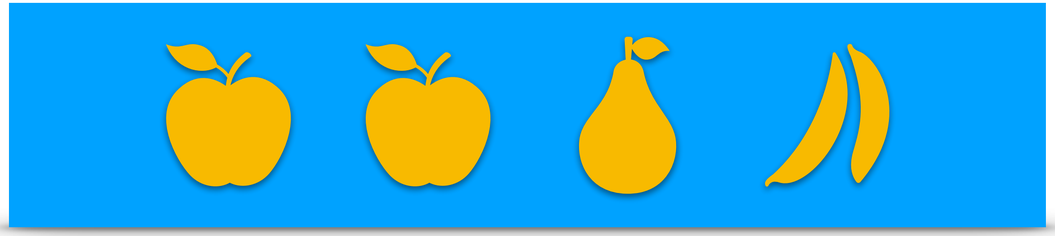
Single Object that hold multiple value of same type

Examples

Grocery List

Contacts

Prime Numbers



2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Creating an Array

```
// Syntax format

dataType [ ] variableName = new  dataType[size] ;
```

Creating an Array of Primitives

```
// Syntax for creating int Array

    int[ ] numbers = new int[3];

   // or

   int numbers[ ]  = new int[3];
```

numbers

Element	0	0	0
Index	0	1	2

Creating an Array of Primitives

```
// Syntax for creating int Array

int[ ] numbers = new int[3];

  numbers[0] = 2 ;
  numbers[1] = 5 ;
  numbers[2] = 7 ;
```

numbers

Element	2	5	7
Index	0	1	2

Creating an Array

```
// Syntax for creating int Array

    int[ ] numbers = new int[ ] {2, 5, 7};

// or directly as below

    int[ ] numbers =  {2, 5, 7};
```

numbers

Element	2	5	7
Index	0	1	2

String Array Example

```
// Syntax for creating String Array

      String[ ] names = new String[ ] {“John”,”Adam”, “Don”};

// or directly as below


    String[ ] names = {“John”,”Adam”, “Don”};
```

names

Element	John	Adam	Don
Index	0	1	2

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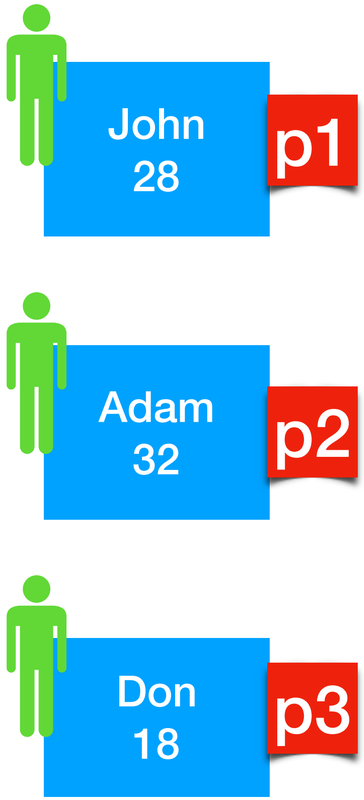
Creating an Array of Reference Type

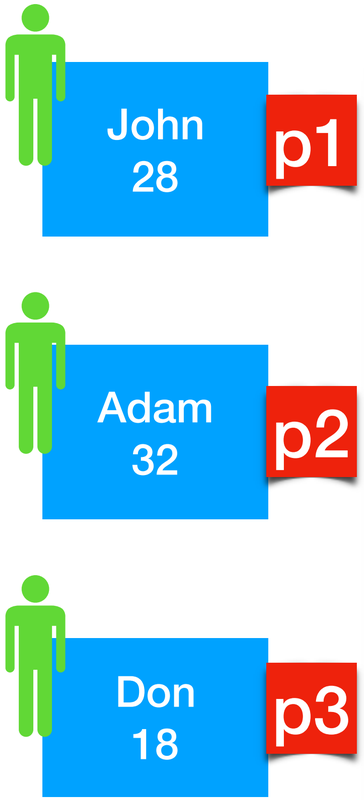



```
// Syntax for creating Person Array

Person p1 = new Person();  //assume name and age assigned already
Person[ ] people = new Person[3];

  people[0] = p1 ;
  people[1] = p2 ;
  people[2] = p3 ;
```

people

Element	p1	p2	p3
Index	0	1	2

Creating an Array of Reference Type




```
// Syntax for creating Person Array

Person[ ] people = new Person[ ] {p1, p2, p3};

// or

Person[ ] people = {p1, p2, p3};
```

people

Element	p1	p2	p3
Index	0	1	2

Using an Array

```
// Syntax for accessing Array elements
 int[] intArray = {2,5,7};

 System.out.println("Numbers 1 " + numbers[0]);
 System.out.println("Numbers 2 " + numbers[1]);
 System.out.println("Numbers 3 " + numbers[2]);
```

numbers

Element	2	5	7
Index	0	1	2

Looping an Array

```
String[] names = {“John”,”Adam”, “Don”};
for (int i = 0; i < names.length(); i ++) {

    System.out.println(“names ” +names[i]);

 }
```

Looping an Array

```
String[] names = {“John”,”Adam”, “Don”};
for (String item: names) {

    System.out.println(“names ” +item);

 }
```

Arrays Class

Using **Arrays** Class from java.util package for common array operations

```
import  java.util.Arrays;

import  java.util.*;
```

Arrays Class

```
int[] targetArrayObject = {11,4,6};
 int   targetItemToSearch = 4 ;

 Arrays.sort(targetArrayObject) ; // 4,6,11
Arrays.binarySearch(targetArrayObject, targetItemToSearch); //0
// Optionally
 Arrays.toString(targetArrayObject);// [4,6,11]
```

Sorting an Array

```
 int[] intArray = {2,15,7,1,3};
// Syntax for sorting Array elements
 Arrays.sort(intArray);

 for (int item: intArray) {

     System.out.println("numbers " +item);

  }
```

Before

Element	2	15	7	1	3
Index	0	1	2	3	4

After

Element	1	2	3	7	15
Index	0	1	2	3	4

Getting string value of Array items

```
int[] ints = {2,15,7,1,3};

Arrays.sort(ints);
// Syntax for sorting Array elements
System.out.println(Arrays.toString(ints));

System.out.println(ints); //[I@7a46a697
```

Sorting a String Array

```
 String[] names = {“John”,”Adam”, “Don”};
// Syntax for sorting Array elements
 Arrays.sort(ints);
 for (String item: names) {

     System.out.println(“names ” +item);

  }
```

Before

Element	John	Adam	Don
Index	0	1	2

After

Element	Adam	Don	John
Index	0	1	2

Searching within an Array

Arrays Class from java.util package provide convenient way to search ONLY IF the array is already sorted

```
// Syntax format
Arrays.binarySearch(yourArray, element) ;
```

Binary search result

Senario	Result
Element found in sorted array	Index of match
Element not found in sorted array	Negative value showing one smaller than the negative of index, where m match needs to be instead to preserve sorted order
Unsorted Array	Unpredictable result

Using Binary Search

```
// Syntax for accessing Array elements
  int[] ints = {2,5,7,14};

System.out.println(Arrays.binarySearch(ints,2));  0
System.out.println(Arrays.binarySearch(ints,7));  2
System.out.println(Arrays.binarySearch(ints,9));  -4
System.out.println(Arrays.binarySearch(ints,15)); -5
```

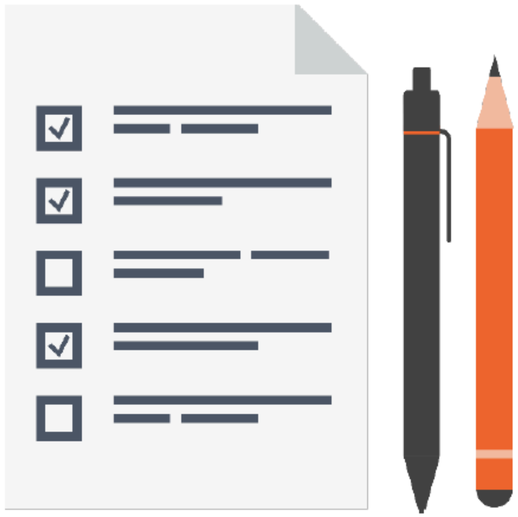
Element	2	5	7	14
Index	0	1	2	3

Using Varargs

Varargs is short for variable arguments where you can pass a variable number of argument with same type.

It can be seen same as array when used as method parameters

Java Programming
Agenda



- Understanding Multi-Dimensional Array
- Declaring , Constructing , Initializing Multi-Dimensional Array
- Accessing multi-dimensional Array items using nested loop

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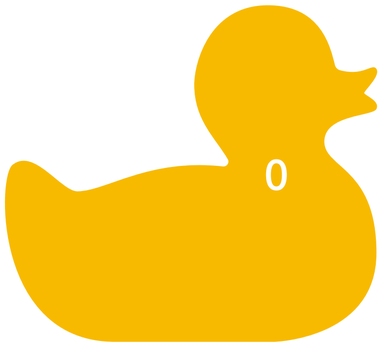
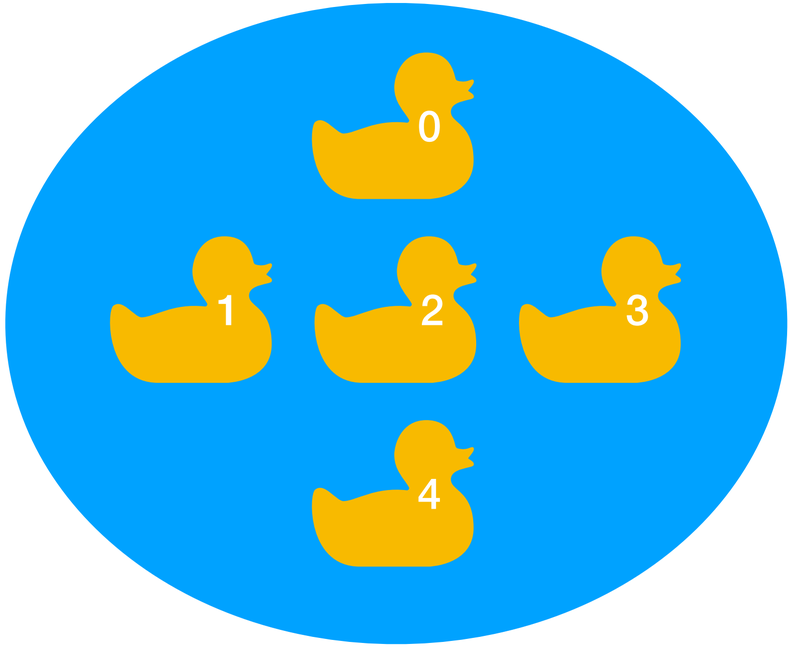
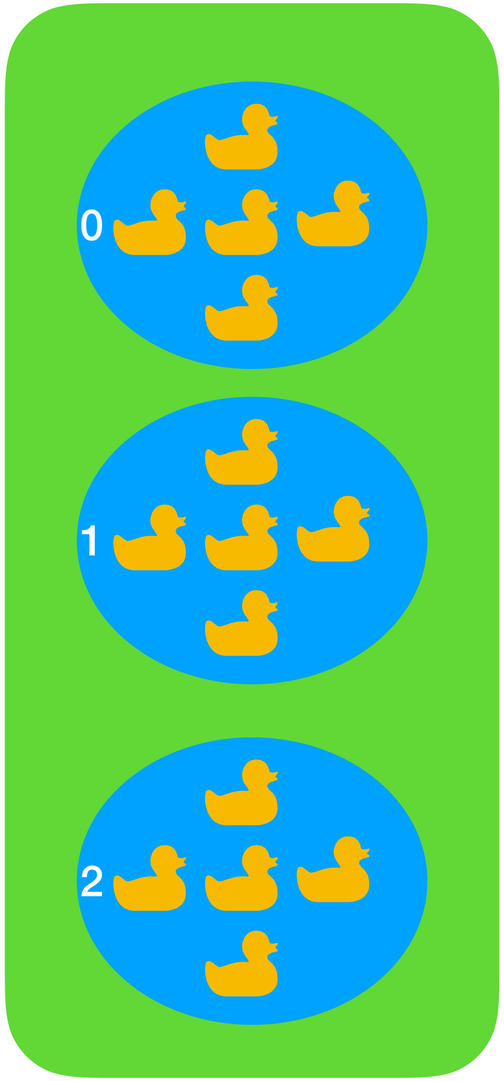
Multi Dimensional Array

An Array Object that store other arrays



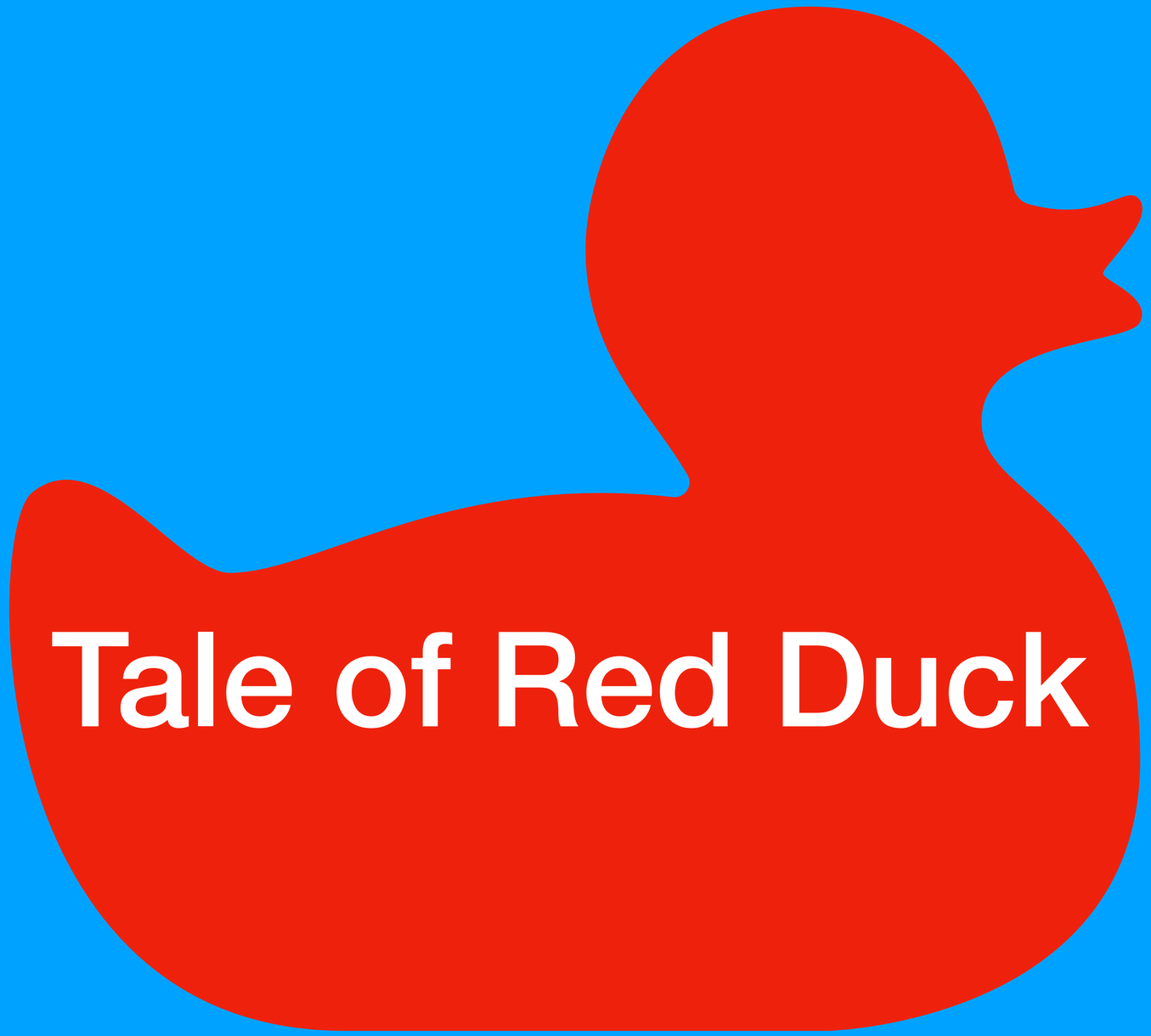





```
int singleDuck ;
```

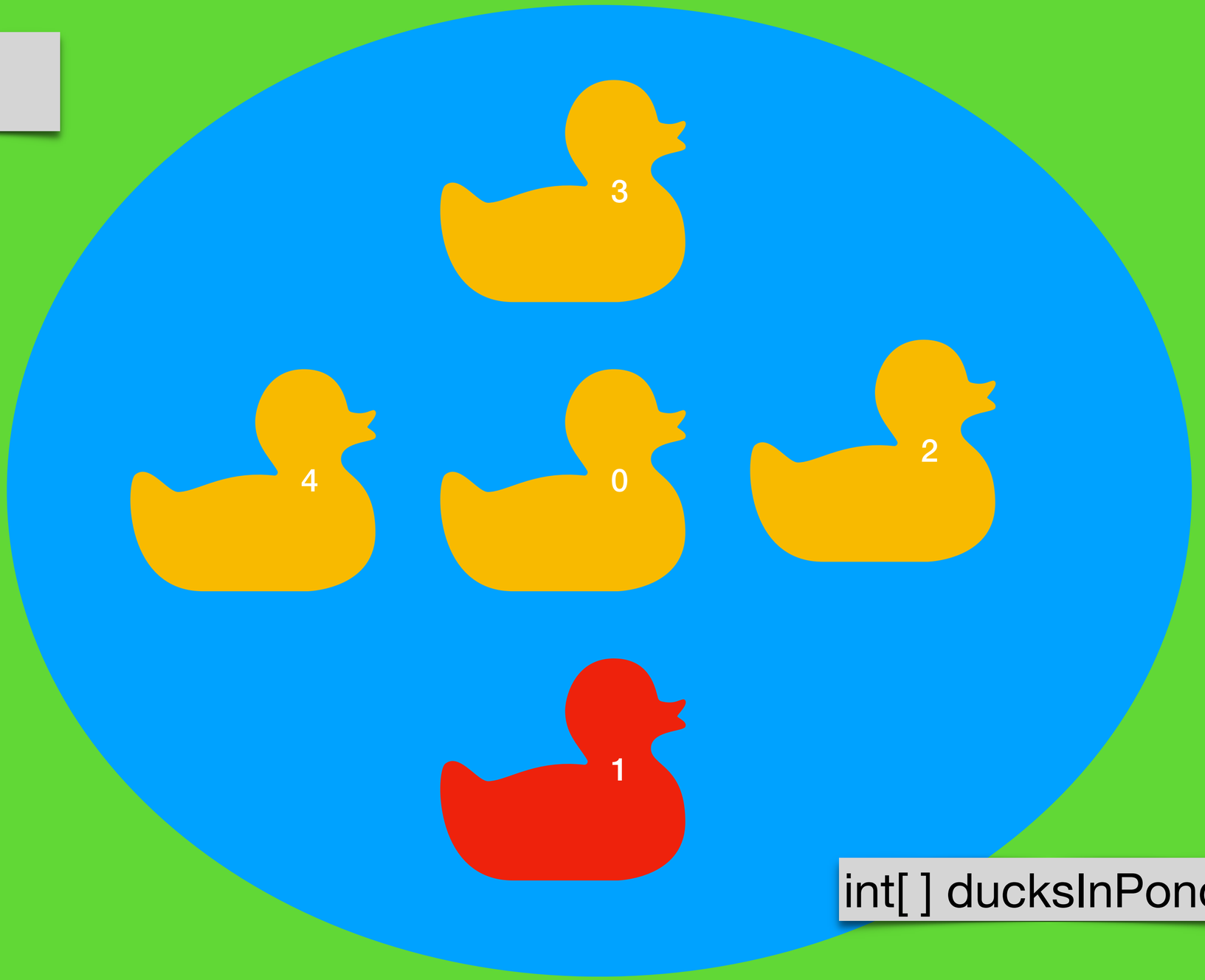
```
int[ ] ducks ;
```

```
int[ ][ ] groupsOfDucks;
```



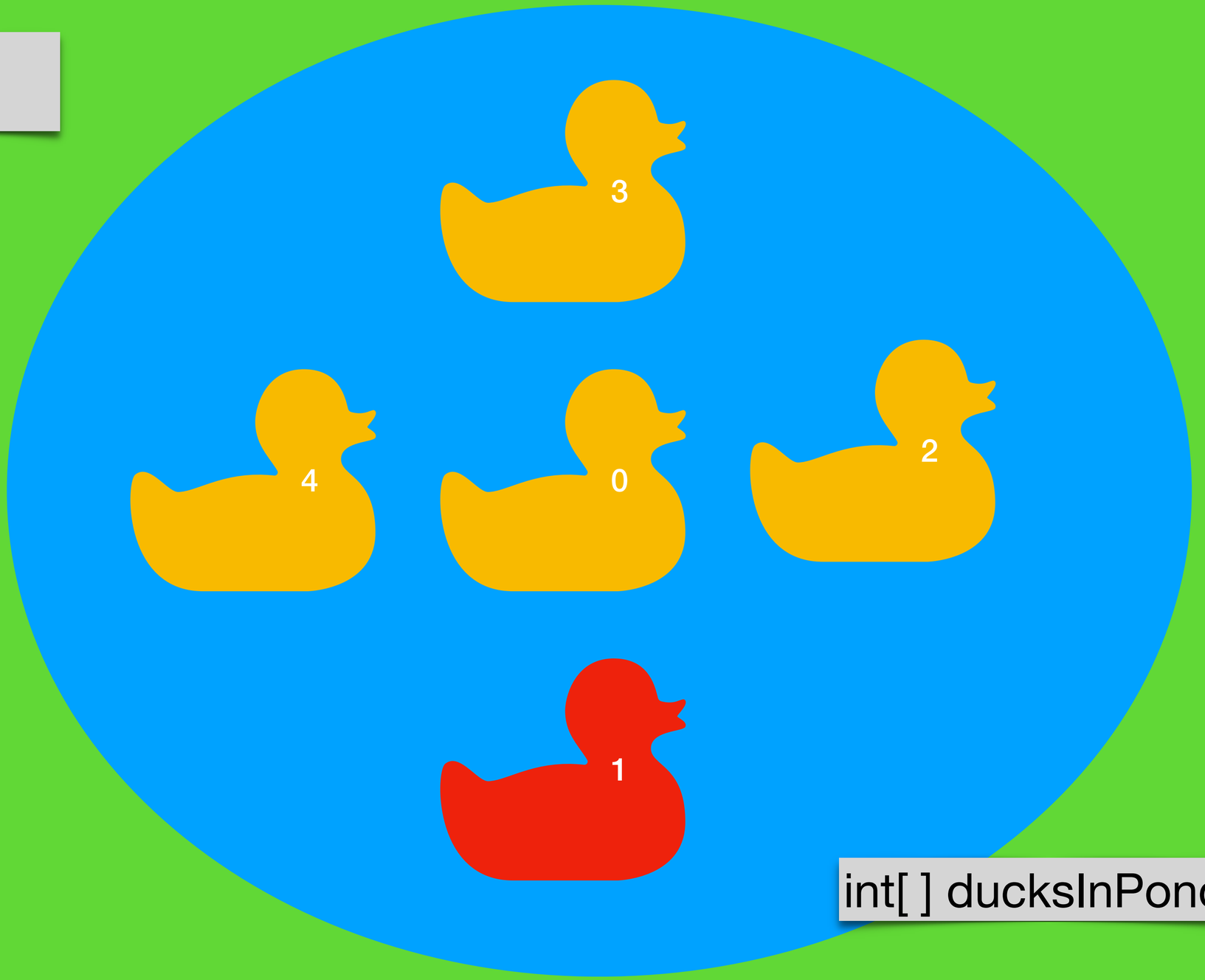

```
int singleDuck;
```

5 ducks



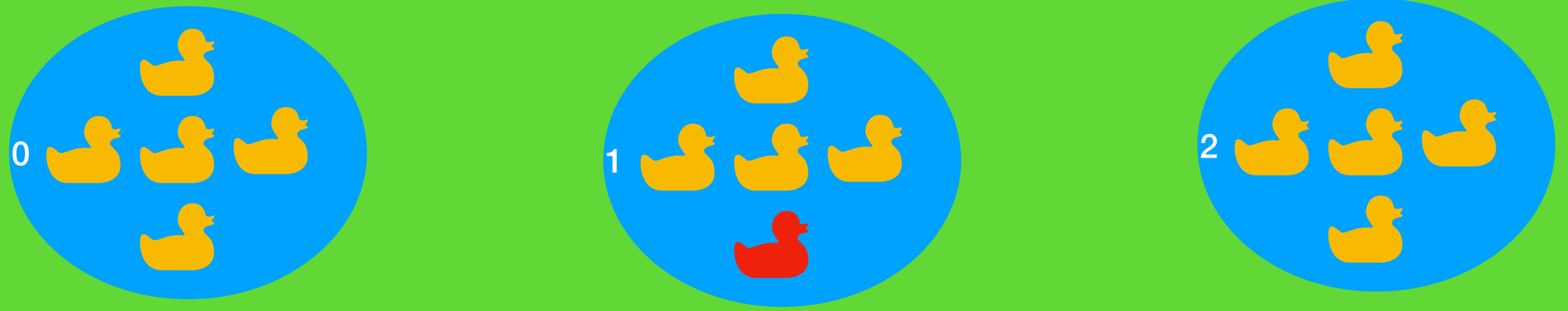
int[ ] ducksInPond;

5 ducks



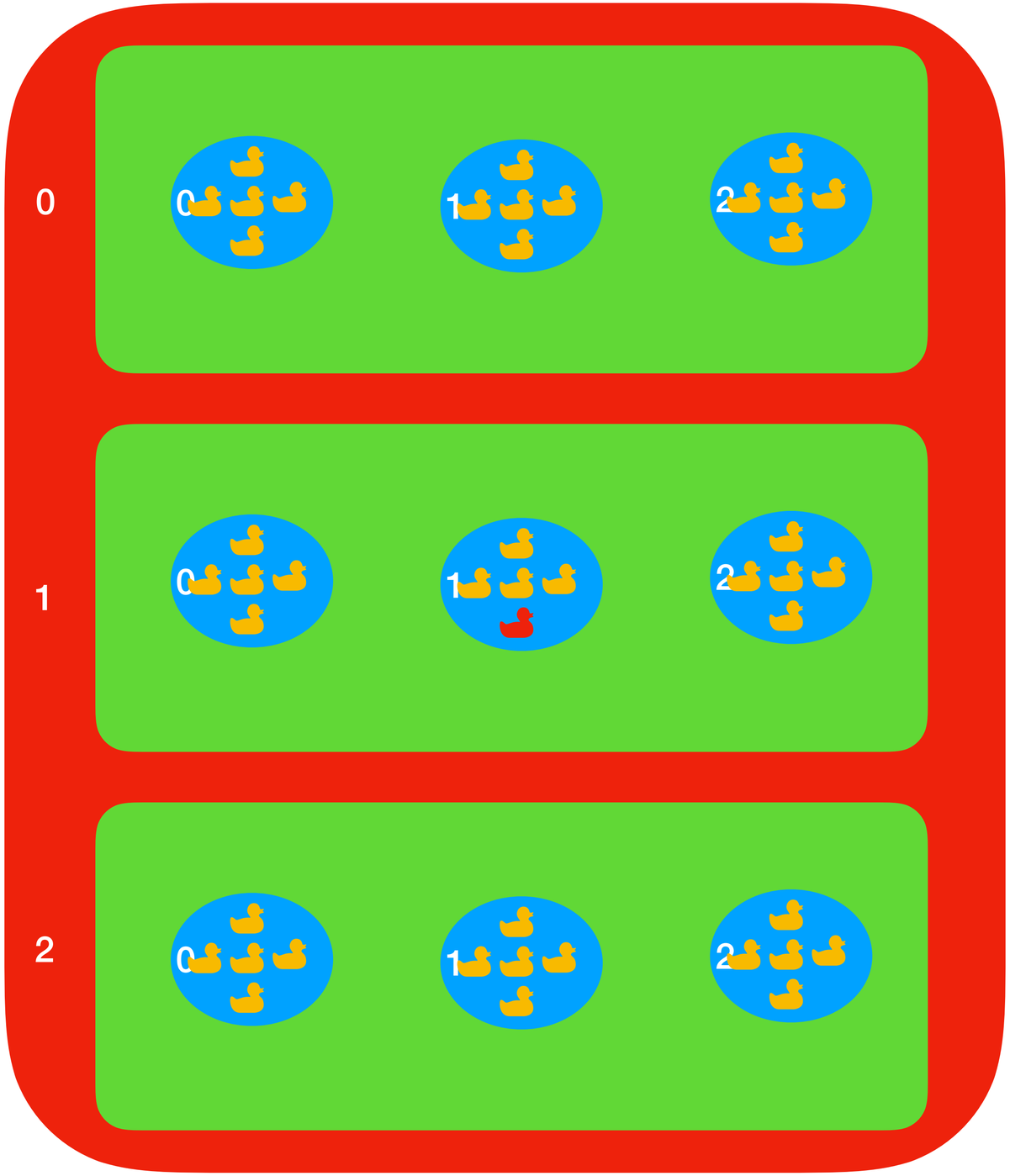
int[ ] ducksInPond;

3 ponds



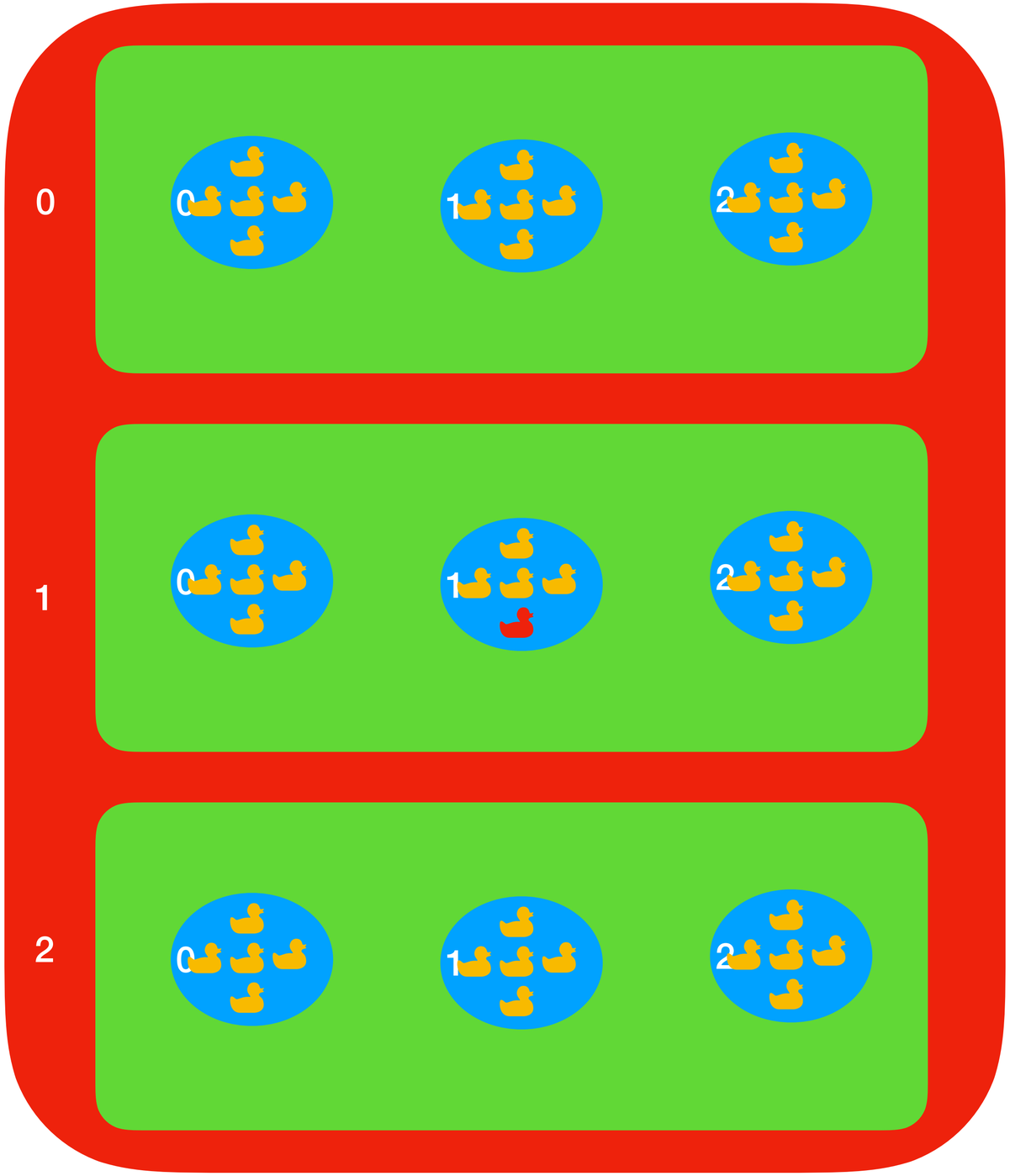

```
int[ ][ ] DuckFarm;
```

3 farms



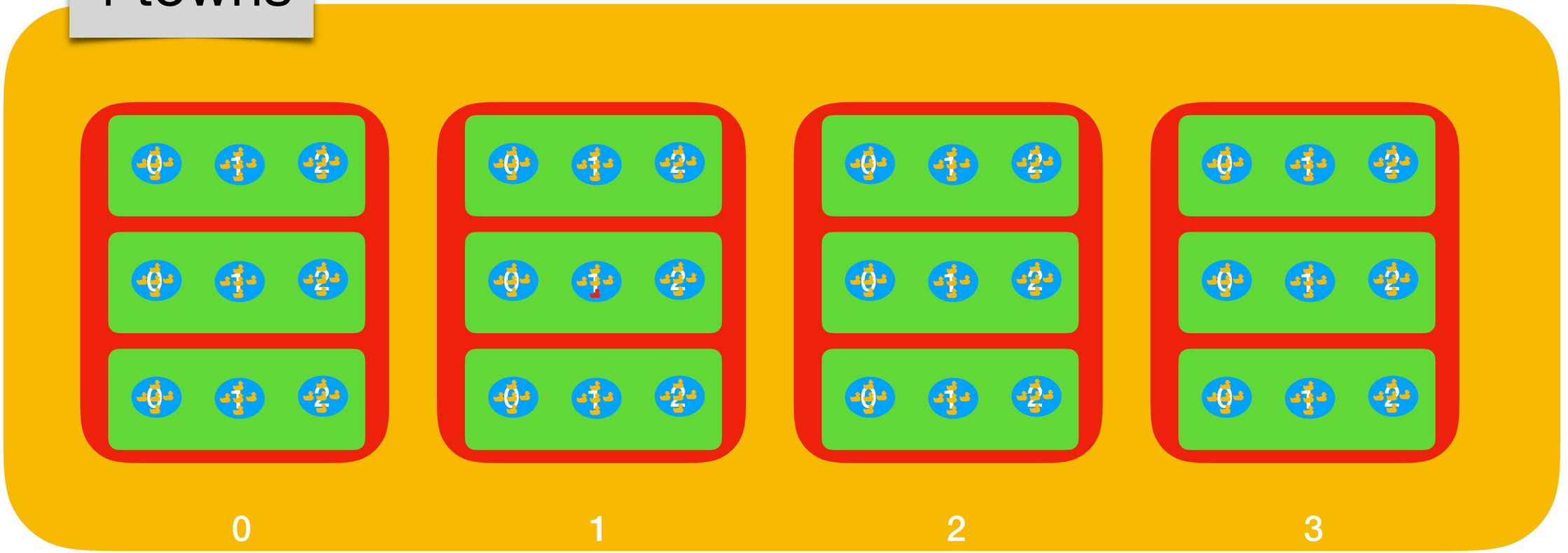

```
int[ ][ ][ ] duckTown;
```

3 farm



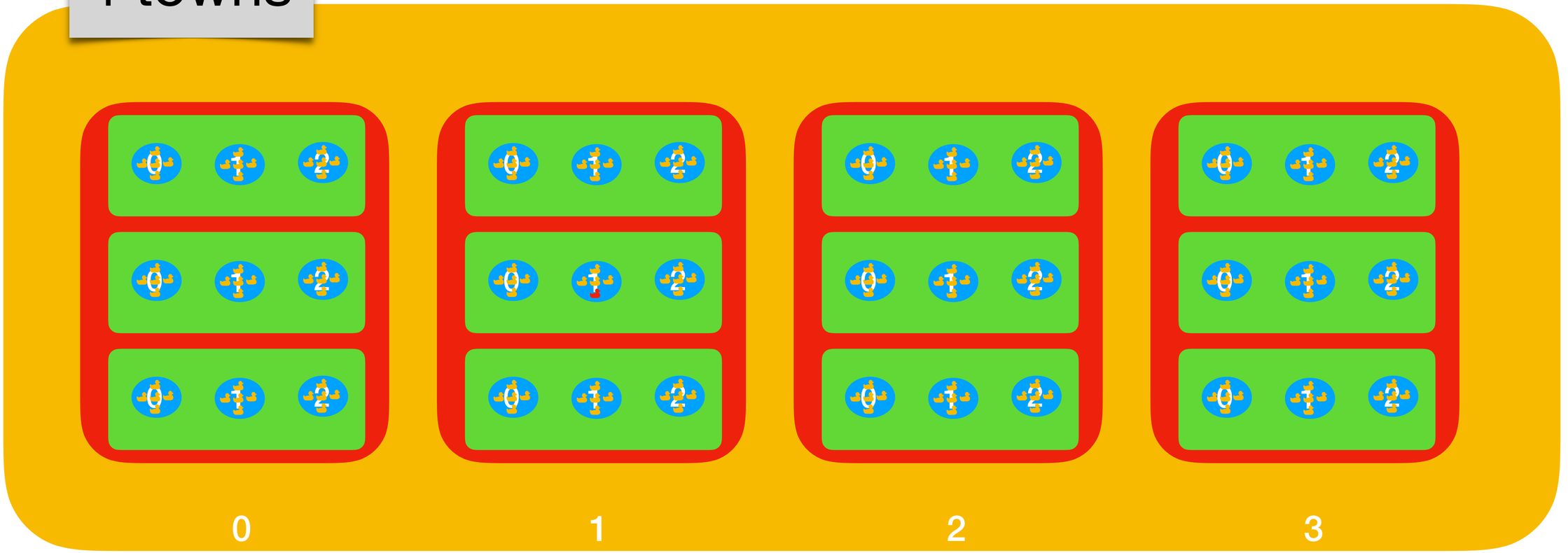

```
int[ ][ ][ ] duckTown;
```

4 towns




```
int[ ][ ][ ][ ] duckCounty;
```

4 towns




```
int[ ][ ][ ][ ] duckCounty;
```

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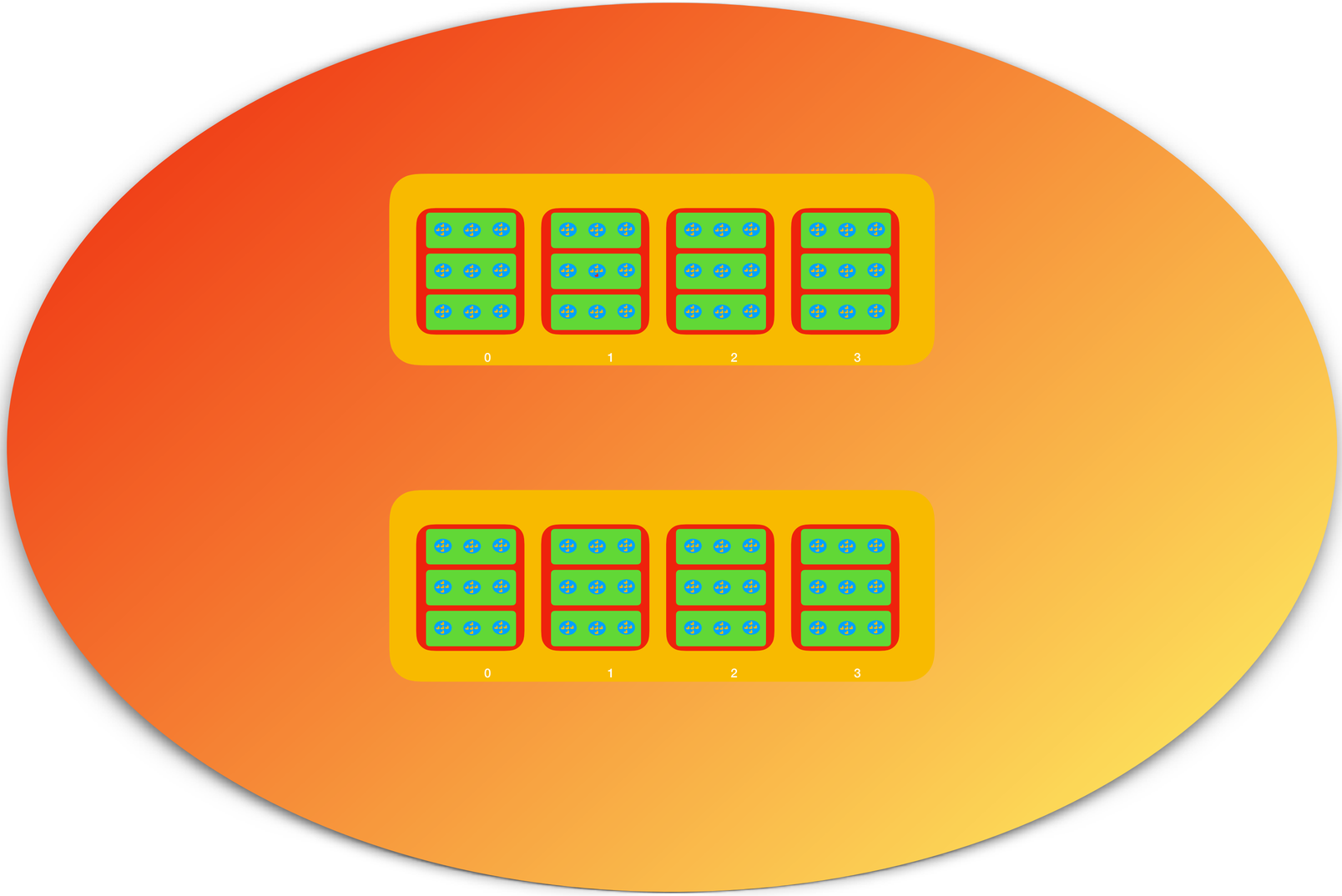


```
int[ ][ ][ ][ ][ ] duckDynasty;
```

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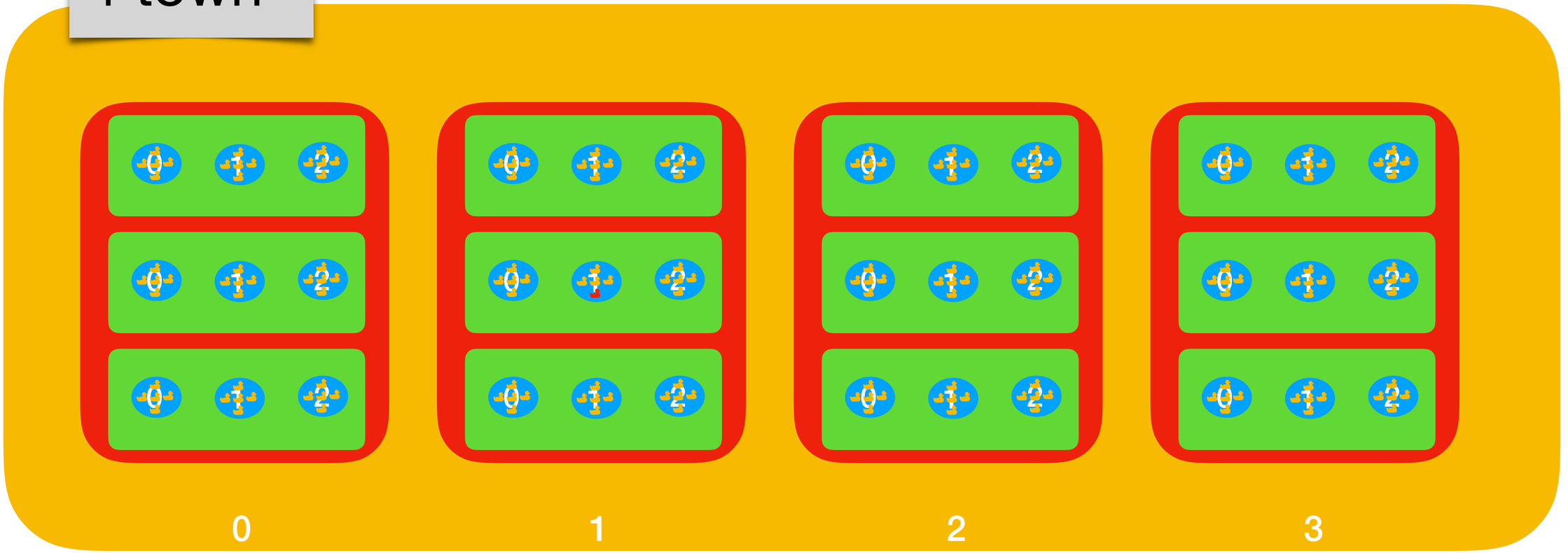
4 town




```
int[ ][ ][ ][ ] duckCounty;
```

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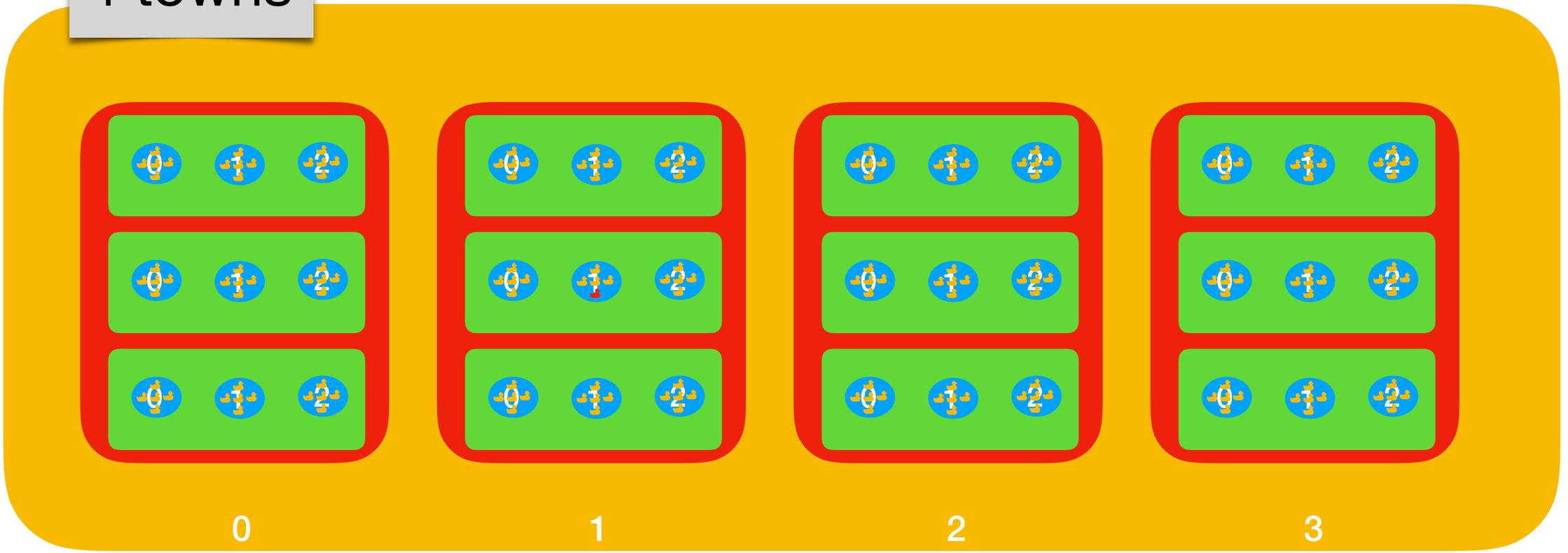
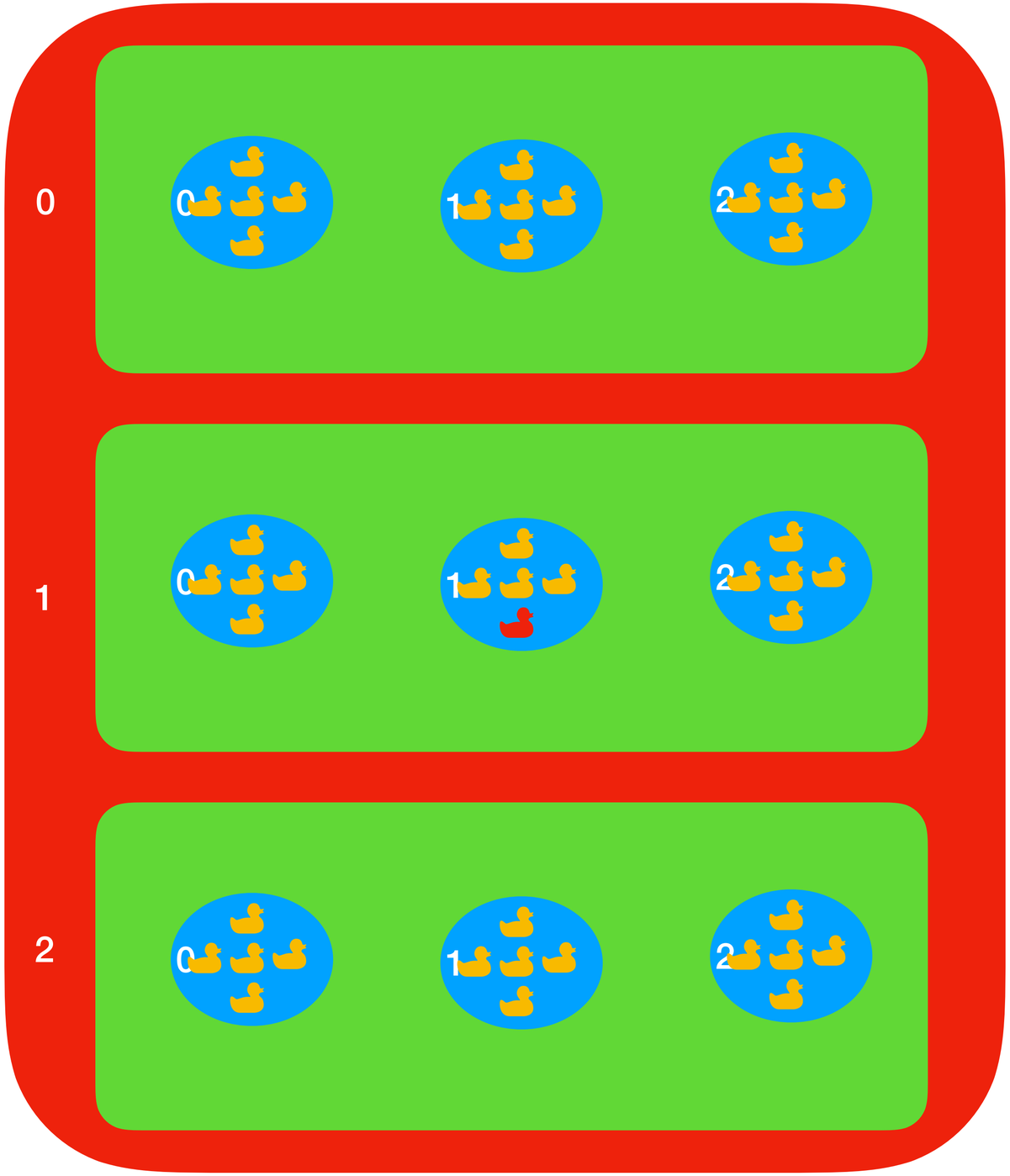
4 towns



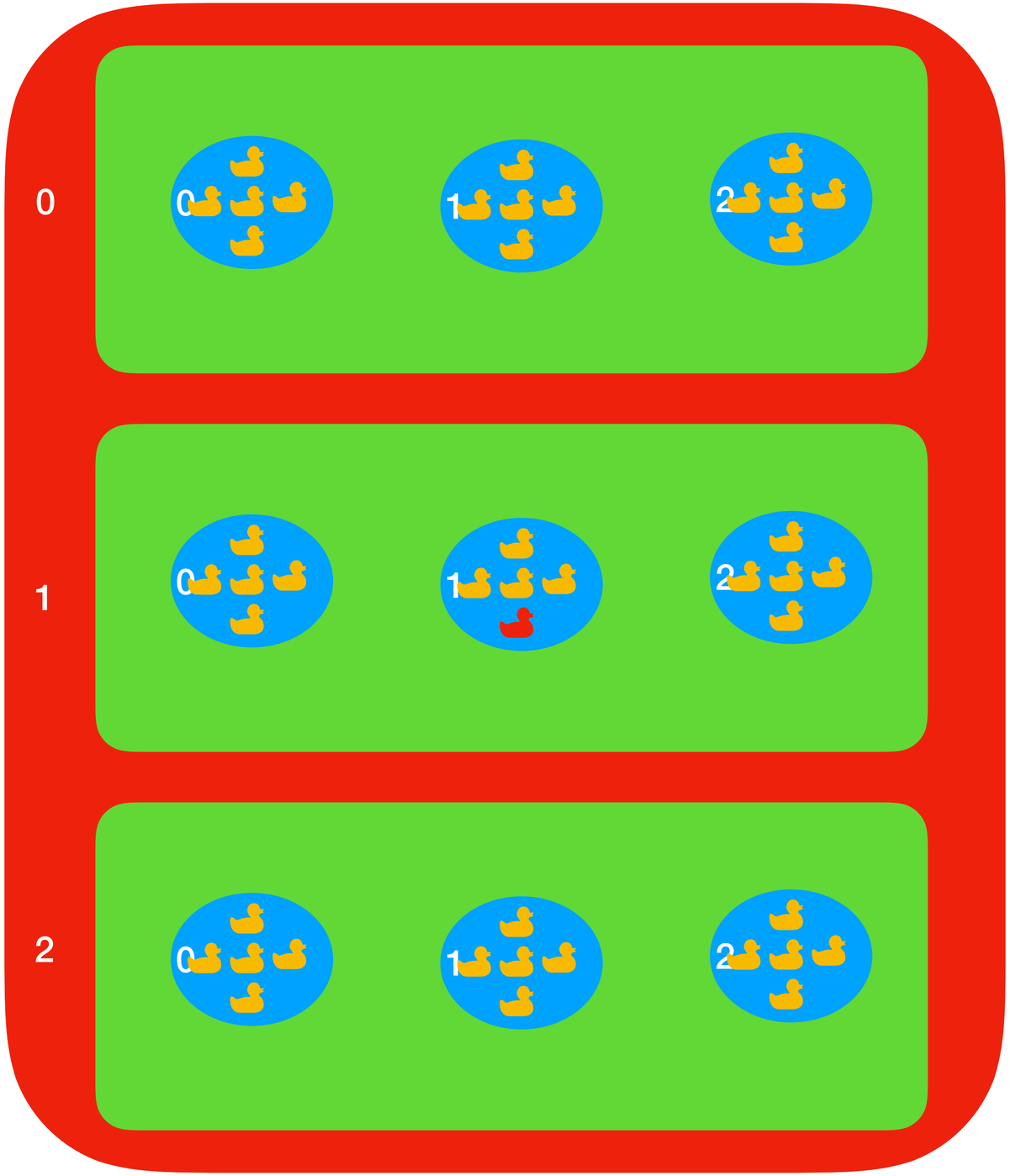

```
int[ ][ ][ ][ ] duckCounty;
```

3 farm



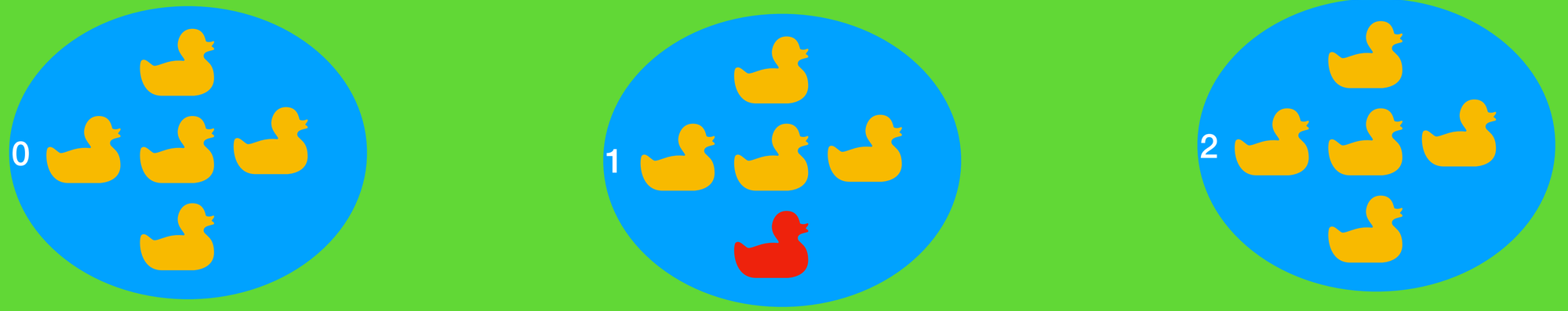

```
int[ ][ ][ ] duckTown;
```

3 farms



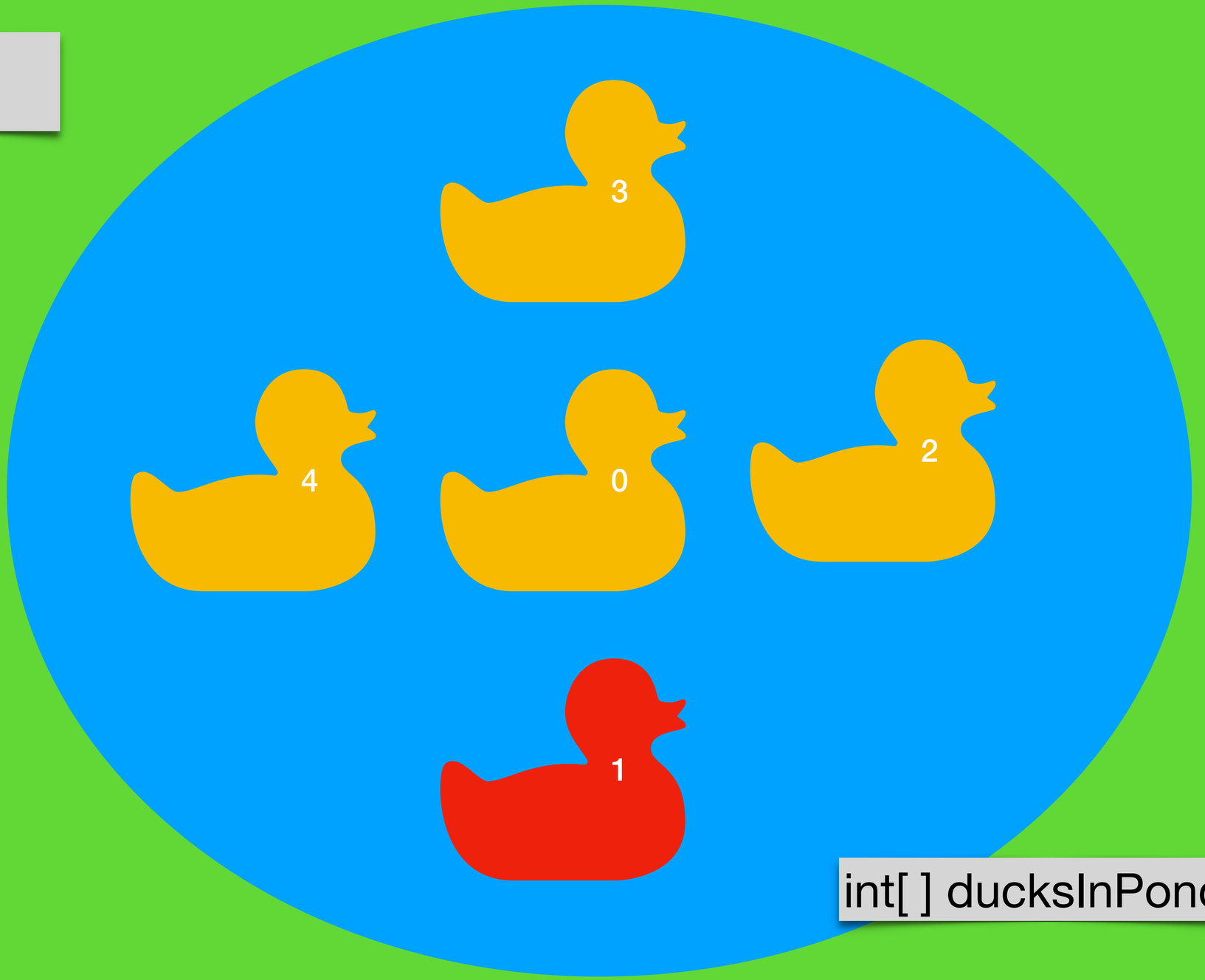

```
int[ ][ ][ ] duckTown;
```

3 ponds



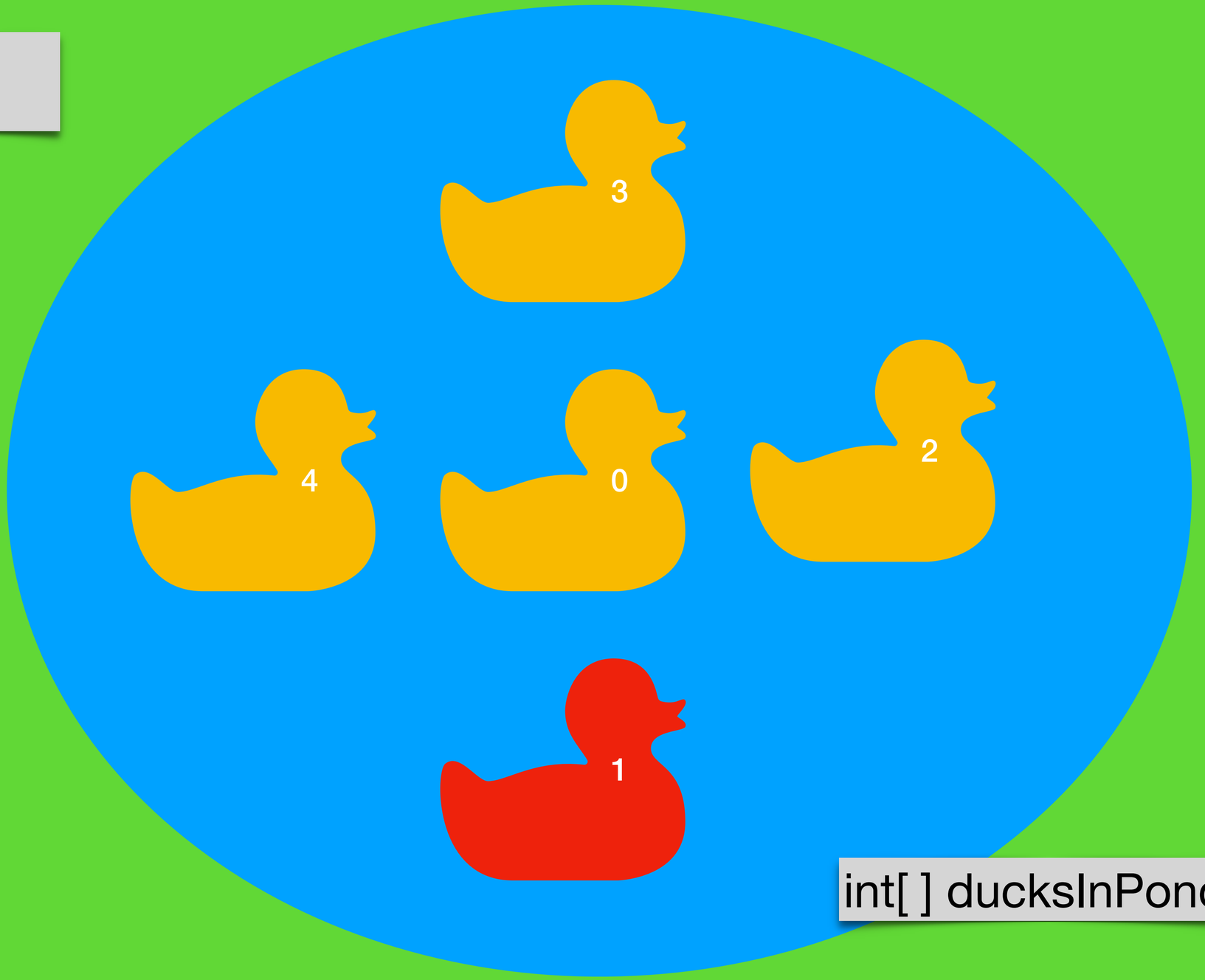

```
int[ ][ ] DuckFarm;
```

5 ducks



int[ ] ducksInPond;

5 ducks



int[ ] ducksInPond;

```
int singleDuck;
```

1 Dimensional Array

An int Array

Element	12	13	43	5	66
Index	0	1	2	3	4

```
int[ ] intArray = {12, 13, 43, 5, 66} ;
```

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2 Dimensional Array

Element	12	13	43	5	66
Index	0	1	2	3	4

Element	12	13	43	5	66
Index	0	1	2	3	4

Element	12	13	43	5	66
Index	0	1	2	3	4

Element	12	13	43	5	66
Index	0	1	2	3	4

Element	12	13	43	5	66
Index	0	1	2	3	4

Element	12	13	43	5	66
Index	0	1	2	3	4

An Array of Int Array

```
int[ ][ ] ArrayOf_IntArray ={ intArray, intArray, intArray,
                              intArray intArray, intArray}    ;
```

0

Element	12	13	43	5	66
Index	0	1	2	3	4

1

Element	12	13	43	5	66
Index	0	1	2	3	4

2

Element	12	13	43	5	66
Index	0	1	2	3	4

3

Element	12	13	43	5	66
Index	0	1	2	3	4

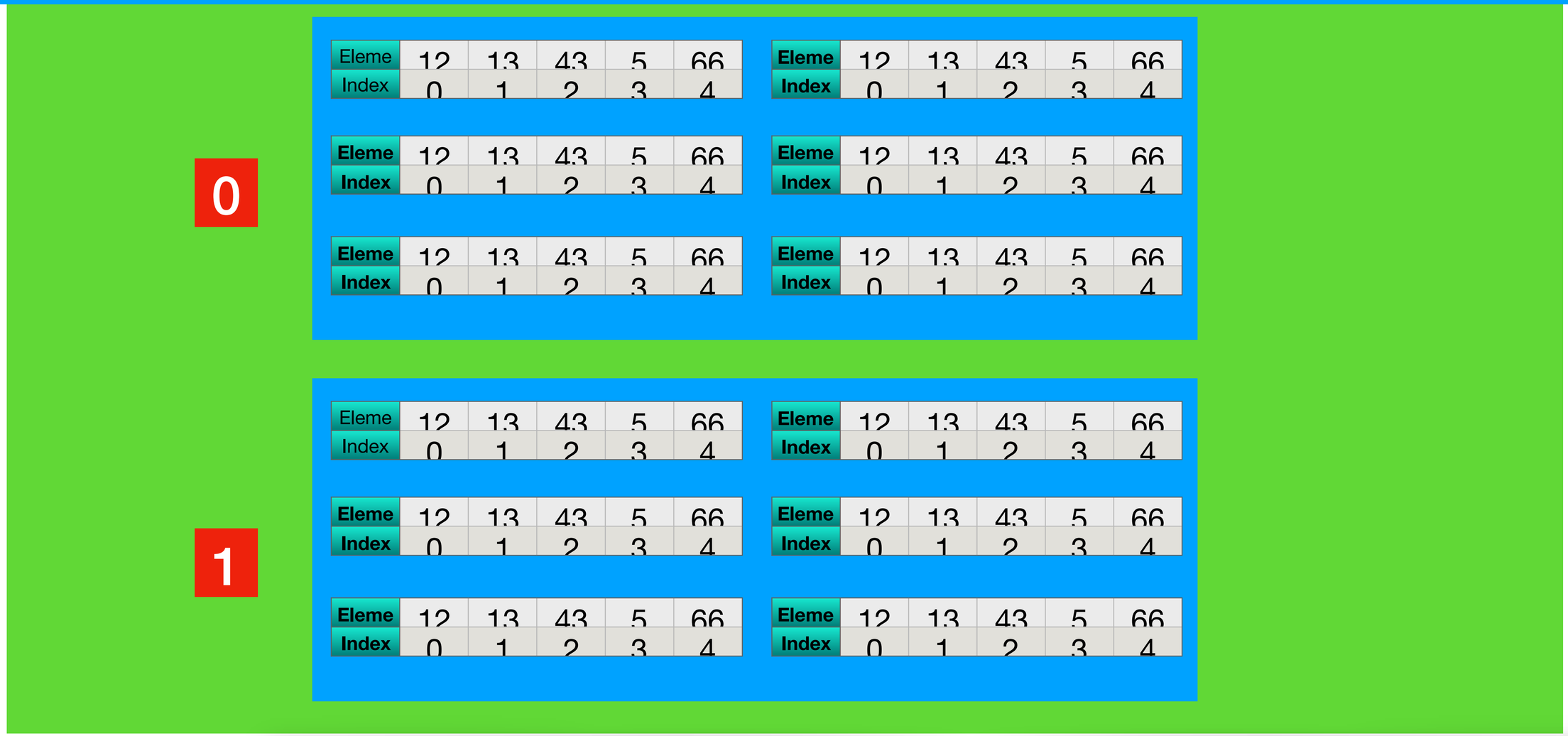
4

Element	12	13	43	5	66
Index	0	1	2	3	4

5

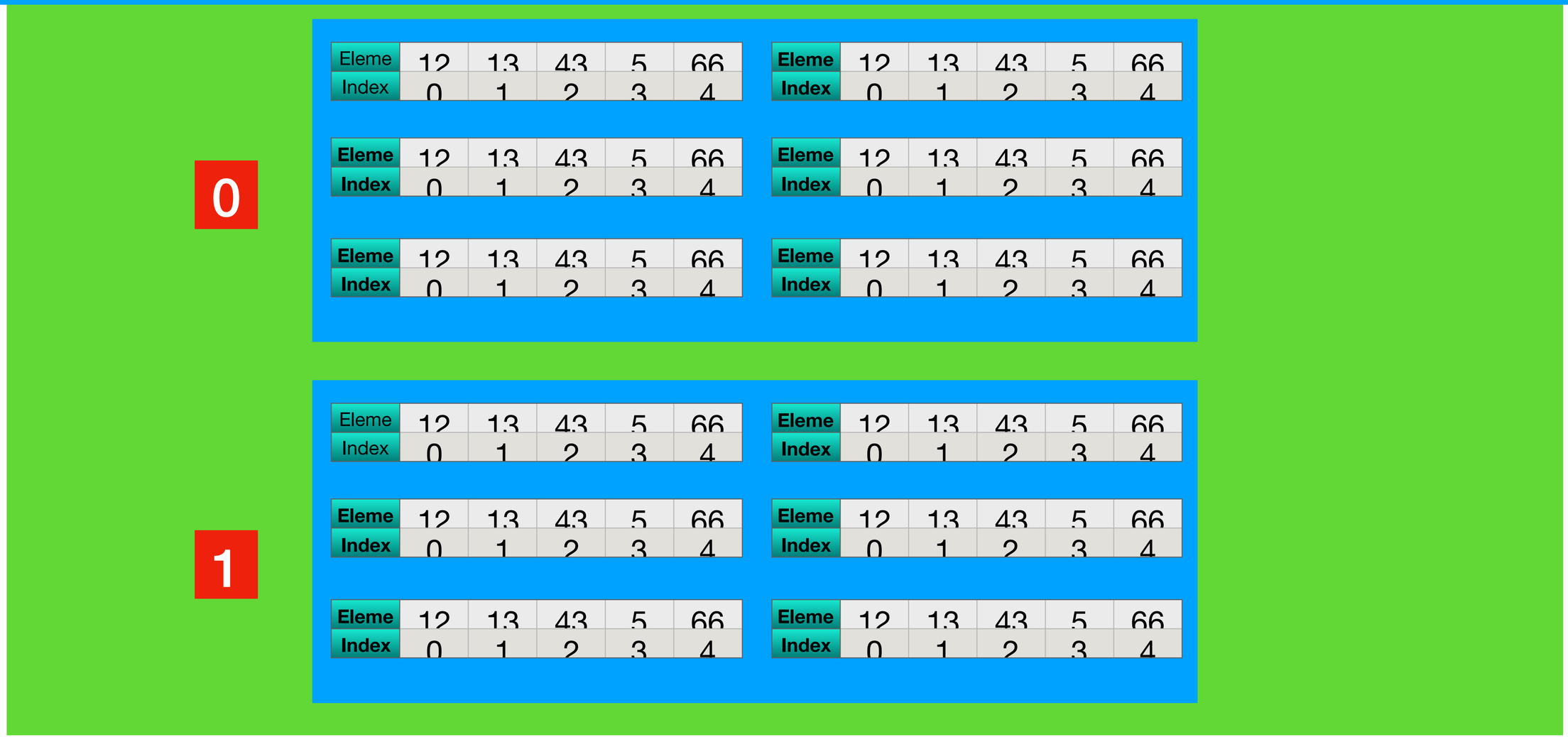
Element	12	13	43	5	66
Index	0	1	2	3	4

3 Dimensional Array




```
int[ ][ ][ ] ThreeDArray ={ArrayOf_IntArray, ArrayOf_IntArray };
```

```
int[ ][ ][ ] ThreeDArray ={ArrayOf_IntArray, ArrayOf_IntArray };
```



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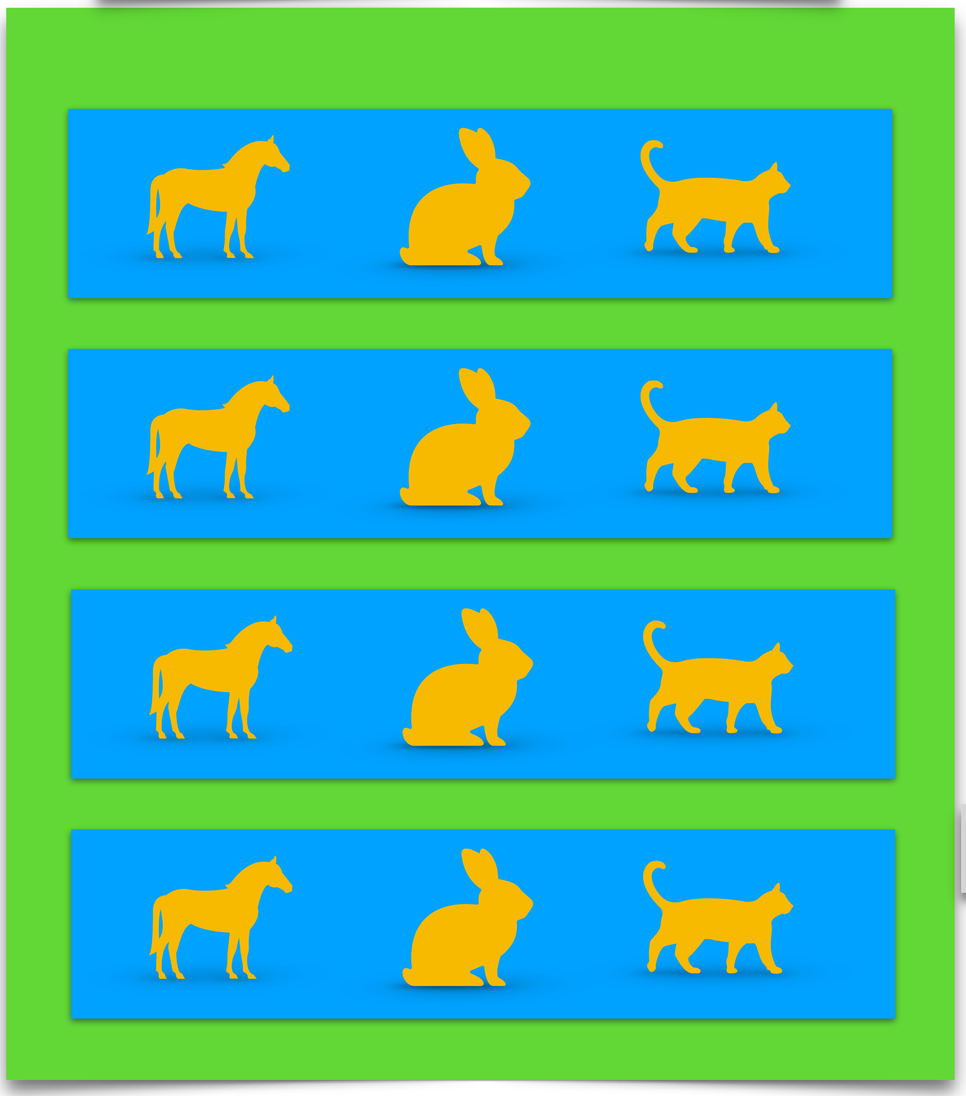
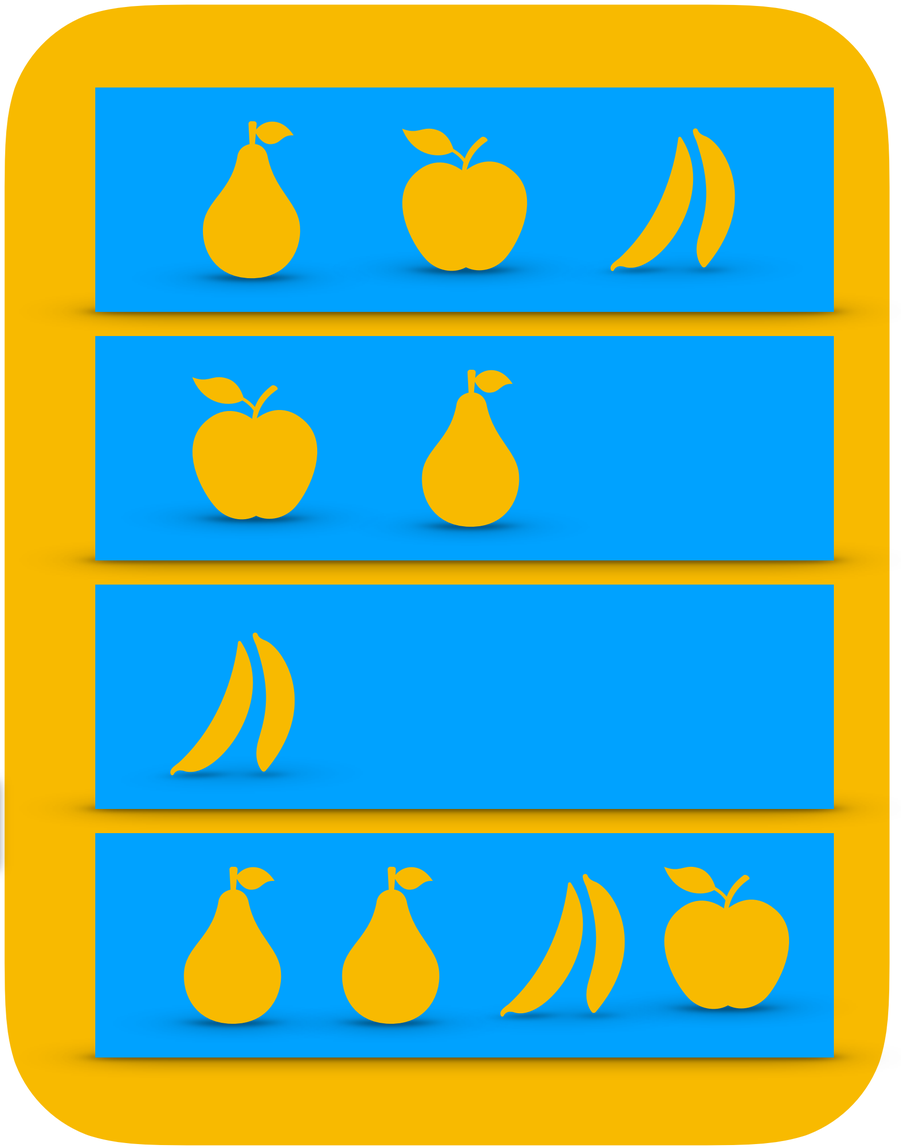
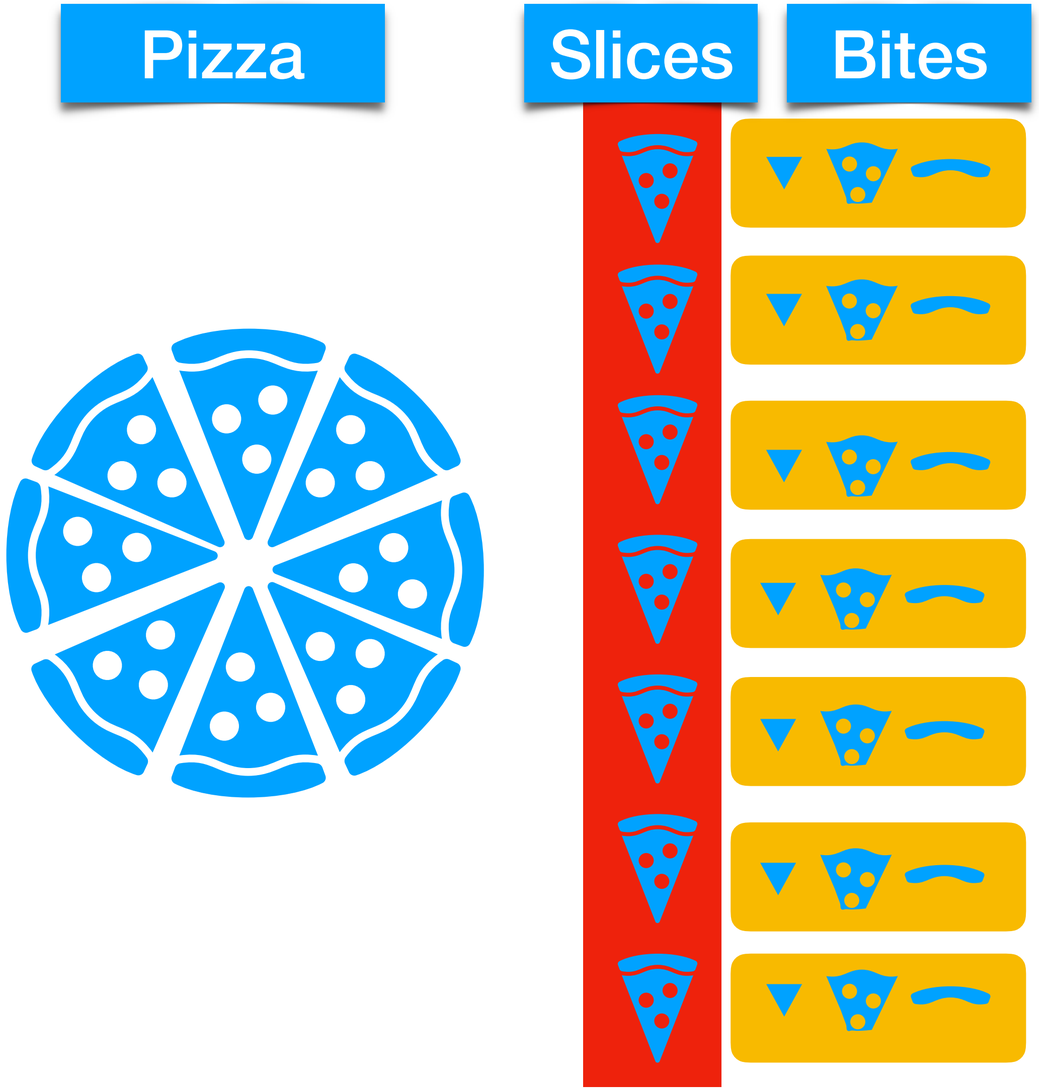
Animal[ ][ ] animalCages ;

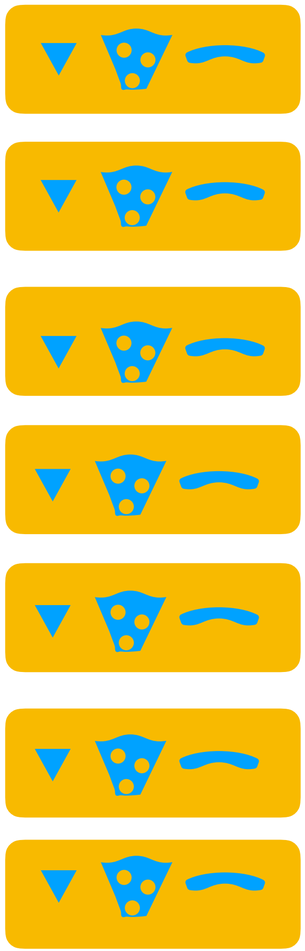


int[ ][ ] pizzaBites ;

Fruit[ ][ ] FruitBoxes ;




Pizza
Slices
Bites



2 Dimensional Array

Slices \ bites	0	1	2
0	00	01	02
1	10	11	12
2	20	21	22
3	30	31	32
4	40	41	42
5	50	51	52
6	10	11	12

CYBERTEK

2 Dimensional Array

Slices \ bites	0	1	2
0	00	01	02
1	10	11	12
2	20	21	22
3	30	31	32
4	40	41	42
5	50	51	52
6	10	11	12

```
//example for declaring 2 demential int array
// with size;

 int[][] intArray = new int[7][3] ;
 int[] intArray[] = new int[7][3] ;
 int intArray[][] = new int[7][3] ;

//example for declaring 2 demential
// String array with size;

 String[][] data = new String[7][3];
```

CYBERTEK

2 Dimensional Array- Excel

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

```
//example for declaring 2 demential int array
// with size and assigning value

int[][] data = new int[2][3] ;
  data[0][0] = 12;
  data[0][1] = 5;
  data[0][2] = 4;
  data[1][0] = 23;
  data[1][1] = 113;
  data[1][2] = 32;
```

2 Dimensional Array- Excel

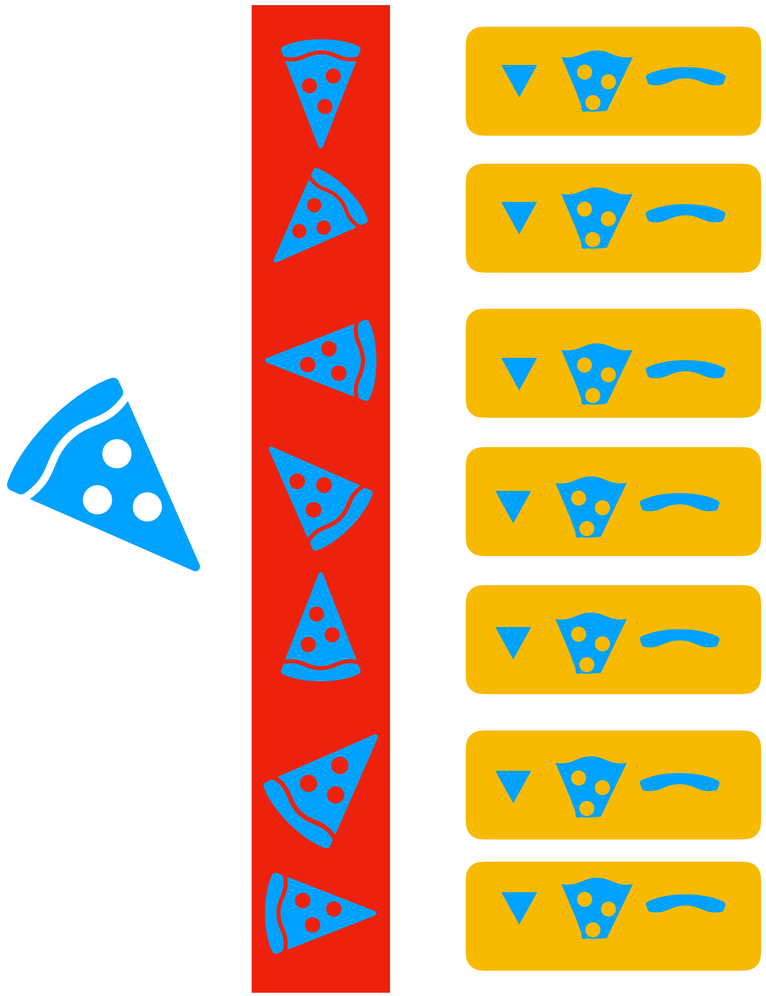
Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

```
//example for declaring 2 dimensional int array
// with size and assigning value

int[][] data = new int[2][3] ;
  data[0] = new int[]{12,5,4};
  data[1] = new int[]{23,113,32};

// second square bracket size is optional

int[][] data = new int[2][] ;
  data[0] = new int[]{12,5,4};
  data[1] = new int[]{23,113,32};
```

2 Dimensional Array- Excel

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

```
//example for declaring 2 demential int array
// in one line and accessing them by index
  int[][] data ={ {12,5,4},{23,113,32} }.

  System.out.println(data[0][0]);
  System.out.println(data[0][1]);
  System.out.println(data[0][2]);
  System.out.println(data[1][0]);
  System.out.println(data[1][1]);
  System.out.println(data[1][2]);
```



2 Dimensional Array

Slices \ bites	0	1	2
0	00	01	02
1	10	11	12
2	20	21	22
3	30	31	32
4	40	41	42
5	50	51	52
6	10	11	12

- Mushroom
- Red Pepper
- Black Olive
- Spinach
- Green Pepper
- Banana Pepper

CYBERTEK

2 Dimensional Array- Excel

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

```
//example for declaring 2 demential int array
//in one line and accessing using for loop
  int[][] data ={ {12,5,4},{23,113,32} }.

  for (int i = 0; i < data.length; i++) {
       System.out.println("********Row : "+ i);

       for (int j = 0; j < data[i].length; j++) {
         System.out.print(data[i][j]+" ");
       }
       System.out.println();
     }
```

2 Dimensional Array- Excel

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

```
//accessing items using foreach loop
  int[][] data ={ {12,5,4},{23,113,32} };

  for (int[] rows : data) {
    System.out.println("*******Row : ");

    for (int columnData : rows) {
      System.out.print(columnData + " ");
    }
    System.out.println();

  }
```

2 Dimensional Array- Excel

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

2 Dimensional Array- Excel-1

Columns / Rows	0	1	2
0	12	5	4
1	23	113	32

3 dimensional array is collection of 2 dimensional arrays

```
// Declaring 2 two dimensional Array
  int[][] data1 ={ {12,5,4},{23,113,32} }
  int[][] data2 ={ {6,15,14},{20,3,88} }

  // Storing above 2 variable to another array to make it
  3 dimensional

  int[][][] threeDArray = {data1, data2}
  // or
  int[][][] threeDArray = new int[2][][];
  threeDArray[0] = data1;
  threeDArray[1] = data2;
```