# Creative Programming

## Arrays and Functions

Technische Universiteit
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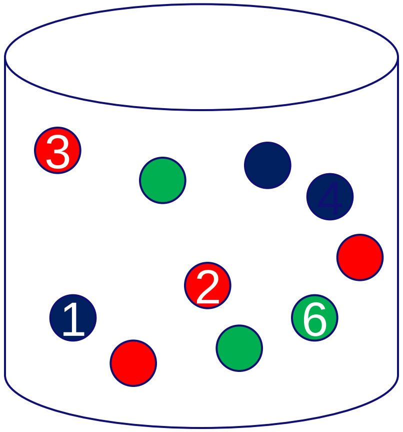
**Where innovation starts**

# Arrays Intro

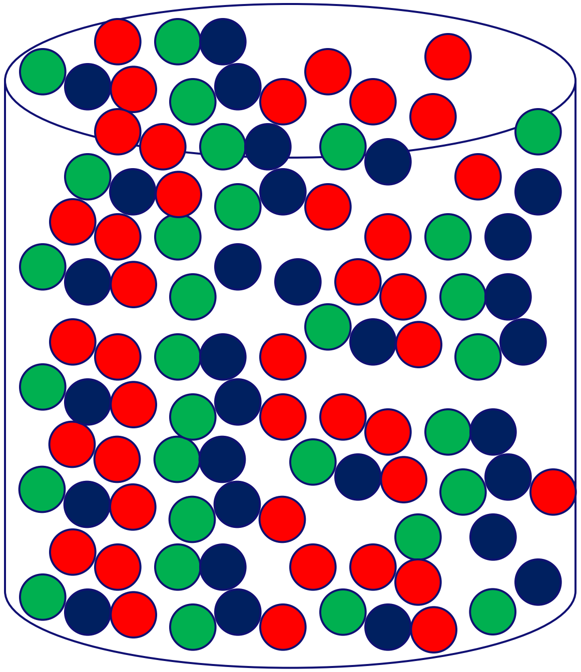
- Suppose you want to model a bag of 10 balls
- Each ball is either red (0) or blue (1) or green (2)



```
int ball1 = 0;

int ball2 = 1;

…

int ball10 = 2;
```

# Arrays Intro

- **Now you want to do the same for 100 balls...**



```
int ball1 = 0;

Int ball2 = 1;

…

int ball100 = 2;
```

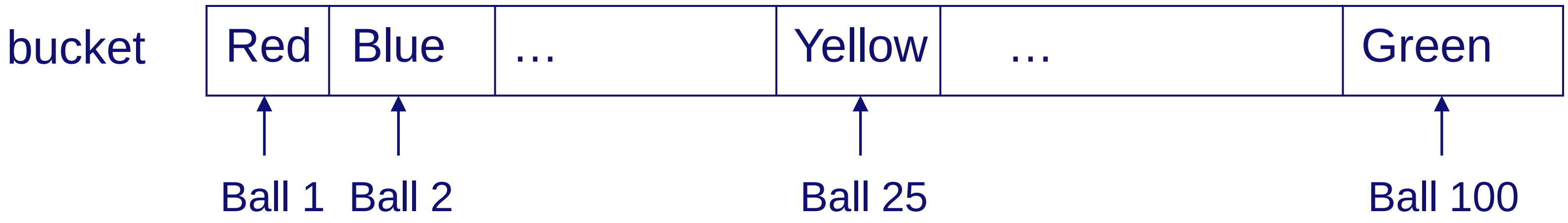
100  variables…

- **Now you want to do the same for 1000 balls...**

# Arrays Intro

- **One variable to store them all**

- **Look at it this way:**



bucket

| Red | Blue | … | Yellow | … | Green |
|---|---|---|---|---|---|

Ball 1 Ball 2 Ball 25 Ball 100

- **Compare to a desk with multiple drawers**

# Arrays: general idea

- A variable that is used as a container of variables
  - Like the bucket of balls
- Can *hold multiple* values of the *same* type
- Access through indexing
  - `bucket[1] = 0;`
  - `bucket[20] = 2;`
- Can be of any size*

* But it *is* limited to 2147483647 elements because of indexing with variable of type int and amount of memory

# Arrays : types and size

- **Declaration:**

```
int[] bucket;
```

holds ints only!!

- **Initialization:**

```
 bucket = new int[100];
```

reserves space for object

holding 100 int’s

- **Combining declaration and initialization:**

```
int[] speeds = {56, 34, 93, 120, 5, 54};
float[] ySpeed = new float[100];
String[] threeNames = {“Jun”,”Loe”,”Peter”};
```

# Arrays: indexing

- Index starts counting at “0” !!!!!

  ```
  int firstElement = speeds[0];
  ```

- length property = actual number of items in the array

  ```
  int len = speeds.length;
  ```

- Last element is: `speeds[speeds.length-1]`
- Runtime error when you go out of range (try it!)

# Looping over an array

```
String[]
firstNames={”Rene”,”Loe”,”Sjriek”,”Peter”};

for(int i=0; i<=firstNames.length; i++){
    println(firstNames[i]);
}
```

**Results in?**

# Examples

- Circles
- Lots of circles
- Sortingcircles

# Functions

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# Functions by example

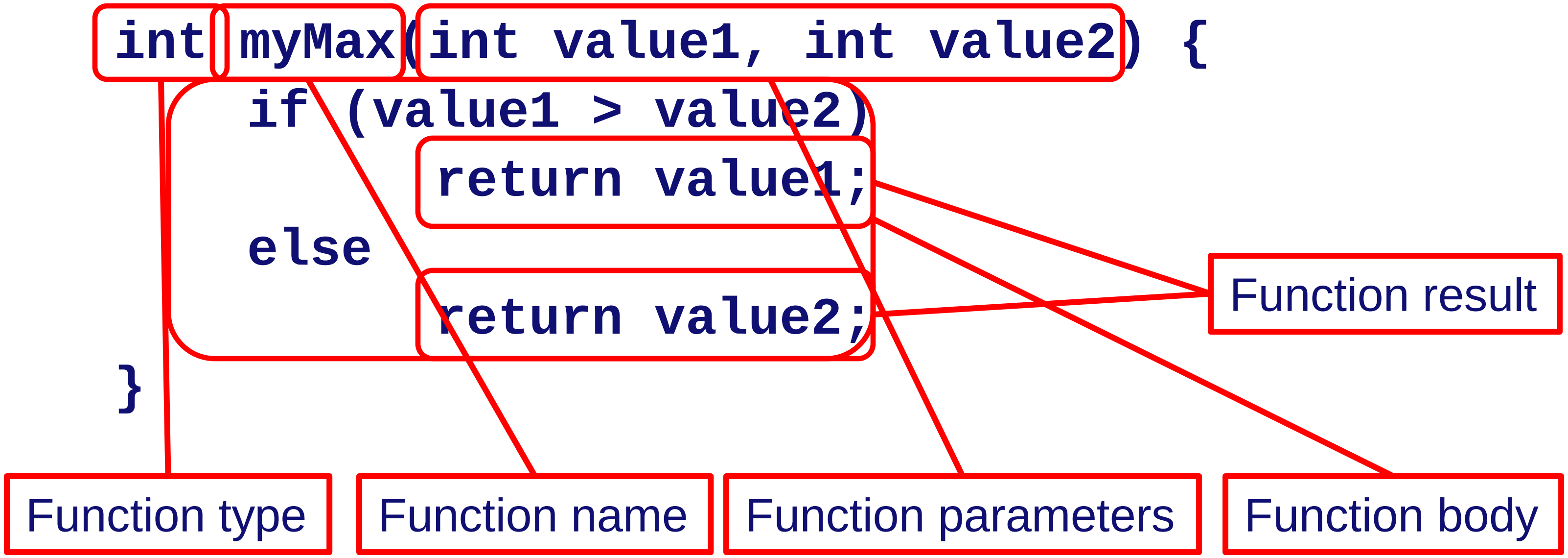
```
int v1, v2, v3, v4, m1, m2, max;

v1 = 20; v2 = 7; v3 = -1; v4 = 3;
if (v1 > v2) m1 = v1; else m1 = v2;
if (v3 > v4) m2 = v3; else m2 = v4;
if (m1 > m2) max = m1; else max = m2;
println(max);
```

```
m1 = myMax(v1,v2);
m2 = myMax(v3,v4);
max = myMax(m1,m2);
```

# Functions: when, why?

- Functions are reusable blocks of code
- Functions add structure to your program



```
int myMax(int value1, int value2) {
      if (value1 > value2)
            return value1;
      else
            return value2;
}
```

# Functions: how, what?

```
int v1, v2, v3, v4, m1, m2, max;

v1 = 20; v2 = 7; v3 = -1; v4 = 3;
m1 = myMax(v1,v2);
m2 = myMax(v3,v4);
max = myMax(m1,m2);
println(max);
```

or

```
println( myMax( myMax(v1,v2), myMax(v3,v4) ) );
```

# Functions: Another example

```
void setup(){
  size(400, 400);
  background(255);
  for(int i=0; i<100; i++){
    rect(
      int(random(width)), int(random(height)),
      random(200), random(200)
    );
  }
}
```

Predefined function

- **What will happen?**

# Functions: parameters & arguments

- **Parameters passed should match definition of function**

```
void myFunction(int x, int y){}
void myFunction(int x, int y, int z){}
void myFunction(float x, float y, float z){}
```

```
myFunction(2, 5);
myFunction(2, 5, 7);
myFunction(2.0, 3.4, 2.33);
```

What does myFunction DO???

# Functions: return

- **Each function that has a return type other than void *must* return using a return statement**

```
int sum;
int computeSum(int x1,int x2,int x3){
    // you could do all sorts of stuff
    // with x1, x2 and x3 before the return
    return x1+x2+x3;
}
sum = computeSum(4,5,6);
```

# Summary Arrays and Functions

- **Arrays:**
  - **Collection of similar data objects**
  - **Access via indexing 0..length-1**

- **Functions:**
  - **Grouping of statements that perform a function**
  - **Efficient by avoiding duplicate code**
  - **Frees you from writing linear code**
  - **Enable you to think more abstract**

# Homework

- **Write a program that displays a static grid of 4x4 rectangles, filled with different colors (randomized at program startup), that outputs the hexadecimal color value of the rectangle where the mouse is clicked.**

  **Use an array to hold the rectangle color values.**

# Homework ctd.

- **Create functions:**

```
String toHex(int i) {
    // converts int i to hexadecimal string
}

boolean insideRect(int x, int y, int w, int h) {
    // returns true if mouse inside rectangle
    // bounded by coordinates (x,y) and (x+w,y+h)
}
```