Creative Programming

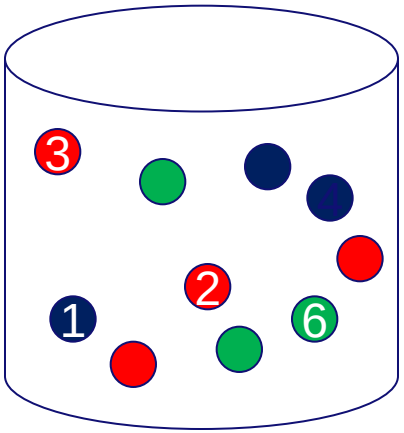
Arrays and Functions

TU/e Technische Universiteit Eindhoven University of Technology

Where innovation starts

Arrays Intro

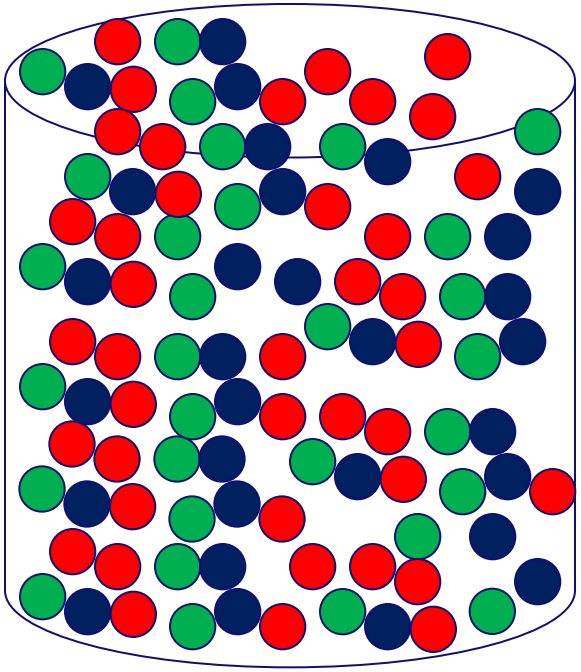
- **Suppose you want to model a bag of 10 balls**
- **Each ball is either red (0) or blue (1) or green (2)**




```
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;
```

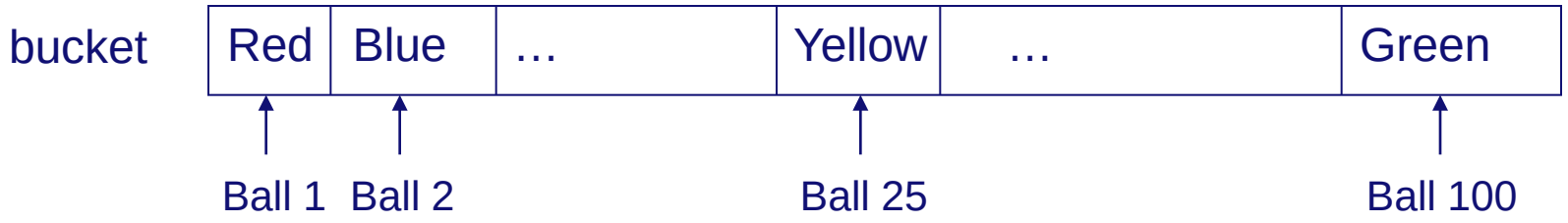
100 variables…

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

Arrays Intro

- **One variable to store them all**

- **Look at it this way:**



- **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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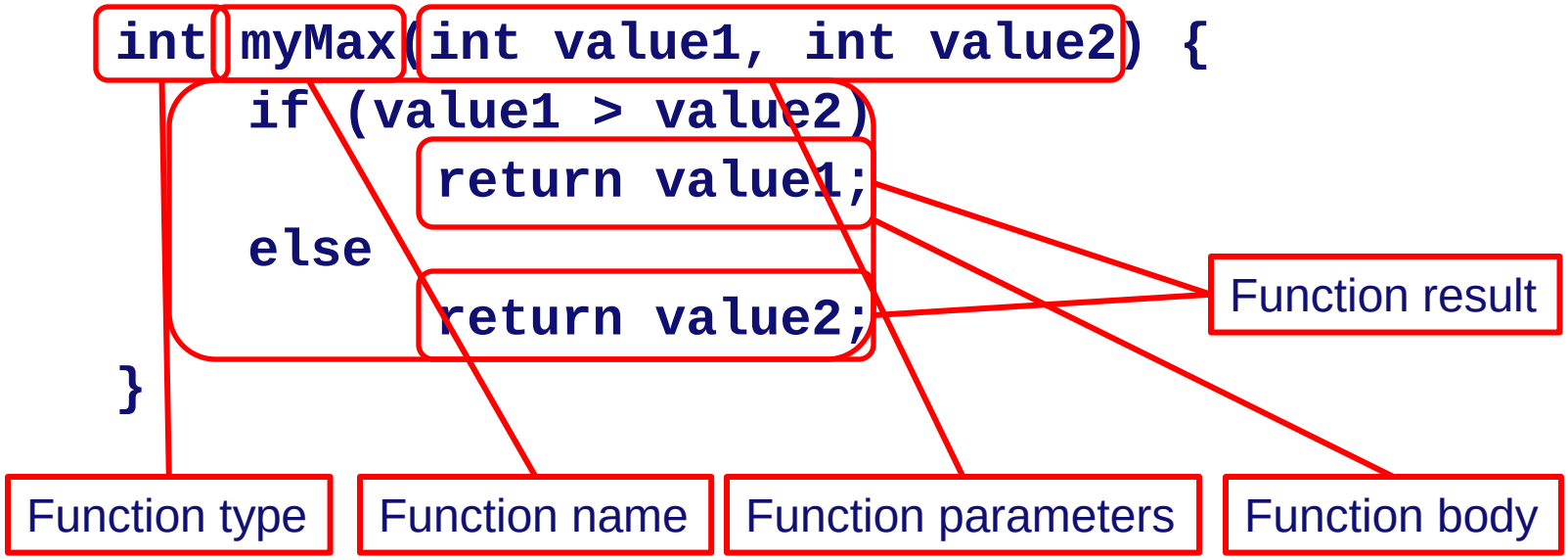
Functions by example

```
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);
```

Functions: when, why?

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



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: 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)
    );
  }
}
```

- 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);
```

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

- **Homework format !!!!!!!!!!!!!!**
  - week<weeknumber of assignment>_<IDNR>.zip

- **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)
}
```