

Making Classes

Nov 21

When you make a class

(with more than just static methods)

- What data will it store?
 - How does the data get in?
- What updates to the data are allowed? How?
- What kind of data does it provide?
- Does it (should it) have a "printable" representation?

The String class

- What data will it store?
 - A string
 - How does the data get in?
 - `new String("string");`
- What updates to the data are allowed? How?
 - None
- What kind of data does it provide?
 - `indexOf`, `substring`, `startsWith`, `length`,
- Does it (should it) have a "printable" representation?
 - Yes, just the string itself

Task: A Charity tracker

- What data will it store?
 - charity name, donations received, goal, ...
- How does the data get in?
- What updates to the data are allowed? How?
 - Just the donations received
- What kind of data does it provide?
 - donations received, percentage of goal, goal, ...
- Does it (should it) have a "printable" representation?
 - Yes, please

Charity class

First Try

```
public class Charity1 {  
    public String name;  
    public int donationTarget;  
    public int donationsReceived;  
}
```

public, not static, not a method
"instance variables"

2 classes in 2 files

javac on User1.java will also compile charity1.java

```
public class User1 {  
    public static void main(String[] args) {  
        Charity1 charity = new Charity1();  
        System.out.println(charity.donationTarget);  
        System.out.println(charity.donationsReceived);  
        System.out.println(charity.name);  
  
        charity.name = "International Crane Foundation";  
        charity.donationsReceived = 10000;  
        charity.donationTarget = 30000;  
    }  
}
```

create an instance

instance variables all get default
values -- like arrays
get to instance variables via "."

Set values of instance variables
via "." also

Observations --Yea

- it works -- ish
- The data for a charity is grouped into one place

Observations -- Boo

- cumbersome to set values of vars
- No controls on var values
- All the work needs to be done by user!

Cumbersome to set

Constructors

Can add controls if needed
E.g., target > 0
name != null

"super();" implicitly the first line
super() is what makes the space

- Set initial values using a "constructor"
 - a special method
 - Purpose is to set the values of instance variables
 - Name of method must be the name of the class
 - NO return type -- it returns an instance of the class
 - Often does nothing but set values of instance variables
 - May be overloaded

```
public class Charity2 {  
    public String name;  
    public int donationTarget;  
    public int donationsReceived;  
  
    public Charity2(String nm, int dt, int dr) {  
        this.name = nm;  
        this.donationTarget = dt;  
        this.donationsReceived = dr;  
    }  
}
```

"this." refers to the instance itself.
May be put before instance variables
Usually optional, never wrong.

Here is the constructor
If I do not write one, java supplies a "no
parameter" constructor that just makes that
space for the instance

Using Charity2

```
public class User2 {  
    public static void main(String[] args) {  
        Charity2 charity = new Charity2("ICF", 10000, 20000);  
        System.out.println(charity.donationTarget);  
        System.out.println(charity.donationsReceived);  
        System.out.println(charity.name);  
  
        charity.name = "International Crane Fouundation";  
        charity.donationsReceived = 10000;  
        charity.donationTarget = 30000;  
    }  
}
```

Everything other than constructor is the same

Do we want to allow anyone to change these in any way?

Charity3

going private

- What data will it store?
 - charity name, donations received, goal, ...
- How does the data get in?
- What updates to the data are allowed? How?
 - Just the donations received
- What kind of data does it provide?
 - donations received, percentage of goal, goal, ...
- Does it (should it) have a "printable" representation?
 - Yes, please

```
public class Charity3 {  
    private String name;  
    private int donationTarget;  
    private int donationsReceived;  
  
    public Charity3(String nm, int dt, int dr) {  
        this.name = nm;  
        this.donationTarget = dt;  
        this.donationsReceived = dr;  
    }  
}
```

"Best practice", but not required, is to make all instance variables "private".

Charity3

getters and setters

- When instance vars are private, no one can see/use them directly
 - Sometimes this is good and intentional
 - FileReader -- where you are in the file
 - Sometimes just awkward
- Solution **public** get and set accessors
 - only write for those instances variables that you want to allow access
 - For Charity class, what should those be?

Charity3

Getter and setter Code

```
public String getName() {  
    return name;  
}  
  
public int getDonationTarget() {  
    return donationTarget;  
}  
  
public int getDonationsReceived() {  
    return donationsReceived;  
}  
  
public void setDonationsReceived(int dr) {  
    donationsReceived = dr;  
}
```

Setters often look like this, but can we do better in this case?

Charity4

Providing the right data

- What data will it store?
 - charity name, donations received, goal, ...
- How does the data get in?
- What updates to the data are allowed? How?
 - Just the donations received
- What kind of data does it provide?
 - donations received, **percentage of goal**, goal, ...
- Does it (should it) have a "printable" representation?
 - Yes, please

```
public class Charity4 {  
    private String name;  
    private int donationTarget;  
    private int donationsReceived;  
  
    public Charity4(String nm, int dt, int dr) {  
        this.name = nm;  
        this.donationTarget = dt;  
        this.donationsReceived = dr;  
    }  
  
    // getters not shown  
  
    public void adjustDonationsReceived(int dr) {  
        donationsReceived += dr;  
    }  
  
    public double percentageOfGoal() {  
        return (double) (donationsReceived * 100)  
            / donationTarget;  
    }  
}
```

A transformation of the data. In this case, uses only instance variables

Charity4

toString

- What data will it store?
 - charity name, donations received, goal, ...
 - How does the data get in?
- What updates to the data are allowed? How?
 - Just the donations received
- What kind of data does it provide?
 - donations received, **percentage of goal**, goal, ...
- Does it (should it) have a "printable" representation?
 - Yes, please

```
public class User4 {  
    public static void main(String[] args) {  
        Charity4 charity = new Charity4("ICF",  
10000, 20000);  
  
        System.out.println(charity);  
    }  
}
```

```
% javac User4.java  
% java User4  
Charity4@1eb44e46
```

UGH .. This looks a lot like print representation of an array!

toString()

Every class has one

- Default toString method is ugly
 - Charity4@1eb44e46
- So "override" with one of your own

```
public String toString() {  
    return name + " has a donation target of " + donationTarget + ". It has received " + donationsReceived  
        + " which is " + percentageOfGoal() + " of its goal.";  
}
```

Charity5

complete?

```
public class Charity5 {
    private String name;
    private int donationTarget;
    private int donationsReceived;

    public Charity5(String nm, int dt, int dr) {
        this.name = nm;
        this.donationTarget = dt;
        this.donationsReceived = dr;
    }

    public String getName() {
        return name;
    }

    public int getDonationTarget() {
        return donationTarget;
    }

    public int getDonationsReceived() {
        return donationsReceived;
    }

    public void adjustDonationsReceived(int dr) {
        donationsReceived += dr;
    }

    public double percentageOfGoal() {
        return (double) (donationsReceived * 100) / donationTarget;
    }

    public String toString() {
        return name + " has a donation target of " + donationTarget + ". It has received " + donationsReceived
            + " which is " + percentageOfGoal() + " of its goal.";
    }
}
```

Activity

- Create 2 instances of Charity5.
 - put them in two variables in a main function
- Determine which instance is (percentagewise) further from its goal
- Use the toString method to print information about that charity

- Repeat, but this time make 5 instances of Charity5
 - put them into an array
- Find the instance that is the furthest from its goal
- Use the toString method to print information about that charity