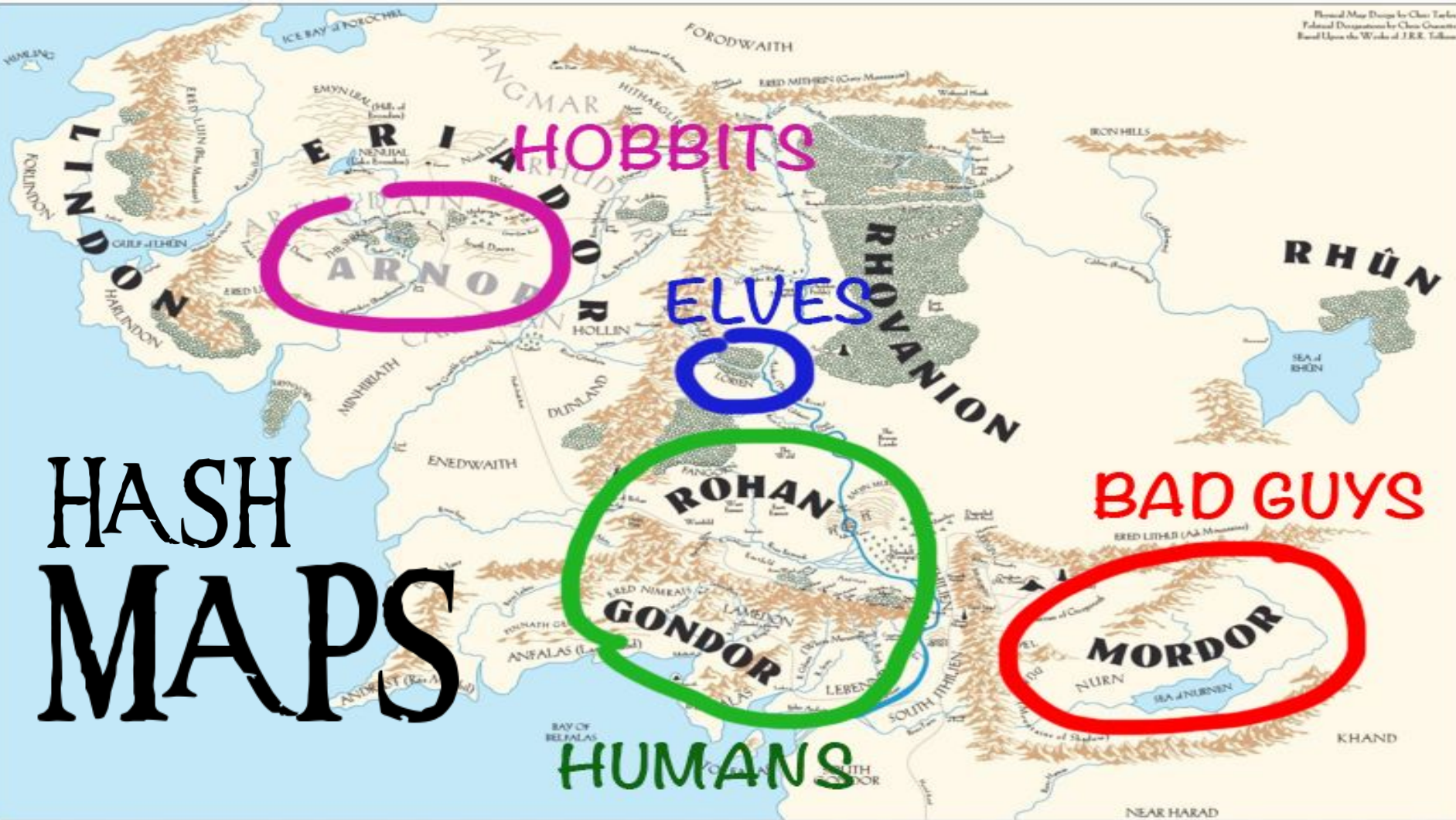


THE ART OF PROGRAMMING - PART 2: KISS



**I HAVEN'T SEEN THAT ONE
SINCE THE '90S.**



HOBBITS

ELVES

BAD GUYS

**HASH
MAPS**

HUMANS

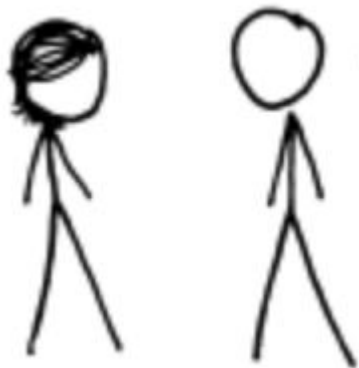
Don Juan's Troubles



Don Juan's Troubles



Hey, Anna, how
are you?



Don Juan's Troubles



I am
Magda!!!



Hey, Anna, how
are you?





Nooooo, my Preciousssss...

Don Juan's Diary 1.0

```
ArrayList<String> days = new ArrayList<String>();
ArrayList<String> names = new ArrayList<String>();

days.add("July 18");
names.add("Magda");

days.add("July 19");
names.add("Anna");

//find date for July 18
int index = days.indexOf("July 18");
String name = names.get(index);

println(name);
```


IS THERE



ANOTHER WAY?

memegenerator.net

Meet HashMap

- A variable type that stores values accessed by index (key)
- Keys are single type of object (e.g., String)
- Keys are **unique**
- **Items have no order**
- Resizable
- Has some helpful methods



wow! Nice to meet you

HashMap is like magic box



HashMap is like magic box



Hey magic box,
this is "Teddy"

HashMap is like magic box



Ok, I will take care of him.

HashMap is like magic box



Hey magic box,
this is "Cupcake
the unicorn"

HashMap is like magic box



So cute,
I will take care
of him.

HashMap is like magic box

Hey magic box,
I want to
play with
"Teddy"



HashMap is like magic box

Here he comes



Hey magic box,
I want to
play with
"Teddy"



Don Juan's Diary 2.0

```
import java.util.HashMap;
```

```
import acm.program.ConsoleProgram;
```

```
public class DonJuan extends ConsoleProgram {  
    public void run() {
```

```
        HashMap<String, String> dates = new HashMap<String, String>();
```

```
    }  
}
```

Don Juan's Diary 2.0

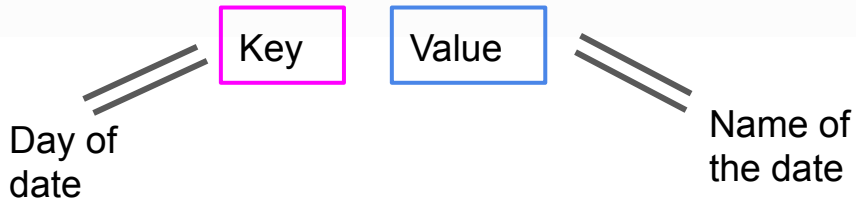
```
import java.util.HashMap;

import acm.program.ConsoleProgram;

public class DonJuan extends ConsoleProgram {
    public void run() {

        HashMap<String, String> dates = new HashMap<String, String>();

    }
}
```



Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");
```

day	name

Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");
```

day	name
July 18	Magda

Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");
```

day	name
July 18	Magda
July 19	Anna

Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");
```

```
//Who I date tomorrow?
```

```
String name = dates.get("July 18");  
println(name);
```

name: Magda

day	name
July 18	Magda
July 19	Anna

Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();
dates.put("July 18", "Magda");
dates.put("July 19", "Anna");

//Who I date tomorrow?
String name = dates.get("July 20");
println(name);
```

day	name
July 18	Magda
July 19	Anna

Don Juan's Diary 2.0

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");
```

```
//Who I date tomorrow?  
String name = dates.get("July 20");  
println(name);
```

No date on July 20



name: null

day	name
July 18	Magda
July 19	Anna

HashMap Methods

<code>map.get(key)</code>	get value specified by key
<code>map.put(key, value)</code>	store pair key:value (insert new or overwrite value for existing key)
<code>map.remove(key)</code>	remove key-value pair, return value
<code>map.clear()</code>	remove the entire content
<code>map.isEmpty()</code>	return <code>true</code> if this HashMap is empty
<code>map.containsKey(key)</code>	return <code>true</code> whether this HashMap contains specified key
<code>map.containsValue(value)</code>	return <code>true</code> whether this HashMap contains specified value
<code>map.size()</code>	return the number of all key-value pairs

Add a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");
```

day	name
July 18	Magda
July 19	Anna

Cancel a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");  
  
dates.remove("July 19");
```

day	name
July 18	Magda



Any date at all?

```
HashMap<String, String> dates = new HashMap<String, String>();  
  
if (dates.isEmpty()) {  
    println("This is impossible for Don Juan");  
}
```

Am I busy tomorrow?

```
String day = readLine("Enter a day: ");  
if (dates.containsKey(day)) {  
    println("You have already a date on " + day);  
} else {  
    println("No way! You should arrange a date on " + day);  
}
```

Do I date ___?

```
String name = readLine("Enter a name: ");
if (dates.containsValue(name)) {
    println("A date with " + name + "is already arranged, don't ask " + name + " out again!");
} else {
    println("Ask " + name + " out on a date!");
}
```

Change a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");  
  
dates.put("July 18", "Jana");
```

day	name
July 18	Magda

Change a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");  
  
dates.put("July 18", "Jana");
```

day	name
July 18	Magda
July 19	Anna

Change a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");  
dates.put("July 18", "Jana");
```

day	name
July 18	Jana
July 19	Anna

Change a date

```
HashMap<String, String> dates = new HashMap<String, String>();  
dates.put("July 18", "Magda");  
dates.put("July 19", "Anna");
```

```
dates.put("July 18", "Jana");
```

Keys are unique!

day	name
July 18	Jana
July 19	Anna



You shall not date twice a day!

!!!!!!!



Nested collections

```
HashMap<String, ArrayList<String>> dates;
```

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
-----	-------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
-----	-------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
-----	-------

day: July 18	name: Magda
--------------	-------------

names: null

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
-----	-------

day: July 18

name: Magda

names: null

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
-----	-------

day: July 18	name: Magda
--------------	-------------

names



Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	

day: July 18

name: Magda

names



Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda

day: July 18	name: Magda
--------------	-------------

names

0	Magda
---	-------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda

day: July 19

name: Anna

names: null

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda

day: July 19	name: Anna
--------------	------------

names: null

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda

day: July 19	name: Anna
--------------	------------

names



Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda
July 19	

day: July 19

name: Anna

names



Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda
July 19	Anna

day: July 19

name: Anna

names

0	Anna
---	------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda
July 19	Anna

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda
July 19	Anna

day: July 18	name: Jana
--------------	------------

names

0	Magda
---	-------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda
July 19	Anna

day: July 18	name: Jana
--------------	------------

names

0	Magda
---	-------

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda, Jana
July 19	Anna

day: July 18	name: Jana
--------------	------------

names

0	Magda
1	Jana

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda, Jana
July 19	Anna

thuNames

0	Magda
1	Jana

Don Juan's Diary 3.0

```
public class DonJuan extends ConsoleProgram {  
  
    private HashMap<String, ArrayList<String>> dates;  
  
    public void run() {  
        dates = new HashMap<String, ArrayList<String>>();  
  
        addDate("July 18", "Magda");  
        addDate("July 19", "Anna");  
        addDate("July 18", "Jana");  
  
        ArrayList<String> thuNames = dates.get("July 18");  
        println(thuNames);  
    }  
  
    private void addDate(String day, String name) {  
        ArrayList<String> names = dates.get(day);  
  
        if (names == null) {  
            names = new ArrayList<String>();  
            dates.put(day, names);  
        }  
  
        names.add(name);  
    }  
}
```

dates

day	names
July 18	Magda, Jana
July 19	Anna

thuNames

0	Magda
1	Jana

[Magda, Jana]



FINAL PROJECTS

Almost there guys! You got this!



ALL THE BEST, MAURICE MOSS.