

# CS105

## Introduction to Object-Oriented Programming

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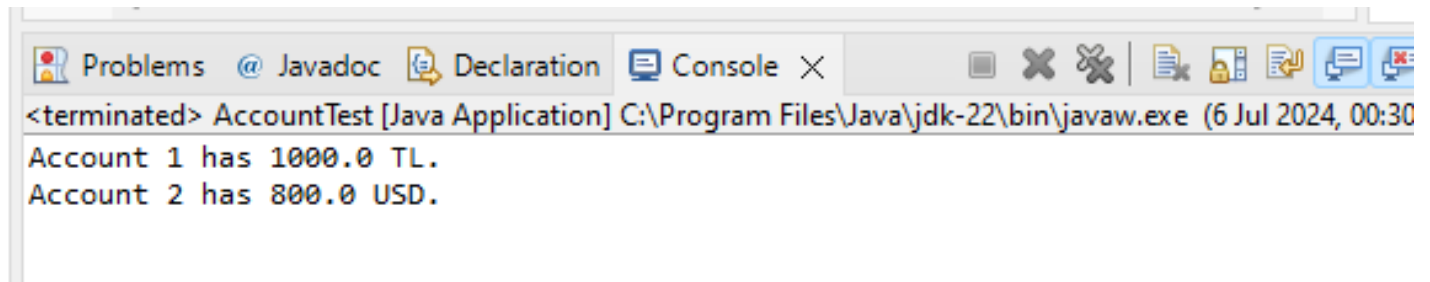
# Classes

# Outline

- Class example - Bank Account
- Depositing Money
- Account Class
- Bank Account – version 1
- Printing Class Variables
- Object Functionality
- Bank Account – version 2
- Bank Account – version 3

# Class example - Bank Account

```
public class AccountTest {  
    public static void main(String[] args) {  
        int account1ID = 1;  
        double account1Balance = 1000;  
        String account1Currency = "TL";  
  
        int account2ID = 2;  
        double account2Balance = 800;  
        String account2Currency = "USD";  
  
        System.out.println("Account " + account1ID  
            + " has " + account1Balance + " "  
            + account1Currency + ".");  
  
        System.out.println("Account " + account2ID  
            + " has " + account2Balance + " "  
            + account2Currency + ".");  
    }  
}
```



The screenshot shows an IDE console window with the following output:

```
<terminated> AccountTest [Java Application] C:\Program Files\Java\jdk-22\bin\javaw.exe (6 Jul 2024, 00:30  
Account 1 has 1000.0 TL.  
Account 2 has 800.0 USD.
```

# Depositing Money

```
// Deposit 50 TL into account 1  
account1Balance = account1Balance + 50;
```

```
// Deposit 300 USD into account 2  
account2Balance = account2Balance + 300;
```

• Before:

account1Balance

1000

account2Balance

800

• After:

account1Balance

1050

account2Balance

1100

# Printing Account Details

```
System.out.println("Account " + account1ID  
    + " has " + account1Balance + " "  
    + account1Currency + ".");
```

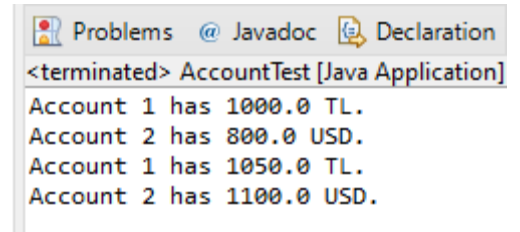
```
System.out.println("Account " + account2ID  
    + " has " + account2Balance + " "  
    + account2Currency + ".");
```

```
// Deposit 50 TL into account 1  
account1Balance = account1Balance + 50;
```

```
// Deposit 300 USD into account 2  
account2Balance = account2Balance + 300;
```

```
System.out.println("Account " + account1ID  
    + " has " + account1Balance + " "  
    + account1Currency + ".");
```

```
System.out.println("Account " + account2ID +  
    " has " + account2Balance + " " +  
    account2Currency + ".");
```



```
Problems @ Javadoc Declaration  
<terminated> AccountTest [Java Application]  
Account 1 has 1000.0 TL.  
Account 2 has 800.0 USD.  
Account 1 has 1050.0 TL.  
Account 2 has 1100.0 USD.
```

# Account Class

- Each account has an **ID**, **balance** and **currency**.
  - These can be thought as attributes of an account.
- Can we have an account object which holds all these necessary data together?

```
public class Account {  
    int number;  
    double balance;  
    String currency;  
}
```

- These are called **member variables** of the class or **fields**.
- They are also referred to as **instance variables**.

# Bank Account – version 1

```
public class Account {  
    int number;  
    double balance;  
    String currency;  
}
```

## Account.java

This is the class which provides the specifics of the Account object

```
Account account1 = new Account();  
account1.number = 1;  
account1.balance = 100;  
account1.currency = "TL";
```

```
Account account2 = new Account();  
account2.number = 2;  
account2.balance = 200;  
account2.currency = "USD";
```

## AccountTest.java

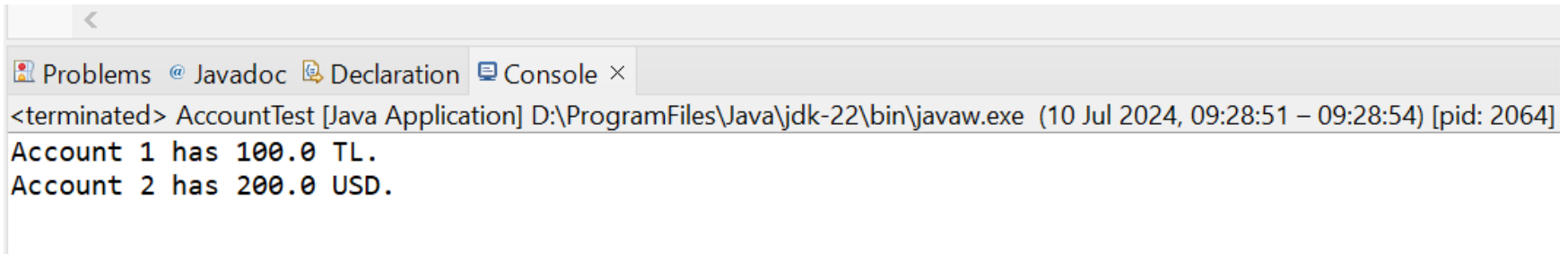
In here, we have two Account objects: account1 and account2



# Printing Class Variables

```
System.out.println("Account " + account1.number  
    + " has " + account1.balance  
    + " " + account1.currency + ".");
```

```
System.out.println("Account " + account2.number  
    + " has " + account2.balance  
    + " " + account2.currency + ".");
```



The screenshot shows an IDE console window with the following content:

```
<terminated> AccountTest [Java Application] D:\ProgramFiles\Java\jdk-22\bin\javaw.exe (10 Jul 2024, 09:28:51 – 09:28:54) [pid: 2064]  
Account 1 has 100.0 TL.  
Account 2 has 200.0 USD.
```

# What will be the output?

```
System.out.println("Account " + account1.number  
    + " has " + account1.balance  
    + " " + account1.currency + ".");
```

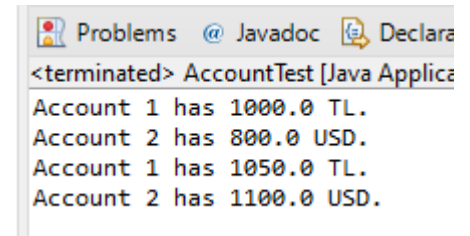
```
System.out.println("Account " + account2.number  
    + " has " + account2.balance  
    + " " + account2.currency + ".");
```

```
// Deposit 50 TL into account 1  
account1.balance = account1.balance + 50;
```

```
// Deposit 300 USD into account 2  
account2.balance = account2.balance + 300;
```

```
System.out.println("Account " + account1.number  
    + " has " + account1.balance  
    + " " + account1.currency + ".");
```

```
System.out.println("Account " + account2.number  
    + " has " + account2.balance  
    + " " + account2.currency + ".");
```



The screenshot shows the 'Problems' window of an IDE. The title bar includes 'Problems', '@ Javadoc', and 'Declare'. The main content area shows the following output:

```
<terminated> AccountTest [Java Applica  
Account 1 has 1000.0 TL.  
Account 2 has 800.0 USD.  
Account 1 has 1050.0 TL.  
Account 2 has 1100.0 USD.
```

# Object Functionality

- Depositing money to an account is actually a functionality of an account.
  - All accounts can be deposited some amounts of money
- How can we make depositing money a functionality of account object?
  - By defining it as a member function...

# Bank Account – version 2

```
public class Account {  
    int number;  
    double balance;  
    String currency;  
    public void deposit(double d) {  
        balance = balance + d;  
    }  
}
```

# deposit member function

- Before **deposit** member function

```
// Deposit 50 TL into account 1
account1.balance = account1.balance + 50;

// Deposit 300 USD into account 2
account2.balance = account2.balance + 300;
```

- After **deposit** member function

```
// Deposit 50 TL into account 1
account1.deposit(50);

// Deposit 300 USD into account 2
account2.deposit(300);
```

# Class

- We have written our first class!

```
public class Account {
```

```
    int number;
```

```
    double balance;
```

```
    String currency;
```

member variables or  
instance variables

```
    public void deposit(double d) {
```

```
        balance = balance + d;
```

```
    }
```

```
}
```

Member  
Functions

# From last lecture...

- Our proposed programs need to **match to the problem** we are trying to solve
  - In the problem, what are the real-world objects?
    - what kind of data do they hold? (attributes)
    - what kind of functionalities they have? (behavior)
  - Solve the problem in terms of these objects
    - Objects in the real world ~ Objects in our programs
    - Low representational gap
- **The object oriented programming**

# Class

- We have written our first class!

```
public class Account {
```

```
    int number;
```

```
    double balance;
```

```
    String currency;
```

member variables or  
instance variables  
**attributes**

```
    public void deposit(double d) {
```

```
        balance = balance + d;
```

```
    }
```

```
}
```

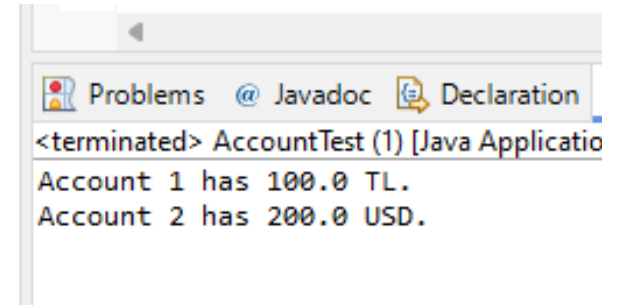
member  
functions  
**behaviors**



# Objects

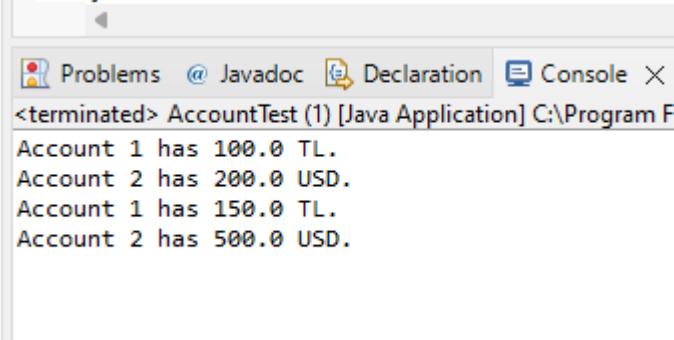
- We have also used this class to create objects!

```
public class AccountTest {  
    public static void main(String[] args) {  
  
        Account account1 = new Account();  
        account1.number = 1;  
        account1.balance = 100;  
        account1.currency = "TL";  
  
        Account account2 = new Account();  
        account2.number = 2;  
        account2.balance = 200;  
        account2.currency = "USD";  
  
        System.out.println("Account " + account1.number  
                            + " has " + account1.balance  
                            + " " + account1.currency + ".");  
  
        System.out.println("Account " + account2.number  
                            + " has " + account2.balance  
                            + " " + account2.currency + ".");  
    }  
}
```



# Objects

```
public class AccountTest {  
    public static void main(String[] args) {  
        Account account1 = new Account();  
        account1.number = 1;  
        account1.balance = 100;  
        account1.currency = "TL";  
        Account account2 = new Account();  
        account2.number = 2;  
        account2.balance = 200;  
        account2.currency = "USD";  
        System.out.println("Account " + account1.number  
            + " has " + account1.balance  
            + " " + account1.currency + ".");  
        System.out.println("Account " + account2.number  
            + " has " + account2.balance  
            + " " + account2.currency + ".");  
  
        // Deposit 50 TL into account 1  
        account1.deposit(50);  
        // Deposit 300 USD into account 2  
        account2.deposit(300);  
        System.out.println("Account " + account1.number  
            + " has " + account1.balance  
            + " " + account1.currency + ".");  
        System.out.println("Account " + account2.number  
            + " has " + account2.balance  
            + " " + account2.currency + ".");  
    }  
}
```



The screenshot shows an IDE window titled "Problems @ Javadoc Declaration Console X". The console output is as follows:

```
<terminated> AccountTest (1) [Java Application] C:\Program F  
Account 1 has 100.0 TL.  
Account 2 has 200.0 USD.  
Account 1 has 150.0 TL.  
Account 2 has 500.0 USD.
```

# Report Account Information

```
System.out.println("Account " + account1.number  
    + " has " + account1.balance  
    + " " + account1.currency + ".");  
System.out.println("Account " + account2.number  
    + " has " + account2.balance  
    + " " + account2.currency + ".");
```

```
// Deposit 50 TL into account 1  
account1.deposit(50);  
// Deposit 300 USD into account 2  
account2.deposit(300);
```

```
System.out.println("Account " + account1.number  
    + " has " + account1.balance  
    + " " + account1.currency + ".");  
System.out.println("Account " + account2.number  
    + " has " + account2.balance  
    + " " + account2.currency + ".");
```

How can we fix this?

- Reporting its information can be a functionality of accounts.
  - **report** member function!

# Bank Account – version 3

- **report** member function!

```
public class Account {
    int number;
    double balance;
    String currency;

    public void deposit(double d) {
        balance = balance + d;
    }
    public void report() {
        System.out.println("Account " + number
            + " has " + balance
            + " " + currency + ".");
    }
}
```

# Bank Account – version 3

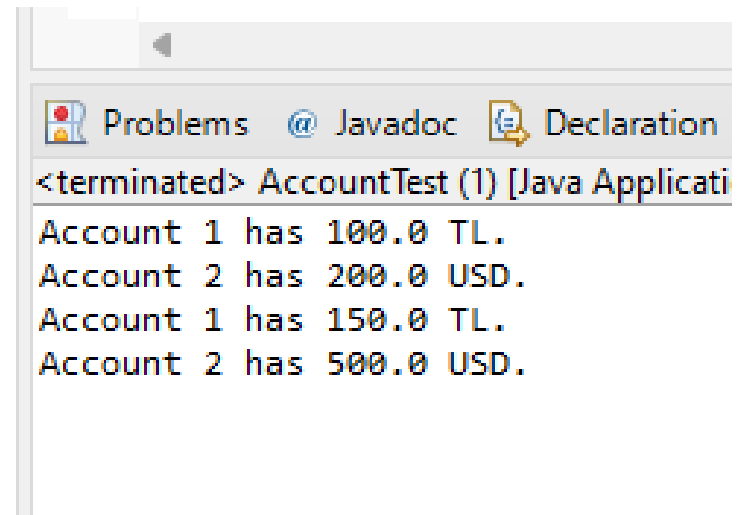
- **report** member function!

```
System.out.println("Account " + account1.number
    + " has " + account1.balance
    + " " + account1.currency + ".");
System.out.println("Account " + account2.number
    + " has " + account2.balance
    + " " + account2.currency + ".");
```

```
public void report() {
    System.out.println("Account " + number
        + " has " + balance
        + " " + currency + ".");
}
}
```

# Bank Account – version 3

```
public class AccountTest {  
    public static void main(String[] args) {  
        Account account1 = new Account();  
        account1.number = 1;  
        account1.balance = 100;  
        account1.currency = "TL";  
  
        Account account2 = new Account();  
        account2.number = 2;  
        account2.balance = 200;  
        account2.currency = "USD";  
  
        account1.report();  
        account2.report();  
  
        // Deposit 50 TL into account 1  
        account1.deposit(50);  
  
        // Deposit 300 USD into account 2  
        account2.deposit(300);  
  
        account1.report();  
        account2.report();  
    }  
}
```



```
<terminated> AccountTest (1) [Java Applicati  
Account 1 has 100.0 TL.  
Account 2 has 200.0 USD.  
Account 1 has 150.0 TL.  
Account 2 has 500.0 USD.
```

**Any Questions?**