Object Examples

- The printer Neo, of type Phaser 4400N, made by Xerox, located in room McConnell 322...
- Mr. Rich, business man, 42 years old, living in Lausanne, Switzerland, married to Mrs. Dufour, ...
- The bank account of Mr. Rich with the Swiss Union Bank...

Attribute and Operation Examples

- Neo has already printed 5614 b/w pages. The toner has to be replaced soon.
- Mr. Rich, business man, 42 years old, living in Lausanne, Switzerland, married to Mrs. Dufour, ...
- Mr. Rich has 36,880 CHF in his checking account. It is time to transfer part of it to his savings account.

Class Examples (2)

- The printer Neo, of type Phaser 4400N, made by Xerox, located in room McConnell 322 … (company)
- Mr. Rich, business man, 42 years old, living in Zug, Switzerland, married with Mrs. Dufour, ...(person, city, country)
- The bank account of Mr. Rich with the Swiss Union Bank... (person, bank)

Generalization Examples

- The printer Neo, of type Phaser 4400N, made by Xerox, located in room McConnell 322...
  - Printer has the subclasses: laser printer, ink-jet printer, daisy printer, etc.
- Mr. Rich, business man, 42 years old, living in Lausanne, Switzerland, married with Mrs. Dufour, ...
  - Person has the subclasses man and woman.
- The bank account of Mr. Rich with the Swiss Union Bank...
  - Bank account has the subclasses: checking account, savings account, fixed term deposit, etc.

Interface Solution

- Interface attributes for a savings account:

```
attribute Natural balance
attribute Range 0..100 interestRate
attribute String number
attribute String owner   (??)
```

- Interface operations for a savings account.

```
operation Natural getBalance()
operation withdraw(Positive amount)
operation deposit(Positive amount)
operation computeInterest()
```

Extension or Intension Solution

- A professor has a name and teaches a subject.
  - Intension
- Jörg is a professor.
  - Extension
- He teaches software engineering.
  - Extension. The value of the attribute `subject` is `"software engineering"`.
- Yesterday, he asked John, a junior student, to explain the difference between the extension and the intension of a class.
  - Extension. The professor instance Jörg sends a message `answerQuestion` to the student instance John.
- Since John is a clever student, he was able to answer the question.
  - Extension. The `impression` attribute value of John is `"clever"`. Difficult to model the sentence "he was able to answer the question".

Professors and Students Solution

1. No impact on the interface of the `Professor` class. The `Student` class must provide in its interface an operation `answerQuestion`:

```
class Student
   operation answerQuestion(String question) return String
…
end class Student
```

2.
```
answer = john.answerQuestion
  (“Difference between Intension and Extension?”)
```

- One cannot show that professor Jörg asks the question, and John cannot know that Jörg is asking. Somewhere in the behaviour (code), professors may send this message, call this operation, but other classes may also ask questions to students.

ETR Solution

- Classes
  - Highway, City, Country, Company, Motorist, Gantry, Account, Vehicle, Transponder
- Objects
  - 407 ETR, Toronto, Canada, Raytheon
- Attributes
  - Motorist.name, Motorist.address, Transponder.monthlyFee, Vehicle.brand, Vehicle.serialNumber
- Not clear
  - Registration, Entry/Exit Point, History

Video Slotmachine Solution

- Classes
  - Machine, Reel, Game, Button, Player
- Objects
  - “the current game”, “the play button”, “the casino server”
- Attributes
  - Machine.currentCredits, Reel.position, Game.currentBet
- Not clear
  - Combination, Outcome, Payline, Paytable