



University of British Columbia
CPSC 111, Intro to Computation
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Tamara Munzner

Interfaces, Polymorphism

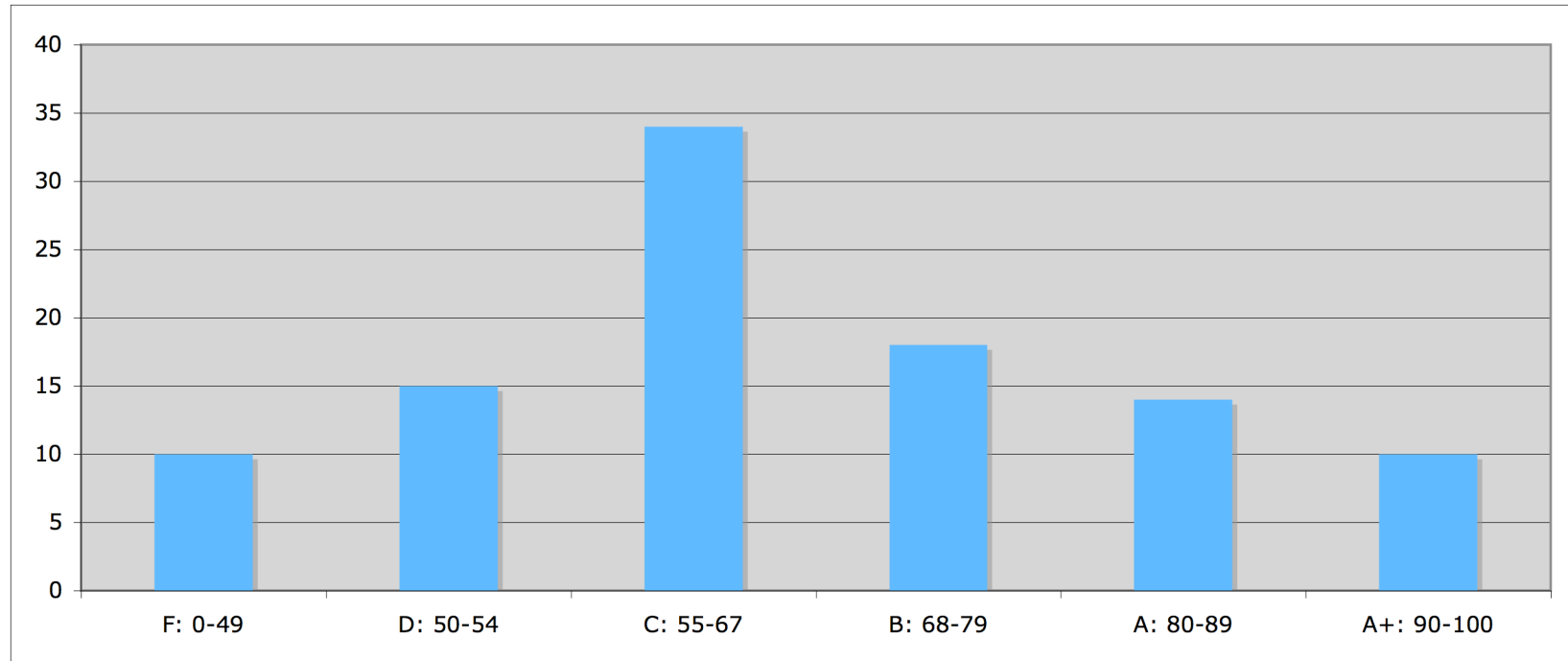
Lecture 29, Fri Mar 26 2010

borrowing from slides by Kurt Eiselt and Paul Carter

<http://www.cs.ubc.ca/~tmm/courses/111-10>

Midterm 2

- raw scores average: 27/60
- percentage scores scaled average: 66/100
- exams back, solutions not distributed until after correction lab in week 11



News: Reminder

- change for labs
 - week 11 was no lab. now will be optional midterm review/correction
 - a chance to work through your mistakes and get some marks back
 - people with Monday (holiday) labs or conflicts can attend another lab and/or work on their own. anyone bring in corrected midterm at beginning of the week 12 lab if not finished working through during week 11 lab

Reading

- Weeklies due today for this week
- Next week:
 - 8.1-.9 (3rd ed)
 - 9.1-9.9 (2nd ed)

Recap: Method Overloading

- Can have multiple methods of same name
- Distinguishes between them with **signature**
 - method name, parameter types and order
- Cannot have two methods with same signature
- Return type is not part of signature

- Any method can be overloaded
 - constructors are very common case

Recap: Interfaces

- **Interface** is collection of constants and abstract methods
 - different meaning than set of public methods that are documented, as in API
 - to implement interface must provide definitions for all its methods
- **Abstract methods** have no implementation or body
 - method header followed by semicolon
 - specifies how to communicate with method, not what it does

Recap: Interface Example

```
public interface VendingMachine
{
    public void vendItem();

    public int getItemsRemaining();

    public int getItemsSold();

    public double getCashReceived();

    public void loadItems(int n);
}
```

```
public class CokeMachine2005 implements VendingMachine
{
```

Recap: Interface Syntax

- Use reserved word **interface** instead of **class** in header
 - no need to use reserved word **abstract** in method headers, is automatic with interfaces
- Use reserved word **implements** followed by interface name in class header

Recap: Polymorphism

- **Polymorphism**: behavior varies depending on actual type of object
 - variables can be **declared** with interface as type, can invoke interface methods on them
 - cannot **construct** interface
 - can only construct objects of some particular class that implements interface
- Polymorphism determined at runtime
 - vs. method overloading, determined at compilation

Recap: Polymorphism Example

```
public class SimCoke2005
{
    public static void main (String[] args)
    {
        VendingMachine foo1 = new CokeMachine2005();
        VendingMachine foo2 = new FrenchFryMachine2005();

        foo1.vendItem();
        foo2.vendItem();
    }
}
```

```
Adding another CokeMachine to your empire
Adding another FrenchFryMachine to your empire
Have a Coke
9 cans remaining
Have a nice hot cup of french fries
9 cups of french fries remaining
```

Polymorphism

- reference to interface type can reference instance of *any* class implementing that interface
 - **static type**: type that variable declared to be
 - determines which members of class can be invoked
 - **dynamic type**: type that variable actually references
 - determines which version of method is called

Interfaces as Contract

- Can write code that works on anything that fulfills contract
 - even classes that don't exist yet!
- Example: Comparable
 - useful if you need to sort items
 - **compareTo (object)**
 - returns $\text{int} < 0$ if this object less than parameter
 - returns 0 if same
 - returns $\text{int} > 0$ if this object greater than parameter

Comparable

- sort method that works on array of objects of **any** type that implements **Comparable**
 - type guaranteed to have **compareTo** method

- we need to sort
 - **Bunny**
 - **Giraffe**
 - **String**
 - **...**

Selection Sort For Int Primitives

```
// selection sort
public class SortTest1
{
    public static void main(String[] args)
    {
        int[] numbers = {16,3,19,8,12};
        int min, temp;
        //select location of next sorted value
        for (int i = 0; i < numbers.length-1; i++)
        {
            min = i;
            //find the smallest value in the remainder of
            //the array to be sorted
            for (int j = i+1; j < numbers.length; j++)
            {
                if (numbers[j] < numbers[min])
                {
                    min = j;
                }
            }
            //swap two values in the array
            temp = numbers[i];
            numbers[i] = numbers[min];
            numbers[min] = temp;
        }

        System.out.println("Printing sorted result");
        for (int i = 0; i < numbers.length; i++)
        {
            System.out.println(numbers[i]);
        }
    }
}
```

Wrappers

- Many classes implement Comparable interface
 - Byte, Character, Double, Float, Integer, Long, Short, String
 - each implements own version of compareTo
- Wrapper classes
 - wraps up (encapsulates) primitive type
 - Double: object wrapping primitive double
 - No: `sort(double[] myData);`
 - Yes: `sort(Double[] myData);`

Multiple Interfaces

- Classes can implement more than one interface at once
 - contract to implement all abstract methods defined in every interface it implements

```
public class MyClass implements Interface1, Interface2,  
    Interface3  
{  
}
```