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Lecture 11: Using Generic Classes

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University of Lagos.

MISTI

Library Classes and Casting

- ArrayList is an implementation of a growable array in Java
  - java.util.ArrayList

- Java 1.3 implementation of ArrayList stored Objects
  - Remember that all classes inherit from the Object class
  - Can store any class!

ArrayList Example

```
ArrayList contactList = new ArrayList();

Person p = new Person("Mike", "123456", 30);
Business b = new Business("Debonaires",
                          "23234");

contactList.add(p);
contactList.add(b);

((Person)contactList.get(0)).print();
```

Casting

((Person)contactList.get(0)).print();

- contactList.get(0) returns a reference of type Object to a Person (“Mike”);
- (Person) casts that Object reference to a reference of type Person.

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Casting

((Person)contactList.get(0)).print();

- contactList.get(0) returns a reference of type Object to a Person (“Mike”);
- (Person) casts that Object reference to a reference of type Person.
- ((Person)contactList.get(0)) evaluates to a reference to a Person.
- .print() calls print on the Person.

Without Casting?

~~contactList.get(0).print();~~

- This would fail at compile time because:
  - ContactList.get(0) returns an Object reference
  - An Object does not define the print() method

Using Inheritance

```
((Contact)contactList.get(0)).print();
```

- Contact defines print(), so we can use Inheritance and cast to the superclass.
  - Person and Business override print()
- Java will call print in Person using dynamic dispatch.

Using Inheritance

- We can write code to print out all Contacts:

```
for (int j = 0; j < contactList.size(); j++) {
  ((Contact)contactList.get(j)).print();
}
```

- But we still have to cast
- And we still have to remember that contactList stores Contacts.

No Error Compiler Error Catching

What if we wrote:

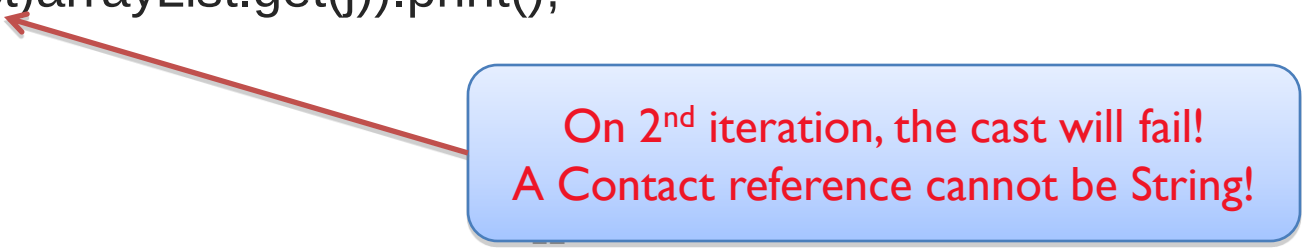
```
contactList.add(new Person(…));
contactList.add(new String(“”));
```

String extends Object so this is legal.

Now:

```
for (int j = 0; j < contactList.size(); j++) {
  ((Contact)arrayList.get(j)).print();

}
```



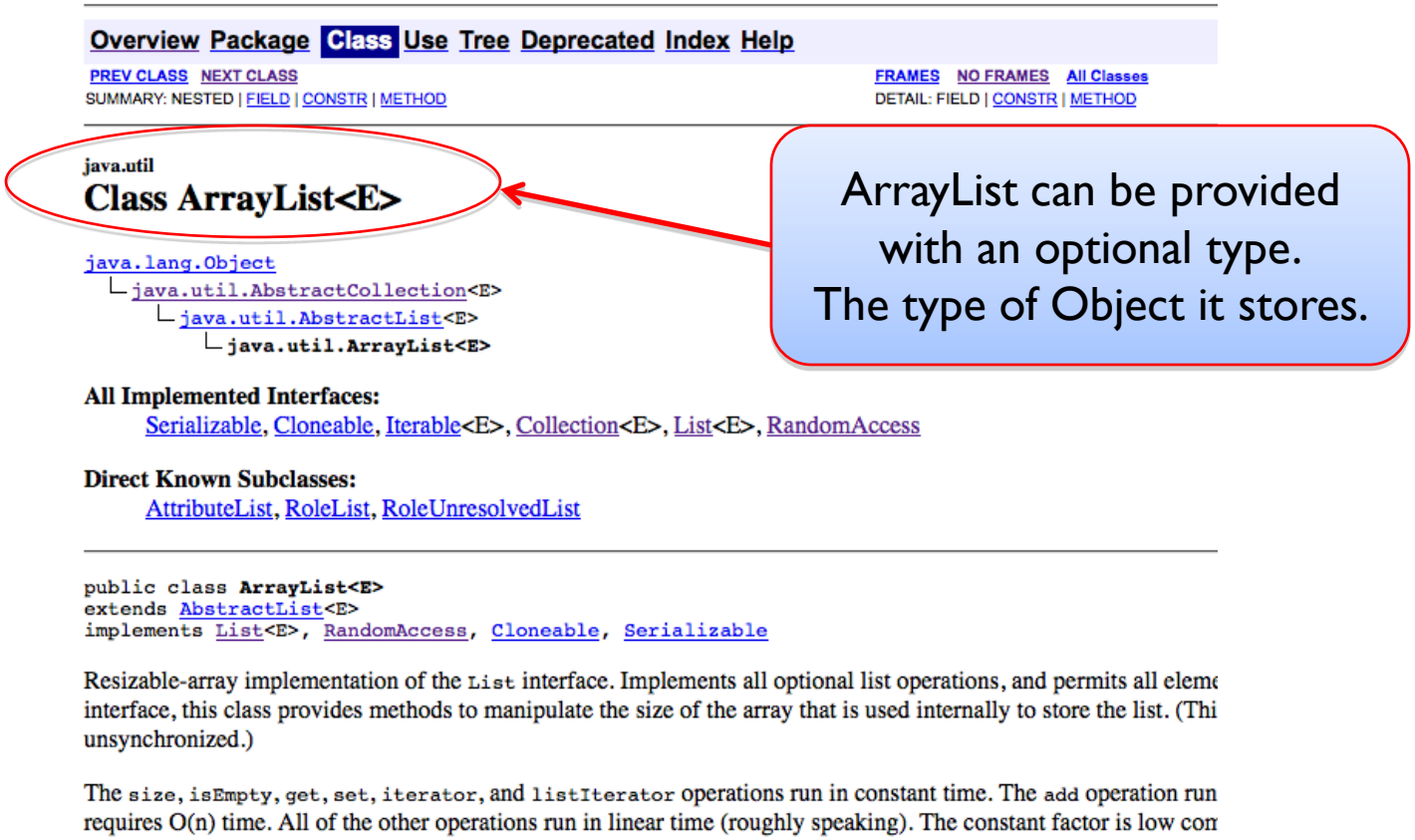
Generics in Java

- The solution to our problems!
- We can define that ArrayList stores only Contacts and subclasses of Contact:

```
ArrayList<Contact> = new ArrayList<Contact>();
```

- This is read “Arraylist of Contacts”
- Now we do not have to cast!
- And we have error checking!

ArrayList JavaDoc



Overview Package Class Use Tree Deprecated Index Help

PREV CLASS NEXT CLASS FRAMES NO FRAMES All Classes

SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD

java.util

Class ArrayList<E>

java.lang.Object
  └ java.util.AbstractCollection<E>
    └ java.util.AbstractList<E>
      └ **java.util.ArrayList<E>**

All Implemented Interfaces:

Serializable, Cloneable, Iterable<E>, Collection<E>, List<E>, RandomAccess

Direct Known Subclasses:

AttributeList, RoleList, RoleUnresolvedList

```
public class ArrayList<E>
extends AbstractList<E>
implements List<E>, RandomAccess, Cloneable, Serializable
```

Resizable-array implementation of the `List` interface. Implements all optional list operations, and permits all eleme
interface, this class provides methods to manipulate the size of the array that is used internally to store the list. (Thi
unsynchronized.)

The `size`, `isEmpty`, `get`, `set`, `iterator`, and `listIterator` operations run in constant time. The `add` operation run
requires O(n) time. All of the other operations run in linear time (roughly speaking). The constant factor is low com

Generics in Java

```
GenericClass<Type> gc = new GenericClass<Type>();
```

- The type specified can either be an interface or a class.

- Reference declaration (left side) has to match object created (right side)

ArrayList ContactList with Generics

```
ArrayList<Contact> contactList =
                    new ArrayList<Contact>();

Person p = new Person("Mike", "123456", 30);
Business b = new Business("Debonaires",
                    "2323323234");

contactList.add(p);
contactList.add(b);

contactList.get(0).print();
```

Using Generics

- We can write code to print out all Contacts:

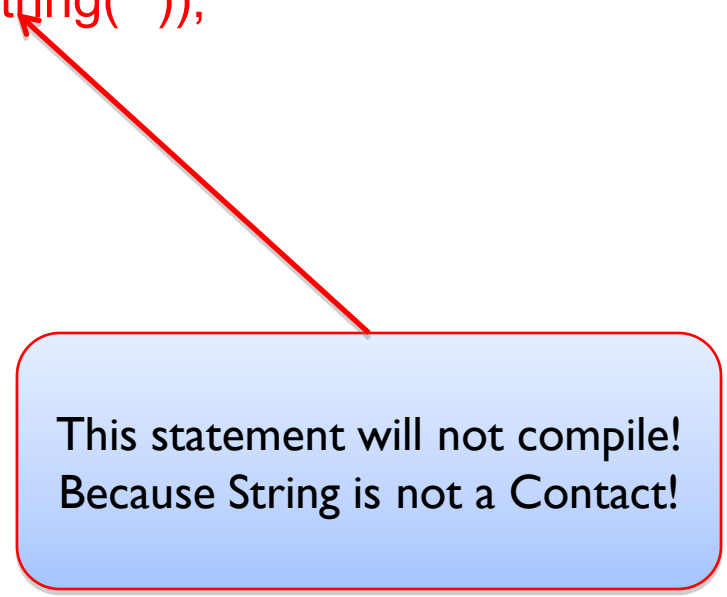
```
for (int j = 0; j < contactList.size(); j++) {
  contactList.get(j).print();
}
```

- No casting!
- Less typing!

Compiler Error Catching

```
ArrayList<Contact> = new ArrayList<Contact>();

contactList.add(new Person(…));
contactList.add(new String(“”));
```



Java Generics

- Use Generics everywhere you can!

- This was a gentle introduction to Generics
  - You can define your own Generic classes but we did not cover this.
  - Generics can get very complex.