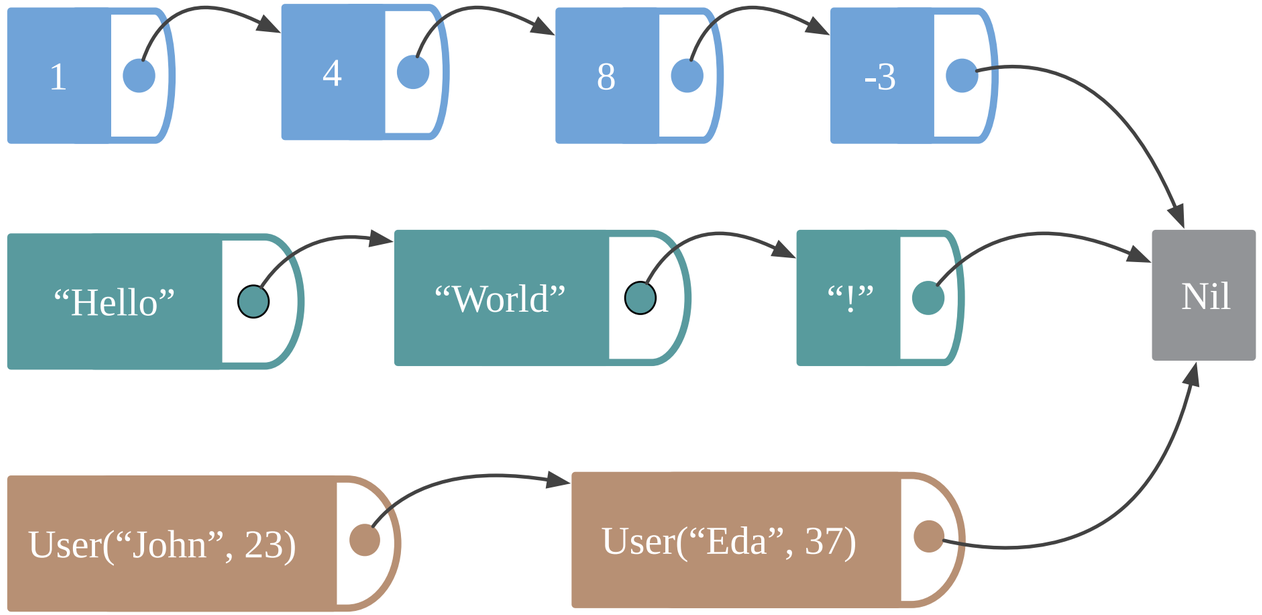
GENERIC FUNCTIONS
PART 1

List is a generic data structure

```
List[Int]

List[String]

List[User]
```

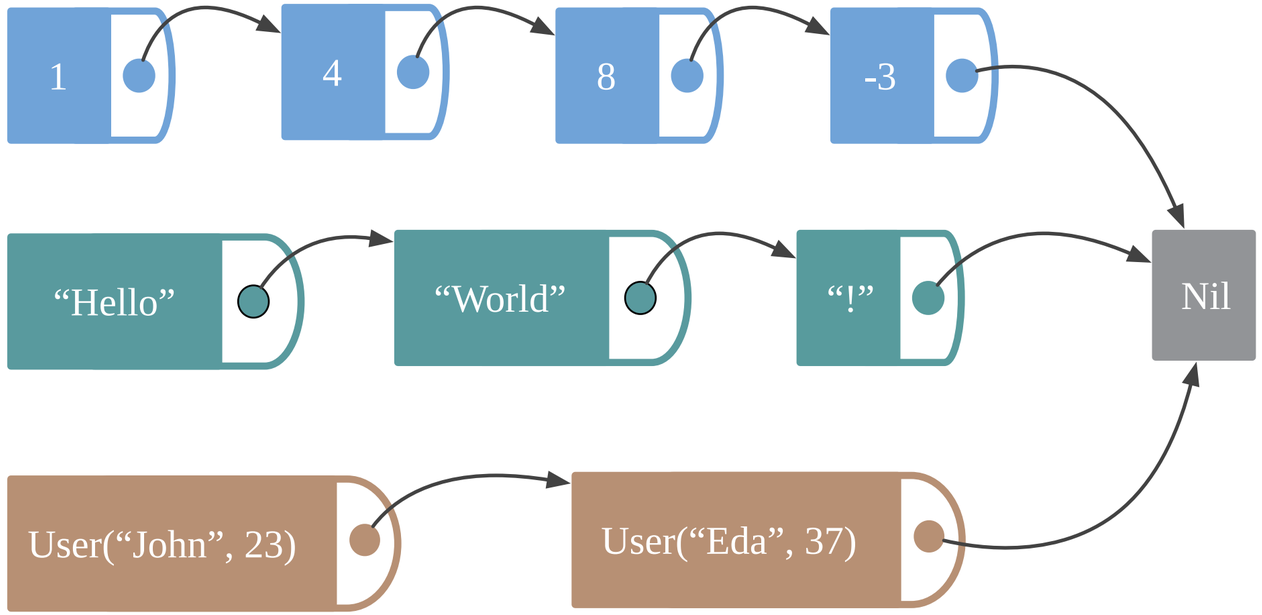


How to avoid duplication?

```
def size(list: List[Int]   ): Int

def size(list: List[String]): Int

def size(list: List[User]  ): Int
```

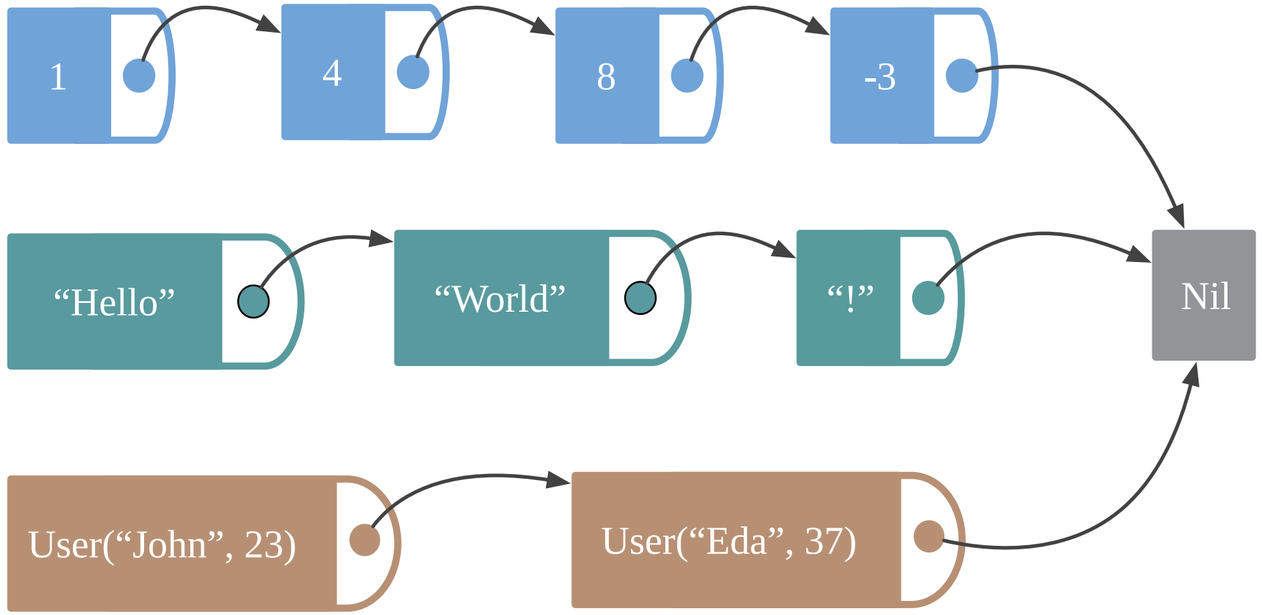


Generic function

```
def size[A](list: List[A]): Int
```

```
size(List(1, 4, 8, -3))
// res1: Int = 4

size(List("Hello", "World", "!"))
// res2: Int = 3
```

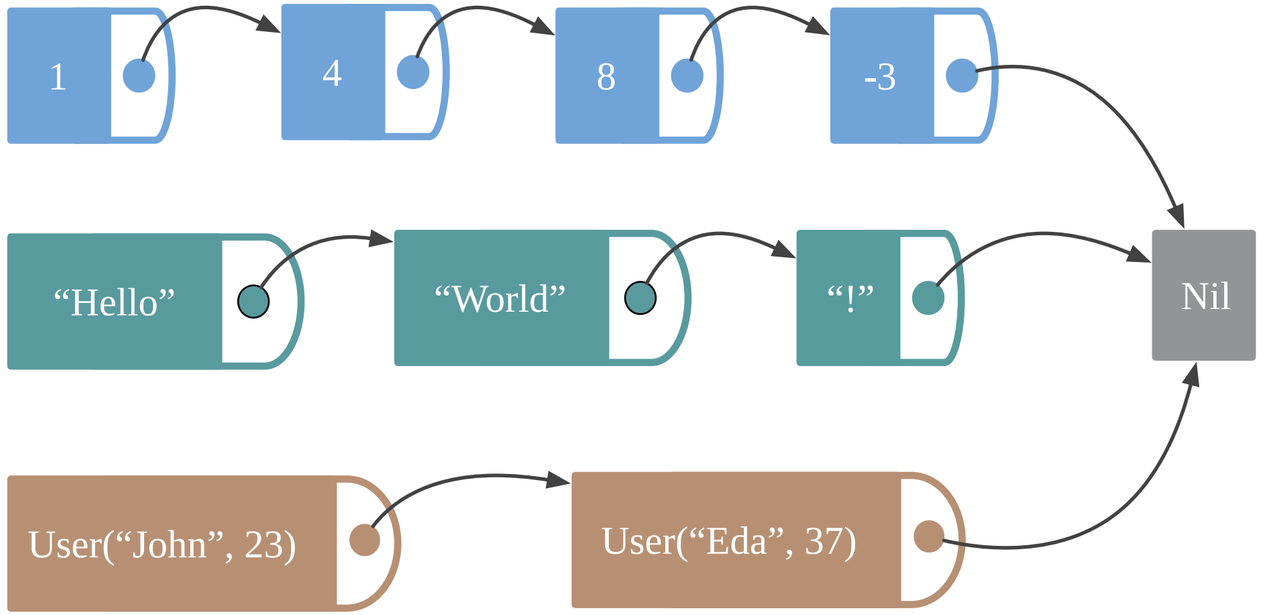


Generic function

```
def size[Elem](list: List[Elem]): Int
```

```
size(List(1, 4, 8, -3))
// res3: Int = 4

size(List("Hello", "World", "!"))
// res4: Int = 3
```



Generic function

```
def map[A](list: List[A], update: A => A): List[A]
```

```
map(List(1,2,3,4), (x: Int) => x + 1)
// res5: List[Int] = List(2, 3, 4, 5)

map(List("Hello", "World"), (x: String) => x.reverse)
// res6: List[String] = List("olleH", "dlroW")
```

Generic function

```
def map[A](list: List[A], update: A => A): List[A]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users, (user: User) => user.name)
// error: type mismatch;
//  found   : App0.this.User => String
//  required: java.io.Serializable => java.io.Serializable
// map(users, (user: User) => user.name)
//            ^^^^^^^^^^^^^^^^^^^^^^^^
```

Generic function

```
def map[A](list: List[A], update: A => A): List[A]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map[User](users, (user: User) => user.name)
// error: type mismatch;
//  found   : String
//  required: App0.this.User
// map[User](users, (user: User) => user.name)
//                                  ^^^^^^^^^
```

Generic function

```
def map[From, To](list: List[From], update: From => To): List[To]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users, (user: User) => user.name)
// res10: List[String] = List("John", "Eda", "Bob")

map(List(1,2,3,4), (x: Int) => x + 1)
// res11: List[Int] = List(2, 3, 4, 5)
```

Generic function

```
def map[From, To](list: List[From], update: From => To): List[To]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users, user => user.name)
// error: missing parameter type
// map(users, user => user.name)
//            ^^^^

map(users, _.name)
// error: missing parameter type for expanded
// function ((<x$1: error>) => x$1.name)
// map(users, _.name)
//            ^
```

Generic function

```
def map[From, To](list: List[From])(update: From => To): List[To]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users)(user => user.name)
// res14: List[String] = List("John", "Eda", "Bob")

map(users)(_.name)
// res15: List[String] = List("John", "Eda", "Bob")
```

Generic function in Dotty/Scala 3

```
def map[From, To](list: List[From], update: From => To): List[To]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users, user => user.name)
// res16: List[String] = List("John", "Eda", "Bob")

map(users, _.name)
// res17: List[String] = List("John", "Eda", "Bob")
```

All generic types are not data structure

```
trait JsonDecoder[A]{
  def decode(value: Json): A
}


case class Predicate[A](value: A => Boolean)
```

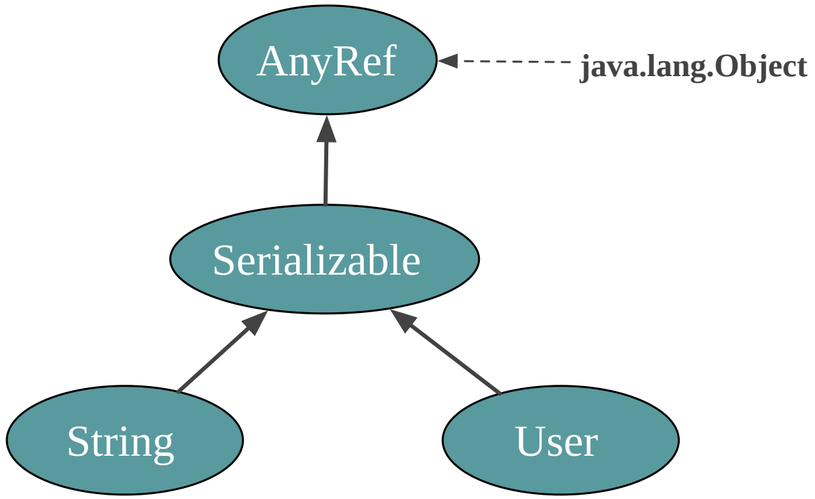
Summary

- Generic functions reduce code duplication
- We can have several type parameters
- We split parameters into different set of parentheses to help type inference

Least Upper Bound (LUB)

```
def map[A](list: List[A], update: A => A): List[A]
```

```
map(users, (user: User) => user.name)
// error: type mismatch;
//  found   : App5.this.User => String
//  required: java.io.Serializable => java.io.Seriali
// map(users, (user: User) => user.name)
//            ^^^^^^^^^^^^^^^^^^^^^^^^^
```



Generic functions in Dotty

```
def map[A](list: List[A], update: A => A): List[A]
```

```
val users = List(User("John", 23), User("Eda", 37), User("Bob", 18))
```

```
map(users, (user: User) => user.name)
// Type Mismatch Error:
// map(users, (user: User) => user.name)
//                            ^^^^^^^^^
//                            Found:    (user.name : String)
//                            Required: User
```