

Tuples & Lists

- Tuples have almost the same syntax as Rust.

```
> joe = (32,185,"married","pilot")
```

```
> :type joe
```

```
joe :: (Num a, Num b) => (a, b, [Char], [Char])
```

```
> (age, height, _, _) = joe
```

```
> age
```

```
=> 32
```

```
> :type age
```

```
age :: Num a => a
```

Type



Pattern Matching



Tuples & Lists

The screenshot shows the Repl.it web interface in a browser. The address bar displays `repl.it/@lutzhamel/Intro#main.hs`. The interface includes a sidebar with a file explorer showing `main.hs` as the active file, along with other files like `area.hs`, `curry.hs`, `fact.hs`, `intinc.hs`, and `rect.hs`. A `Run` button is visible in the top right of the editor area. The main editor displays the following Haskell code and its execution output:

```
https://Intro.lutzhamel.repl.run

GHCi, version 8.6.5
> joe = (32,185,"married","pilot")
>
> :type joe
joe :: (Num a, Num b) => (a, b, [Char], [Char])
>
> (age, height, _, _) = joe
> age
=> 32
> :type age
age :: Num a => a
=> 32
> 
```

Tuples & Lists

- Nested tuples – say we want to specify a circle with a center and a radius...

```
> circle = ((2.5,3.6),5.0)
> circle
=> ((2.5,3.6),5.0)
> :type circle
circle :: (Fractional a, Fractional b1, Fractional b2) => ((a, b1), b2)
=> ((2.5,3.6),5.0)
> center, radius) = circle
➤ center
=> (2.5,3.6)
> radius=> 5.0
```

Tuples & Lists

The screenshot shows the Repl.it web interface. The browser tab is titled "Repl.it - Intro" and the address bar shows "repl.it/@lutzhamel/Intro#main.hs". The interface includes a "Run" button and "Upgrade" and "Share" options. On the left, a "Files" sidebar lists "main.hs" (selected), "area.hs", "curry.hs", "fact.hs", "intinc.hs", and "rect.hs". The main editor displays the following Haskell code:

```
https://Intro.lutzhamel.repl.run

GHCi, version 8.6.5
> circle = ((2.5,3.6),5.0)
> circle
=> ((2.5,3.6),5.0)
> :type circle
circle
  :: (Fractional a, Fractional b1, Fractional b2) => ((a, b1), b2)
=> ((2.5,3.6),5.0)
> (center, radius) = circle
> center
=> (2.5,3.6)
> radius
=> 5.0
>
```

Tuples & Lists

- In a list all elements are of the same type

```
> oddlist = [ 1, 3, 5, 7, 9 ]  
> :type oddlist  
oddlist :: Num a => [a]  
> █
```

different from tuples!

```
nested = [(1,2),(3,4)]  
nested = [[1,2],[3,4]]  
nested = [[1,2],[3,4,5]]  
nested = [(1,2),(3,4,5)]
```

} what is the type of these constructions?

Tuples & Lists

- There exists a special list → the empty list: `[]`

```
> mylist = []  
> :type mylist  
mylist :: [a]  
> █
```



Polymorphic type!

List Operators

- **null** – tests whether a list is empty
 - `null :: [a] -> Bool`

```
> null [1,2,3]
=> False
> null []
=> True
> █
```

List Operators

- ++ - concatenates two lists
 - $(++) :: [a] \rightarrow [a] \rightarrow [a]$

Recall, any infix operator can be viewed as a function by putting parentheses around it.

```
> [1,2,3]++[4,5,6]
=> [1,2,3,4,5,6]
> ["not"]++["married"]
=> ["not","married"]
> ['n','o','t']++"married"
=> "notmarried"
> 
```

But...

List Operators

- `:` - (cons operator) glue elements together to form a list
- the last element has to always be a list
 - `(:)` :: `a -> [a] -> [a]`

```
> 1 : [2,3]
=> [1,2,3]
> 1 : 2 : 3 : [] == [1,2,3]
=> True
> 1 : rest = [1,2,3]
> rest
=> [2,3]
> 1 : rest = [4,5,6]
> rest
*** Exception: <interactive>:26:1-18: Non-exhaustive patterns in 1 : rest
> a : 2 : rest = [3,2,1,0]
> a
=> 3
> rest
=> [1,0]
>
```

List Operators

- **head** – return the first element of a list
 - `head :: [a] -> a`

```
❏ head [1,2,3]
=> 1
❏ head "Hello"
=> 'H'
❏ head []
❏ x = head []
❏ x
*** Exception: Prelude.head: empty list
❏
```

List Operators

- **tail** – return the list without its first element
 - `tail :: [a] -> [a]`

```
➤ tail [1,2,3]
=> [2,3]
➤ tail "Hello"
=> "ello"
➤ x = tail []
➤ x
*** Exception: Prelude.tail: empty list
➤
```

List Operators

- (a) `x = ["hello"] ++ ["there"]`
- (b) `x = ["hello" ++ "there"]`
- (c) `joe = (32, 185, "married", "pilot")`
`jack = (29, 160, "not married", "cook")`
`people = [joe, jack]`
- (d) `l = [[1,2,3],["one", "two", "three"]]`
- (e) `x = [1,2,3]`
`h = head(x)`
`t = tail(x)`
`l = h : t`
`l?`
- (f) `y = 1:2:3`
- (g) `nested = [(1,2),(3,4,5)]`