What is a Functional Language?

Opinions differ, and it is difficult to give a precise definition, but generally speaking:

- Functional programming is **style** of programming in which the basic method of computation is the application of functions to arguments;

- A functional language is one that **supports** and **encourages** the functional style.
Example

Summing the integers 1 to 10 in Java:

```java
int total = 0;
for (int i = 1; i <= 10; i++)
    total = total + i;
```

The computation method is **variable assignment**.
Example

Summing the integers 1 to 10 in Haskell:

```
sum [1..10]
```

The computation method is function application.
Historical Background

1930s:

Alonzo Church develops the lambda calculus, a simple but powerful theory of functions.
1950s:

John McCarthy develops **Lisp**, the first functional language, with some influences from the lambda calculus, but retaining variable assignments.
1960s:

Peter Landin develops ISWIM, the first pure functional language, based strongly on the lambda calculus, with no assignments.
Historical Background

1970s:

John Backus develops FP, a functional language that emphasizes higher-order functions and reasoning about programs.
Historical Background

1970s:

Robin Milner and others develop ML, the first modern functional language, which introduced type inference and polymorphic types.
Historical Background

1970s - 1980s:

David Turner develops a number of lazy functional languages, culminating in the Miranda system.
Historical Background

1987:

An international committee starts the development of Haskell, a standard lazy functional language.
Historical Background

1990s:

Phil Wadler and others develop type classes and monads, two of the main innovations of Haskell.
2003:

The committee publishes the Haskell Report, defining a stable version of the language; an updated version was published in 2010.
Historical Background

2010-date:

Standard distribution, library support, new language features, development tools, use in industry, influence on other languages, etc.
A Taste of Haskell

\[
f [] = []
\]

\[
f (x:xs) = f \; ys \; ++ \; [x] \; ++ \; f \; zs
\]

where

\[
ys = [a \mid a \leftarrow xs, a \leq x]
\]

\[
zs = [b \mid b \leftarrow xs, b > x]
\]