

# Constructor Functions

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## Abstract

Isabelle’s code generator performs various adaptations for target languages. Among others, constructor applications have to be fully saturated. That means that for constructor calls occurring as arguments to higher-order functions, synthetic lambdas have to be inserted. This entry provides tooling to avoid this construction altogether by introducing constructor functions.

## 1 Introduction

```
theory Constructor-Funs  
  imports Main  
  keywords constructor-funs :: thy-decl  
begin
```

Importing this theory adds a preprocessing step to the code generator: All datatype constructors are replaced by functions, and all constructor calls are replaced by function calls. For example, for the *Suc* constructor of *nat*, a new constant with the same type and the definition  $suc' n = Suc\ n$  is created. Then, all instances of *Suc* (except for in the constructor functions themselves) are replaced. Note that the constructor functions are defined in eta-long form.

Note that this does not affect constructors declared by **code-datatype**, only **datatype** (and **free-constructors**).

The motivation for doing this is to avoid target-specific lambda-insertion by the code generator. In some target languages, constructors cannot be used as functions. As a consequence, terms like  $map\ Suc\ xs$  have to be printed as  $map\ (fn\ x => Suc\ x)\ xs$ . This entails generation of fresh names outside of the proof kernel. The transformation provided by this theory ensures that all constructor calls are fully saturated. This makes supporting target languages that forbid partially-applied constructor calls much easier.

The obvious downside is that this construction will usually degrade performance of generated code. To some extent, an optimising compiler that performs inlining can alleviate that.

## 2 Setup

*<ML>*

**end**

## 3 Usage

```
theory Test-Constructor-Funs  
imports Constructor-Funs  
begin
```

This entry provides a **datatype** plugin and a separate command. The plugin runs by default on all defined datatypes, but it can be disabled individually:

```
datatype (plugins del: constructor-funs) 'a tree = Node | Fork 'a 'a tree list
```

```
context begin
```

The **constructor-funs** command can be used to add constructor functions if the plugin has been disabled during datatype definition.

```
constructor-funs tree
```

```
end
```

Records are supported.

```
record 'a meep =  
  field1 :: 'a  
  field2 :: nat
```

Nested and mutual recursion are supported.

```
datatype  
  'a mlist1 = MNil1 | MCons1 'a 'a mlist2 and  
  'a mlist2 = MNil2 | MCons2 'a 'a mlist1
```

## 4 Examples

```
datatype 'a seq = Nil | Cons 'a 'a seq
```

```
fun app :: 'a seq  $\Rightarrow$  'a seq  $\Rightarrow$  'a seq where  
app Nil ys = ys |  
app (Cons x xs) ys = Cons x (app xs ys)
```

```
fun map where  
map - Nil = Nil |  
map f (Cons x xs) = Cons (f x) (map f xs)
```

```
definition bla = map (Cons True) Nil
```

The generated code never calls constructors directly, but only through regular functions. These functions are defined in eta-long form.

```
declare [[constructor-funs]]
```

```
export-code app bla plus-nat-inst.plus-nat in SML
```

```
export-code app bla plus-nat-inst.plus-nat checking SML Scala
```

```
end
```