The Language GF

BNF-converter

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This document was automatically generated by the *BNF-Converter*. It was generated together with the lexer, the parser, and the abstract syntax module, which guarantees that the document matches with the implementation of the language (provided no hand-hacking has taken place).

The lexical structure of GF

Identifiers

Identifiers ⟨*Ident*⟩ are unquoted strings beginning with a letter, followed by any combination of letters, digits, and the characters `_ '`, reserved words excluded.

Literals

Integer literals ⟨*Int*⟩ are nonempty sequences of digits.

String literals ⟨*String*⟩ have the form `"`x`"`, where x is any sequence of any characters except `"` unless preceded by `\`.

Double-precision float literals ⟨*Double*⟩ have the structure indicated by the regular expression ⟨*digit*⟩ + '.'⟨*digit*⟩ + ('e'-?⟨*digit*⟩+)? i.e. two sequences of digits separated by a decimal point, optionally followed by an unsigned or negative exponent.

LString literals are recognized by the regular expression '"'(⟨*anychar*⟩−'"')*'"'

Reserved words and symbols

The set of reserved words is the set of terminals appearing in the grammar. Those reserved words that consist of non-letter characters are called symbols, and they are treated in a different way from those that are similar to identifiers. The lexer follows rules familiar from languages like Haskell, C, and Java, including longest match and spacing conventions.

The reserved words used in GF are the following:

```
Lin          PType      Str
Strs         Tok        Type
abstract     case       cat
concrete     data       def
flags        fn         fun
grammar      in         include
incomplete   instance   interface
let          lin        lincat
lindef       lintype    of
open         oper       out
package      param      pattern
pre          printname  resource
reuse        strs       table
tokenizer    transfer   union
var          variants   where
with
```

The symbols used in GF are the following:

```
;   =    {
}   (    )
:   ->   **
,   [    ]
-   .    |
%   ?    <
>   @    !
*   +    ++
\   =>   _
$   /
```

Comments

Single-line comments begin with $--$.
Multiple-line comments are enclosed with $\{-$ and $-\}$.

The syntactic structure of GF

Non-terminals are enclosed between $\langle$ and $\rangle$. The symbols ::= (production), | (union) and ϵ (empty rule) belong to the BNF notation. All other symbols are terminals.

⟨*Grammar*⟩ ::= ⟨*ListModDef*⟩

⟨*ListModDef*⟩ ::= ϵ
| ⟨*ModDef*⟩ ⟨*ListModDef*⟩

⟨*ModDef*⟩ ::= ⟨*ModDef*⟩ `;`
| `grammar` ⟨*Ident*⟩ = { `abstract` = ⟨*Ident*⟩ `;` ⟨*ListConcSpec*⟩ }
| ⟨*ComplMod*⟩ ⟨*ModType*⟩ = ⟨*ModBody*⟩

⟨*ConcSpec*⟩ ::= ⟨*Ident*⟩ = ⟨*ConcExp*⟩

⟨*ListConcSpec*⟩ ::= ϵ
| ⟨*ConcSpec*⟩
| ⟨*ConcSpec*⟩ `;` ⟨*ListConcSpec*⟩

⟨*ConcExp*⟩ ::= ⟨*Ident*⟩ ⟨*ListTransfer*⟩

⟨*ListTransfer*⟩ ::= ϵ
| ⟨*Transfer*⟩ ⟨*ListTransfer*⟩

⟨*Transfer*⟩ ::= `(` `transfer in` ⟨*Open*⟩ `)`
| `(` `transfer out` ⟨*Open*⟩ `)`

⟨*ModType*⟩ ::= `abstract` ⟨*Ident*⟩
| `resource` ⟨*Ident*⟩
| `interface` ⟨*Ident*⟩
| `concrete` ⟨*Ident*⟩ `of` ⟨*Ident*⟩
| `instance` ⟨*Ident*⟩ `of` ⟨*Ident*⟩
| `transfer` ⟨*Ident*⟩ `:` ⟨*Open*⟩ −> ⟨*Open*⟩

⟨*ModBody*⟩ ::= ⟨*Extend*⟩ ⟨*Opens*⟩ { ⟨*ListTopDef*⟩ }
| ⟨*Ident*⟩ `with` ⟨*ListOpen*⟩
| ⟨*ListIncluded*⟩ `**` ⟨*Ident*⟩ `with` ⟨*ListOpen*⟩
| `reuse` ⟨*Ident*⟩
| `union` ⟨*ListIncluded*⟩

⟨*ListTopDef*⟩ ::= ϵ
| ⟨*TopDef*⟩ ⟨*ListTopDef*⟩

⟨*Extend*⟩ ::= ⟨*ListIncluded*⟩ `**`
| ϵ

⟨*ListOpen*⟩ ::= ϵ
| ⟨*Open*⟩
| ⟨*Open*⟩ `,` ⟨*ListOpen*⟩

⟨*Opens*⟩ ::= ϵ
| `open` ⟨*ListOpen*⟩ `in`

⟨*Open*⟩ ::= ⟨*Ident*⟩
| (⟨*QualOpen*⟩ ⟨*Ident*⟩)
| (⟨*QualOpen*⟩ ⟨*Ident*⟩ = ⟨*Ident*⟩)

⟨*ComplMod*⟩ ::= ϵ
| `incomplete`

⟨*QualOpen*⟩ ::= ϵ
| `incomplete`
| `interface`

⟨*ListIncluded*⟩ ::= ϵ
| ⟨*Included*⟩
| ⟨*Included*⟩ , ⟨*ListIncluded*⟩

⟨*Included*⟩ ::= ⟨*Ident*⟩
| ⟨*Ident*⟩ [⟨*ListIdent*⟩]
| ⟨*Ident*⟩ − [⟨*ListIdent*⟩]

⟨*Def*⟩ ::= ⟨*ListName*⟩ : ⟨*Exp*⟩
| ⟨*ListName*⟩ = ⟨*Exp*⟩
| ⟨*Name*⟩ ⟨*ListPatt*⟩ = ⟨*Exp*⟩
| ⟨*ListName*⟩ : ⟨*Exp*⟩ = ⟨*Exp*⟩

⟨*TopDef*⟩ ::= `cat` ⟨*ListCatDef*⟩
| `fun` ⟨*ListFunDef*⟩
| `data` ⟨*ListFunDef*⟩
| `def` ⟨*ListDef*⟩
| `data` ⟨*ListDataDef*⟩
| `transfer` ⟨*ListDef*⟩
| `param` ⟨*ListParDef*⟩
| `oper` ⟨*ListDef*⟩
| `lincat` ⟨*ListPrintDef*⟩
| `lindef` ⟨*ListDef*⟩
| `lin` ⟨*ListDef*⟩
| `printname cat` ⟨*ListPrintDef*⟩
| `printname fun` ⟨*ListPrintDef*⟩
| `flags` ⟨*ListFlagDef*⟩
| `printname` ⟨*ListPrintDef*⟩
| `lintype` ⟨*ListDef*⟩
| `pattern` ⟨*ListDef*⟩
| `package` ⟨*Ident*⟩ = { ⟨*ListTopDef*⟩ } ;
| `var` ⟨*ListDef*⟩
| `tokenizer` ⟨*Ident*⟩ ;

⟨*CatDef*⟩ ::= ⟨*Ident*⟩ ⟨*ListDDecl*⟩
| [⟨*Ident*⟩ ⟨*ListDDecl*⟩]
| [⟨*Ident*⟩ ⟨*ListDDecl*⟩] { ⟨*Integer*⟩ }

⟨*FunDef*⟩ ::= ⟨*ListIdent*⟩ `:` ⟨*Exp*⟩

⟨*DataDef*⟩ ::= ⟨*Ident*⟩ `=` ⟨*ListDataConstr*⟩

⟨*DataConstr*⟩ ::= ⟨*Ident*⟩
| ⟨*Ident*⟩ `.` ⟨*Ident*⟩

⟨*ListDataConstr*⟩ ::= ϵ
| ⟨*DataConstr*⟩
| ⟨*DataConstr*⟩ `|` ⟨*ListDataConstr*⟩

⟨*ParDef*⟩ ::= ⟨*Ident*⟩ `=` ⟨*ListParConstr*⟩
| ⟨*Ident*⟩ `=` `(` `in` ⟨*Ident*⟩ `)`
| ⟨*Ident*⟩

⟨*ParConstr*⟩ ::= ⟨*Ident*⟩ ⟨*ListDDecl*⟩

⟨*PrintDef*⟩ ::= ⟨*ListName*⟩ `=` ⟨*Exp*⟩

⟨*FlagDef*⟩ ::= ⟨*Ident*⟩ `=` ⟨*Ident*⟩

⟨*ListDef*⟩ ::= ⟨*Def*⟩ `;`
| ⟨*Def*⟩ `;` ⟨*ListDef*⟩

⟨*ListCatDef*⟩ ::= ⟨*CatDef*⟩ `;`
| ⟨*CatDef*⟩ `;` ⟨*ListCatDef*⟩

⟨*ListFunDef*⟩ ::= ⟨*FunDef*⟩ `;`
| ⟨*FunDef*⟩ `;` ⟨*ListFunDef*⟩

⟨*ListDataDef*⟩ ::= ⟨*DataDef*⟩ `;`
| ⟨*DataDef*⟩ `;` ⟨*ListDataDef*⟩

⟨*ListParDef*⟩ ::= ⟨*ParDef*⟩ `;`
| ⟨*ParDef*⟩ `;` ⟨*ListParDef*⟩

⟨*ListPrintDef*⟩ ::= ⟨*PrintDef*⟩ `;`
| ⟨*PrintDef*⟩ `;` ⟨*ListPrintDef*⟩

⟨*ListFlagDef*⟩ ::= ⟨*FlagDef*⟩ `;`
| ⟨*FlagDef*⟩ `;` ⟨*ListFlagDef*⟩

⟨*ListParConstr*⟩ ::= ϵ
| ⟨*ParConstr*⟩
| ⟨*ParConstr*⟩ `|` ⟨*ListParConstr*⟩

⟨*ListIdent*⟩ ::= ⟨*Ident*⟩
| ⟨*Ident*⟩ `,` ⟨*ListIdent*⟩

⟨*Name*⟩ ::= ⟨*Ident*⟩
| `[` ⟨*Ident*⟩ `]`

⟨*ListName*⟩ ::= ⟨*Name*⟩
| ⟨*Name*⟩ `,` ⟨*ListName*⟩

⟨*LocDef*⟩ ::= ⟨*ListIdent*⟩ `:` ⟨*Exp*⟩
| ⟨*ListIdent*⟩ `=` ⟨*Exp*⟩
| ⟨*ListIdent*⟩ `:` ⟨*Exp*⟩ `=` ⟨*Exp*⟩

⟨*ListLocDef*⟩ ::= ϵ
| ⟨*LocDef*⟩
| ⟨*LocDef*⟩ `;` ⟨*ListLocDef*⟩

⟨*Exp6*⟩ ::= ⟨*Ident*⟩
| `{` ⟨*Ident*⟩ `}`
| `%` ⟨*Ident*⟩ `%`
| ⟨*Sort*⟩
| ⟨*String*⟩
| ⟨*Integer*⟩
| ⟨*Double*⟩
| `?`
| `[ ]`
| `data`
| `[` ⟨*Ident*⟩ ⟨*Exps*⟩ `]`
| `[` ⟨*String*⟩ `]`
| `{` ⟨*ListLocDef*⟩ `}`
| `<` ⟨*ListTupleComp*⟩ `>`
| `(` `in` ⟨*Ident*⟩ `)`
| `<` ⟨*Exp*⟩ `:` ⟨*Exp*⟩ `>`
| `(` ⟨*Exp*⟩ `)`
| ⟨*LString*⟩

⟨*Exp5*⟩ ::= ⟨*Exp5*⟩ `.` ⟨*Label*⟩
| `{` ⟨*Ident*⟩ `.` ⟨*Ident*⟩ `}`
| `%` ⟨*Ident*⟩ `.` ⟨*Ident*⟩
| ⟨*Exp6*⟩

⟨*Exp4*⟩ ::= ⟨*Exp4*⟩ ⟨*Exp5*⟩
| `table` { ⟨*ListCase*⟩ }
| `table` ⟨*Exp6*⟩ { ⟨*ListCase*⟩ }
| `table` ⟨*Exp6*⟩ `[` ⟨*ListExp*⟩ `]`
| `case` ⟨*Exp*⟩ `of` { ⟨*ListCase*⟩ }
| `variants` { ⟨*ListExp*⟩ }
| `pre` { ⟨*Exp*⟩ `;` ⟨*ListAltern*⟩ }
| `strs` { ⟨*ListExp*⟩ }
| ⟨*Ident*⟩ `@` ⟨*Exp6*⟩
| ⟨*Exp5*⟩
| `Lin` ⟨*Ident*⟩

⟨*Exp3*⟩ ::= ⟨*Exp3*⟩ `!` ⟨*Exp4*⟩
| ⟨*Exp3*⟩ `*` ⟨*Exp4*⟩
| ⟨*Exp3*⟩ `**` ⟨*Exp4*⟩
| ⟨*Exp4*⟩

⟨*Exp1*⟩ ::= ⟨*Exp2*⟩ + ⟨*Exp1*⟩
| ⟨*Exp2*⟩

⟨*Exp*⟩ ::= ⟨*Exp1*⟩ ++ ⟨*Exp*⟩
| \ ⟨*ListBind*⟩ −> ⟨*Exp*⟩
| \ \ ⟨*ListBind*⟩ => ⟨*Exp*⟩
| ⟨*Decl*⟩ −> ⟨*Exp*⟩
| ⟨*Exp3*⟩ => ⟨*Exp*⟩
| `let` { ⟨*ListLocDef*⟩ } `in` ⟨*Exp*⟩
| `let` ⟨*ListLocDef*⟩ `in` ⟨*Exp*⟩
| ⟨*Exp3*⟩ `where` { ⟨*ListLocDef*⟩ }
| `fn` { ⟨*ListEquation*⟩ }
| `in` ⟨*Exp5*⟩ ⟨*String*⟩
| ⟨*Exp1*⟩

⟨*Exp2*⟩ ::= ⟨*Exp3*⟩

⟨*ListExp*⟩ ::= ϵ
| ⟨*Exp*⟩
| ⟨*Exp*⟩ `;` ⟨*ListExp*⟩

⟨*Exps*⟩ ::= ϵ
| ⟨*Exp6*⟩ ⟨*Exps*⟩

⟨*Patt2*⟩ ::= `_`
| ⟨*Ident*⟩
| `{` ⟨*Ident*⟩ `}`
| ⟨*Ident*⟩ `.` ⟨*Ident*⟩
| ⟨*Integer*⟩
| ⟨*Double*⟩
| ⟨*String*⟩
| `{` ⟨*ListPattAss*⟩ `}`
| `<` ⟨*ListPattTupleComp*⟩ `>`
| `(` ⟨*Patt*⟩ `)`

⟨*Patt1*⟩ ::= ⟨*Ident*⟩ ⟨*ListPatt*⟩
| ⟨*Ident*⟩ `.` ⟨*Ident*⟩ ⟨*ListPatt*⟩
| ⟨*Patt2*⟩ `*`
| ⟨*Ident*⟩ `@` ⟨*Patt2*⟩
| ⟨*Patt2*⟩

⟨*Patt*⟩ ::= ⟨*Patt*⟩ `|` ⟨*Patt1*⟩
| ⟨*Patt*⟩ `+` ⟨*Patt1*⟩
| ⟨*Patt1*⟩

⟨*PattAss*⟩ ::= ⟨*ListIdent*⟩ `=` ⟨*Patt*⟩

⟨*Label*⟩ ::= ⟨*Ident*⟩
| `$` ⟨*Integer*⟩

⟨*Sort*⟩ ::= `Type`
| `PType`
| `Tok`
| `Str`
| `Strs`

⟨*ListPattAss*⟩ ::= ϵ
| ⟨*PattAss*⟩
| ⟨*PattAss*⟩ `;` ⟨*ListPattAss*⟩

⟨*ListPatt*⟩ ::= ⟨*Patt2*⟩
| ⟨*Patt2*⟩ ⟨*ListPatt*⟩

⟨*Bind*⟩ ::= ⟨*Ident*⟩
| `_`

⟨*ListBind*⟩ ::= ϵ
| ⟨*Bind*⟩
| ⟨*Bind*⟩ `,` ⟨*ListBind*⟩

⟨*Decl*⟩ ::= `(` ⟨*ListBind*⟩ `:` ⟨*Exp*⟩ `)`
| ⟨*Exp4*⟩

⟨*TupleComp*⟩ ::= ⟨*Exp*⟩

⟨*PattTupleComp*⟩ ::= ⟨*Patt*⟩

⟨*ListTupleComp*⟩ ::= ϵ
| ⟨*TupleComp*⟩
| ⟨*TupleComp*⟩ `,` ⟨*ListTupleComp*⟩

⟨*ListPattTupleComp*⟩ ::= ϵ
| ⟨*PattTupleComp*⟩
| ⟨*PattTupleComp*⟩ `,` ⟨*ListPattTupleComp*⟩

⟨*Case*⟩ ::= ⟨*Patt*⟩ `=>` ⟨*Exp*⟩

⟨*ListCase*⟩ ::= ⟨*Case*⟩
| ⟨*Case*⟩ `;` ⟨*ListCase*⟩

⟨*Equation*⟩ ::= ⟨*ListPatt*⟩ `->` ⟨*Exp*⟩

⟨*ListEquation*⟩ ::= ϵ
| ⟨*Equation*⟩
| ⟨*Equation*⟩ `;` ⟨*ListEquation*⟩

⟨*Altern*⟩ ::= ⟨*Exp*⟩ `/` ⟨*Exp*⟩

⟨*ListAltern*⟩ ::= ϵ
| ⟨*Altern*⟩
| ⟨*Altern*⟩ `;` ⟨*ListAltern*⟩

⟨*DDecl*⟩ ::= `(` ⟨*ListBind*⟩ `:` ⟨*Exp*⟩ `)`
| ⟨*Exp6*⟩

⟨*ListDDecl*⟩ ::= ϵ
| ⟨*DDecl*⟩ ⟨*ListDDecl*⟩

⟨*OldGrammar*⟩ ::= ⟨*Include*⟩ ⟨*ListTopDef*⟩

⟨*Include*⟩ ::= ϵ
| `include` ⟨*ListFileName*⟩

⟨*FileName*⟩ ::= ⟨*String*⟩
| ⟨*Ident*⟩
| `/` ⟨*FileName*⟩
| `.` ⟨*FileName*⟩
| `-` ⟨*FileName*⟩
| ⟨*Ident*⟩ ⟨*FileName*⟩

⟨*ListFileName*⟩ ::= ⟨*FileName*⟩ **;**
| ⟨*FileName*⟩ **;** ⟨*ListFileName*⟩