Unit 4
BNF and Syntax Diagrams

Backus-Naur form and variants

- **Metasyntax**: a syntax used to describe the syntax of languages,
- **BNF(**Backus–Naur FormBNF) is a metasyntax used to express context free grammars
- BNF is widely used as a notation for the grammars programming languages, instruction sets, communication protocols and parts of natural language grammars

Backus-Naur form and variants (cont)

- A set of rules is specified. These are known as **production** rules.
- Each production rule defines the pattern that represents a named structured part of the language
- The name of such a part is called a **non-terminal** symbol in the language.
- The basic elements of the language are called **terminal** symbols.

Backus-Naur form and variants (cont)

- Each rule contains the name of the non-terminal being defined, followed by the sequence or alternative sequences allowed for that symbol. A defining sequence can contain any terminal and non-terminal symbols allowed for that language.
- The definition of a rule can also contain the symbol being defined by that rules. This is called **recursive** definition.

Example: Grammar for Arithmetic Expressions

- **Productions**

```
<Exp>    ::=
           “+”<Expr2>|”-”<Expr2>|<Expr2>
<Expr2> ::= <Term><Expr3>
<Expr3> ::= “+” <Term><Expr3>|
            ”-”<Term><Expr3>|ε
<Term>  ::= <Factor> <Term2>
<Term2> ::= “*” <Factor> <Term2> |”/”<Factor> <Term2>|ε
<Factor> ::=“ident”|”number”|”(“<Exp>”)”
```

- **Terminal symbols**
  - simple TS: "+", "-", "*", "/", "(", ")"
  - terminal classes: “ident”, “number”
- **Nonterminal symbols**
  - <Expr>, <Expr2>, <Expr3>, <Term>, <Term2>, <Factor>
- **Start symbol**
  - <Expr>

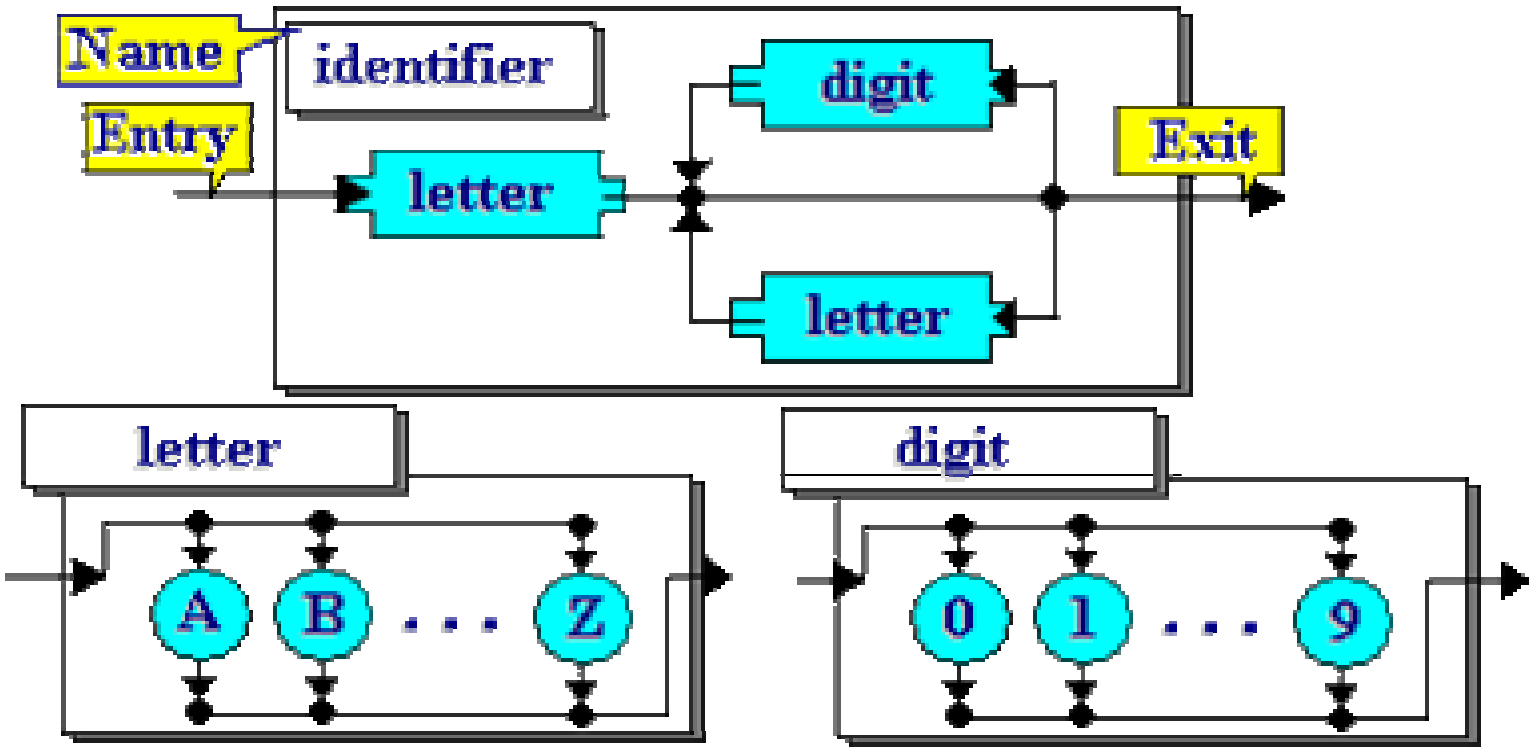
EBNF(Extended BNF)

- Terminal symbols start with lower-case letters
- Nonterminal symbols start with upper-case letters
- **Metasymbols**
  - | (...) separates alternatives groups
  - [...] alternatives optional part
  - {...} iterative part

Syntax Diagram

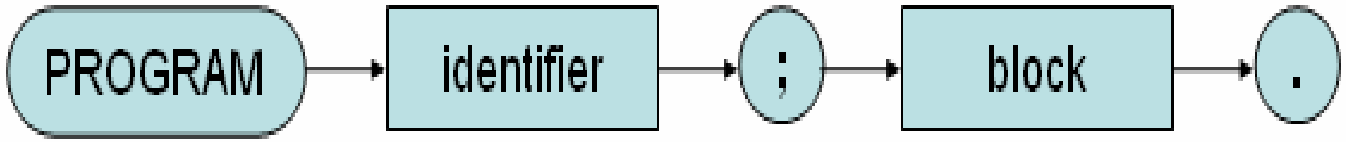
- Each diagram defines a non-terminal
- There is a main diagram which defines the language
- Each diagram has an entry point and an end point
- Terminals are represented by round boxes
- Nonterminals are represented by square boxes.

Examples of syntax diagram

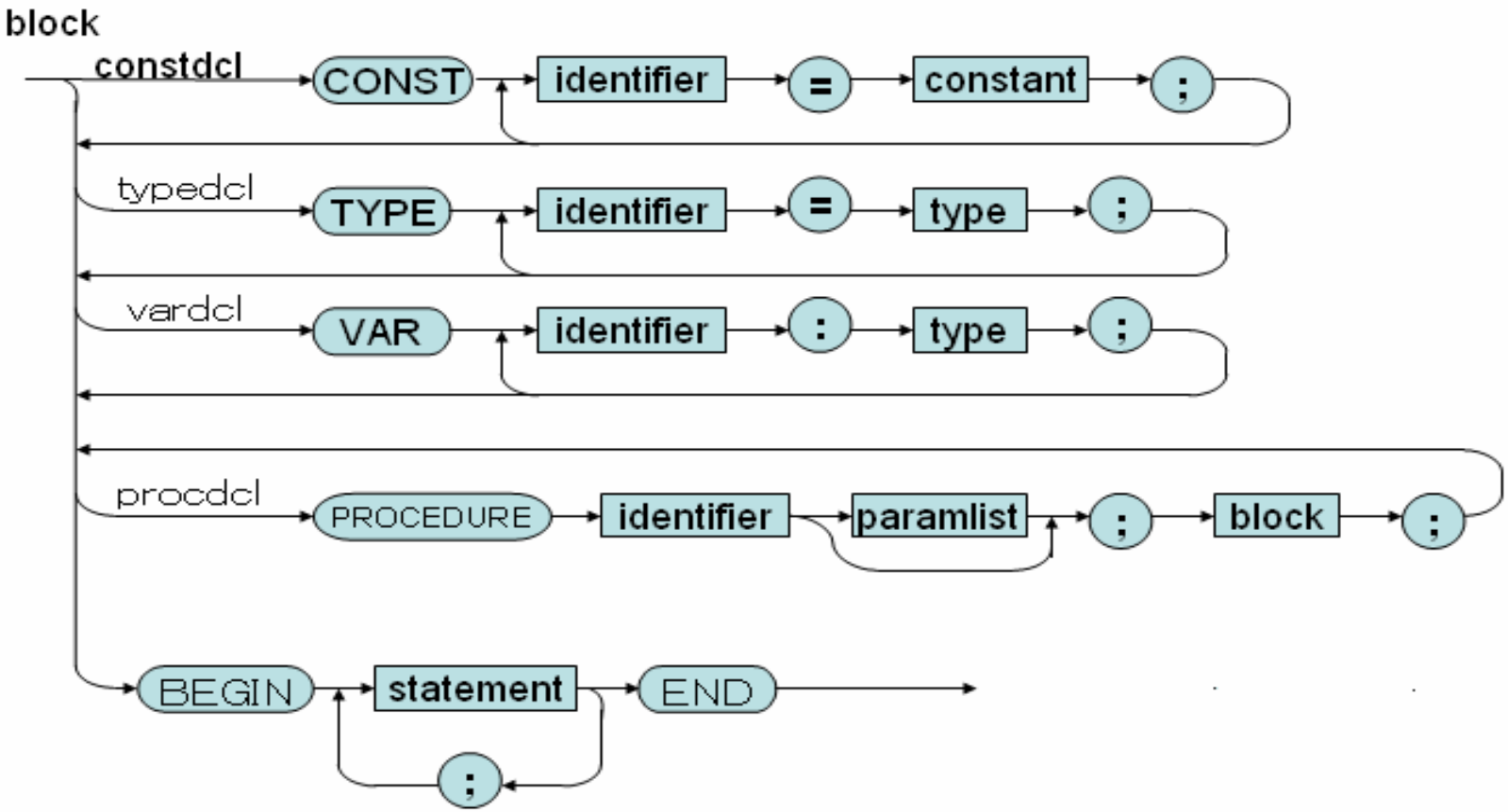


Syntax Diagrams of KPL (program)

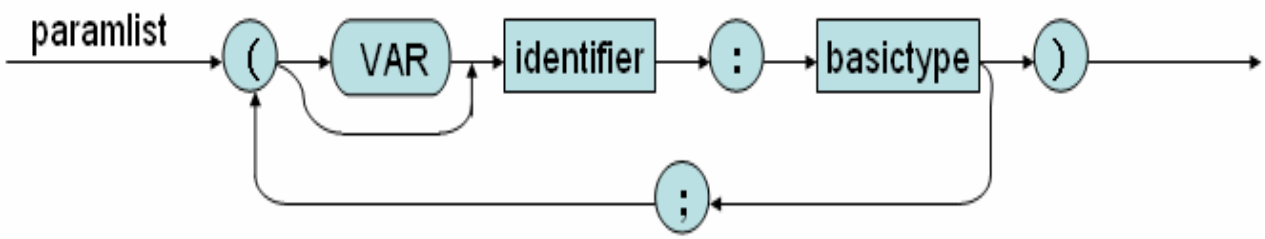
program

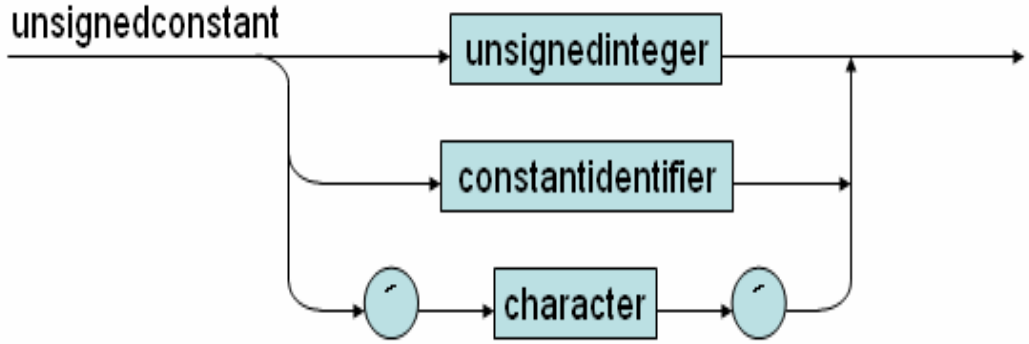


Syntax Diagrams of KPL(block)

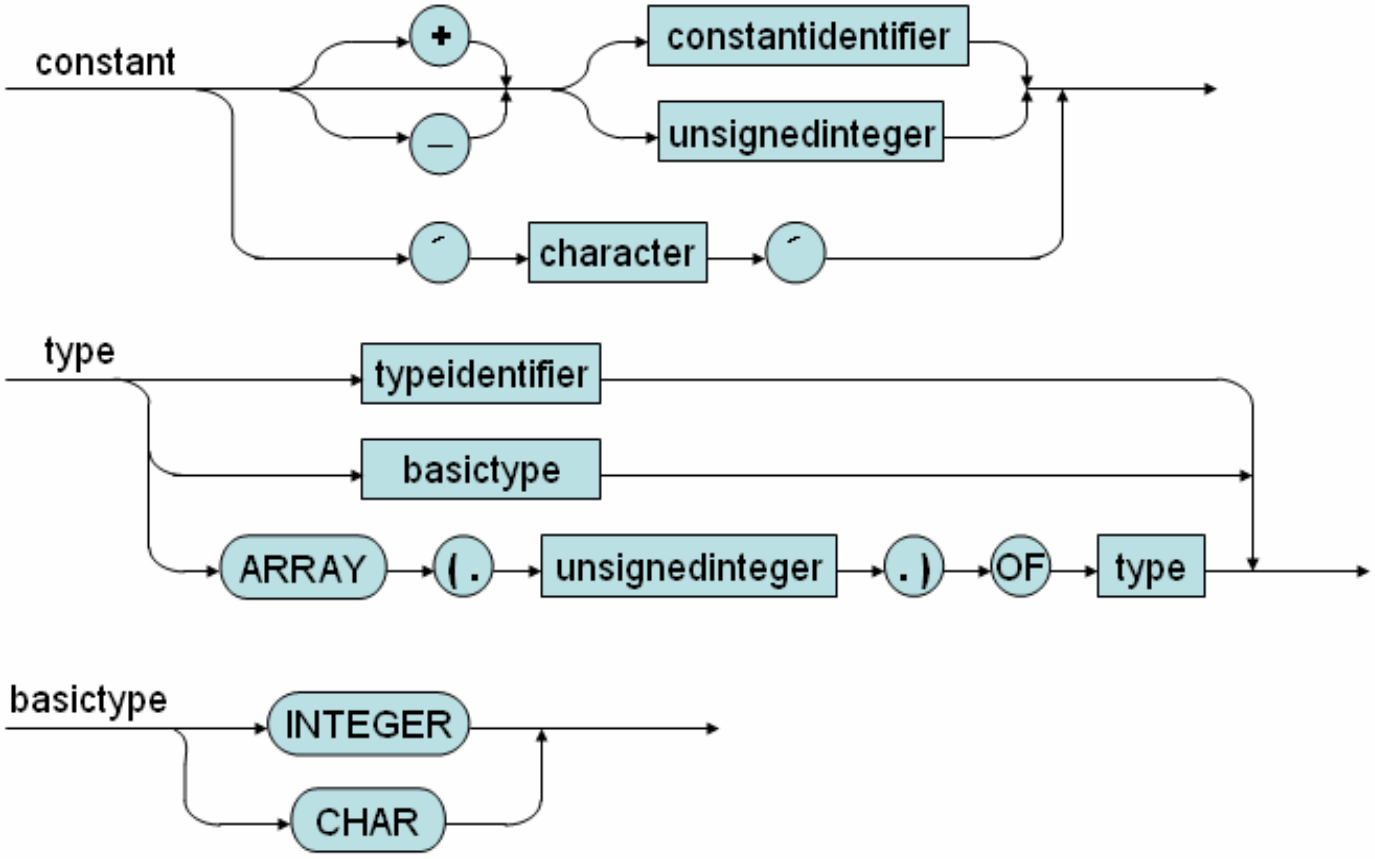


Syntax Diagrams of KPL (list of parameters, unsigned constant)

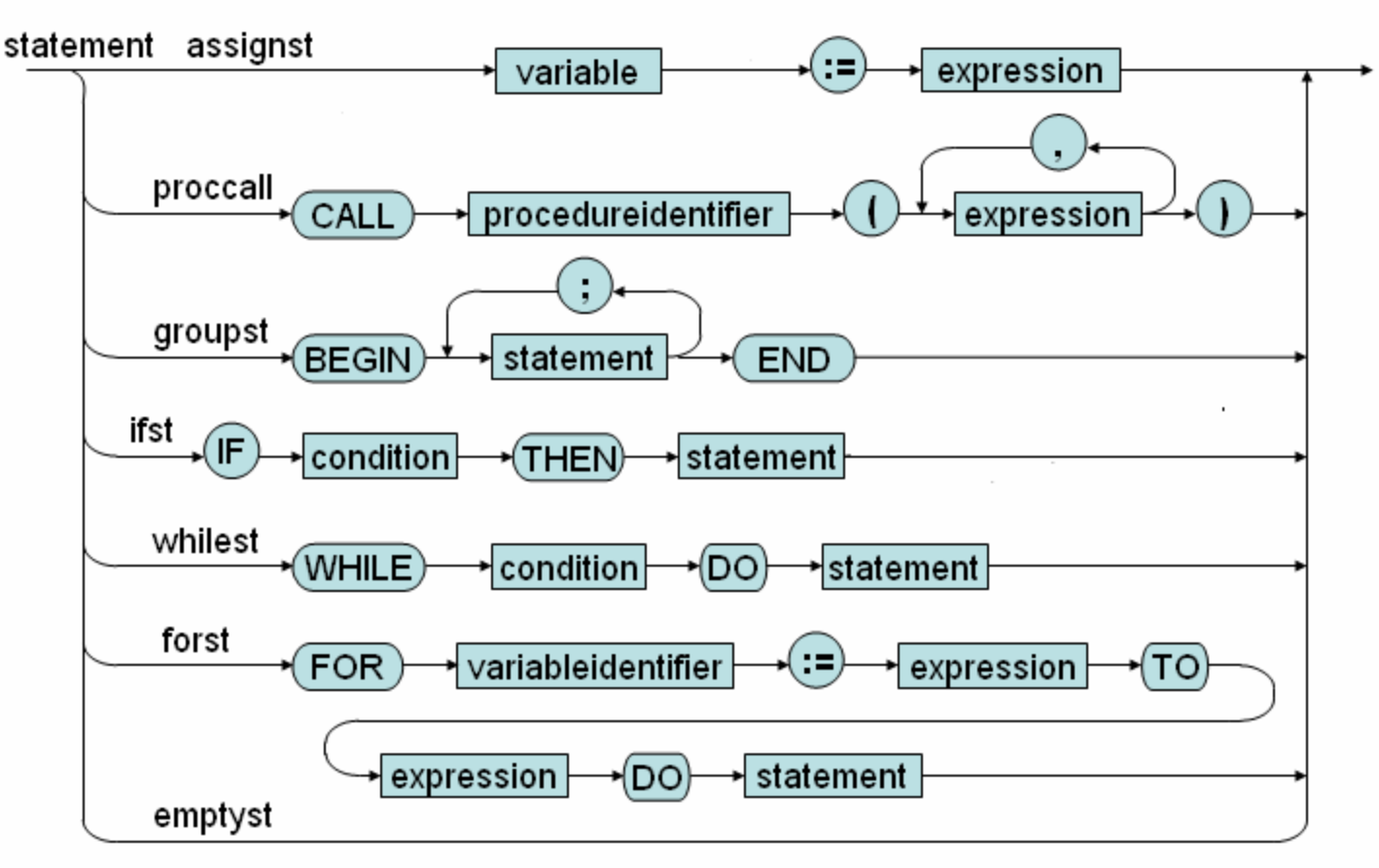




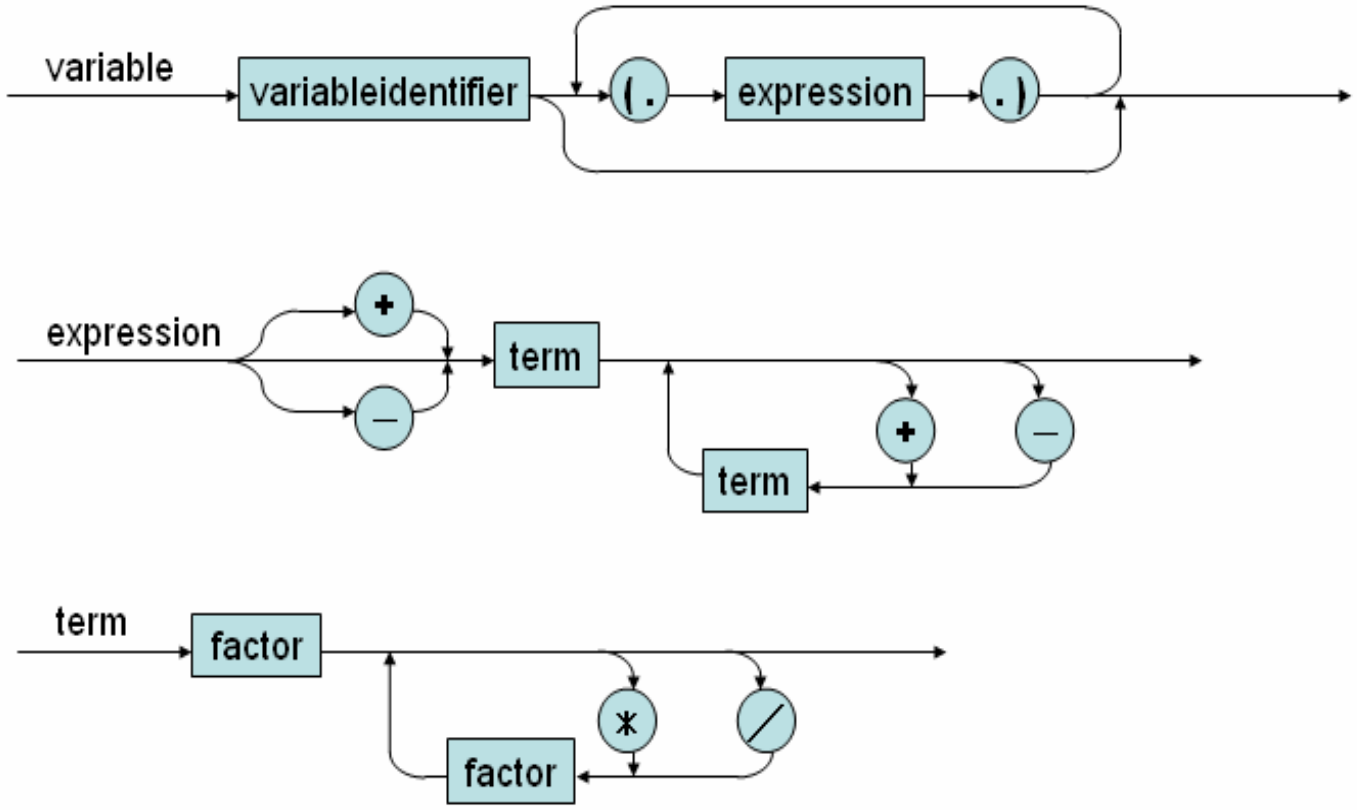
Syntax Diagrams of KPL (declarations)



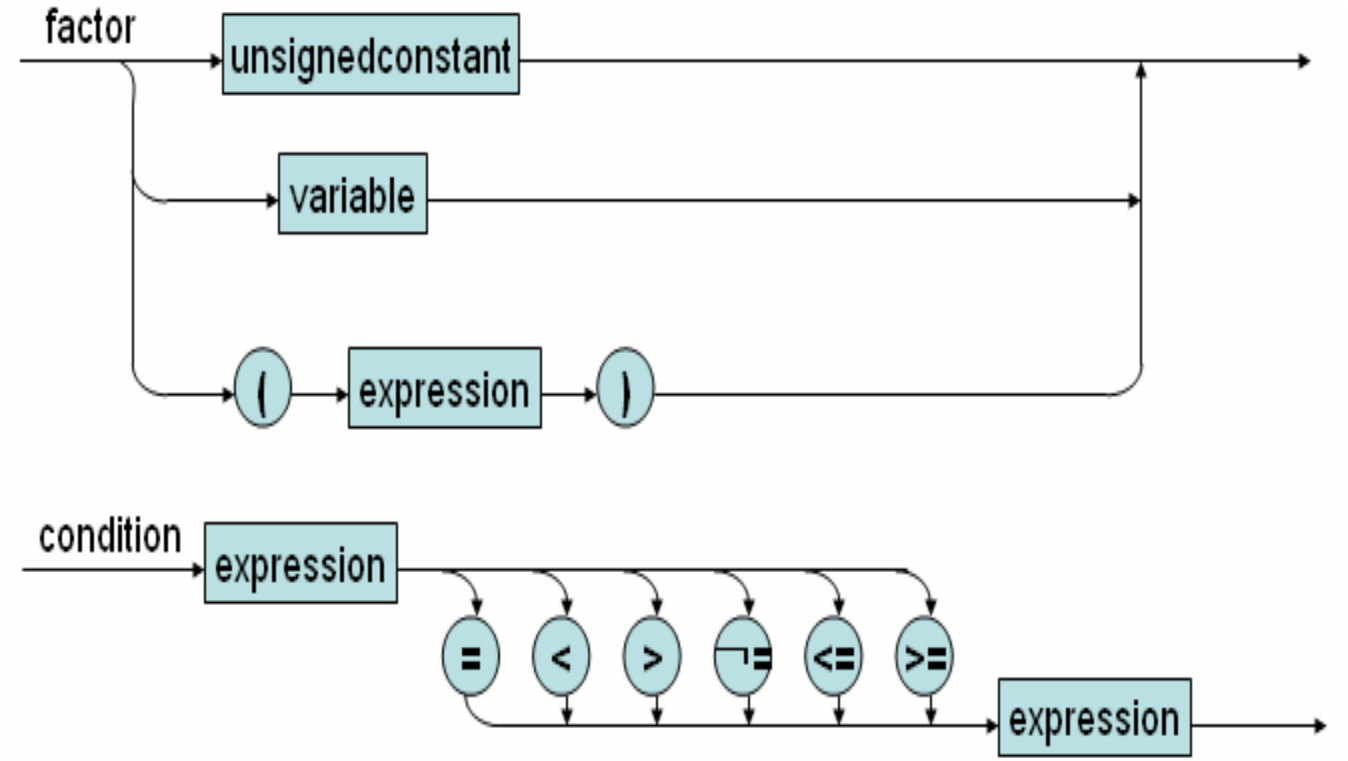
Syntax Diagrams of KPL (statement)



Syntax Diagrams of KPL (variable,expression,term)



Syntax Diagrams of KPL (factor,condition)



Syntax Diagrams of KPL (identifier,unsigned integer)