Pascal in EBNF

Resources on Pascal

- Jim Welsh & John Elder, Introduction to Pascal
- Any other book you know
- gpc documentation
- Internet resources – links in the course site

EBNF

Meta-notation for describing the grammar of a language

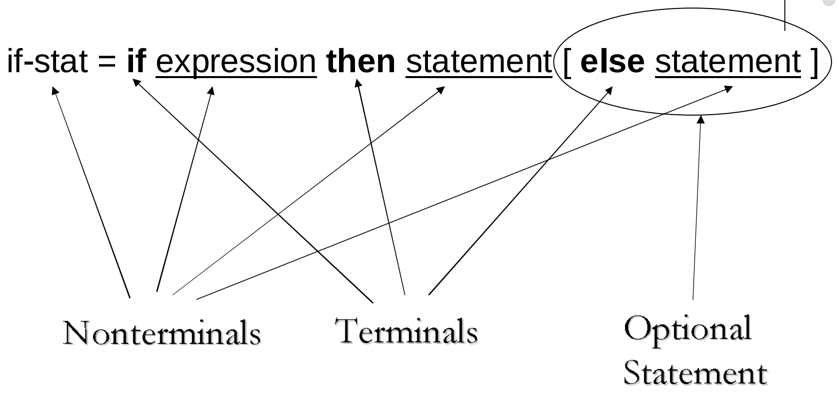
- **Nonterminals**= concepts of the language, written in our notation in normal font or with underscore.
- **Terminals** = actual legal strings, written in bold font, or between " ".
- | is choice among several possibilities
- [ ] enclose optional constructs
- { } encloses zero or more repetitions

- One nonterminal is designated as the *start* of any derivation.
- A sequence of terminals not derivable from the *start* symbol by rules of the grammar is illegal.
- *Example:*

  if-stat = **if** <u>expression</u> **then** <u>statement</u> [**else** <u>statement</u>]

EBNF Example

if-stat = **if** expression **then** statement [**else** statement]



Pascal Program Structure

The base Pascal nonterminal:

program = program-heading block "."

```
program ProgramName(input,output);
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;

begin
   writeln( func(n*n,n-2,Red) )
end.
```

Pascal Program Structure

program-heading = **program** identifier "(" identifier-list ")" ";"

```
program ProgramName(input,output);
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;

begin
   writeln( func(n*n,n-2,Red) )
end.
```

Pascal Program Structure

block = declaration-part statement-part

```
program ProgramName(input,output);
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;

begin
   writeln( func(n*n,n-2,Red) )
end.
```

Pascal Program Structure

declaration-part = [label-declaration-part]
[constant-definition-part]
[type-definition-part]
[variable-declaration-part]
procedure-and-function-declaration-part

```
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;
```

Pascal Program Structure

constant-definition-part =
const constant-definition ";" { constant-definition ";" }

Zero or more repetitions

constant-definition =
identifier "=" constant

```
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;
```

Pascal Program Structure

type-definition-part =
type type-definition ";" { type-definition ";" }

type-definition =
identifier "=" type

```
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;
```

Pascal Program Structure

variable-declaration-part =
var variable-declaration ";" {variable-declaration ";" }

variable-declaration =
identifier-list ":" type

```
const n = 100;
type Color = (Red, Green, Blue, Yellow);
     Index = 1..100;
var c : Color;
    i,j : Index; { comment – indexes }

function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;
```

Pascal Program Structure

procedure-and-function-declaration-part =
{ (procedure-declaration | function-declaration) ";" }

function-declaration = function-heading ";" function-body

function-heading =
function identifier [formal-parameter-list] ":" result-type

function-body = block

```
function func(m,n : Integer; c : Color) : boolean;
var count : integer;
begin
   if m = 42 then
   begin
        …
   end;
   func := true
end;
```

Pascal Program Structure

statement-part = **begin** statement-sequence **end**

statement-sequence = statement { “;” statement }

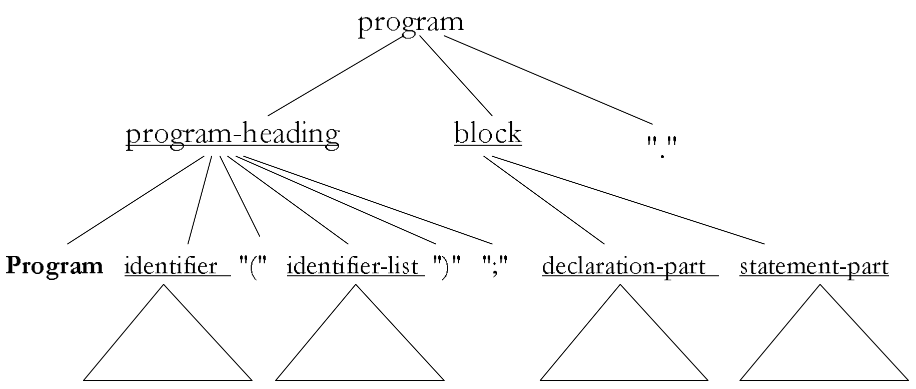
statement = …| procedure statement | …

procedure-statement = procedure-identifier [actual-parameter-list]

```
begin
   writeln( func(n*n,n-2,Red) )
end.
```

EBNF Tree

- We can see the EBNF derivation as a syntax tree of the program:



Data Types

- Pascal has 4 primitive types:

  integer, real, char, boolean

  var *i : integer ;*

  hasPassed : boolean;

- We can also create our own types:
  - Enumerated types

    type *Color* = (Red, Green, Blue, Yellow);

    Enumerated types are comparable:

    Red < Blue = true,
    succ(Red) = Green,
    pred(Blue) = Green,
    ord(Yellow) = 3

Data Types

- Pascal has 4 primitive types:

  integer, real, char, boolean

  ***var** i : integer*

  hasPassed : boolean

- We can also create our own types:
  - Subrange types

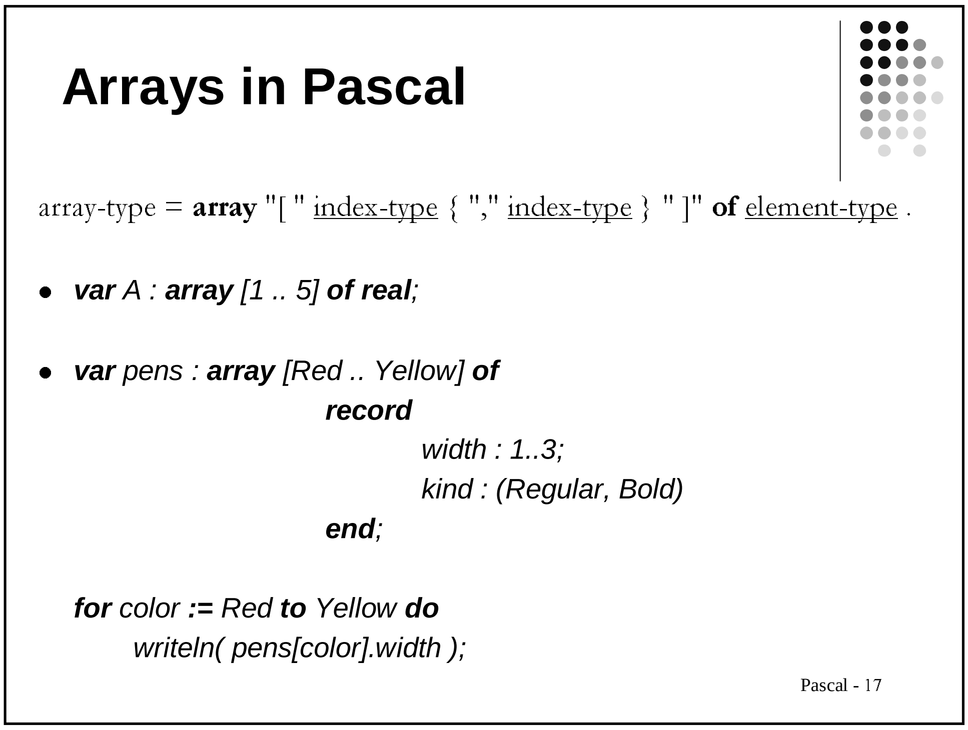
```
type Letter = ‘A’ .. ‘Z’
     Index = 3 .. 8
     Colorlist = Red .. Blue
```

Data Types

- We can also create *records* which are complex types, like C *structs*

  record-type = **record** field-list **end**

```
type date = record
        day : 1 .. 31;
        month : January .. December;
        year : 1900 .. 2000
      end;
```



Arrays in Pascal

array-type = **array** "[" <u>index-type</u> { "," <u>index-type</u> } "]" **of** <u>element-type</u> .

- ***var*** *A :* ***array*** *[1 .. 5]* ***of real****;*

- ***var*** *pens :* ***array*** *[Red .. Yellow]* ***of***

```
                    record
                          width : 1..3;
                          kind : (Regular, Bold)
                    end;

for color := Red to Yellow do
    writeln( pens[color].width );
```

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