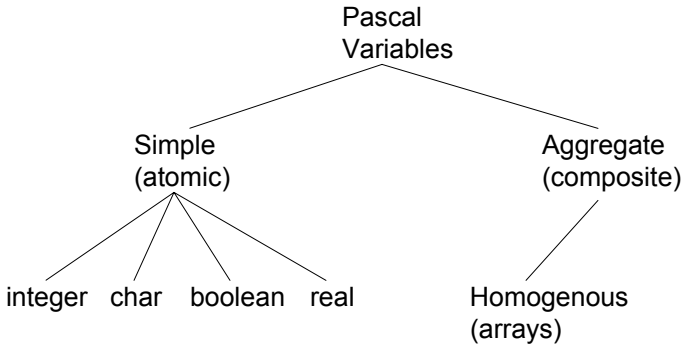
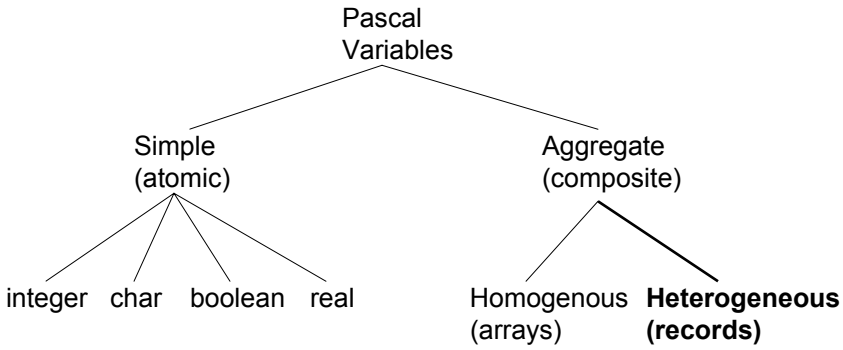
Records

You will learn in this section of notes how to create a new, composite type, that can be composed of different types of elements.

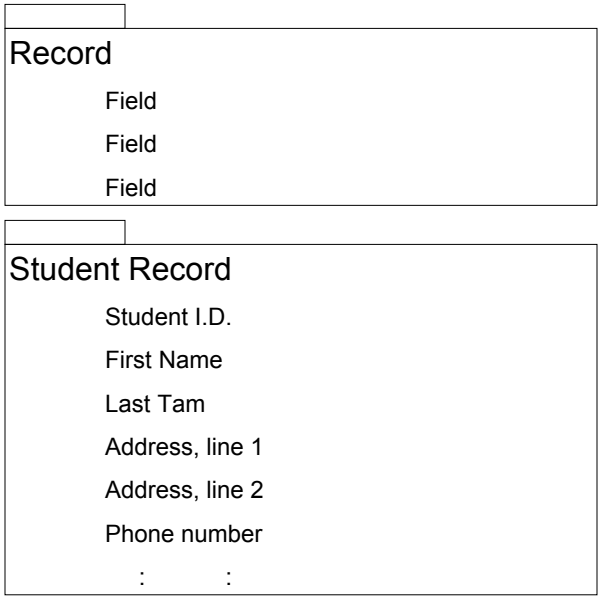
Types Of Variables: What You Know



Types Of Variables: What You Will Learn About



What Is A Record?



Declaring Records

Format:

Name of record = record

name of field (1) : *type of field (1)*;

name of field (2) : *type of field (2)*;

name of field (3) : *type of field (3)*;

: : : : : :

name of field (n) : *type of field (n)*;

end; (* Record declaration *)

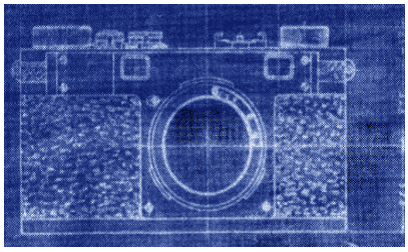
Declaring Records (2)

Example:

```
StudentRecord = record
    studentIdentification : integer;
    firstName             : array [1..20] of char;
    lastName              : array [1..20] of char;
    phoneNumber           : integer;
end;
```

A Record Definition Is Like A Blueprint

- It indicates the format for what an example of the record should look like (what fields will exist)
- No memory is allocated.



Declaring Variables That Are Records

Format:

name of variable : *name of record*;

Example:

```
var jamesTam     : StudentRecord;
var bartSimpson  : StudentRecord;
```

Declaring An Instance Of A Record Actually Creates A Record

- Something has now been actually created.

Declaring Variables That Are Records

Format:

name of variable : *name of declared record*;

Example:

var jamesTam : StudentRecord;
var bartSimpson : StudentRecord;

Declaring Arrays Of Records

Method:

1) Declare the record
2) Declare a type for the array of records
3) Declare the array of records

As with arrays of simple types, the second step is essential in Pascal for passing the array as a parameter into functions and procedures!

Declaring Arrays Of Records

```
type
  StudentRecord = record
      studentIdentification  : integer;
      firstName              : array [1..20] of char;
      lastName               : array [1..20] of char;
      phoneNumber            : integer;
  end;

  StudentRecordList = array [1..30000] of StudentRecord;

          :                    :                    :
  var universityOfCalgaryStudentRecords : StudentRecordList;
```

Declaring Arrays Of Records

```
type
  StudentRecord = record
      studentIdentification : integer;
      firstName             : array [1..20] of char;
      lastName              : array [1..20] of char;
      phoneNumber           : integer;
  end;

  StudentRecordList = array [1..30000] of StudentRecord;

        :                    :                    :

  var universityOfCalgaryStudentRecords : StudentRecordList;
```

1. Declaring a new Record

2. Declaring a type for the array of records

3. Declaring a new instance of type "StudentRecordList"

Passing Records And Arrays Of Records As Parameters

Looks the same as passing in other types of variables

Can be passed in as value or variable parameters

Examples (function or procedure call):

```
displayStudent (jamesTam);
initializeStudentRecords (universityOfCalgaryStudentRecords);
```

Examples (function or procedure definition)

```
procedure displayStudent (jamesTam : StudentRecord);
begin
end;  (* Procedure displayStudent *)

procedure initializeStudentRecords (var
    universityOfCalgaryStudentRecords : StudentRecordList);
begin
end; (* Procedure initializeStudentRecords *)
```

Using Record Variables

Example: Declaring the record and instances of the record

```
type
  StudentRecord = record
      studentIdentification  : integer;
      firstName              : array [1..20] of char;
      lastName               : array [1..20] of char;
      phoneNumber            : integer;
  end;
begin
    var jamesTam     : StudentRecord;
    var bartSimpson  : StudentRecord;
     :        :                  :
end.
```


Using Record Variables (2)

Assignment (field-by-field basis):

e.g.,

```
bartSimpson.studentIdentification := 123456;
bartSimpson.firstName := 'bart';
bartSimpson.lastName := 'simpson';
bartSimpson.phoneNumber :=1234567;
```

Assignment (entire record – if the records are of the same type)

e.g.,

```
jamesTam := bartSimpson;
```

Using Record Variables (3)

- Input and output via read/readln and write/writeln
- Must be done on a field by field basis (if the field is a type that can be "understood" by read/readln or write/writeln

e.g.,

```
write('Enter ID for student : ');
readln(jamesTam.studentIdentification);

writeln('First name: ', jamesTam.firstName);
```


A Shortcut For Referencing All The Fields Of A Record: With-do

Allows you to refer to the fields of a record without having to constantly refer to the name of the record variable.

Format:

```
with name of record variable do
    body
```

Example:

```
with bartSimspon do
begin
    writeln('Student record:');
    writeln('First name: ':11, firstName);
    writeln('Last name: ':11, lastName);
    writeln('ID number: ':11, studentIdentification);
    writeln('Phone: ':11, phoneNumber);
end; (* With do for Bart Simpson *)
```

Putting This All Together

You can find a full version of this program in Unix under:
/home/231/examples/records/person.p

```
program person (input, output);

const
  NAMELENGTH = 16;
  NOPEOPLE   =  4;

type
  Person =  Record
            name   : array [1..NAMELENGTH] of char;
            age      : integer;
            height  : real;
            weight : real;
          end; (* Declaration of Person *)
```


Putting This All Together (2)

```
People = array [1..NOPEOPLE] of Person;

procedure manualInitialization (var calgaryPeople : People );
var
  i : integer;
```

Putting This All Together (3)

```
begin (* Start of manualInitialization *)
  for i := 1 to NOPEOPLE do
  begin
    with calgaryPeople[i] do
    begin
      write('Enter name of person: ');
      readln(name);
      write('Enter age of person in whole years: ');
      readln(age);
      write('Enter the height of the person in inches: ');
      readln(height);
      write('Enter the weight of the person in pounds: ');
      readln(weight);
      writeln;
    end; (* With-do *)
  end; (* Initialization for-loop *)
end; (* End of manualInitialization *)
```


Putting It All Together (4)

```
procedure fileInitialization (var peopleValues  : text;
                              var calgaryPeople : People);
var
  i : integer;
```

Putting It All Together (5)

```
begin   (* Start of fileInitialization *)
  reset(peopleValues, 'peopleValues');
  writeln('Reading initial values from file "peopleValues"');
  for i := 1 to NOPEOPLE do
  begin
    with calgaryPeople[i] do
    begin
      readln(peopleValues, name);
      readln(peopleValues, age);
      readln(peopleValues, height);
      readln(peopleValues, weight);
      readln(peopleValues);
    end; (* With-do *)
```


Putting It All Together (6)

```
procedure display (calgaryPeople : People);
var
  i : integer;
begin (* Start of display *)
  writeln;
  for i := 1 to NOPEOPLE do
  begin
    with calgaryPeople[i] do
    begin
      writeln;
      writeln('Name: ', name);
      writeln('Age: ', age);
      writeln('Height: ', height:0:2);
      writeln('Weight: ', weight:0:2);
    end; (* With-do *)
  end; (* Display for-loop *)
  writeln;
end; (* End of display *)
```

Putting It All Together (7)

```
begin   (* Main program *)
  var peopleValues          : text;
  var calgaryPeople         : People;
  var initializationMethod : integer;

  writeln;
  writeln('Select method to set starting values for the people');
  writeln('Enter "1" to read the values in from a file');
  writeln('Enter "2" to manually enter in the values yourself');
  write('Enter your choice: ');
  readln(initializationMethod);
  writeln;
```


Putting It All Together (8)

```
case (initializationMethod) of
  1 :
  begin
      fileInitialization(peopleValues, calgaryPeople);
      display(calgaryPeople);
  end;

  2 :
  begin
     manualInitialization(calgaryPeople);
     display(calgaryPeople);
  end;

  else
  begin
    writeln('Your choice was not one of the available options.');
    writeln('Restart program and select again.');
  end; (* else case *)
```

Putting It All Together (9)

```
    end; (* case *)
end.  (* program *)
```


You Should Now Know

- How to declare a record
- How to declare instances of records
- The difference between accessing an entire record and individual fields of a record and how each one is done in Pascal
- How to work with arrays of records
  - How to declare an array of records
  - How to access individual array elements
  - Passing arrays of records as parameters
- How to use the with-do construct