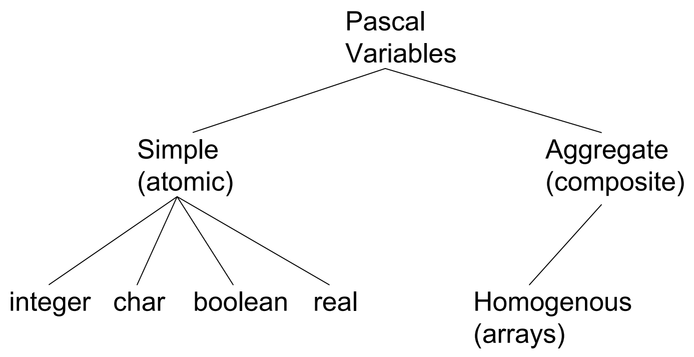
Records

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

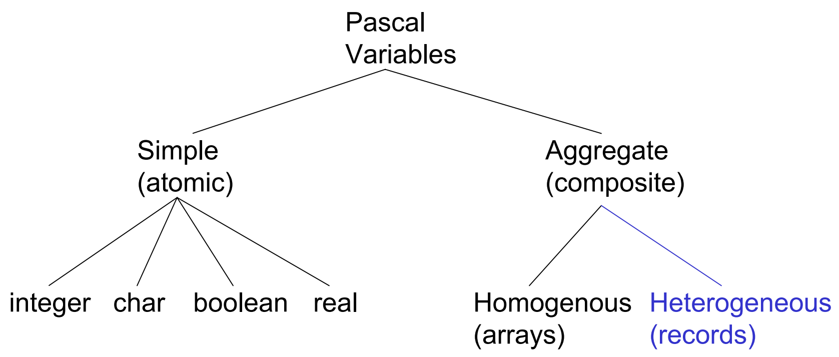
James Tam

Types Of Variables: What You Know



James Tam

Types Of Variables: What You Will Learn About



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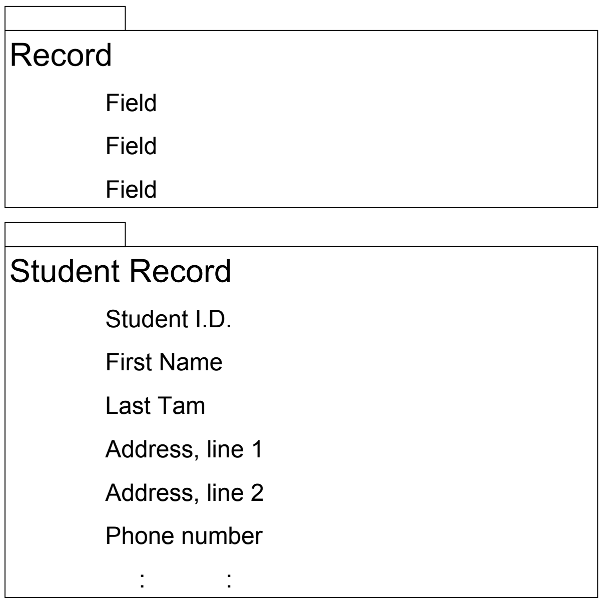
What Is A Record?



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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 *)
```

James Tam

Declaring Records (2)

Example:

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

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Declaring Variables That Are Records

Format:

name of variable : *name of record*;

Example:

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

James Tam

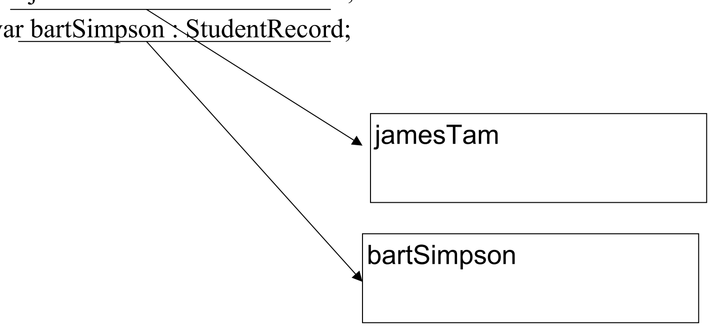
Declaring Variables That Are Records

Format:

name of variable : *name of declared record*;

Example:

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



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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!

James Tam

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;
```

James Tam

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 *)
```

Returning Composite Types From Functions

- You cannot return composite types of variables (arrays and records) from functions.
- To have changes to these types of variables be retained after the function or procedure has ended they must be passed as variable parameters (example shown on previous slide)

James Tam

Using Record Variables

Example: Declaring the record and instances of the record

```
type
  Person =  Record
              name   : array [1..8] of char;
              age      : integer
              height  : real;
              weight : real;
            end; (* Declaration of Person *)

begin
   jack, jo : Person;
```

James Tam

Using Record Variables (2)

Assignment (field-by-field basis):

e.g.,

```
jo.name := 'joanne';
jo.age := 20;
jo.height := 68.5;
jo.weight := 110;
jack.age = jo.age;
```

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

e.g.,

```
jack := jo;
```

Using Record Variables (3)

Input and output via read/readln and write/writeln

Must be done on a field by field basis

e.g.,

```
write('Enter age for Jack : ');
 readln(jack.age);

writeln('Jack is ', jack.age, ' years old);
```

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 jack do
begin
    writeln('Stats for ', name);
    writeln('Age: ', age);
    writeln('Height :', height);
    writeln('Weight :', weight);
end; (* With do for jack *)
```

James Tam

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 *)
```

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Putting This All Together (2)

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

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

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Putting This All Together (3)

```
begin (* Start of manuallyInitializeCalgaryPeople *)
  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 manuallyInitializeCalgaryPeople *)
```

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Putting It All Together (4)

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

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Putting It All Together (5)

```
begin   (* Start of defaultInitializeCalgaryPeople *)
  assign(peopleValues, 'peopleValues');
  reset(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 *)
  end; (* Initialization for-loop *)
  close(peopleValues);
end; (* End of defaultInitializeCalgaryPeople *)
```

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Putting It All Together (6)

```
procedure displayCalgaryPeople (calgaryPeople : People);
var
  i : integer;
begin (* Start of displayCalgaryPeople *)
  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 displayCalgaryPeople *)
```

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
        defaultInitializeCalgaryPeople(peopleValues, calgaryPeople);
        displayCalgaryPeople(calgaryPeople);
   end;

   2 :
   begin
       manuallyInitializeCalgaryPeople(calgaryPeople);
       displayCalgaryPeople(calgaryPeople);
   end;

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

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Putting It All Together (9)

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

James Tam

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

James Tam