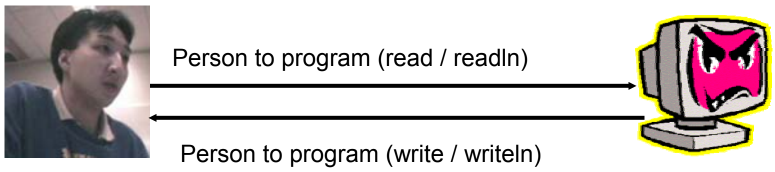
Introduction To Files In Pascal

In this section of notes you will learn how to read from and write to files in your Pascal programs.

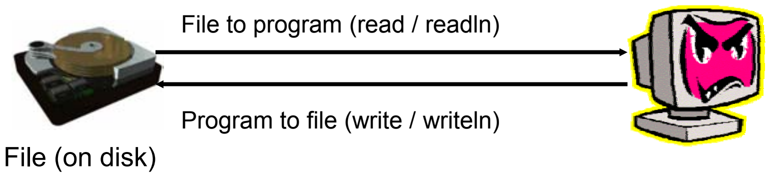
What You Know About Input And Output

Comes from the user or is displayed to the user


Person to program (read / readln)
Person to program (write / writeln)

What You Will Learn: Input And Output Using Files

Information is retrieved from and written out to a file (typically on disk).


File to program (read / readln)
Program to file (write / writeln)
File (on disk)

Why Bother With Files?

- Too much information to input all at once
- The information must be persistent (RAM is volatile)
- Etc.

What You Need In Order To Read Information From A File

1. Declare a file variable
2. Open the file
3. A command to read the information

1. Declaring File Variables

Allows the program access to a file

Format:

name of file variable : text;

Example:

```
letterGrades : text;
```

2. Opening Files

Prepares the file for reading:

A. Links the file variable with the physical file (references to the file variable are references to the physical file).

B. Positions the file pointer.

Format:

reset (*name of file variable, location and name of file*);

Example:

(File variable declaration for constant or variable filename)

```
var letterGrades : text;
```

(Constant file name)

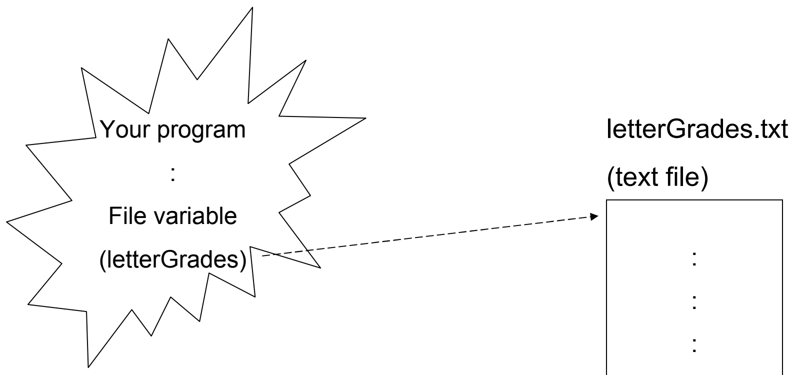
```
reset (letterGrades, 'letterGrades.txt');
```

OR

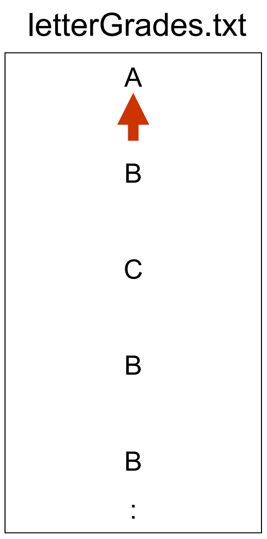
(Variable file name)

```
var  inputFile : string [80];
readln(inputFile);
reset(letterGrades, inputFile);
```

A. Linking The File Variable With The Physical File



B. Positioning The File Pointer



3. Reading Information From Files

Performed with read or readln

Format:

read (*name of file variable*, variable to store the information);

readln (*name of file variable*, variable to store the information);

Example:

readln(letterGrades, letter);

3. Reading Information From Files (2)

Typically reading is done within the body of a loop

Format:

```
while NOT EOF (name of file variable) do
begin
    read (name of file variable, variable to store the information);
        OR
    readln (name of file variable, variable to store the information);
end; (* Done reading from input file *)
```

Example:

```
while NOT EOF (letterGrades) do
begin
    readln(letterGrades, letter);
    writeln(letter);
end; (* Loop to read letter grades file *)
```

James Tam

An Alternative Approach To Reading Files

- Employ a sentinel in the file
- Keep reading from the file until the sentinel value is encountered

Example:

```
var inputFile  : text;
var num        : integer;
    :              :
readln (inputFile, num);
while NOT (num = -1) do
begin
    writeln(num);
    readln(inputFile, num);
end; (* Done reading input file *)
```

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Reading From Files: Putting It All Together

A complete version of this program can be found in Unix under /home/231/examples/files/grades.p:

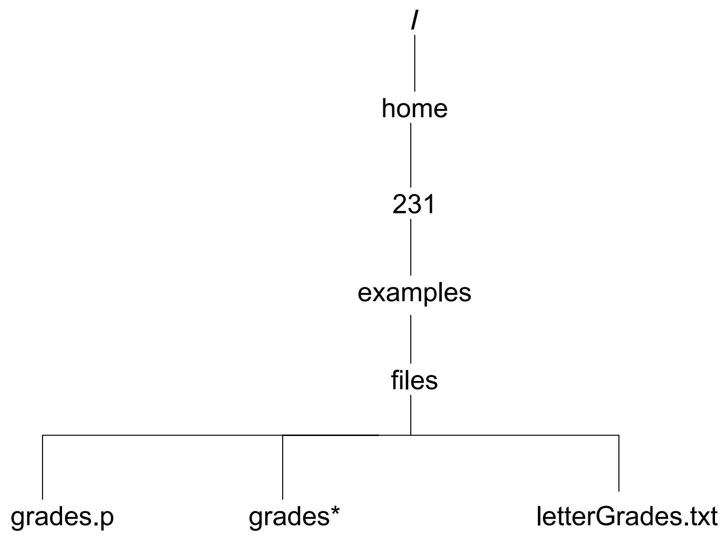
```
program grades (output);
const
  FILENAME_LENGTH = 256;
begin
  var letterGrades : text;
  var letter       : char;
  var inputFile    : string[FILENAME_LENGTH];

  write('Enter name of input file: ');
  readln(inputFile);
  reset(letterGrades, inputFile);
  writeln('Opening file ', inputFile, ' for reading.');
  while NOT EOF (letterGrades) do
  begin
    readln(letterGrades, letter);
    writeln(letter);
  end;
```

Reading From Files: Putting It All Together (2)

```
  close(letterGrades);
  writeln('Completed reading of file ‘, inputFile);
end.
```

View Of Files In Unix



What You Need To Write Information To A File

1. Declare a file variable
2. Open the file
3. A command to write the information

1. Declaring An Output File Variable

- No difference in the declaration of a file variable when writing to a file from the case of reading from a file.

Format:

name of file variable: text;

Example:

```
letterGrades : text;
gradePoints  : text;
```

2. Opening The File

Two methods:

1) Rewriting – erases the old contents of the file (*rewrites* over what was already there).
2) Appending – retain the old contents of the file (*appends* the new information at the end).

Format (rewriting / appending):

rewrite (*name of file variable, location and name of physical file*);
append (*name of file variable, location and name of physical file*);

Example (rewriting / appending):

```
(Constant file name)
var gradePoints : text;
rewrite(gradePoints, ‘gradePoints.txt’);
append(gradePoints, ‘gradePoints.txt’);
```

Opening The File (2)

Example (rewriting / appending):

(Variable file name)

```
const
    SIZE = 256;
            :
    var outputFile   : string[SIZE];
    var gradePoints : text;
    write('Enter the name of the output file: ');
    readln (outputFile);
    rewrite(gradePoints, outputFile);
                        OR
    append(gradePoints, outputFile);
```

3. Writing To A File

Format:

write (*name of file variables*, variable(s) and/or strings to write);

writeln (*name of file variables*, variable(s) and/or strings to write);

Example:

```
writeln(gradePoints, gpa);
```

Writing To A File: Putting It All Together

A complete version of this program can be found in Unix under: /home/231/examples/files/grades2.p

```
program grades (output);

const
  FILE_NAME_LENGTH = 256;

begin
  var letterGrades       : text;
  var gradePoints        : text;
  var letter             : char;
  var gpa                : integer;
  var inputFileName      : string[FILE_NAME_LENGTH];
  var outputFileName     : string[FILE_NAME_LENGTH];
```

Writing To A File: Putting It All Together (2)

```
  write('Enter the name of file that contains the letter grades: ');
  readln(inputFileName);
  write('Enter the name of the file to store the grade points: ');
  readln(outputFileName);

  reset(letterGrades, inputFileName);
  rewrite(gradePoints, outputFileName);

  writeln('Opening file ', inputFileName, ' for reading.');
  writeln('Opening file ', outputFileName, ' for writing.');
```

Writing To A File: Putting It All Together (3)

```
while NOT EOF (letterGrades) do
begin
    readln(letterGrades, letter);
    case (letter) of
    'A'    :    gpa := 4;
    'B'    :    gpa := 3;
    'C'    :    gpa := 2;
    'D'    :    gpa := 1;
    'F'    :    gpa := 0;
    else        gpa := -1;
  end; (* case *)
  writeln(gradePoints, gpa);
end; (* Loop to read letter grades file *)
```

Writing To A File: Putting It All Together (4)

```
  writeln('Completed reading and writing to files.');
  close(letterGrades);
  close(gradePoints);
end.
```

Details Of Write And Writeln For Files: Intuitive View

```
Program statement         Effect on file
rewrite(data,’data.txt’);                  (Open file
                                           "data.txt" and
                                            position file
                          ^                 pointer at
                                            start)

write (data, 'x');        x
                           ^

write(data, 'y');         xy
                            ^
write(data, 'z');         xyz
                             ^

writeln(data);            xyz
                          _
                          ^

write(data,'a');          xyz
                          a
                           ^
```

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Details Of Write And Writeln For Files: Actual View

```
Program statement         Effect on file
rewrite(data,‘data.txt’);                   (Open file
                                            "data.txt" and
                                            position file
                          ^                 pointer at start)

write (data, 'x');        x
                           ^

write(data, 'y');         xy
                            ^
write(data, 'z');         xyz
                             ^

writeln(data);            xyz<EOL>
                                  ^

write(data,'a');          xyz<EOL>a
                                   ^
```

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Details Of Read And Readln For Files: Intuitive View[1]

```
Program statement          Effect on file     Effect in program
reset (data, ‘data.txt’); xyz                (Open file
                          ^                  "data.txt" and
                                             position file
                                             pointer at
                                             start)
                          a

read(data, ch);           xyz                Value of ch: 'x'
                           ^
                          a

readln(data, ch);         xyz                Value of ch: ‘y’

                          a
                          ^

read(data, ch);           xyz                Value of ch: 'a'


                          a
                           ^
```

1 Assume that the code on the previous slide has created the file called "data.txt"

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Details Of Read And Readln For Files: Actual View[1]

```
Program statement          Effect on file     Effect in
                                             program
reset (data, ‘data.txt’); xyz<EOL>a          (Open file
                          ^                  "data.txt" and
                                             position file
                                             pointer at start)

read(data, ch);           xyz<EOL>a          Value of ch: 'x'
                           ^

readln(data, ch);         xyz<EOL>a          Value of ch: 'y’
                                  ^

read(data, ch);           xyz<EOL>a          Value of ch:'a'
                                   ^

read(data,ch);            xyz<EOL>a
                                   ^
```

1 Assume that the code on the previous slide has created the file called "data.txt"

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Details Of Read And Readln For Files: Actual View[1]

```
Program statement         Effect on file     Effect in
                                             program
reset (data, 'data.txt'); xyz<EOL>a          (Open file
                          ^                  "data.txt" and
                                             position file
                                             pointer at start)

read(data, ch);           xyz<EOL>a          Value of ch: 'x'
                           ^

readln(data, ch);         xyz<EOL>a          Value of ch: 'y'
                                  ^

read(data, ch);           xyz<EOL>a          Value of ch:'a'
                                   ^

read(data,ch);            xyz<EOL>a          Error: read past
                                   ^         the end of the
                                             file
```

1 Assume that the code on the previous slide has created the file called "data.txt"

Explicitly Dealing With Empty Files

Recall:

EOF (*name of file variable*)

- Q: Has the end of file been reached:
- Returns true if the file pointer is not pointing at a character in the file.
- Returns false if the file pointer is pointer at a character in the file.

Explicitly Dealing With Empty Files: An Example

A complete version of this program can be found in Unix under:
/home/231/examples/files/fileExampleThree.p

```
program fileExampleThree (input,output);

const
  FILENAME_LENGTH =  256;
  LINE_LENGTH = 80;

begin
  var inputFilename      : string[FILENAME_LENGTH];
  var inputFileVariable  : text;
  var line               : string[LINE_LENGTH];

  write('Enter the name of the input file: ');
  readln(inputFilename);
  reset(inputFileVariable,inputFilename);
```

Explicitly Dealing With Empty Files: An Example (2)

```
  if EOF (inputFileVariable) then
  begin
    writeln('File ', inputFilename, ' is empty.');
  end
  else
  begin
    writeln('Opening file ', inputFilename, ' for reading');
    while NOT EOF (inputFileVariable) do
    begin
      readln(inputFileVariable,line);
      writeln(line);
    end;
  end;
  writeln(‘Closing file ‘, inputFilename);
  close(inputFileVariable);
end.
```

Passing File Variables As Parameters

Must be passed as variable parameters *only*.

Format:

```
procedure nameProcedure (var nameFile : text);
```

Example:

```
procedure fileInputOuput (var letterGrades : text;
                          var gradePoints  : text);
```

You Should Now Know

- How to declare a file variable
- How to open a file for reading
- How to open a file a file for writing (rewrite and append mode)
- How to read (read/readln) from and write (write/writeln) to a file
- The details of how information is read from and written to a file through read/readln and write/writeln
- How to close a file and why it is good practice to do this explicitly
- How to explicitly deal with empty files
- How to pass file variables as parameters