COSC 1306 - Prog for Non-Majors
Files and Exceptions

Dr. Mohan

McMurry University

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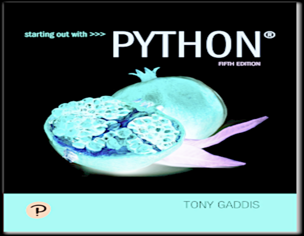
Lesson Topics Overview

- Introduction to File Input and Output.
- Using Loops to Process Files.
- Processing Records.
- Exceptions.

Fifth Edition



Chapter 6

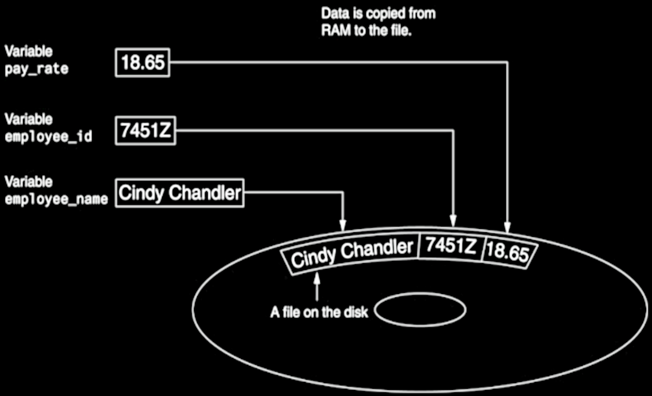
Files and Exceptions

Introduction to File Input and Output (1 of 4)

- For program to retain data between the times it is run, you must save the data.
  - Data is saved to a file, typically on computer disk.
  - Saved data can be retrieved and used at a later time,
- **Writing data to:** saving data on a file.
- **Output file:** a file that data is written to.

Introduction to File Input and Output (2 of 4)

Figure 6-1 Writing data to a file

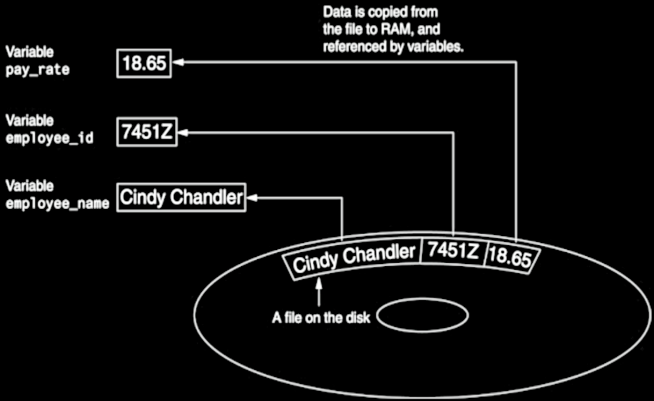


Introduction to File Input and Output (3 of 4)

- **Reading data from:** process of retrieving data from a file.
  - **Input file:** a file from which data is read.
  - **Three steps** when a program uses a file.
    - Open the file.
    - Process the file.
    - Close the file.

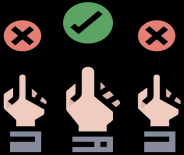
Introduction to File Input and Output (4 of 4)

Figure 6-2 Reading data from a file



Types of Files and File Access Methods

- In general, two types of files:
  - **Text file:** contains data that has been encoded as text.
  - **Binary file:** contains data that has not been converted to text.
- Two ways to access data stored in file:
  - **Sequential access:** file read sequentially from beginning to end, can't skip ahead.
  - **Direct access:** can jump directly to any piece of data in the file.

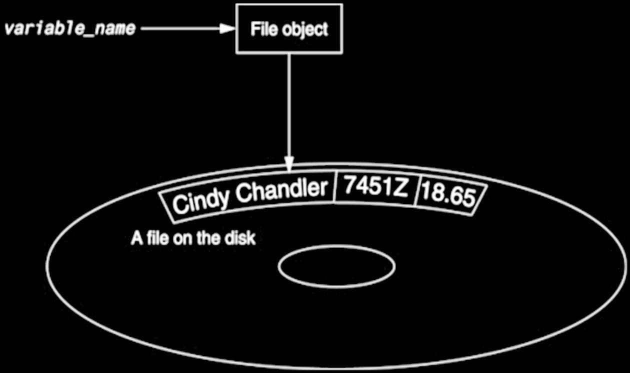


Filenames and File Objects (1 of 2)

- **Filename extensions:** short sequences of characters that appear at the end of a filename preceded by a period.
  - Extension indicates type of data stored in the file.
- File object: object associated with a specific file.
  - Provides a way for a program to work with the file: file object referenced by a variable.

Filenames and File Objects (2 of 2)

Figure 6-4 A variable name references a file object that is associated with a file



Opening a File

- **open function:** used to open a file.
  - Creates a file object and associates it with a file on the disk.
  - General format:

    file_object = open(filename, mode)
- **Mode:** string specifying how the file will be opened.
  - Example: reading only ('r'), writing ('w'), and appending ('a').

Specifying the Location of a File

- If **open function** receives a filename that does not contain a path, assumes that file is in same directory as program.
- If program is running and file is created, it is created in the same directory as the program.
  - Can specify alternative path and file name in the open function argument.
    - Prefix the path string literal with the letter r.

Writing Data to a File

- **Method:** a function that belongs to an object.
    - Performs operations using that object.
- File object's write method used to write data to the file.

  Format: file_variable.write(string)

- File should be closed using file object close method.

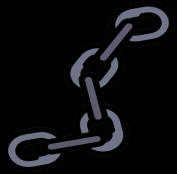
  Format: file_variable.close()

Reading Data From a File

- **read method:** file object method that reads entire file contents into memory.
  - Only works if file has been opened for reading.
  - Contents returned as a string.
- **readline method:** file object method that reads a line from the file.
  - Line returned as a string, including '\n'.
- **Read position:** marks the location of the next item to be read from a file.

Concatenating a Newline to and Stripping it From a String

- In most cases, data items written to a file are values referenced by variables.
  - Usually necessary to concatenate a '\n' to data before writing it.
    - Carried out using the + operator in the argument of the write method.
- In many cases need to remove '\n' from string after it is read from a file.
  - **rstrip method:** string method that strips specific characters from end of the string.



Appending Data to an Existing File

- When open file with ’w’ mode, if the file already exists it is overwritten.
- To append data to a file use the ’a’ mode.
  - If file exists, it is not erased, and if it does not exist it is created.
  - Data is written to the file at the end of the current contents.

Writing and Reading Numeric Data

- Numbers must be converted to strings before they are written to a file.
- **str function:** converts value to string.
- Number are read from a text file as strings.
  - Must be converted to numeric type in order to perform mathematical operations.
  - Use int and float functions to convert string to numeric value.

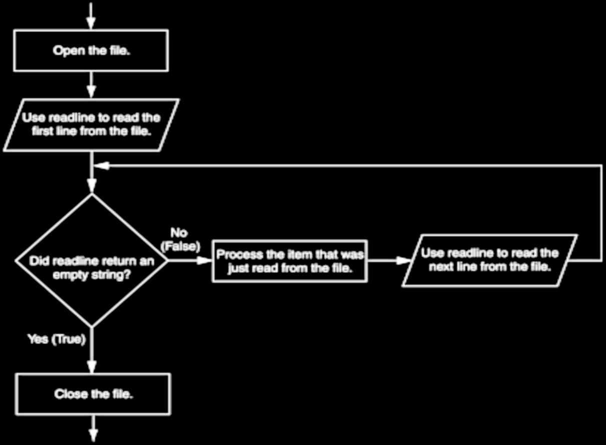
Using Loops to Process Files (1 of 2)

- **Files typically** used to hold large amounts of data.
  - Loop typically involved in reading from and writing to a file.
- Often **the number of items** stored in file is unknown.
  - The readline method uses an empty string as a sentinel when end of file is reached.
  - Can write a while loop with the condition.

    while line != ''

Using Loops to Process Files (2 of 2)

Figure 6-17 General logic for detecting the end of a file

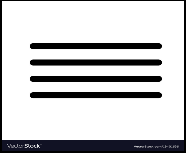

Open the file.
Use readline to read the first line from the file.
Did readline return an empty string?
No (False)
Process the item that was just read from the file.
Use readline to read the next line from the file.
Yes (True)
Close the file.

Using Python's for Loop to Read Lines

- **Python** allows the programmer to write a for loop that automatically reads lines in a file and stops when end of file is reached.
- Format:

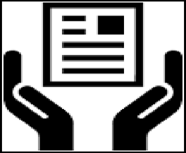
  colorgreenfor line in file_object:

  colorgreenstatements
- The **loop iterates** once over each line in the file.



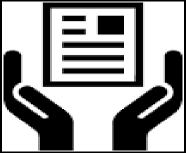
Processing Records (1 of 2)

- **Record:** set of data that describes one item.
- **Field:** single piece of data within a record.
- Write record to sequential access file by writing the fields one after the other.
- Read record from sequential access file by reading each field until record complete.



Processing Records (2 of 2)

- When working with **records**, it is also important to be able to:
  - Add records.
  - Display records.
  - Search for a specific record.
  - Modify records.
  - Delete records.



Exceptions (1 of 4)

- **Exception:** error that occurs while a program is running.
  - Usually causes program to abruptly halt.
- **Traceback:** error message that gives information regarding line numbers that caused the exception.
  - Indicates the type of exception and brief description of the error that caused exception to be raised.

Exceptions (2 of 4)

- Many **exceptions** can be prevented by careful coding.
  - **Example:** input validation.
  - Usually involve a simple decision construct.
- Some exceptions cannot be avoided by careful coding.
  - **Examples:**
    - Trying to convert non-numeric string to an integer.
    - Trying to open for reading a file that doesn't exist.

Exceptions (3 of 4)

- **Exception handler:** code that responds when exceptions are raised and prevents program from crashing.
  - In Python, written as try/except statement.
    - General format:

```
try:
    statements
except exceptionName:
    statements
```

    - **Try suite:** statements that can potentially raise an exception.
    - **Handler:** statements contained in except block.

Exceptions (4 of 4)

- **If statement** in try suite raises exception:
  - Exception specified in **except clause**:
    - Handler immediately following except clause executes.
    - Continue program after try/except statement.
  - Other exceptions:
    - Program halts with traceback error message.
- If **no exception** is raised, handlers are skipped.

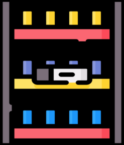
Handling Multiple Exceptions

- Often code in try suite can throw more than one type of exception.
  - Need to write except clause for each type of exception that needs to be handled.
- An **except clause** that does not list a specific exception will handle any exception that is raised in the try suite.
  - Should always be last in a series of except clauses

Displaying an Exception's Default Error Message

- **Exception object:** object created in memory when an exception is thrown.
  - Usually contains default error message pertaining to the exception.
  - Can assign the exception object to a variable in an except clause.
    - Example:

      except ValueError as err:
  - Can pass exception object variable to print function to display the default error message.



The else Clause

- **try/except** statement may include an optional else clause, which appears after all the except clauses.
  - Aligned with try and except clauses.
  - Syntax similar to else clause in decision structure.
  - **Else suite:** block of statements executed after statements in try suite, only if no exceptions were raised.
    - If exception was raised, the else suite is skipped.

The finally Clause

- **try/except statement** may include an optional finally clause, which appears after all the except clauses.
    - Aligned with try and except clauses.
    - General format:

```
finally:
    statements
```

    - **Finally suite:** block of statements after the finally clause.
        - Execute whether an exception occurs or not.
        - Purpose is to perform cleanup before exiting.

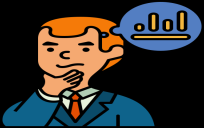
What If an Exception Is Not Handled?

- **Two ways** for exception to go unhandled:
  - No except clause specifying exception of the right type.
  - Exception raised outside a try suite.
- In both cases, **exception** will cause the program to halt.
  - Python documentation provides information about exceptions that can be raised by different functions.

Lesson Summary

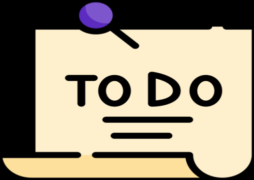
This chapter covered:

- Types of files and file access methods.
- Filenames and file objects.
- Writing data to a file.
- Reading data from a file and determining when the end of the file is reached.
- Processing records.
- Exceptions, including:
  - Traceback messages.
  - Handling exceptions,



Things to do

- Read Textbook Chapter-6.
- Practice the exercise problems at the end of Chapter-6.



Questions?

Please ask your Questions to clarify!