Introduction to: Computers & Programming: Exception Handling

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Summary

• An Error halts the program and prints out an Error Message, this is called:
  – “raising an exception”

• How & Why your program can overtly raise an exception

• How & Why you can prevent a program from crashing by
  – anticipating errors with an if statement or
  – “catching an exception”
  – What should you do with an exception once you caught it?
Errors that Raise Exceptions

- These are errors that cause the program to halt.
- Special 'error' messages are printed to the screen.
- Examples
  - TypeError: if a function or operator is called with the wrong type of argument
    - 'The book' * 'The book'
    - len(5)
  - ValueError: similar to TypeError, except the argument is the correct type but inappropriate for another reason:
    - int('hello') ## Argument cannot be converted to an integer
  - IOError: if a file or path doesn't exist
    - Instream = read('abc','r')
  - IndexError: An index refers to a nonexistant position in a sequence
    - 'hello'[5]
Preventing Errors

• while (answer != 'yes') and (answer != 'no'):
   answer = input('Answer yes or no: ')

• The function isinstance(object, type)
  – Possible types: int,str,list,tuple,dict...
  – Can be used to prevent type errors
  – if (not isinstance(input_string,str)):
    print('The variable “input_string” is',input_string)
    print('This is not a string')
    input_string = 'invalid_string'
  – if type(input_string) != str:
    • Same as above: type(object) → returns the type of any object

• The functions: os.path.isfile(path), os.path.isdir(path)
  – Can be used to prevent IOError
Raising Exceptions

- If you decide that a certain situation warrants an error message, you can put it in your code.
- The syntax is as follows:
  
  ```python
  def foul_language(string):
      if string in ['chicken','turkey','pheasant']:
          raise Exception('Foul Language')
  ```

- Generating specific type of exception:
  
  ```python
  def foul_language(string):
      if string in ['chicken','turkey','pheasant']:
          raise TypeError('Foul Language')
  ```
- `IOError(string), ValueError(string), etc.`
Catching Exceptions

• If you are aware of possible exceptions, you can:
  – Let your program crash OR
  – Design your code to elegantly handle each type of possible exception
    • *** Preferred if other people will use your program

• try & except
  – similar to if/elif/else
  – Put your code in a block under 'try:'
  – Put what to do for each exception in blocks of code under 'except:' statements.
For any Type of Exception

• def get_an_integer():
    while True:
        try:
            number = int(input('Pick an integer: '))
            return(number)
        except:
            print('That wasn\'t an integer!')

• This will continually ask the user for an integer until they put one in. Note that the return statement causes the function to end.

• In this case. try/except, is little like if/else
For Specific Types of Exceptions (similar to if/elif/else)

def divide_10_by_an_integer ():
    while True:
        try:
            number = int(input('Pick an integer: '))
            output = 10/number
            return(output)
        except ValueError:
            print('That wasn\'t an integer!')
        except ZeroDivisionError:
            print('You can\'t divide by zero!')
        except:
            print('Something is wrong! Try again!')
Using Default Error Messages

def divide_10_by_an_integer2 ():
    while True:
        try:
            number = int(input('Pick an integer: '))
            output = 10/number
            return(output)
        except ValueError as err:  ### using default message
            print(err)
        except ZeroDivisionError:  ### using my message
            print('You can\'t divide by zero!')
        except:
            print('Something is wrong! Try again!')
**Else: Executes if there is no Exception**

```python
def divide_10_by_an_integer3 ():
    while True:
        try:
            number = int(input('Pick an integer: '))
            output = 10/number
        except ValueError:
            print('That wasn\'t an integer!')
        except ZeroDivisionError:
            print('You can\'t divide by zero!')
        except:
            print('Something is wrong! Try again!')
        else:
            return(output)  ## equivalent to putting the return statement last in the try block
```
'finally' statements: execute at the end (unless a return statement precedes)

```python
def divide_10_by_an_integer4():
    while True:
        try:
            number = int(input('Pick an integer: '))
            output = 10/number
            return(output)
        except ValueError:
            print('That wasn\'t an integer!')
        except ZeroDivisionError:
            print('You can\'t divide by zero!')
        except:
            print('Something is wrong! Try again!')
    finally:
        print('''This program was sponsored by NYU\'s CS Division. It is being released 'as is' and NYU is not responsible for any bugs.'''
```
Summary

• Exception or Error Handling is a necessary part of writing code, particularly if it is going to be used by people other than yourself.
• Python's exception handling system is very similar syntactically to `if/elif/else` statements
  • `try:` – used before main block of code
  • `except Exception:` – like `elif:` statement conditioned on Exception (a particular type of exception)
  • `except:` – all other types of exceptions
  • `raise Exception('ABC')` – to raise exception of your own
    – If you “catch” an exception and don't raise one, the program will not halt
  • `else` – at the end, if no exception is raised
  • `finally` – at the end, whether an exception is raised or not.
• [http://docs.python.org/release/3.0.1/c-api/exceptions.html](http://docs.python.org/release/3.0.1/c-api/exceptions.html)
Homework 8 – Due 25th Class

• [http://cs.nyu.edu/courses/fall17/CSCI-UA.0002-007/hw8.html](http://cs.nyu.edu/courses/fall17/CSCI-UA.0002-007/hw8.html)

• This HW has an Exception portion and an Input-Output (IO) portion.

• This talk is helpful for the former, but not the latter.