COMP110: Principles of Computing

8: Exceptions and debugging

Learning outcomes

- **Explain** the usefulness of exceptions and assertions in writing robust software
- **Write** Python programs that throw and catch exceptions
- **Use** the PyCharm debugger to trace the execution of programs

Reading

E. Dijkstra, 1968. Go To Statement Considered Harmful. *Communications of the ACM*, 11(3):147–148.

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- In compiled languages, can allow for faster iteration via **incremental recompilation**

Modules in Python

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mymodule.py

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program.py

```
import mymodule

mymodule.test()
```

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- `__name__` is a built-in variable (note the double underscores!)

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Exceptions

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- Some operations in a program can fail
- Exceptions are a way of signalling that failure

Raising exceptions

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- `ValueError` is a built-in class
- Its initialiser takes one argument: a human-readable string describing the error
- The exception is an **instance** of the `ValueError` class

Built-in exception types

https://docs.python.org/2/library/exceptions.html

Custom exception types

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```
class UnreticulatedSplineError(Exception):
    def __init__(self, message):
            Exception.__init__(self, message)

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if not spline.is_reticulated():
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- Inherit from built-in class `Exception`
- Just like any other class — can contain any required fields and methods

Catching exceptions

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- An uncaught exception kills the program

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- This can be powerful in the hands of a good programmer...
- ... or confusing in the hands of a bad one

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  - Generally best to let these crash the program so that the programmer can notice and fix them
  - A commercially released program might catch them to allow the user to submit a bug report to the developer

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- `assert` should **only** be used to catch programmer errors, therefore you should **never** try to handle `AssertionError` in a `try ... except` block
- In some programming languages, assertions are stripped out of "Release" builds — so avoid assertions with side-effects!

More options with try blocks

```
try:
    input_file = open(filename, "rt")
except IOError as err:
    print "File error:", err
else:
    print "This only executes if the try block did not ↩
         raise an exception"
finally:
    print "This executes whether or not the try block  ↩
        raised an exception, even if there were  ↩
        uncaught exceptions"
```

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if index >= 0 and index < len(list):
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The debugger

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But there's a better way...

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- View the **call stack**

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  - **Step out**: run until the current function returns

Debugging in PyCharm

(demo)

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Worksheet D