# Exception Hierarchies



Austin Bingham
COFOUNDER - SIXTY NORTH
@austin\_bingham



Robert Smallshire
COFOUNDER - SIXTY NORTH
@robsmallshire

### Overview



Inheritance relationships between exceptions

Streamlined exception handling

All exceptions inherit from a single base class

Difference exception handling strategies

# Exception Hierarchy



Exceptions are arranged into an inheritance hierarchy.

This facilitates catching exceptions by their base classes.

### Exception Hierarchies

```
>>> s = [1, 4, 6]
>>> s[5]
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
IndexError: list index out of range
>>> d = dict(a=65, b=66, c=67)
>>> d['x']
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
KeyError: 'x'
>>>
```

### Related Exceptions

### Similar purpose

Both exceptions communicate that a requested value doesn't exist.

### **Inheritance**

We can explore their inheritance graphs to see if they're related.

\_\_mro\_\_

We can use their method resolution orders as way to see their inheritance graphs.

### Exception Hierarchies

```
>>> IndexError.__mro__
(<class 'IndexError'>, <class 'LookupError'>, <class 'Exception'>, <class 'BaseE
xception'>, <class 'object'>)
>>> KeyError.__mro__
(<class 'KeyError'>, <class 'LookupError'>, <class 'Exception'>, <class 'BaseExc
eption'>, <class 'object'>)
>>>
```

# We can catch both IndexError and KeyError by catching LookupError.

```
🧓 words 🔻 🕨 🇯 🕟 😘 🗊 🔲 🔾
lookups ) % lookups.py
lookups.py >
         def lookups():
              s = [1, 4, 6]
              try:
                    item = s[5]
              except LookupError:
                    print("Handled IndexError")
              d = dict(a=65, b=66, c=67)
              try:
                    value = d['x']
10
              except LookupError:
                    print("Handled KeyError")
         lookups() > except LookupError
 Python Console ×

⇒ >>> from lookups import *

                                                                                               Special Variables
  >>> lookups()
     Handled IndexError
     Handled KeyError
  0 >>>
                                                                                              1:1 LF UTF-8 4 spaces Python 3.8 (code_editor) 🚡 💆
Replay server listening on port 14415: You just opened lookups (a minute ago)
```

### Exception Hierarchy

```
BaseException
                                   +-- NameError
                                                                       +-- SyntaxError
 +-- SystemExit
                                        +-- UnboundLocalError
                                                                             +-- IndentationError
+-- KeyboardInterrupt
                                   +-- OSError
                                                                                  +-- TabError
                                        +-- BlockingIOError
 +-- GeneratorExit
                                                                        +-- SystemError
                                        +-- ChildProcessError
                                                                        +-- TypeError
 +-- Exception
      +-- StopIteration
                                        +-- ConnectionError
                                                                        +-- ValueError
     +-- StopAsyncIteration
                                             +-- BrokenPipeError
                                                                             +-- UnicodeError
                                                                                  +-- UnicodeDecodeError
      +-- ArithmeticError
                                             +-- ConnectionAbortedError
           +-- FloatingPointError
                                             +-- ConnectionRefusedError
                                                                                  +-- UnicodeEncodeError
           +-- OverflowError
                                             +-- ConnectionResetError
                                                                                  +-- UnicodeTranslateError
           +-- ZeroDivisionError
                                        +-- FileExistsError
                                                                        +-- Warning
                                                                             +-- DeprecationWarning
      +-- AssertionError
                                        +-- FileNotFoundError
                                        +-- InterruptedError
                                                                             +-- PendingDeprecationWarning
      +-- AttributeError
      +-- BufferError
                                        +-- IsADirectoryError
                                                                             +-- RuntimeWarning
                                        +-- NotADirectoryError
                                                                             +-- SyntaxWarning
      +-- EOFError
      +-- ImportError
                                        +-- PermissionError
                                                                             +-- UserWarning
                                                                             +-- FutureWarning
           +-- ModuleNotFoundError
                                        +-- ProcessLookupError
      +-- LookupError
                                        +-- TimeoutError
                                                                             +-- ImportWarning
                                   +-- ReferenceError
           +-- IndexError
                                                                             +-- UnicodeWarning
                                   +-- RuntimeError
           +-- KeyError
                                                                             +-- BytesWarning
      +-- MemoryError
                                        +-- NotImplementedError
                                                                             +-- ResourceWarning
                                        +-- RecursionError
                                                                                           Python 3.8
```

### Avoid Catching Exception

```
+-- NameError
                                                                       +-- SyntaxError
BaseException
                                        +-- UnboundLocalError
 +-- SystemExit
                                                                             +-- IndentationError
 +-- KeyboardInterrupt
                                   +-- OSError
                                                                                  +-- TabError
 +-- GeneratorExit
                                        +-- BlockingIOError
                                                                        +-- SystemError
                                        +-- ChildProcessError
                                                                        +-- TypeError
+-- Exception
      +-- StopIteration
                                        +-- ConnectionError
                                                                        +-- ValueError
      +-- StopAsyncIteration
                                             +-- BrokenPipeError
                                                                             +-- UnicodeError
      +-- ArithmeticError
                                             +-- ConnectionAbortedError
                                                                                  +-- UnicodeDecodeError
           +-- FloatingPointError
                                             +-- ConnectionRefusedError
                                                                                  +-- UnicodeEncodeError
           +-- OverflowError
                                             +-- ConnectionResetError
                                                                                  +-- UnicodeTranslateError
           +-- ZeroDivisionError
                                        +-- FileExistsError
                                                                        +-- Warning
      +-- AssertionError
                                        +-- FileNotFoundError
                                                                             +-- DeprecationWarning
      +-- AttributeError
                                        +-- InterruptedError
                                                                             +-- PendingDeprecationWarning
                                        +-- IsADirectoryError
      +-- BufferError
                                                                             +-- RuntimeWarning
                                        +-- NotADirectoryError
                                                                             +-- SyntaxWarning
      +-- EOFError
                                        +-- PermissionError
      +-- ImportError
                                                                             +-- UserWarning
                                        +-- ProcessLookupError
           +-- ModuleNotFoundError
                                                                             +-- FutureWarning
                                        +-- TimeoutError
      +-- LookupError
                                                                             +-- ImportWarning
           +-- IndexError
                                   +-- ReferenceError
                                                                             +-- UnicodeWarning
                                                                             +-- BytesWarning
           +-- KeyError
                                   +-- RuntimeError
      +-- MemoryError
                                        +-- NotImplementedError
                                                                             +-- ResourceWarnin
                                        +-- RecursionError
```

# The Practicality of OSError



OSError tells us that something has gone wrong with a filesystem operation

Often it's not necessary to know the details of exactly what went wrong

Even when you catch the general exception type, the details are still available

### Summary



Exceptions are organized into a class hierarchy

You can catch an exception by its base class

Used MRO to explore relationships between exceptions

BaseException is a base class of all exception types

Non-system-exiting exceptions inherit from Exception

Catch the most specific type of exception

Be practical about catching more general exceptions