

CS 535 Object-Oriented Programming & Design
Fall Semester, 2010
Doc 10 Exceptions, Streams & Files
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Exceptions

Basic Issues

How are exceptions raised (started)

How to handle exceptions

What can one do when handling exceptions

How is the correct handler found for an exception

Basic Handling of Exceptions

[ProtectedBlock]

on: ExceptionList

do: [:exception | HandlerBlock]

```
[numerator := 5.
```

```
denominator := 0.0.
```

```
numerator / denominator]
```

```
on: ZeroDivide
```

```
do:
```

```
[:exception |
```

```
Transcript
```

```
show: exception description;
```

```
cr]
```

Catching Multiple Exceptions

Use a comma or ExceptionSets

[1/0]

on: Warning , ZeroDivide

do: [:exception | code here]

| exceptions |

exceptions := ExceptionSet with: Warning with: ZeroDivide.

[1/0]

on: exceptions

do: [:exception | code here]

ensure:

[block] ensure: [clean up block]

Ensure that the clean up block will be done

If block ends due to an exception

Execute handler for exception

Execute clean up block

Example

```
[[10/0] ensure: [Transcript show: 'In ensure'; cr]]
```

```
on: ZeroDivide
```

```
do: [:exception | Transcript show: 'In handler';cr ]
```

Output in Transcript

In handler

In ensure

ifCurtailed:

[block] ifCurtailed: [clean up block]

Clean up block is done only if [block] ends abnormally

Raising Exceptions

Implicitly Raised Exceptions

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Explicitly Raised Exceptions

Send message to an exception class

Warning raiseSignal: 'This string is the signal description'

Error raiseSignal

Error raiseSignal: 'Problem here'

Object Methods That Raise Exception

`self error: 'Error message'`

Simplest way to raise an exception

`self halt`

`self halt: 'Message'`

Raises Halt exception.

Allows user to invoke debugger or resume

`self shouldNotImplement`

Used in subclasses in inherited methods that do not belong in the subclass

`self subclassResponsibility`

Used in methods to declare them abstract

Indicated subclasses must implement this method

Exceptions are Classes

Error

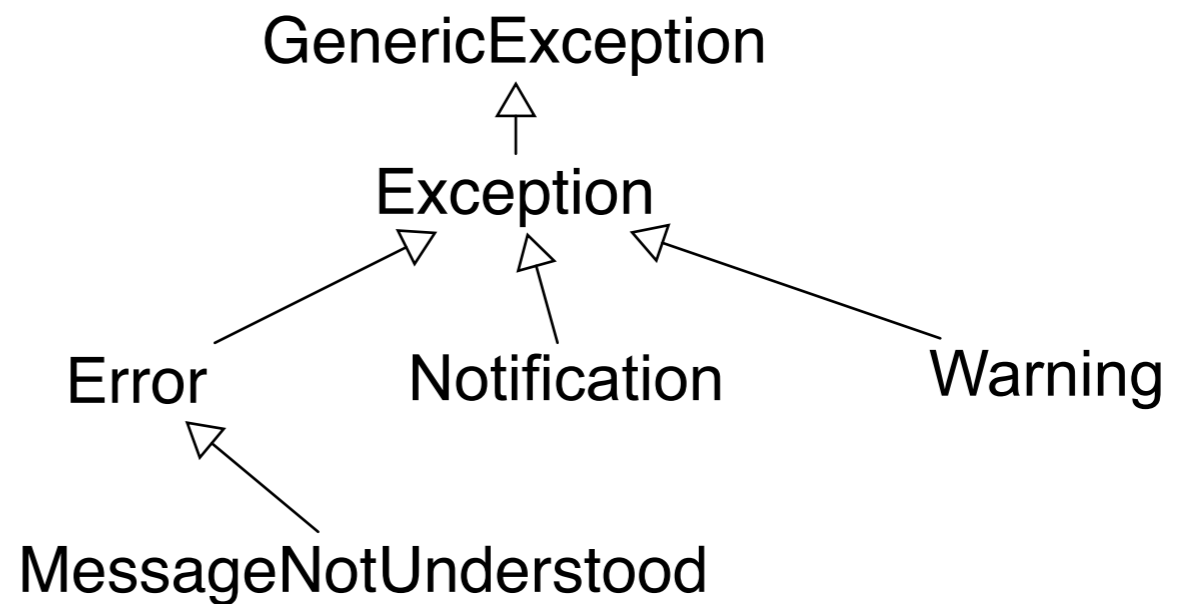
Normal Exception behavior
Your exceptions should subclass Error

Notification

Something interesting has occurred
If it is not handled, it will pass by without effect

Warning

An unusual event the user needs to know about
Asks the user if the program should continue



MessageNotUnderstood

A method was sent to an object that does not implement it

Exception Default Action

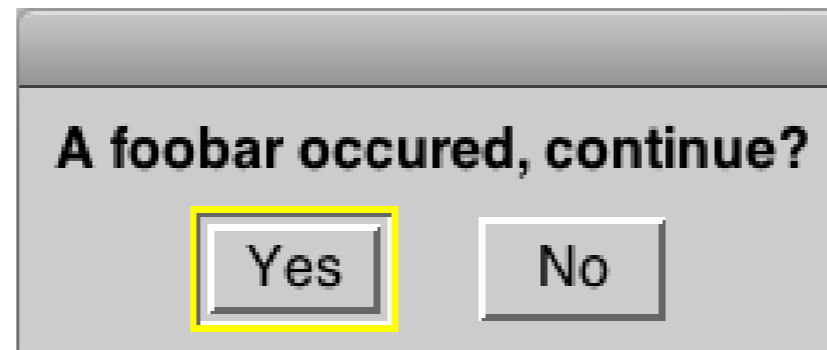
All exceptions have default action

What happens if exception is not caught in on:do:

Warning Default Behavior

Warning raiseSignal: 'An error occurred, continue?'

Result



Warning with handler

```
[Warning raiseSignal: 'Hi Mom'.  
Transcript show: 'End']  
  on: Warning  
  do: [:exception | Transcript show: 'Handler']
```

Output in Transcript

Handler

Finding the Exception Handler

When an exception is raised the enclosing handlers are searched

- Start with the code that raised the exception
- Search the "closest" enclosing handler first
- Continue searching the enclosing handlers

The first handler that deals with the exception is used

If no handlers handle the exception the exception's default action is done

```
[[1/0]
```

```
  on: ZeroDivide
```

```
  do: [:exception | Transcript show: 'First']]
```

```
    on: ZeroDivide
```

```
    do: [:exception | Transcript show: 'Second']
```

Inheritance and Exception

All subexceptions are caught by an exception in on:do:

ZeroDivide is a subclass of Error

The ZeroDivide exception will be caught in the following

```
[1/0]
```

```
on: Error
```

```
do:
```

```
[:exception |
```

```
Transcript
```

```
show: exception description;
```

```
cr]
```

Resumable Exceptions

```
| result |  
[result := 10 / 0 + 5.  
Transcript show: result printString]  
on: ZeroDivide  
do: [:exception | exception resume: 1]
```

Output in Transcript

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```
| result |  
[result := 10/0.  
Transcript show: result printString]  
on: ZeroDivide  
do:  
[:exception |  
exception resume ]
```

Output in Transcript

nil

retry

```
| x y result |  
x := 10.  
y := 0.  
[result := x / y.  
Transcript show: result printString]  
on: ZeroDivide  
do:  
[:exception |  
y := 1.  
exception retry ]
```

Output in Transcript

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Creating Your Own Exceptions

Subclass the correct existing Exception

Almost always Error

If you want the exception to be resumable

Make method `isResumable` return true

If you want non-standard default behavior

Override the method `defaultAction`

Common Mistake

LinkedList>>at: anIndex

Requirement: throw an exception if anIndex < 1 or anIndex > List size

```
[(anIndex < 1 or: [anIndex > self size]) ifTrue: [self error: 'Out of bounds'].
```

```
current := self head.
```

```
[anIndex - 1] timesRepeat: [current := current next].
```

```
^current value.
```

```
]
```

```
on: Error
```

```
do: [:exception |
```

```
    Transcript show: 'error'.
```

```
    ^nil]
```

Point of Exceptions

Something unexpected occurred in your method

Your method can not handle the problem

Raise exception to inform caller
you can not handle the request
do to exceptional condition

Caller

May have to cancel operation
Be able to fix error
let someone else handle the problem

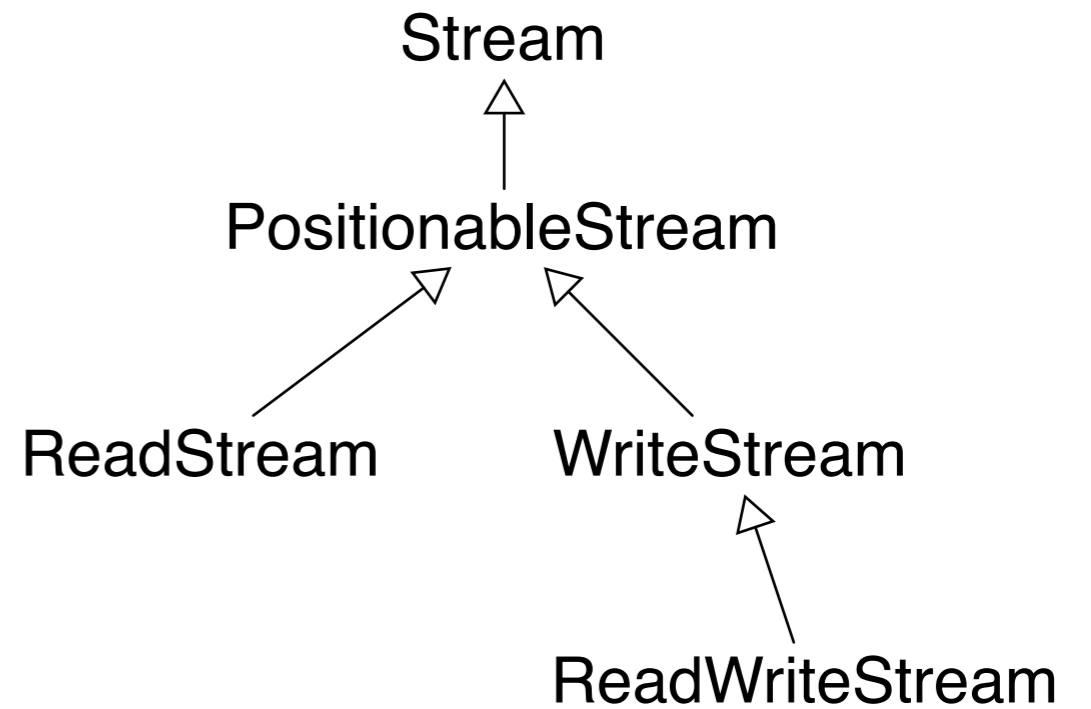
Streams

Streams

Iterate or traverse over

- Sequenceable Collections
- File contents

Maintains pointer to current position in collection



Stream Methods

next	Returns the next element
next: n	Returns the n next elements
nextPut: anElement	Inserts anElement at next position
nextPutAll: aCollection	Inserts collection elements starting at the next position
contents	Returns all the elements
flush	Write any unwritten information
atEnd	true if at the end of the collection
cr space tab crtab	Write the specified white space
print: anObject	Print anObject on the stream

PeekableStream Methods

skip: n	Increases the position by n
skipTo: anElement	Increases the position to after anElement
upToSeparator	Return contents up to a separator, skip over separator
reset	Set position to 0
peek	Return next element, position not changed
peekFor: anObject	Return true if next element = anObject

WriteStream Examples

```
| x |  
x := WriteStream on: String new.  
x  
  nextPut: $A;  
  nextPutAll: ' Cat in the Hat';  
  nextPutAll: ' Comes Back';  
  contents
```

Result

'A Cat in the Hat Comes Back'

```
| x |  
x := WriteStream on: Array new.  
x  
  nextPut: 5;  
  nextPut: 'cat';  
  nextPut: $a.  
x contents
```

Result

#(5 'cat' \$a)

nextPut: & nextPutAll:

x := WriteStream on: String new.

x nextPut: 56. "Runtime error, must be character"

x nextPut: 56 printString. "Error, string is not a character"

x print: 56 "OK"

x nextPutAll: 56 printString "OK"

nextPut:

adds one element to the stream

nextPutAll:

Argument must be a collection

Elements of the argument are added one at a time to the collection

Explain This

```
| x |  
x := WriteStream on: Array new.  
x  
  nextPut: 'cat';  
  nextPut: 'in';  
  nextPut: 'hat'.  
x contents
```

Result

```
#('cat' 'in' 'hat')
```

```
| x |  
x := WriteStream on: Array new.  
x  
  nextPutAll: 'cat';  
  nextPutAll: 'in';  
  nextPutAll: 'hat'.  
x contents
```

Result

```
#($c $a $t $i $n $h $a $t)
```

Repositioning of the stream

```
(WriteStream on: String new)  
  nextPutAll: 'Cat in the Hat';  
  position: 4;  
  nextPutAll: 'Comes Back';  
  contents
```

Result
'Cat Comes Back'

ReadStream Examples

	Transcript
<pre> x x := ReadStream on: 'Cat-in-the-Hat-Comes-Back'.</pre>	
Transcript	
print: x next; cr;	C
print: x peek; cr;	a
print: x next; cr;	a
show: (x upTo: \$e); cr;	t-in-th
show: (x upToAll: 'Comes'); cr;	-Hat-
show: x upToEnd; cr;	Comes-Back
show: x contents	Cat-in-the-Hat-Comes-Back

ReadStream on an Array

	Transcript
<code> x x := ReadStream on: #('Cat' 'in' 'the' 'Hat' 'Comes' 'Back' 'Again' 'by' 'Zeus').</code>	
Transcript	
<code>show: x next; cr;</code>	Cat
<code>show: x peek; cr;</code>	in
<code>show: x next; cr;</code>	in
<code>show: (x upTo: 'Comes'); cr;</code>	#('the' 'Hat')
<code>show: (x upToAll: #('Again' 'by')); cr;</code>	#('Back')
<code>show: x upToEnd</code>	#('Again' 'by' 'Zeus')

ReadStream

The elements returned by the stream are elements in the underlying collection

upTo: requires elements of the underlying collection

upToAll: requires a collection of elements of the underlying collection

next returns an element of the underlying stream

Most uses have String as underlying collection

Files

Example

```
| name file fileWrite fileRead|
name := 'sampleFile'.
file := name asFilename.
fileWrite := file writeStream.
fileWrite
  nextPutAll: 'Hello world';
  nextPutAll: 'How are you?';
  cr;
  close.
fileRead := file readStream.
Transcript show: fileRead contents.
fileRead close.
fileAppend := file appendStream.
fileAppend
  nextPutAll: 'I am well';
  cr;
  close.
Transcript show: file contentsOfEntireFile
```

File Objects

Filename named: 'filename'

'filename' asFilename

Both create a File object on a file

The filename string is a
file in the current directory or
Full path to the file

Writing to a File

Filename>>writeStream

- Opens a write stream on the file
- If file does not exist create the file
- If file does exist erase current contents

Filename>>appendStream

- Returns a write stream on the file
- If file does not exist create the file
- If file does exist the stream appends to the contents

Filename>>readStream

- Returns a read stream on the file
- File must exist
- Stream reads from the beginning of the file

Close your Files

Always close streams on files

If you do not close the stream, the VM keeps the file open

```
| name file fileWrite |  
name := 'sampleFile'.  
file := name asFilename.  
[fileWrite := file writeStream.  
1 /0.  
fileWrite  
  nextPutAll: 'Hello world';  
  nextPutAll: 'How are you?';  
  cr.]  
ensure: [fileWrite close].
```

Some File Operations in Filename

isDirectory	Returns true if Filename object is a directory
fileSize	Returns size of the file represented by filename object
delete	Delete the file or directory represented by filename object
directoryContents	Returns the contents of a filename object that represents a directory
makeDirectory	Make the filename object a directory.