Testing

Interface and Implementation

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  ...math goes here...
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def integrate(func, x1, x2):
  ...math goes here...
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```

Interface: (f, x_1, x_2) -> integral

Implementation: we don't (have to) care

Often use this idea to simplify unit testing

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Or some up-front design

Back to those fields in Saskatchewan...

Test function that reads a photo from file

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def read_photo(filename):
  result = set()
  reader = open(filename, ’r’)
  …fill result with rectangles in file…
  reader.close()
  return result
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```
def read_photo(filename):
  result = set()
  reader = open(filename, 'r')
  …fill result with rectangles in file…
  reader.close()
  return result

def test_photo_containing_only_unit():
  assert read_photo('unit.pht') == { ((0, 0), (1, 1)) }
```

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The longer tests take to run, the less often they will be run

And the more often developers will have to backtrack to find and fix bugs

Original function

```
def count_rect(filename):
  reader = open(filename, ’r’)
  count = 0
  for line in reader:
    count += 1
  reader.close()
  return count
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One rectangle per line, no comments or blank lines

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One rectangle per line, no comments or blank lines

Real counter would be more sophisticated

Refactored

```
def count_rect_in(reader):
  count = 0
  for line in reader:
    count += 1
  return count

def count_rect(filename):
  reader = open(filename, 'r')
  result = count_rect_in(reader)
  reader.close()
  return result
```

Refactored

```
def count_rect_in(reader):
  count = 0
  for line in reader:
    count += 1
  return count

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  reader = open(filename, 'r')
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  reader.close()
  return result
```

Does the work, but does *not* open the file

Refactored

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def count_rect_in(reader):
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  reader = open(filename, 'r')
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Opens the file

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Opens the file

Keeps name of original function

Now write tests

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```
from StringIO import StringIO

Data = ’’’0 0 1 1
1 0 2 1
2 0 3 1’’’

def test_num_rect():
  reader = StringIO(Data)
  assert count_rect(reader) == 3
```

Now write tests

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A "file" that tests can be run on

Now write tests

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Data = '''0 0 1 1
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Acts like a file, but uses a string in memory for storage

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Doesn't know it isn't reading from a real file

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```
def test_write_unit_only():
  fixture = { ((0, 0), (1, 1)) }
  writer = StringIO()
  photo_write(fixture, writer)
  result = writer.getvalue()
  assert result == '0 0 1 1\n'
```

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Get everything written to the `StringIO` as a string

One more task

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```
def photo_write(photo, writer):
  contents = list(photo)
  contents.sort()
  for rect in contents:
    print >> writer, rect[0][0], rect[0][1],
                     rect[1][0], rect[1][1]
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One more task

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Why do the extra work of sorting?

This version is simpler and faster

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def photo_write(photo, writer):
  for rect in photo:
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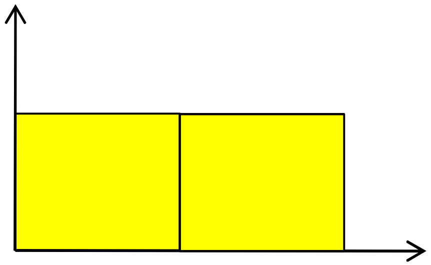
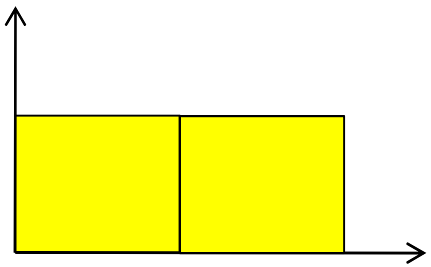
But there is no way to predict its output!





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two_fields = { ((0, 0), (1, 1)), ((1, 0), (2, 1)) }
photo_write(two_fields, …)
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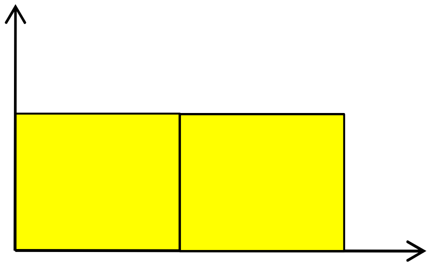

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```
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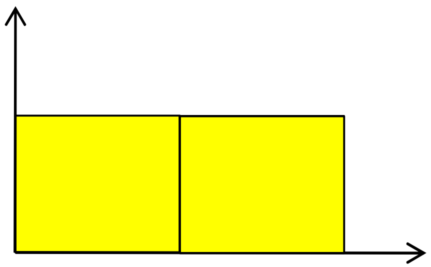

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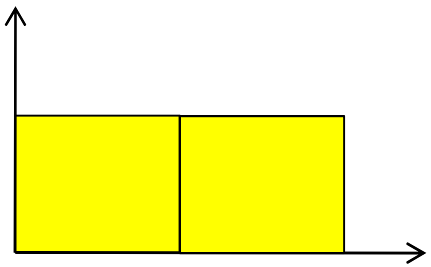

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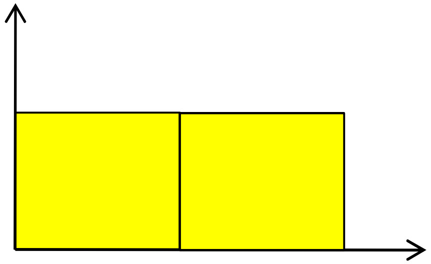
$$\boxed{\begin{matrix}0&0&1&1\\1&0&2&1\end{matrix}} \neq \boxed{\begin{matrix}1&0&2&1\\0&0&1&1\end{matrix}}$$



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Sets are unordered

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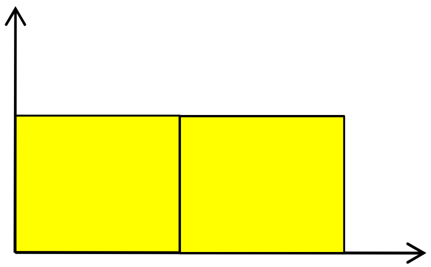

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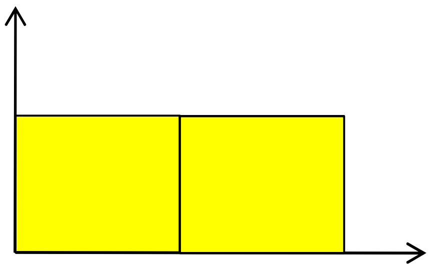
~~Sets are unordered~~

Set elements are stored in an arbitrary order



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We can't test if we can't predict the result

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Do photo files have a newline at the end of the last line or not?

Either answer is better than "maybe"

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Make things you are going to examine deterministic software carpentry

created by

Greg Wilson

August 2010