

XQuery Tutorial

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References

- XQuery 1.0: An XML Query Language
 - www.w3.org/TR/xquery/
- XML Query Use Cases
 - www.w3.org/TR/xmlquery-use-cases
- What is XQuery: Katz, 2004. “XQuery from the Experts”
 - <http://www.gnu.org/software/qexo/XQuery-Intro.html>
- XQuery Tutorial
 - http://www.datadirect.com/developer/xquery/xquery_tutorial/index.ssp
- XQuery Tutorial
 - <http://www.w3schools.com/xquery/default.asp>

Availability

- Xquery Interpreter:
 - <http://atlas.isi.edu/xquery>
- Advice:
 - Case matters
 - Write your queries incrementally!
 - It is hard to debug entire queries

Example XML Document: bib.xml

```
<bib>
  <book year="1994">
    <title>TCP/IP Illustrated</title>
    <author><last>Stevens</last><first>W.</first></author>
    <publisher>Addison-Wesley</publisher>
    <price> 65.95</price>
  </book>
  <book year="1992">
    <title>Advanced Programming in the Unix environment</title>
    <author><last>Stevens</last><first>W.</first></author>
    <publisher>Addison-Wesley</publisher>
    <price>65.95</price>
  </book>
```

Example XML Document: bib.xml

```
<book year="2000">
```

```
  <title>Data on the Web</title>
```

```
  <author><last>Abiteboul</last><first>Serge</first></author>
```

```
  <author><last>Buneman</last><first>Peter</first></author>
```

```
  <author><last>Suciu</last><first>Dan</first></author>
```

```
  <publisher>Morgan Kaufmann Publishers</publisher>
```

```
  <price> 39.95</price>
```

```
</book>
```

```
<book year="1999">
```

```
  <title>The Economics of Technology and Content for Digital TV</title>
```

```
  <editor> <last>Gerbarg</last><first>Darcy</first> <affiliation>CITI</affiliation>  
  </editor>
```

```
  <publisher>Kluwer Academic Publishers</publisher>
```

```
  <price>129.95</price>
```

```
</book>
```

```
</bib>
```

Xquery Overview

- Xquery is an expression language
 - Every statement evaluates to some result
 - `let $x := 5 let $y := 6 return 10*$x+$y`
 - Evaluates to 56
- Primitive types
 - Number, boolean, strings, dates, times, durations, and XML types

Nodes and Expressions

- Various functions create or return nodes
 - Document function reads an XML file
 - `doc("http://atlas.isi.edu/xquery/bib.xml")`
 - We will use `doc("bib.xml")` throughout, but you must use the expansion to run the demo
 - Element constructor creates a node:
 - `<doc><par>Blah Blah</par></doc>`
 - Use curly braces to embed Xquery expressions inside an element constructor

Path Expressions

- Xquery uses path expressions from Xpath (a W3C standard)
- Let \$b := doc("bib.xml")
return <result>{\$b/bib/book}</result>
- /book selects the child elements named book
- /book/author selects the author elements of the top-level book elements

Path Expressions (cont.)

- `//book`
 - returns all book elements that appear anywhere in the document
- `//book[author/last = “Stevens”]`
 - all book elements with author = “Hunter”
- `//book[@year > 1999]`
 - book elements with attribute year > 1999
- `//book[@pages]`
 - all book elements that have a pages attribute

Advanced Path Expressions

- `//book/(author | editor)` – returns all author or editor elements from current node
- `(//book | //collection)[publisher = $pub]` – books for collections where publisher equals \$pub variable

```
let $d := doc("http://atlas.isi.edu/xquery/bib.xml")
```

```
let $pub := "Morgan Kaufmann Publishers"
```

```
return <result>{
```

```
($d//book | $d//collection)[publisher = $pub]
```

```
}</result>
```

- `(//book)[1]/title/text()` – returns the text nodes of the first book element

FLWOR Expressions

- For/Let, Where, Order by, Result Expressions

```
<html>{  
let $d := doc("bib.xml")  
for $b in $d/bib/book  
where $b[@year > 1998]  
order by $b/publisher  
return <book>{$b/title, $b/price, $b/publisher}</book>  
}</html>
```

Projection

- Return the names of all authors of books

```
let $d := doc("bib.xml")
```

```
return <result>{$d/bib/book/author}</result>
```

```
=
```

```
<result>
```

```
<author><last>Stevens</last><first>W.</first></author>
```

```
<author><last>Stevens</last><first>W.</first></author>
```

```
<author><last>Abiteboul</last><first>Serge</first></author>
```

```
<author><last>Buneman</last><first>Peter</first></author>
```

```
<author><last>Suciu</last><first>Dan</first></author>
```

```
</result>
```

Project (cont.)

- The same query can also be written as a for loop

```
/bib/book/author
```

```
=
```

```
for $bk in doc("bib.html")/bib/book return
```

```
  for $aut in $bk/author return $aut
```

```
=
```

```
<author><last>Stevens</last><first>W.</first></author>
```

```
<author><last>Stevens</last><first>W.</first></author>
```

```
<author><last>Abiteboul</last><first>Serge</first></author>
```

```
<author><last>Buneman</last><first>Peter</first></author>
```

```
<author><last>Suciu</last><first>Dan</first></author>
```

Selection

- Return the titles of all books published before 1997

```
/bib/book[@year < "1997"]/title
```

```
=
```

```
<title>TCP/IP Illustrated</title>
```

```
<title>Advanced Programming in the Unix environment</title>
```

Selection (cont.)

- Return the titles of all books published before 1997

```
/bib/book[@year < "1997"]/title
```

=

```
for $bk in doc("bib.xml")/bib/book
```

```
  where $bk/@year < "1997"
```

```
    return $bk/title
```

=

```
<title>TCP/IP Illustrated</title>
```

```
<title>Advanced Programming in the Unix environment</title>
```

Selection (cont.)

- Return book with the title “Data on the Web”

```
/bib/book[title = "Data on the Web"]
```

```
=
```

```
<book year="2000">
```

```
  <title>Data on the Web</title>
```

```
  <author><last>Abiteboul</last><first>Serge</first></author>
```

```
  <author><last>Buneman</last><first>Peter</first></author>
```

```
  <author><last>Suciu</last><first>Dan</first></author>
```

```
  <publisher>Morgan Kaufmann Publishers</publisher>
```

```
  <price> 39.95</price>
```

```
</book>
```

Selection (cont.)

- Return the price of the book “Data on the Web”

`/bib/book[title = "Data on the Web"]/price`

`=`

`<price> 39.95</price>`

How would you return the book with a price of \$39.95?

Selection (cont.)

- Return the book with a price of \$39.95

```
for $bk in doc("bib.xml")/bib/book
```

```
  where $bk/price = "39.95"
```

```
  return $bk
```

```
=
```

```
let $d:= doc("bib.xml")
```

```
  return $d/bib/book[price = "39.95"]
```

```
=
```

```
<book year="2000">
```

```
  <title>Data on the Web</title>
```

```
  <author><last>Abiteboul</last><first>Serge</first></author>
```

```
  <author><last>Buneman</last><first>Peter</first></author>
```

```
  <author><last>Suciu</last><first>Dan</first></author>
```

```
  <publisher>Morgan Kaufmann Publishers</publisher>
```

```
  <price> 39.95</price>
```

```
</book>
```

Construction

- Return year and title of all books published before 1997

```
for $bk in doc("bib.xml")/bib/book
```

```
  where $bk/@year < "1997"
```

```
  return <book>{ $bk/@year, $bk/title }</book>
```

```
=
```

```
<book year="1994">
```

```
  <title>TCP/IP Illustrated</title>
```

```
</book>
```

```
<book year="1992">
```

```
  <title>Advanced Programming in the Unix environment</title>
```

```
</book>
```

Grouping

- Return titles for each author

```
<result>{  
let $d:= doc("http://atlas.isi.edu/xquery/bib.xml")  
for $l in distinct-values($d//author/last)  
return  
<author name="{ $l }">  
  { $d/bib/book[author/last = $l]/title }  
</author>  
}</result>
```

Grouping Cont.

=

```
<result>
```

```
  <author name="Stevens">
```

```
    <title>TCP/IP Illustrated</title>
```

```
    <title>Advanced Programming in the Unix environment</title>
```

```
  </author>
```

```
  <author name="Abiteboul">
```

```
    <title>Data on the Web</title>
```

```
  </author>
```

```
</result>
```

Join

Return the books that cost more at amazon than fatbrain

Let \$amazon := doc(<http://www.amazon.com/books.xml>),

Let \$fatbrain := doc(<http://www.fatbrain.com/books.xml>)

For \$am in \$amazon/books/book,

 \$fat in \$fatbrain/books/book

Where \$am/isbn = \$fat/isbn

 and \$am/price > \$fat/price

Return <book>{ \$am/title, \$am/price, \$fat/price }<book>

Functions

Define function reverse (\$items)

{

 let \$count := count(\$items)

 for \$i in 0 to \$count

 return \$items[\$count - \$i]

}

Reverse(1 to 5)

Note: (1 to 5) = (1, 2, 3, 4, 5)

Example Query 1

```
<bib>
{
  for $b in doc("bib.xml")/bib/book
  where $b/publisher = "Addison-Wesley" and $b[@year > 1991]
  return
    <book year="{ $b/@year }">
      {$b/title}
    </book>
}
</bib>
```

What does this do?

Result Query 1

```
<bib>
```

```
  <book year="1994">
```

```
    <title>TCP/IP Illustrated</title>
```

```
  </book>
```

```
  <book year="1992">
```

```
    <title>Advanced Programming in the Unix environment</title>
```

```
  </book>
```

```
</bib>
```

Example Query 2

```
<results>
{ for $b in doc("bib.xml")/bib/book,
  $t in $b/title,
  $a in $b/author/last
return
  <result>
    { $t }
    { $a }
  </result> }
</results>
```

Result Query 2

```
<results>
  <result><title>TCP/IP Illustrated</title>
    <last>Stevens </last>
  </result>
  <result><title>Advanced Programming in the Unix environment</title>
    <last>Stevens</last>
  </result>
  <result><title>Data on the Web</title>
    <last>Abiteboul</last>
  </result>
  <result> <title>Data on the Web</title>
    <last>Buneman</last>
  </result>
  <result><title>Data on the Web</title>
    <last>Suciu</last>
  </result>
</results>
```

Example Query 3

```
<bib>
```

```
{ for $b in doc("bib.xml")//book
```

```
  where $b/publisher = "Addison-Wesley" and $b/@year > "1991"
```

```
  order by $b/title
```

```
  return <book> { $b/@year } { $b/title } </book>
```

```
}
```

```
</bib>
```

Example Result 3

```
<bib>  
  <book year="1992">  
    <title>Advanced Programming in the Unix environment</title>  
  </book>  
  <book year="1994">  
    <title>TCP/IP Illustrated</title>  
  </book>  
</bib>
```