

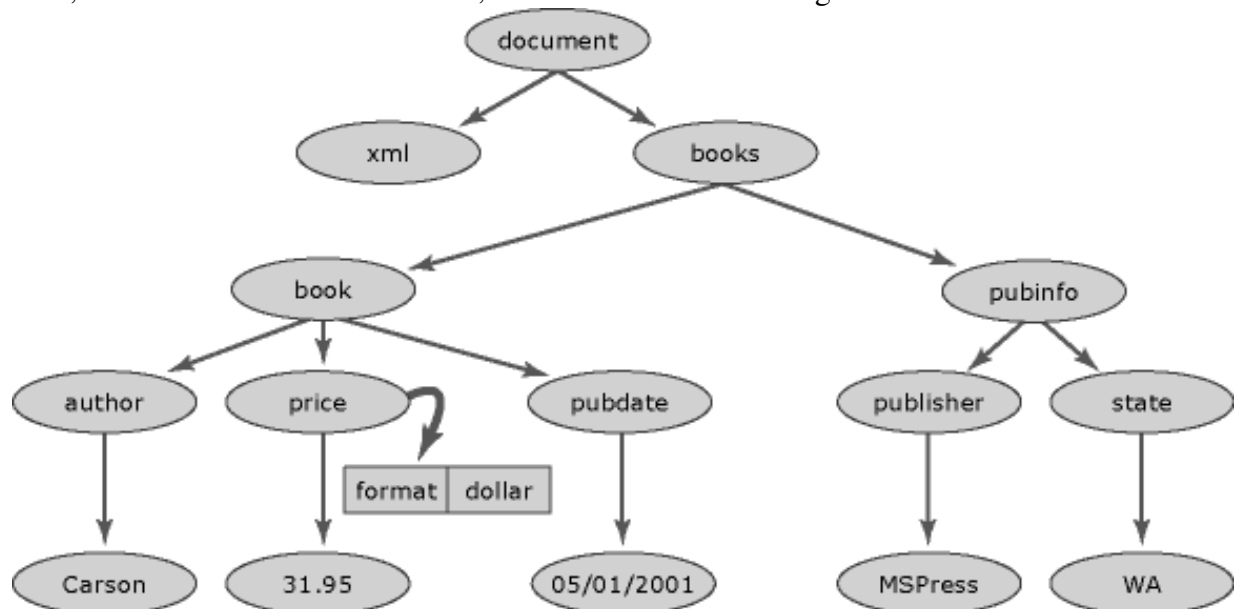
# COMP207 Tutorial Exercises

## Week 8 (23<sup>rd</sup>–25<sup>th</sup> November)

The exercises below provide an opportunity for you to experiment with and become more familiar with XPath. They would likely be easier to verify if you had access to a XPath interpreter (i.e. finding out if what you did was correct), like you saw at the lectures, but if you do not (e.g. because you do not have access to a device connected to the internet during the tutorial), just ask...

### 1 Understanding axes

Consider this XML tree (from "XML Document Object Model (DOM)" by Microsoft). The square nodes are attributes. Note that each node has a unique label, so they are easy to refer to. Leaves, besides "xml" and the attribute, are not elements but strings.



For each of the following, try to find which node(s) is/are:

- (a) child of pubinfo
- (b) previous-sibling of price
- (c) descendant of book
- (d) ancestor of publisher
- (e) parent of pubdate
- (f) self of xml

## 2 Exercises

The following two exercises cover XPath. When you use conditions in XPath (or later XQuery), keep in mind that equalities have an implicit *existential* semantics. For example, if  $E_1$  and  $E_2$  are XPath (or later XQuery) expressions,  $c$  is a constant value (e.g., a string), and  $*$  is any of the comparison relationships in XPath (or later XQuery) ( $=$ ,  $\neq$ ,  $<$ ,  $\dots$ ), then  $E_1 * c$  is true if and only if there exists an item  $i$  in the result to  $E_1$  such that  $i * c$  (if  $c$  is a string constant, then the tags around  $i$  will be removed before the comparison). Similarly,  $E_1 * E_2$  is true if and only if there exist items  $i_1$  and  $i_2$  in the result to  $E_1$  and  $E_2$ , respectively, such that  $i_1 * i_2$ .

**Exercise 1** (Exercise 12.1.1 in [1]). Write XPath expressions for the following queries (for the makers.xml file from the next page). What do these XPath return?

- (a) Find the amount of RAM on each PC.
- (b) Find the price of each product of any kind.
- (c) Find all the printer elements.
- (d) Find the makers of laser printers.
- (e) Find the makers of PCs and/or laptops.
- (f) Find the model numbers of PCs with a hard disk of at least 500GB.
- (g) Find the makers of all colour laser printers.
- (h) Find the makers of at least two PCs.

**Exercise 2** (Exercise 12.1.2 in [1]). Here, we consider battleships.xml. In this document, data about ships is nested within their class element, and information about battles appears inside each ship element. Write the following queries in XPath. What is the result of each?

- (a) Find the names of all ships.
- (b) Find all the Class elements for classes with a displacement larger than 35000.
- (c) Find all the Ship elements for ships that were launched before 1917.
- (d) Find the names of the ships that were sunk.
- (e) Find the years in which ships having the same name as their class were launched.
- (f) Find the names of all ships that were in battles.
- (g) Find the Ship elements for all ships that fought in two or more battles.

## References

- [1] Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom. *Database Systems - The Complete Book*. Pearson Education, 2nd edition, 2009.

### 3 Example XML Documents

The exercises refer to the following XML document “makers.xml” and “battleships.xml” (based on the product data XML file in [1, Chapter 12]), which can be downloaded from Canvas:

#### 3.1 makers.xml

```
<?xml version="1.0" encoding="utf-8" standalone="yes" ?>
<products>
  <maker name="A">
    <pc model="1001" price="1800">
      <speed>3.6</speed>
      <ram>16</ram>
      <harddisk>1024</harddisk>
    </pc>
    <pc model="1002" price="1250">
      <speed>2.3</speed>
      <ram>8</ram>
      <harddisk>256</harddisk>
    </pc>
    <laptop model="2004" price="1250">
      <speed>2.3</speed>
      <ram>8</ram>
      <harddisk>128</harddisk>
      <screen>13</screen>
    </laptop>
    <laptop model="2005" price="2350">
      <speed>2.8</speed>
      <ram>16</ram>
      <harddisk>256</harddisk>
      <screen>15</screen>
    </laptop>
  </maker>
  <maker name="E">
    <pc model="1011" price="2728">
      <speed>4.3</speed>
      <ram>32</ram>
      <harddisk>500</harddisk>
    </pc>
    <pc model="1012" price="878">
      <speed>3.5</speed>
      <ram>8</ram>
      <harddisk>250</harddisk>
    </pc>
    <laptop model="2001" price="1499">
      <speed>3.8</speed>
      <ram>8</ram>
      <harddisk>250</harddisk>
      <screen>15.6</screen>
    </laptop>
    <printer model="3002" price="226">
      <colour>true</colour>
      <type>laser</type>
    </printer>
  </maker>
```

```

<maker name="H">
  <printer model="3006" price="60">
    <colour>true</colour>
    <type>ink-jet</type>
  </printer>
  <printer model="3007" price="150">
    <colour>false</colour>
    <type>laser</type>
  </printer>
</maker>
</products>

```

### 3.2 battleships.xml

```

<Ships>
  <Class name = "Kongo" type = "be" country = "Japan" numGuns = "8" bore =
    "14" displacement = "32000">
    <Ship name = "Kongo" launched = "1913" />
    <Ship name = "Hiei" launched = "1914" />
    <Ship name = "Kirishima" launched = "1915">
      <Battle outcome = "sunk">Guadalcanal</Battle>
    </Ship>
    <Ship name = "Haruna" launched = "1915"/>
  </Class>
  <Class name = "North Carolina" type = "bb" country = "USA"
    numGuns = "9" bore = "16" displacement = "37000">
    <Ship name = "North Carolina" launched = "1941"/>
    <Ship name = "Washington" launched = "1941">
      <Battle outcome = "ok">Guadalcanal</Battle>
    </Ship>
  </Class>
  <Class name = "Tennessee" type = "bb" country = "USA"
    numGuns = "12" bore = "14" displacement = "32000">
    <Ship name = "Tennessee" launched = "1920">
      <Battle outcome = "ok">Surigao S trait</Battle>
    </Ship>
    <Ship name = "California" launched = "1921">
      <Battle outcome = "ok">Surigao Strait</Battle>
    </Ship>
  </Class>
  <Class name = "King George V" type = "bb"
    country = "Great Britain"
    numGuns = "10" bore = "14" displacement = "32000">
    <Ship name = "King George V" launched = "1940"/>
    <Ship name = "Prince of Wales" launched = "1941">
      <Battle outcome = "damaged">Denmark Strait</Battle>
      <Battle outcome = "sunk">Malaya</Battle>
    </Ship>
    <Ship name = "Duke of York" launched = "1941">
      <Battle outcome = "ok">North Cape</Battle>
    </Ship>
    <Ship name = "Howe" launched = "1942"/>
    <Ship name = "Anson" launched = "1942"/>
  </Class>
</Ships>

```