# XML and Databases
# Tutorial session 3: SAX parsing
# DAG Building
# Binary tree encoding

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Week 4

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- Only the callbacks need to be defined by the programmer
- The programmer has to handle the storage/buildling

# Sample SAX program in Java

Read an XML Document, count the number of elements.

```
import org.apache.xerces.parsers.SAXParser;
import org.w3c.dom.*;
import java.util.*;
import java.io.*;

import org.xml.sax.Attributes;
import org.xml.sax.SAXException;
import org.xml.sax.SAXParseException;
import org.xml.sax.XMLReader;
import org.xml.sax.helpers.DefaultHandler;


...
```

# Sample SAX program in Java

```
class SAXExample {

  class MyHandler extends DefaultHandler {
    int count;

    void startElement(String nsuri, String local,
                      String raw, Attributes att)
    {
      count++;
      System.out.println("<"+local+">");
    }
    void endElement(String nsuri, String local,
                    String raw)
    {
      System.out.println("</"+local+">");
    }
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# Sample SAX program in Java

```
  void characters(char[] buffer, int start,int len)
  {
    System.out.println(new String(buffer, start,len);
  }
  void startDocument()
  {
    count = 0;
  }
  void endDocument()
  {
   System.out.println(count + " elements in the document");
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public static void main(char [] args){
  SAXParser parser;
  try {
    parser = new SAXParser();
    MyHandler handle= new MyHandler();
    parser.setContentHandler(handle);
    parser.setErrorHandler(handle);
    parser.parse(args[0]);
  }
  catch (Exception e) {
    System.out.println ("Error during parsing"
                        + e.toString());
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Algorithm:
During SAX Parsing, the first time a node is seen, create the corresponding DAGNode, put it in a Hashtable and associate a unique ID.
Then, before inserting an element into a DAG, check that it is not already in the Hashtable

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Any object can be used as a Key for a Hashtable.
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  LinkedList<Integer> getChildren() {
    return children;
  }
  String getTag() { return tag; }
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Let's use it!

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//Maps a DAGNode to some ID
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System.out.println(table.get(n1)); //prints 1
Integer v = table.get(n2);
if (n == null)
  System.out.println("Object not found");
else
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By default, Java uses the *address* of the Object for a hash and == to implement `.equals()`!

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      if (!tag.equals(n2.tag)) return false;
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     };
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   }
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- Once parsing is finished, you have a hash table from `DAGNode` to `Integer`;
- iterate this table and create the reversed one, from `Integer` to `DAGNode` (this is your dag!);
- to print the entries of the dag in increasing order of IDs:

  ```
  TreeSet<Integer> keys = new TreeSet<Integer>(dag.getKeys());
  ```

  just iterate this tree set, you visit the IDs in order

# Binary trees: FirstChild/NextSibling encoding

Bijection between an unranked-tree (XML Document) and a binary tree.
Given a node:

- its first child points to its first child in the original document

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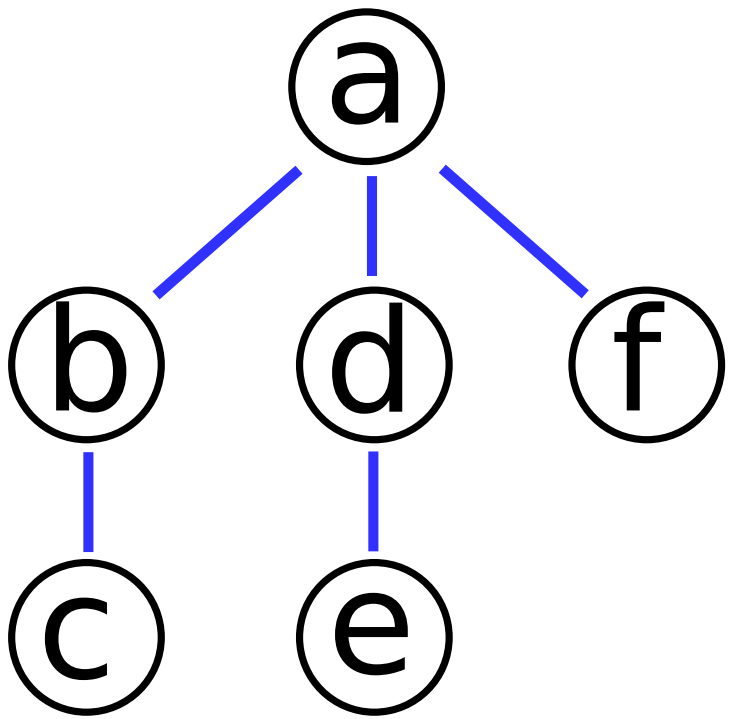

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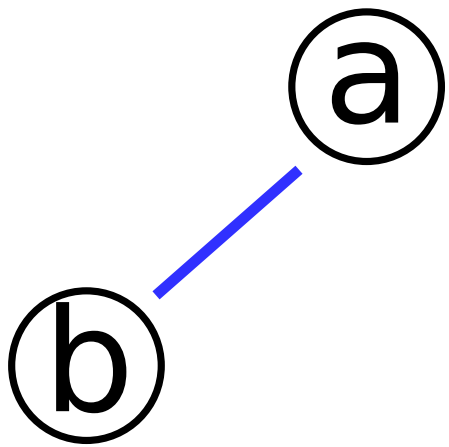

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Bijection between an unranked-tree (XML Document) and a binary tree.
Given a node:

- its first child points to its first child in the original document
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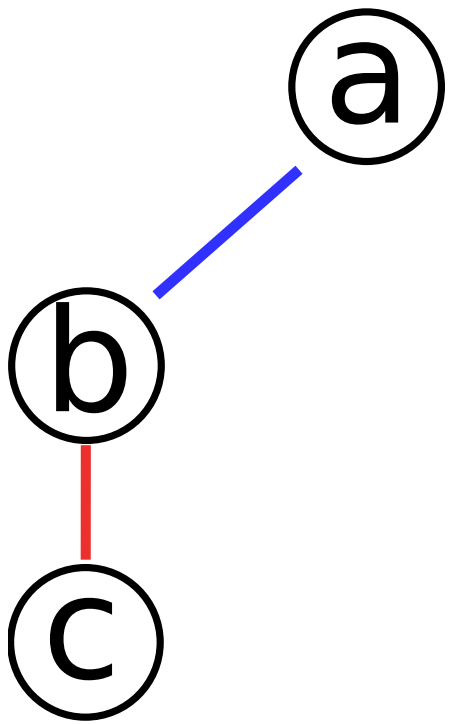

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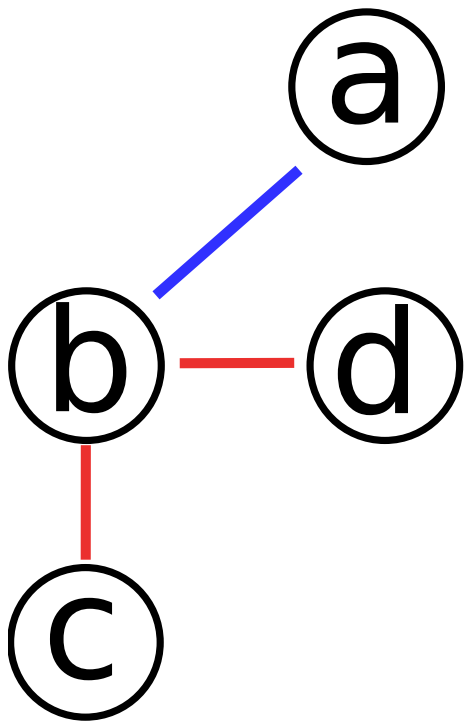

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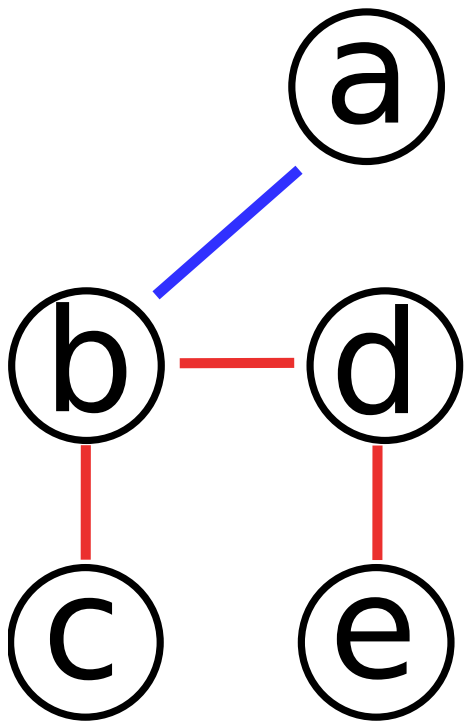

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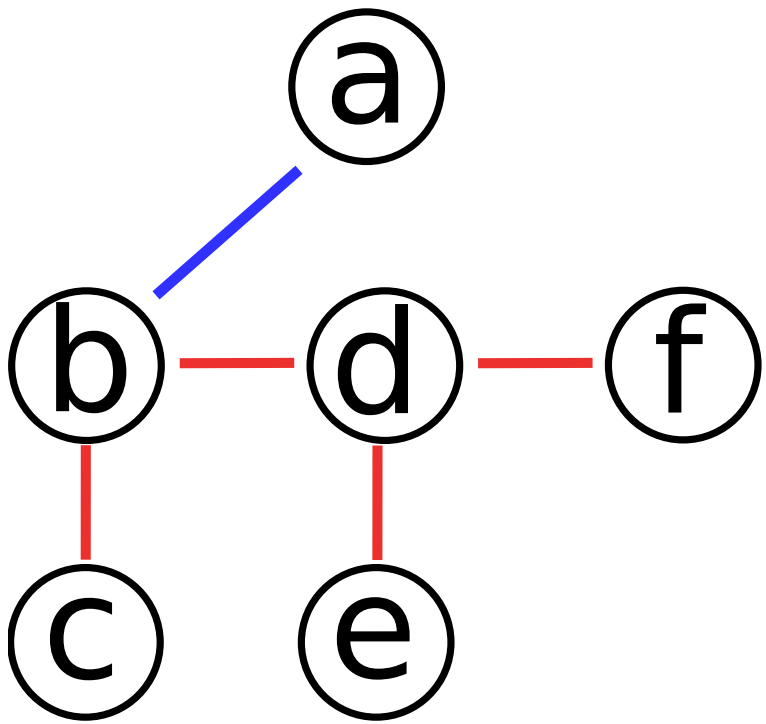

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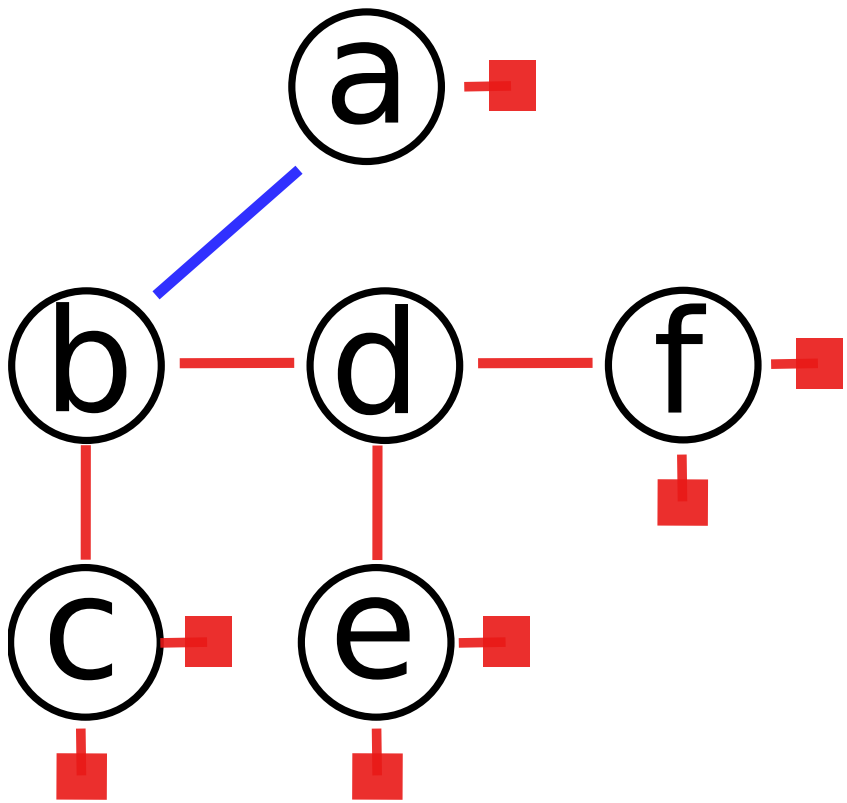

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- Preserves the document order

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- Everything else may be different (height, width, . . . )

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# Binary Tree Wrapper around an Unranked Event Handler

We want to use the previouly defined `MyHandler` to print the binary tree

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class MyBinaryHandler extends Default Handler{
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  Integer LEFT = new Integer(0);
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```
class MyBinaryHandler extends Default Handler{
  MyHandler handler;
  Stack<Pair<String,Integer>> stack;
  Integer LEFT = new Integer(0);
  Integer RIGHT = new Integer(1);

  void startDocument(){
    handler = new MyHandler();
    stack = new Stack<Pair<String,Integer>>();
    stack.push(new Pair<String,Integer>("",LEFT));
  }
```

# Binary Tree Wrapper around an Unranked Event Handler

```
  void startElement(String nsuri, String label,
                    String raw, Attributes atts)
{
   stack.push(new Pair<String,Integer>(label,LEFT));
   handler.startElement(nsuri,label,raw,atts);
  }

  void endElement(String nsuri, String label,
                  String raw)
{
   Pair<String,Integer> top = stack.peek();
   if (top.getSecond().equals(LEFT)){
     top.setSecond(RIGHT);
     handler.startElement(null,"_","_",null);
     handler.endElement(null,"_","_",null);
}
```

# Binary Tree Wrapper around an Unranked Event Handler

```
else { // Direction is RIGHT
      handler.startElement(null,"_","_",null);
      handler.endElement(null,"_","_",null);
```

# Binary Tree Wrapper around an Unranked Event Handler

```
else { // Direction is RIGHT
      handler.startElement(null,"_","_",null);
      handler.endElement(null,"_","_",null);

      while(top.getSecond().equals(RIGHT)){
        handler.endElement(null,top.getFirst(),top.getFi
        stack.pop();
        top = stack.peek();
      };
```

# Binary Tree Wrapper around an Unranked Event Handler

```
else { // Direction is RIGHT
      handler.startElement(null,"_","_",null);
      handler.endElement(null,"_","_",null);

      while(top.getSecond().equals(RIGHT)){
        handler.endElement(null,top.getFirst(),top.getFi
        stack.pop();
        top = stack.peek();
      };

      top.setSecond(RIGHT);
```

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else { // Direction is RIGHT
      handler.startElement(null,"_","_",null);
      handler.endElement(null,"_","_",null);

      while(top.getSecond().equals(RIGHT)){
        handler.endElement(null,top.getFirst(),top.getFi
        stack.pop();
        top = stack.peek();
      };

      top.setSecond(RIGHT);
    }//else
 }// endElement()
```

# Binary Tree Wrapper around an Unranked Event Handler

```
void endDocument(){
    Pair<String,Integer> top = stack.peek();
    if (top.getSecond().equals(RIGHT)){
      handler.startElement(null,"_","_",null);
      handler.endElement(null,"_","_",null);
      handler.endElement(null,top.getFirst(),top.getFirs
    };
 }

} //end class MyBinHandler
```