Vietnam and Japan Joint
ICT HRD Program

ICT 5 Web Development

Chapter 9. XML & XHTML

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Content

1. XML and XHTML Overview
2. XML Components
3. DTD & XML Schema
4. XML Validation
5. XML Applications

1.1. XML (eXtensible Markup Language)

- A new standard by W3C, derived from SGML
- EXtensible Markup Language (XML) is a meta-language that describes the content of the document (self-describing data)

  Java = Portable Programs; XML = Portable Data
- XML does not specify the tag set or grammar of the language
  - Tag Set – markup tags that have meaning to a language processor
  - Grammar – defines correct usage of a language's tag

1.1. XML (2)

- Applications of XML
  - Media for data interchange
    - A better alternative to proprietary data formats
  - B2B transactions on the Web
    - Electronic business orders (ebXML)
    - Financial Exchange (IFX)
    - Messaging exchange (SOAP)

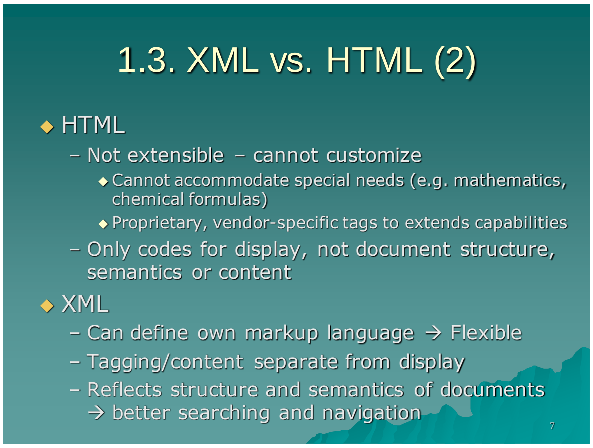
```
<?xml version="1.0" encoding="utf-8"?>
<recipe>
    <name>Iced Tea</name>
    <description>An iced tea that we serve everyday</description>
    <preparation>…</preparation>
</recipe>
```

1.2. XML vs. SGML

- SGML (Standard Generalized Markup Language)
  - ISO-standard meta-language
  - Powerfull but very complex, suffers from lack of industry support
  - The basis for XML, first published in 1988
- XML (eXtensible Markup Language)
  - Simpler yet offers most of the power of SGML because it is also a meta-language
  - More likely to have broad industry support, because many companies and universitites involved in development

1.3. XML vs. HTML

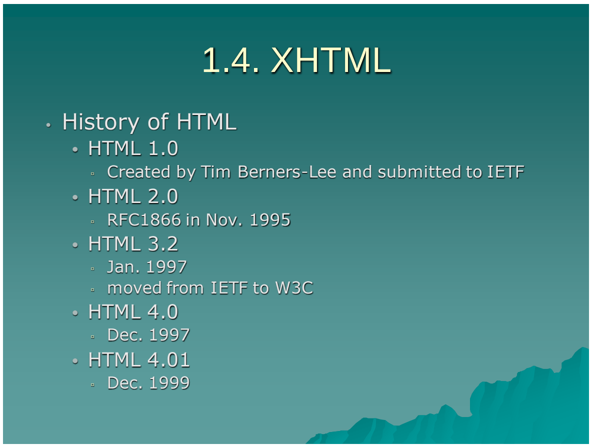
- Both based on SGML
  - XML is a subset of SGML
  - HTML is a markup language written in SGML
- XML fundamentally separates content (data and language) from presentation; HTML specifies the presentation
- HTML explicitly defines a set of legal tags as well as the grammar (intended meaning)
  - <TABLE> … </TABLE>
- XML allows any tags or grammar to be used (hence, eXtensible)
  - <BOOK> … </BOOK>



1.3. XML vs. HTML (2)

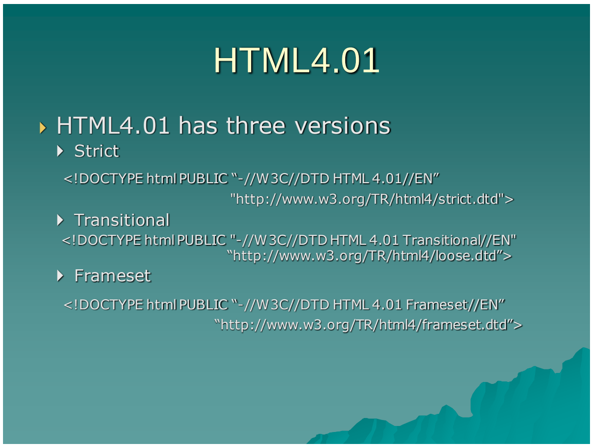
- HTML
  - Not extensible – cannot customize
    - Cannot accommodate special needs (e.g. mathematics, chemical formulas)
    - Proprietary, vendor-specific tags to extends capabilities
  - Only codes for display, not document structure, semantics or content
- XML
  - Can define own markup language → Flexible
  - Tagging/content separate from display
  - Reflects structure and semantics of documents → better searching and navigation

7



1.4. XHTML

- History of HTML
  - HTML 1.0
    - Created by Tim Berners-Lee and submitted to IETF
  - HTML 2.0
    - RFC1866 in Nov. 1995
  - HTML 3.2
    - Jan. 1997
    - moved from IETF to W3C
  - HTML 4.0
    - Dec. 1997
  - HTML 4.01
    - Dec. 1999



HTML4.01

- HTML4.01 has three versions
  - Strict

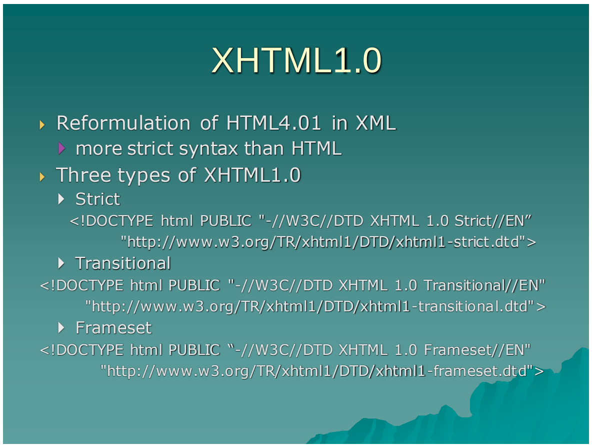
```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01//EN"
                          "http://www.w3.org/TR/html4/strict.dtd">
```

  - Transitional

```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
                          "http://www.w3.org/TR/html4/loose.dtd">
```

  - Frameset

```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Frameset//EN"
                        "http://www.w3.org/TR/html4/frameset.dtd">
```



XHTML1.0

- Reformulation of HTML4.01 in XML
  - more strict syntax than HTML
- Three types of XHTML1.0
  - Strict

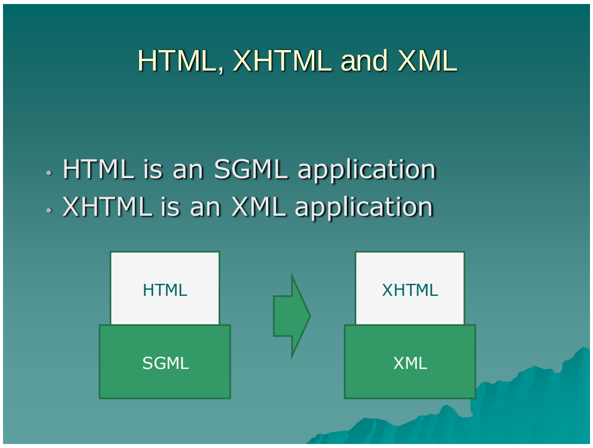
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
        "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
```

  - Transitional

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
```

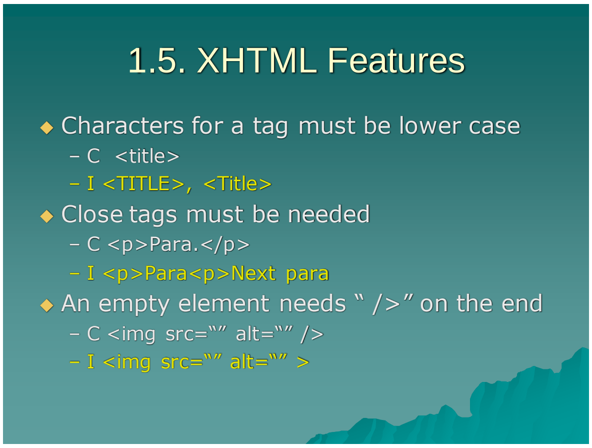
  - Frameset

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Frameset//EN"
      "http://www.w3.org/TR/xhtml1/DTD/xhtml1-frameset.dtd">
```



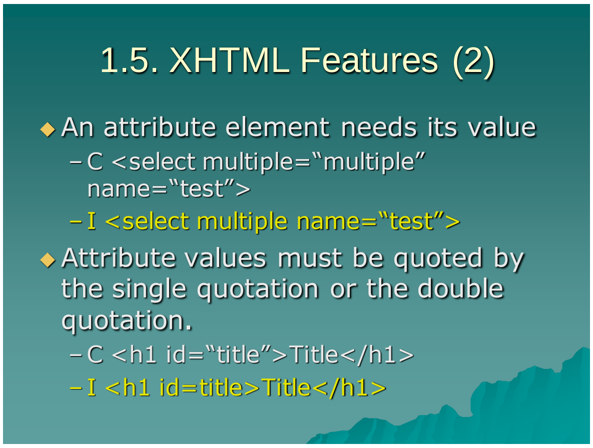
HTML, XHTML and XML

- HTML is an SGML application
- XHTML is an XML application



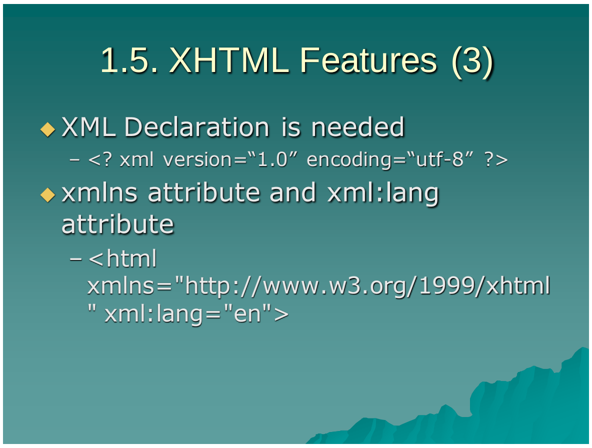
1.5. XHTML Features

- Characters for a tag must be lower case
  - C <title>
  - I <TITLE>, <Title>
- Close tags must be needed
  - C <p>Para.</p>
  - I <p>Para<p>Next para
- An empty element needs “ />” on the end
  - C <img src=“” alt=“” />
  - I <img src=“” alt=“” >



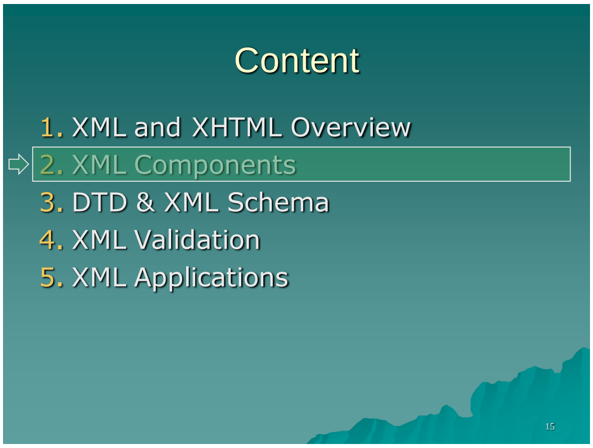
1.5. XHTML Features (2)

- An attribute element needs its value
  - C <select multiple="multiple" name="test">
  - I <select multiple name="test">
- Attribute values must be quoted by the single quotation or the double quotation.
  - C <h1 id="title">Title</h1>
  - I <h1 id=title>Title</h1>



1.5. XHTML Features (3)

- XML Declaration is needed
  - <? xml version="1.0" encoding="utf-8" ?>
- xmlns attribute and xml:lang attribute
  - <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">



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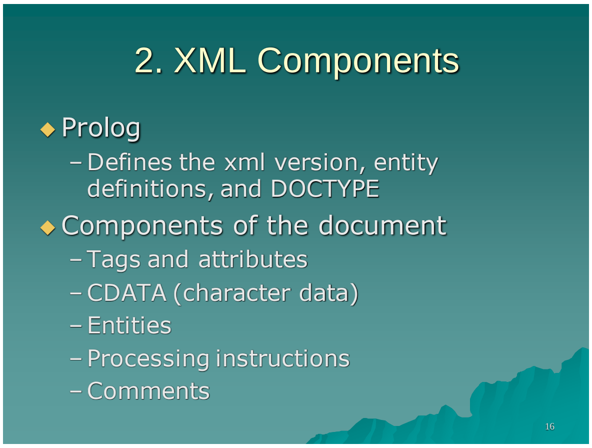
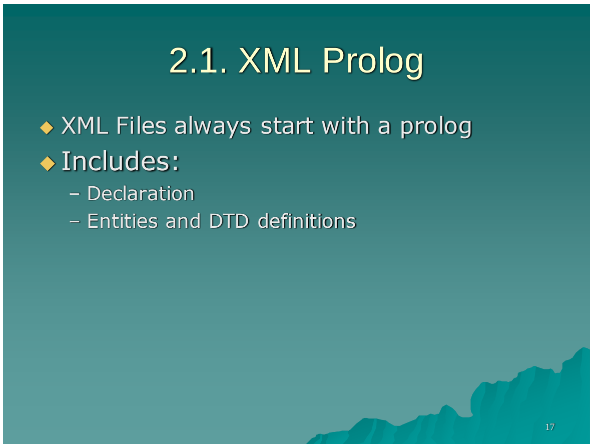


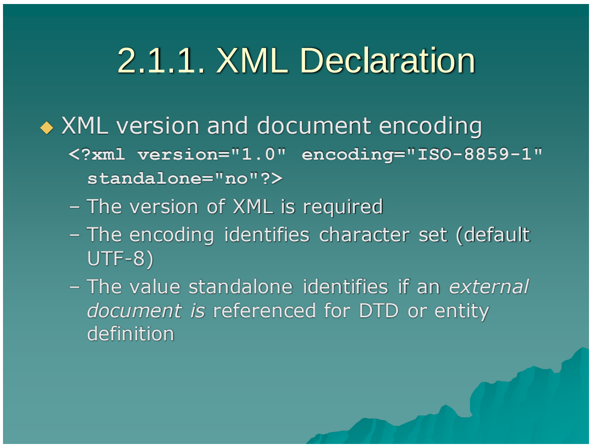
2. XML Components

- Prolog
  - Defines the xml version, entity definitions, and DOCTYPE
- Components of the document
  - Tags and attributes
  - CDATA (character data)
  - Entities
  - Processing instructions
  - Comments



2.1. XML Prolog

- XML Files always start with a prolog
- Includes:
  - Declaration
  - Entities and DTD definitions

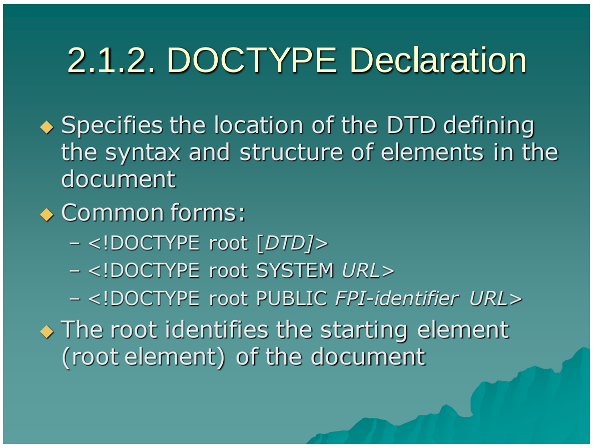


2.1.1. XML Declaration

- XML version and document encoding

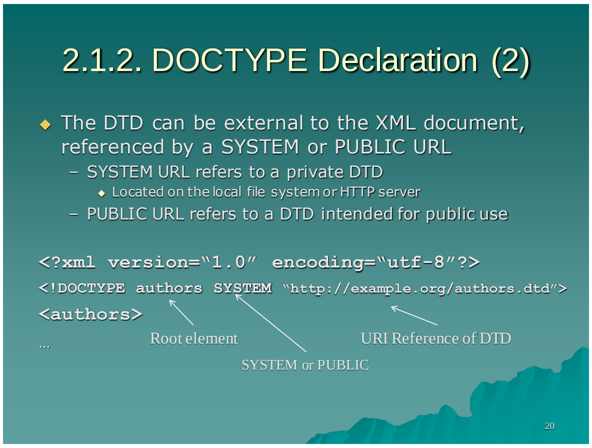
  `<?xml version="1.0" encoding="ISO-8859-1" standalone="no"?>`

  - The version of XML is required
  - The encoding identifies character set (default UTF-8)
  - The value standalone identifies if an *external document is* referenced for DTD or entity definition



2.1.2. DOCTYPE Declaration

- Specifies the location of the DTD defining the syntax and structure of elements in the document
- Common forms:
  - <!DOCTYPE root [*DTD*]>
  - <!DOCTYPE root SYSTEM *URL*>
  - <!DOCTYPE root PUBLIC *FPI-identifier URL*>
- The root identifies the starting element (root element) of the document



2.1.2. DOCTYPE Declaration (2)

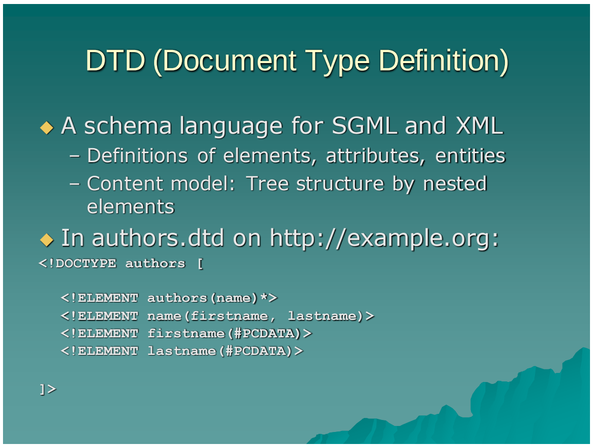
- The DTD can be external to the XML document, referenced by a SYSTEM or PUBLIC URL
  - SYSTEM URL refers to a private DTD
    - Located on the local file system or HTTP server
  - PUBLIC URL refers to a DTD intended for public use

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE authors SYSTEM "http://example.org/authors.dtd">
<authors>
…
```

Root element

URI Reference of DTD

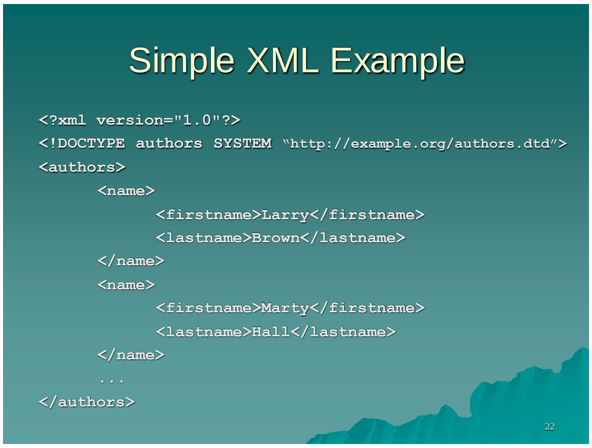
SYSTEM or PUBLIC



DTD (Document Type Definition)

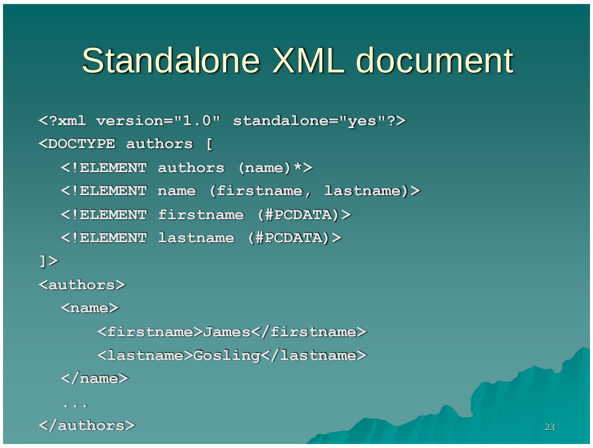
- A schema language for SGML and XML
  - Definitions of elements, attributes, entities
  - Content model: Tree structure by nested elements
- In authors.dtd on http://example.org:

```
<!DOCTYPE authors [

  <!ELEMENT authors(name)*>
  <!ELEMENT name(firstname, lastname)>
  <!ELEMENT firstname(#PCDATA)>
  <!ELEMENT lastname(#PCDATA)>

]>
```



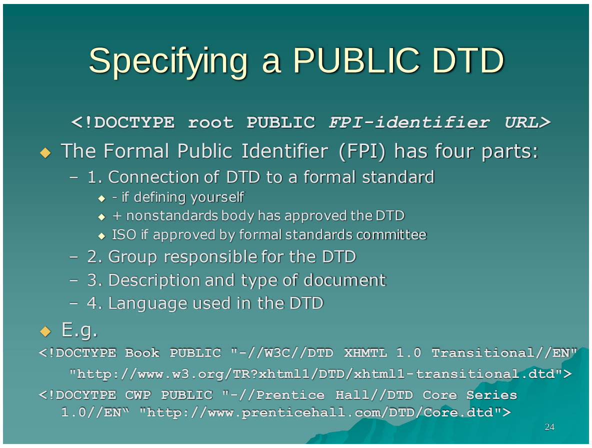
Simple XML Example

```
<?xml version="1.0"?>
<!DOCTYPE authors SYSTEM "http://example.org/authors.dtd">
<authors>
      <name>
            <firstname>Larry</firstname>
            <lastname>Brown</lastname>
      </name>
      <name>
            <firstname>Marty</firstname>
            <lastname>Hall</lastname>
      </name>
      ...
</authors>
```



Standalone XML document

```
<?xml version="1.0" standalone="yes"?>
<DOCTYPE authors [
  <!ELEMENT authors (name)*>
  <!ELEMENT name (firstname, lastname)>
  <!ELEMENT firstname (#PCDATA)>
  <!ELEMENT lastname (#PCDATA)>
]>
<authors>
  <name>
      <firstname>James</firstname>
      <lastname>Gosling</lastname>
  </name>
  ...
</authors>
```

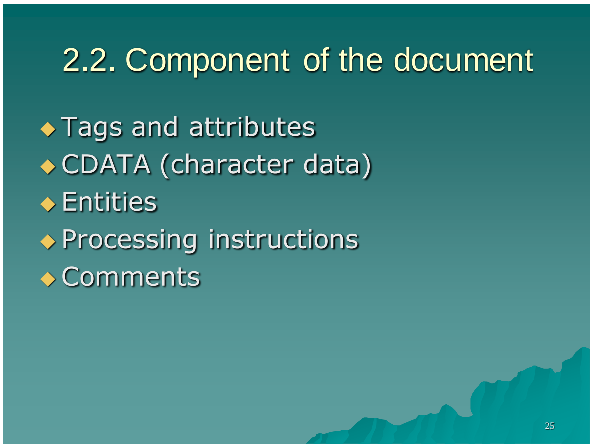


Specifying a PUBLIC DTD

<!DOCTYPE root PUBLIC *FPI-identifier URL*>

- The Formal Public Identifier (FPI) has four parts:
  - 1. Connection of DTD to a formal standard
    - - if defining yourself
    - + nonstandards body has approved the DTD
    - ISO if approved by formal standards committee
  - 2. Group responsible for the DTD
  - 3. Description and type of document
  - 4. Language used in the DTD
- E.g.

```
<!DOCTYPE Book PUBLIC "-//W3C//DTD XHMTL 1.0 Transitional//EN"
   "http://www.w3.org/TR?xhtml1/DTD/xhtml1-transitional.dtd">
<!DOCYTPE CWP PUBLIC "-//Prentice Hall//DTD Core Series
  1.0//EN" "http://www.prenticehall.com/DTD/Core.dtd">
```

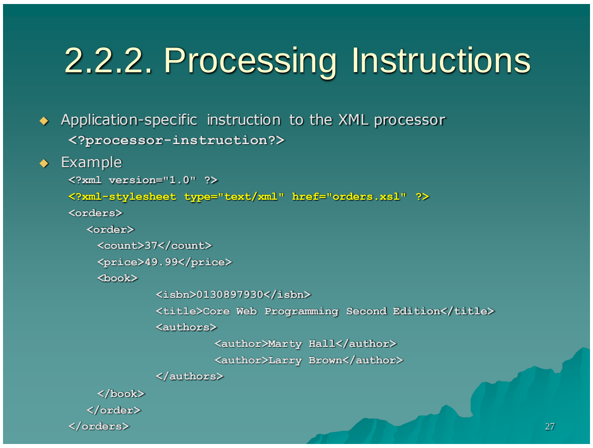


2.2. Component of the document

- Tags and attributes
- CDATA (character data)
- Entities
- Processing instructions
- Comments

2.2.1. XML Comment

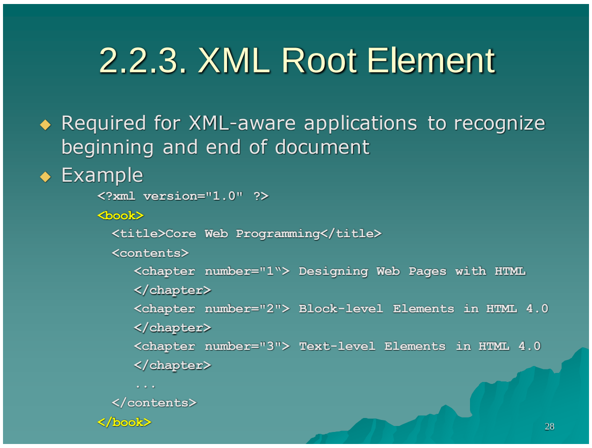
- XML Comments
  - The same as HTML comments
  - `<!-- This is an XML and HTML comment -->`



2.2.2. Processing Instructions

- Application-specific instruction to the XML processor
  `<?processor-instruction?>`
- Example

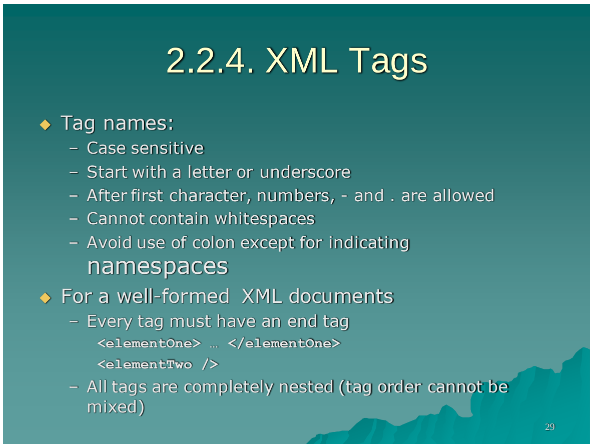
```
<?xml version="1.0" ?>
<?xml-stylesheet type="text/xml" href="orders.xsl" ?>
<orders>
   <order>
     <count>37</count>
     <price>49.99</price>
     <book>
               <isbn>0130897930</isbn>
               <title>Core Web Programming Second Edition</title>
               <authors>
                         <author>Marty Hall</author>
                         <author>Larry Brown</author>
               </authors>
     </book>
   </order>
</orders>
```



2.2.3. XML Root Element

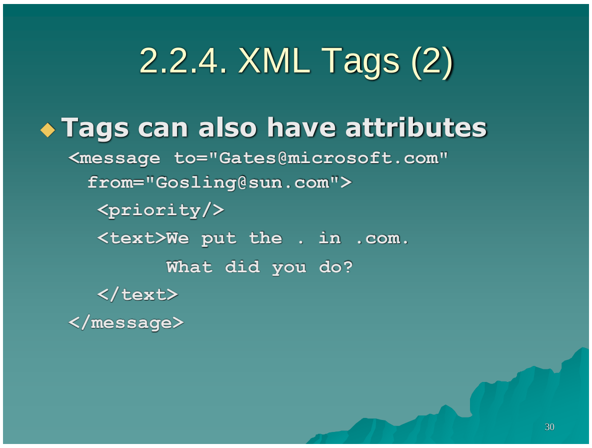
- Required for XML-aware applications to recognize beginning and end of document
- Example

```
<?xml version="1.0" ?>
<book>
  <title>Core Web Programming</title>
  <contents>
     <chapter number="1“> Designing Web Pages with HTML
     </chapter>
     <chapter number="2"> Block-level Elements in HTML 4.0
     </chapter>
     <chapter number="3"> Text-level Elements in HTML 4.0
     </chapter>
     ...
  </contents>
</book>
```



2.2.4. XML Tags

- Tag names:
  - Case sensitive
  - Start with a letter or underscore
  - After first character, numbers, - and . are allowed
  - Cannot contain whitespaces
  - Avoid use of colon except for indicating namespaces
- For a well-formed XML documents
  - Every tag must have an end tag
    `<elementOne> … </elementOne>`
    `<elementTwo />`
  - All tags are completely nested (tag order cannot be mixed)



2.2.4. XML Tags (2)

- **Tags can also have attributes**

```
<message to="Gates@microsoft.com"
  from="Gosling@sun.com">
   <priority/>
   <text>We put the . in .com.
         What did you do?
   </text>
</message>
```

2.2.5. XML Attributes

- Element Attributes
  - Attributes provide metadata for the element
  - Every attribute must be enclosed in "" with no commas in between
  - Same naming conventions as elements

2.2.6. Document Entities

- Entities refer to a data item, typically text
  - General entity references start with & and end with ;
  - The entity reference is replaced by it's true value when parsed
  - The characters < > & ' " require entity references to avoid conflicts with the XML application (parser)

&lt; &gt; &amp; &quot; &apos;

- Entities are user definable

```
<?xml version="1.0" standalone="yes" ?>
<!DOCTYPE book [
  <!ELEMENT book (title)>
  <!ELEMENT title (#PCDATA)>
  <!ENTITY COPYRIGHT "2001, Prentice Hall">
]>
<book>
  <title>Core Web Programming, &COPYRIGHT;</title>
</book>
```

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Well-formed versus Valid

- An XML document can be *well-formed if it* follows basic syntax rules
- An XML document is *valid if its structure* matches a Document Type Definition (DTD) or an XML Schema

3.1. Document Type Definition (DTD)

- Defines Structure of the Document
  - Allowable tags and their attributes
  - Attribute values constraints
  - Nesting of tags
  - Number of occurrences for tags
  - Entity definitions

DTD Examples

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!ELEMENT perennials (daylily)*>
<!ELEMENT daylily (cultivar, award*, bloom, cost)+>
<!ATTLIST daylily
status (in-stock | limited | sold-out) #REQUIRED>
<!ELEMENT cultivar (#PCDATA)>
<!ELEMENT award (name, year)>
<!ELEMENT name (#PCDATA)>
<!ATTLIST name note CDATA #IMPLIED>
<!ELEMENT year (#PCDATA)>
<!ELEMENT bloom (#PCDATA)>
<!ATTLIST bloom code (E | EM | M | ML | L | E-L) #REQUIRED>
<!ELEMENT cost (#PCDATA)>
<!ATTLIST cost discount CDATA #IMPLIED>
<!ATTLIST cost currency (US | UK | CAN) "US">
```

3.2. XML Schema

- W3C recommendation released May 2001
  - – http://www.w3.org/TR/xmlschema-0/
  - – http://www.w3.org/TR/xmlschema-1/
  - – http://www.w3.org/TR/xmlschema-2/
  - Depends on following specifications
    - XML-Infoset, XML-Namespaces, XPath
- Benefits:
  - Standard and user-defined data types
  - Express data types as patterns
  - Higher degree of type checking
  - Better control of occurrences
- Clearly the future … but limited support

XML Schema Example

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
   <xsd:element name="perennials"  type="PerennialType"/>
   <xsd:complexType name="PerennialType" >
        <xsd:element name=daylily"  type="DaylilyType"
                                      maxOccurs="unbounded"/>
   </xsd:complexType>
   <xsd:complexType name="DaylilyType" >
        <xsd:sequence>
          <xsd:element name="cultivar" type="xsd:string"/>
          <xsd:element name="award"  type="AwardType"
                                      maxOccurs="unbounded"/>
          <xsd:element name="bloom"  type="xsd:string"/>
          <xsd:element name="cost"  type="xsd:decimal"/>
        </xsd:sequence>
        <xsd:attribute name="status"  type="StatusType"
                                           use="required"/>
   </xsd:complexType>
```

XML Schema Example (2)

```
   <xsd:simpleType name="StatusType">
        <xsd:restriction base="xsd:string">
              <xsd:enumeration value="in-stock"/>
              <xsd:enumeration value="limited"/>
              <xsd:enumeration value="sold-out"/>
        </xsd:restriction>
   </xsd:simpleType>
   ...
</xsd:schema>
```

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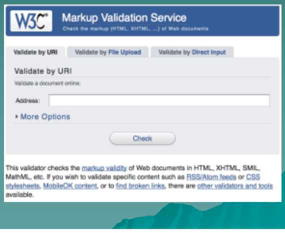
4. XML Validation

- DTD Validaton
  - Process of checking a document against a DTD
    - Correct syntax
    - Correct structure
  - If the document is invalid, a user agent may not be able to handle it correctly
    - parse error

Markup Validation Service

- Validator for HTML
  - URI, Local File or Direct Input
- http://validator.w3.org



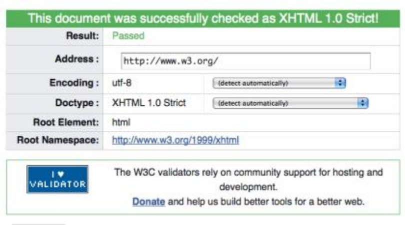
Validate by URI

Validate a document online:

Address:

This validator checks the markup validity of Web documents in HTML, XHTML, SMIL, MathML, etc. If you wish to validate specific content such as RSS/Atom feeds or CSS stylesheets, MobileOK content, or to find broken links, there are other validators and tools available.

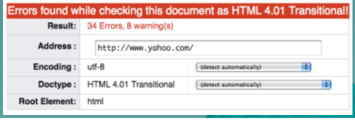
Validator Results



This document was successfully checked as XHTML 1.0 Strict!

Result:	Passed	
Address :	http://www.w3.org/	
Encoding :	utf-8	(detect automatically)
Doctype :	XHTML 1.0 Strict	(detect automatically)
Root Element:	html	
Root Namespace:	http://www.w3.org/1999/xhtml	

The W3C validators rely on community support for hosting and development.
Donate and help us build better tools for a better web.

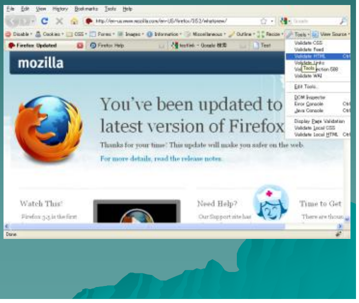


Errors found while checking this document as HTML 4.01 Transitional!

Result:	34 Errors, 8 warning(s)	
Address :	http://www.yahoo.com/	
Encoding :	utf-8	(detect automatically)
Doctype :	HTML 4.01 Transitional	(detect automatically)
Root Element:	html	

Web Developer Tool with Validator

- A link to the validation service on the Tool menu
  - It posts the URI of the current page to the validator



Content-Type

- An HTML document can specify its MIME type and character encoding with meta http-equiv
  - NOTE: it is unrelated to xml declaration

```
<meta http-equiv="Content-Type"
   content="text/html;charset=utf-8" />
```

Content

1. XML and XHTML Overview
2. XML Components
3. DTD & XML Schema
4. XML Validation
5. XML Applications

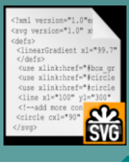
46

5. XML Application

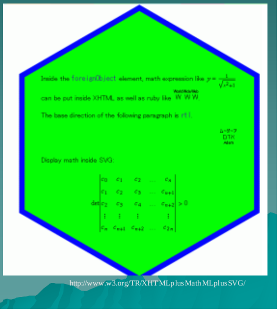
- MathML
  - Mathematical expressions
- SVG (Scalable Vector Graphics)
  - 2D graphics applications and images
- KML (Keyhole Markup Language)
  - Geographical data for Google Earth, Maps, etc...
- XUL (XML User Interface Language, /ˈzuːl/)
  - GUI descriptions for Mozilla project applications (firefox)
- EPUB (Electronic PUBlications)
  - E-book description standard
- ATOM
  - Web content and metadata syndication format
  - Replacement of RSS

XML Namespace

- A way to use various XML applications as components for a document
  - Ex) HTML + MathML + SVG



```
<?xml version="1.0"e
<svg version="1.0" x
<defs>
 <linearGradient x1="99.7"
 </defs>
  <use xlink:href="#box_gr
  <use xlink:href="#circle
  <use xlink:href="#circle
  <line x1="100" y1="300"
  <!--add more con
 <circle cx1="90"
</svg>
```



Inside the foreignObject element, math expression like $y = \frac{1}{\sqrt{x^2+1}}$

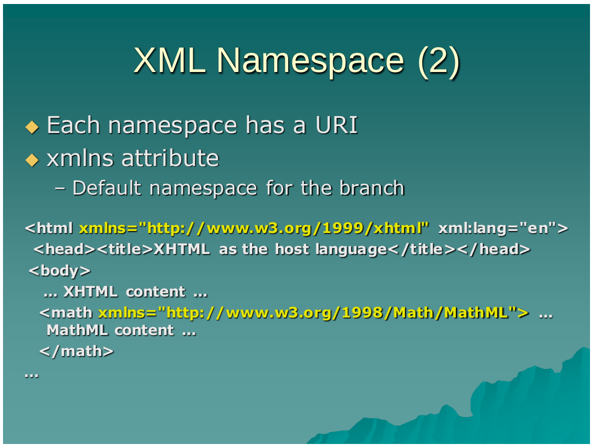
can be put inside XHTML as well as ruby like W W W.

The base direction of the following paragraph is rtl.

Display math inside SVG:

$$\det\begin{vmatrix} c_0 & c_1 & c_2 & \cdots & c_n \\ c_1 & c_2 & c_3 & \cdots & c_{n+1} \\ c_2 & c_3 & c_4 & \cdots & c_{n+2} \\ \vdots & \vdots & \vdots & & \vdots \\ c_n & c_{n+1} & c_{n+2} & \cdots & c_{2n} \end{vmatrix} > 0$$

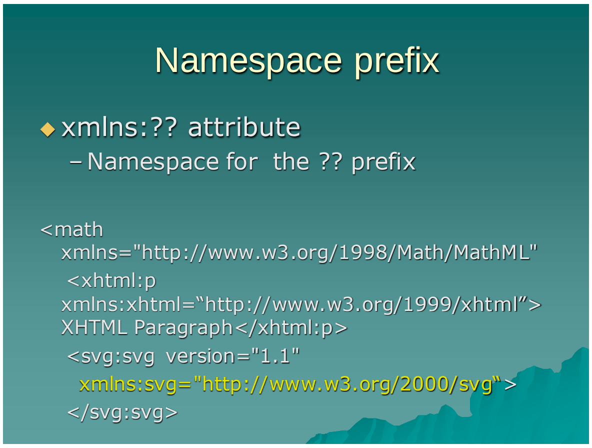
http://www.w3.org/TR/XHTMLplusMathMLplusSVG/



XML Namespace (2)

- Each namespace has a URI
- xmlns attribute
  - Default namespace for the branch

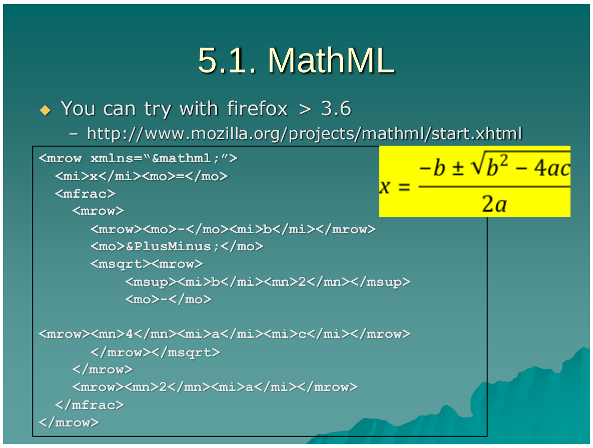
```
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
 <head><title>XHTML as the host language</title></head>
 <body>
   ... XHTML content ...
  <math xmlns="http://www.w3.org/1998/Math/MathML"> ...
   MathML content ...
  </math>
...
```



Namespace prefix

- xmlns:?? attribute
  - Namespace for the ?? prefix

```
<math
   xmlns="http://www.w3.org/1998/Math/MathML"
    <xhtml:p
   xmlns:xhtml="http://www.w3.org/1999/xhtml">
   XHTML Paragraph</xhtml:p>
    <svg:svg version="1.1"
      xmlns:svg="http://www.w3.org/2000/svg">
    </svg:svg>
```

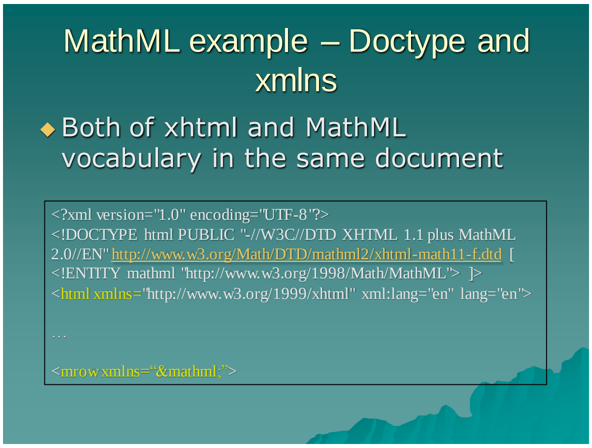


5.1. MathML

- You can try with firefox > 3.6
  - http://www.mozilla.org/projects/mathml/start.xhtml

```
<mrow xmlns="&mathml;">
  <mi>x</mi><mo>=</mo>
  <mfrac>
    <mrow>
      <mrow><mo>-</mo><mi>b</mi></mrow>
      <mo>&PlusMinus;</mo>
      <msqrt><mrow>
          <msup><mi>b</mi><mn>2</mn></msup>
          <mo>-</mo>

<mrow><mn>4</mn><mi>a</mi><mi>c</mi></mrow>
      </mrow></msqrt>
    </mrow>
    <mrow><mn>2</mn><mi>a</mi></mrow>
  </mfrac>
</mrow>
```

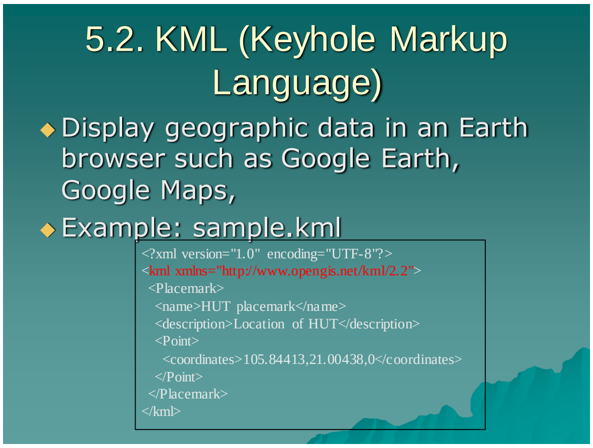
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



MathML example – Doctype and xmlns

- Both of xhtml and MathML vocabulary in the same document

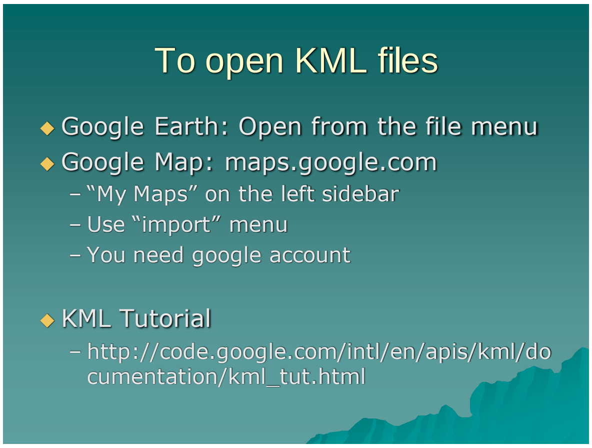
```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1 plus MathML
2.0//EN" http://www.w3.org/Math/DTD/mathml2/xhtml-math11-f.dtd [
<!ENTITY mathml "http://www.w3.org/1998/Math/MathML"> ]>
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">


…


<mrow xmlns="&mathml;">
```



5.2. KML (Keyhole Markup Language)

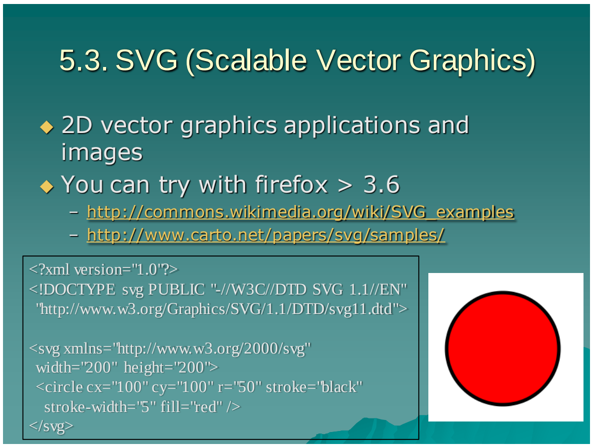
- Display geographic data in an Earth browser such as Google Earth, Google Maps,
- Example: sample.kml

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
 <Placemark>
  <name>HUT placemark</name>
  <description>Location of HUT</description>
  <Point>
   <coordinates>105.84413,21.00438,0</coordinates>
  </Point>
 </Placemark>
</kml>
```



To open KML files

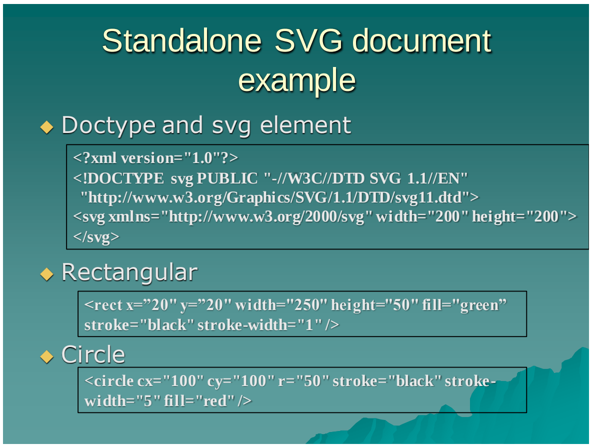
- Google Earth: Open from the file menu
- Google Map: maps.google.com
  - "My Maps" on the left sidebar
  - Use "import" menu
  - You need google account
- KML Tutorial
  - http://code.google.com/intl/en/apis/kml/documentation/kml_tut.html



5.3. SVG (Scalable Vector Graphics)

- 2D vector graphics applications and images
- You can try with firefox > 3.6
  - http://commons.wikimedia.org/wiki/SVG_examples
  - http://www.carto.net/papers/svg/samples/

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
 "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">

<svg xmlns="http://www.w3.org/2000/svg"
 width="200" height="200">
 <circle cx="100" cy="100" r="50" stroke="black"
   stroke-width="5" fill="red" />
</svg>
```



Standalone SVG document example

- Doctype and svg element

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
 "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
<svg xmlns="http://www.w3.org/2000/svg" width="200" height="200">
</svg>
```

- Rectangular

```
<rect x=”20” y=”20” width="250" height="50" fill="green”
stroke="black" stroke-width="1" />
```

- Circle

```
<circle cx="100" cy="100" r="50" stroke="black" stroke-
width="5" fill="red" />
```