0301402 INTRODUCTION TO XML

UNIT	MODULES	WEIGHTAGE
1	Introduction to XML	20 %
2	Document Type Definition (DTD)	20 %
3	XML Namespace	20 %
4	XML Schema	20 %
5	Extensible StyleSheet Language (XSL)	20 %

UNIT - 4 XML Schema

- Introductio to Schema
- Features
- DTD versus XML Schema
- XML Schema Type System
  - Simple Types
  - Complex Types
- Grouping of Data
- Deriving Types
- Attributes

Introduction to Schema

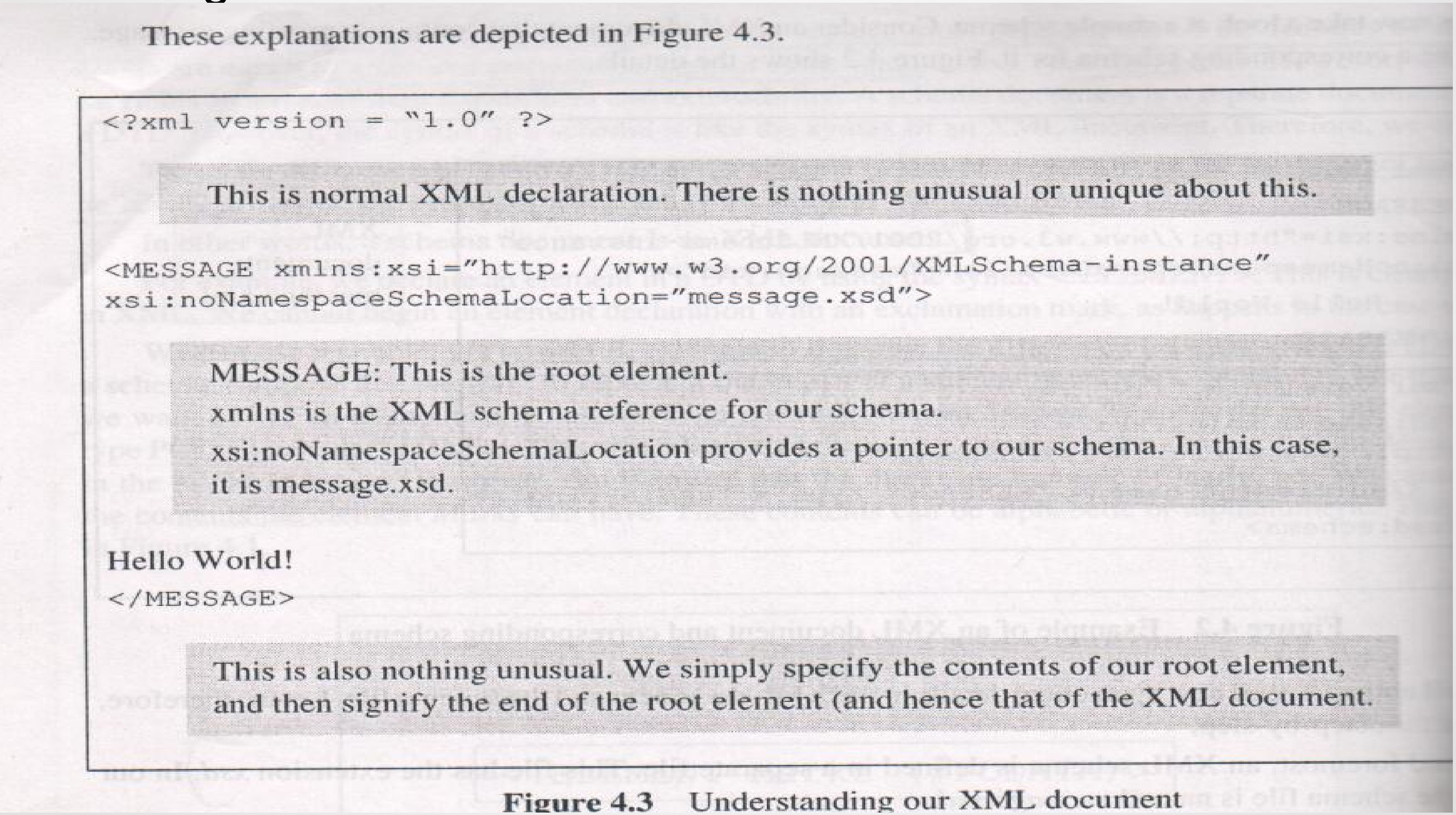
- A schema is **an alternative to DTD.**
- DTD are easier to write and provide supports for some feature, **but schemas are far richer in terms of their capabilites and extensibility.**
- The main difference between a DTD and a schema is that the **syntax of a DTD is different from that an XML. But syntax of a schema as that of an XML.**

Introduction to Schema

- **DEMO**
  - message.xml
  - message.xsd
- XML schema is defined in a separate file.
- This file has the extension **.xsd**

Introduction to Schema

- Message.xml



These explanations are depicted in Figure 4.3.

```
<?xml version = “1.0” ?>
```

This is normal XML declaration. There is nothing unusual or unique about this.

```
<MESSAGE xmlns:xsi=”http://www.w3.org/2001/XMLSchema-instance”
xsi:noNamespaceSchemaLocation=”message.xsd”>
```

MESSAGE: This is the root element.

xmlns is the XML schema reference for our schema.

xsi:noNamespaceSchemaLocation provides a pointer to our schema. In this case, it is message.xsd.

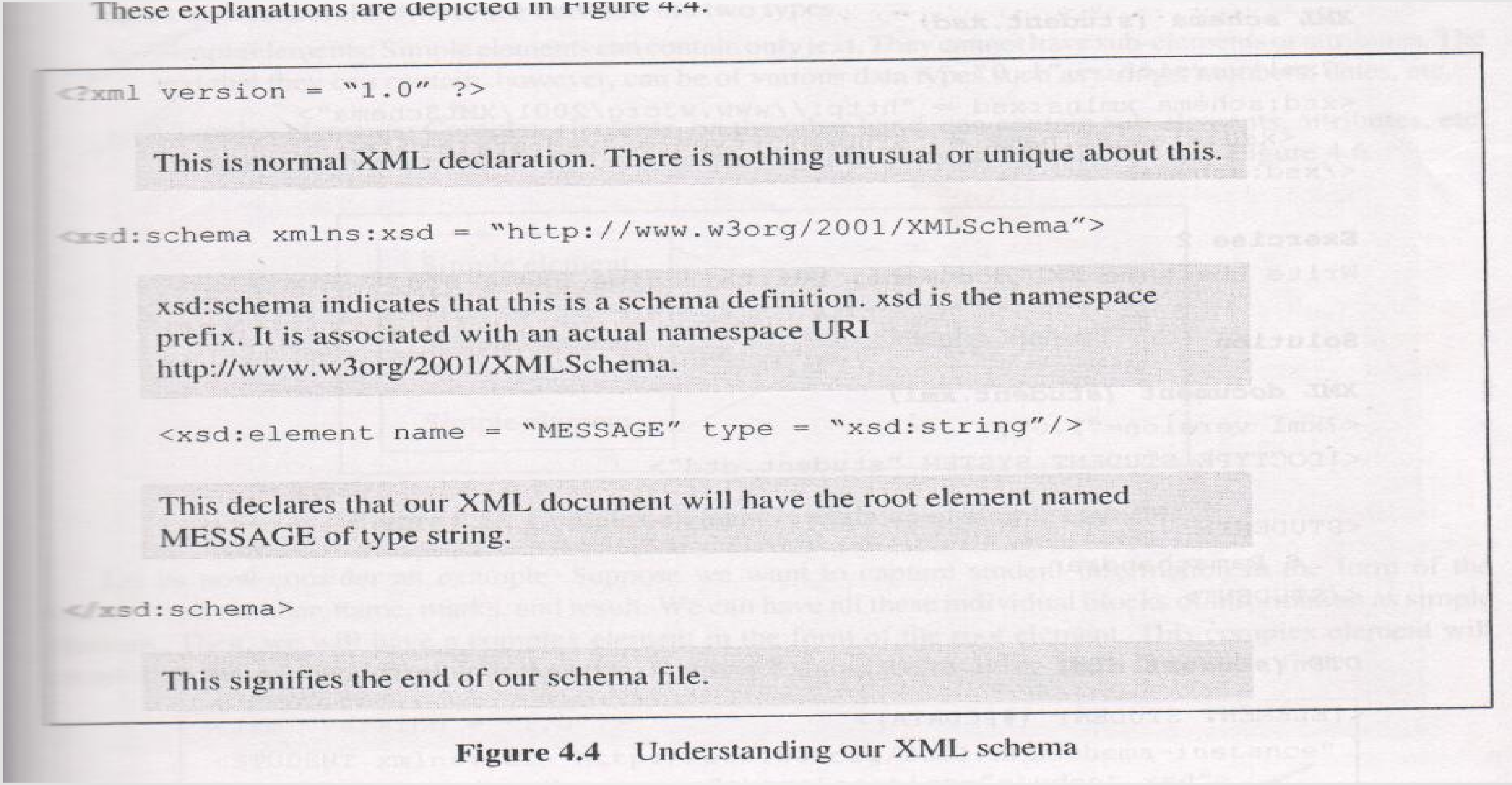
```
Hello World!
</MESSAGE>
```

This is also nothing unusual. We simply specify the contents of our root element, and then signify the end of the root element (and hence that of the XML document.

Figure 4.3 Understanding our XML document

Introduction to Schema

- Message.xsd



These explanations are depicted in Figure 4.4.

```
<?xml version = "1.0" ?>
```

This is normal XML declaration. There is nothing unusual or unique about this.

```
<xsd:schema xmlns:xsd = "http://www.w3org/2001/XMLSchema">
```

xsd:schema indicates that this is a schema definition. xsd is the namespace prefix. It is associated with an actual namespace URI http://www.w3org/2001/XMLSchema.

```
<xsd:element name = "MESSAGE" type = "xsd:string"/>
```

This declares that our XML document will have the root element named MESSAGE of type string.

```
</xsd:schema>
```

This signifies the end of our schema file.

Figure 4.4 Understanding our XML schema

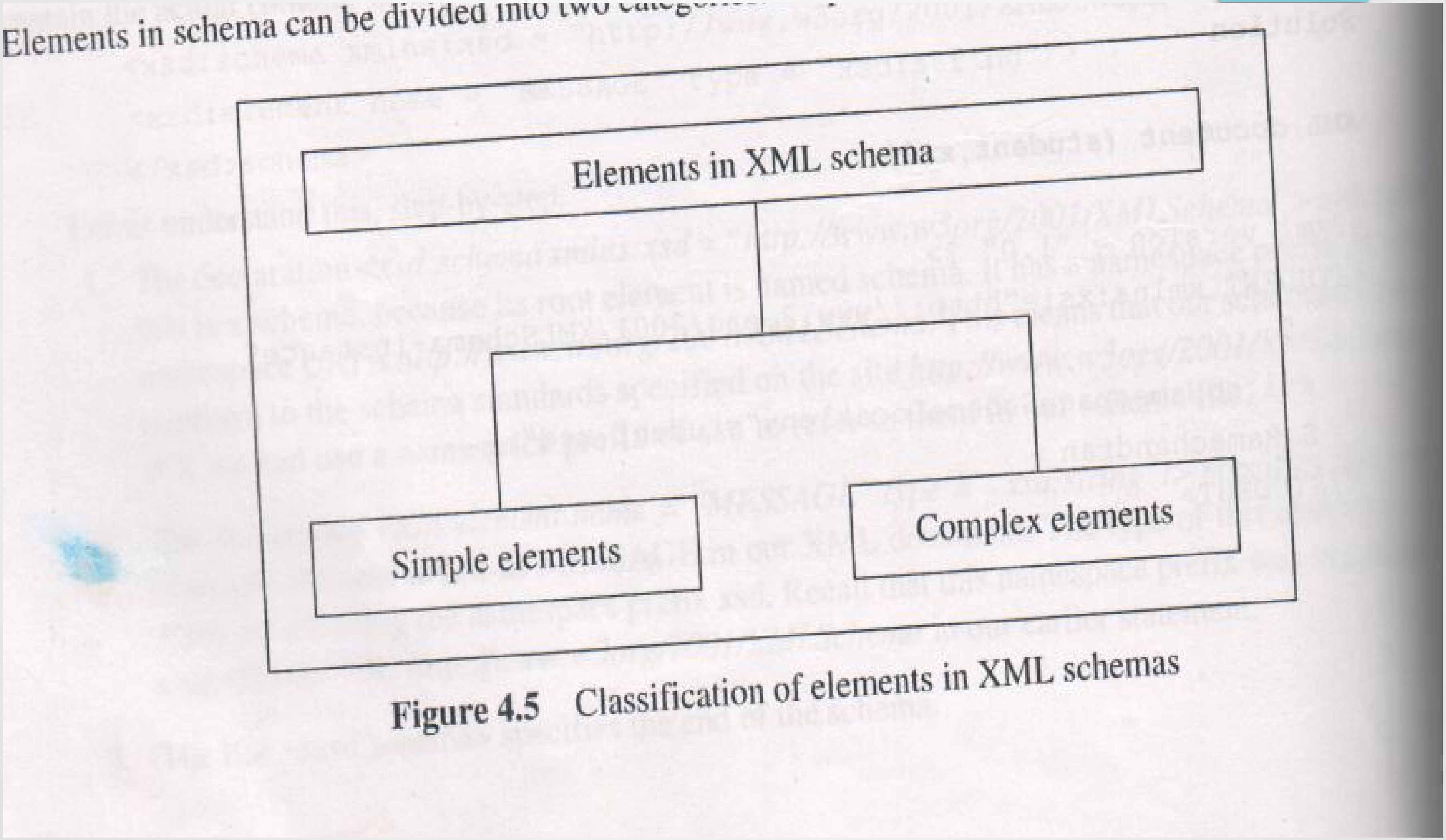
Introduction to Schema – class work

- Write an XML document that contains a single element to specify the name of the student. Provide a corresponding XML Schema
- DEMO
  - Student.xml
  - Student.xsd

XML Schema Type System

- Element in schema can be divided into two categories :
  - Simple Elements
  - Complex Elements
- **Simple Element** can contain only text. They cannot have sub-element or attributes.
- **Complex Element** can contain sub elements, attributes etc.

XML Schema Type System



Elements in schema can be divided into two catego

Elements in XML schema

Simple elements

Complex elements

Figure 4.5 Classification of elements in XML schemas

Complex Types

- Complex element is made up of simple elements

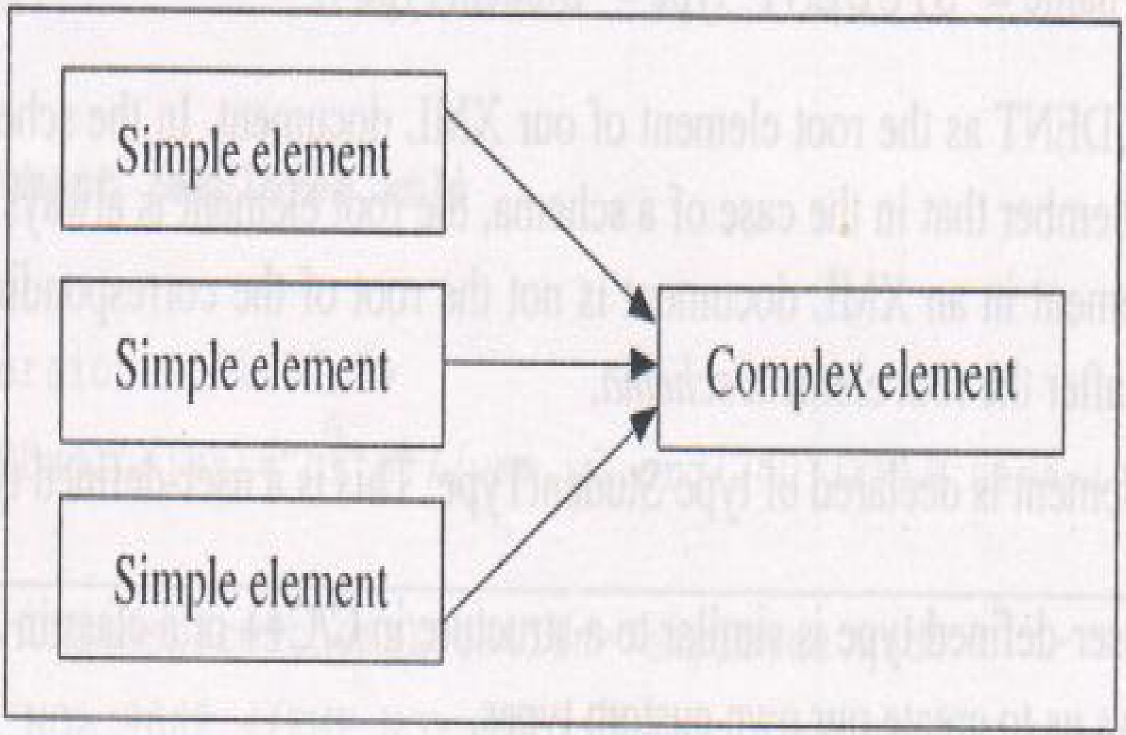


Figure 4.6 Complex element is made up of simple elements

Complex Types

- **Complex Type Demo**
  - Student1.xml
  - Student1.xsd

Complex Types – class work

- Write an XML document and a corresponding XML schema for maintaining the employee number, name, desigation and salary.
- DEMO
  - employee.xml
  - employee.xsd

Specifying the Frequency

- If we want to repeat the information in XML then we must use either :
  - **minOccurs attribute**
  - **maxOccurs attribute**
- **minOccurs** attribute specifies the minimum number of occurrences that the element have. The default vale is 1.
- **maxOccurs** attribute specifies the maximum number of occurrences that the element have. The default vale is 1.

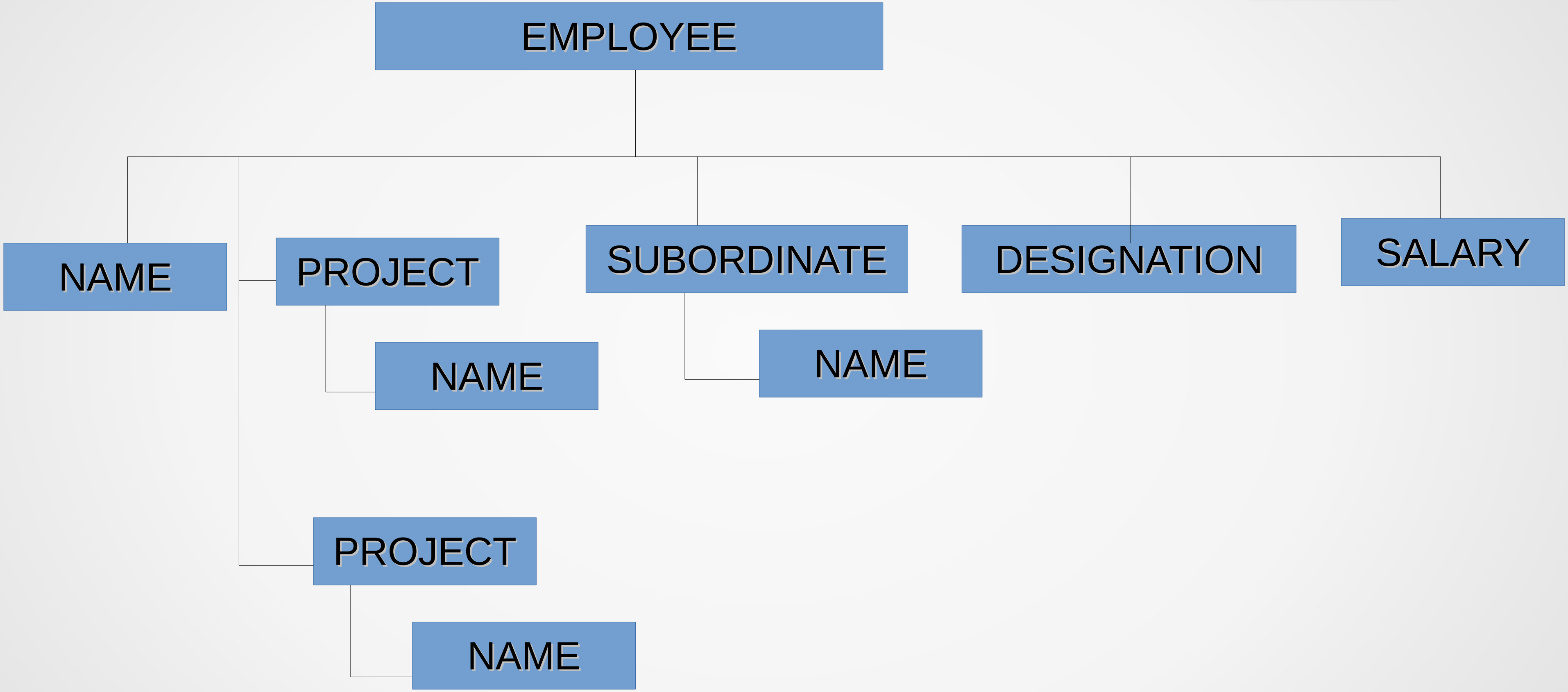
Specifying the Frequency

- DEMO
  - book.xml
  - bool.xsd

Specifying the Frequency

Requirement	Set minOccurs to	Set maxOccurs to
An element should occur exactly once	1	1
An element should occur at least once and possibly many more time	1	unbounded
An elemet is optional or may occur for any number of time	0	unbounded
An element may not occur at all, or may occur only once	0	1

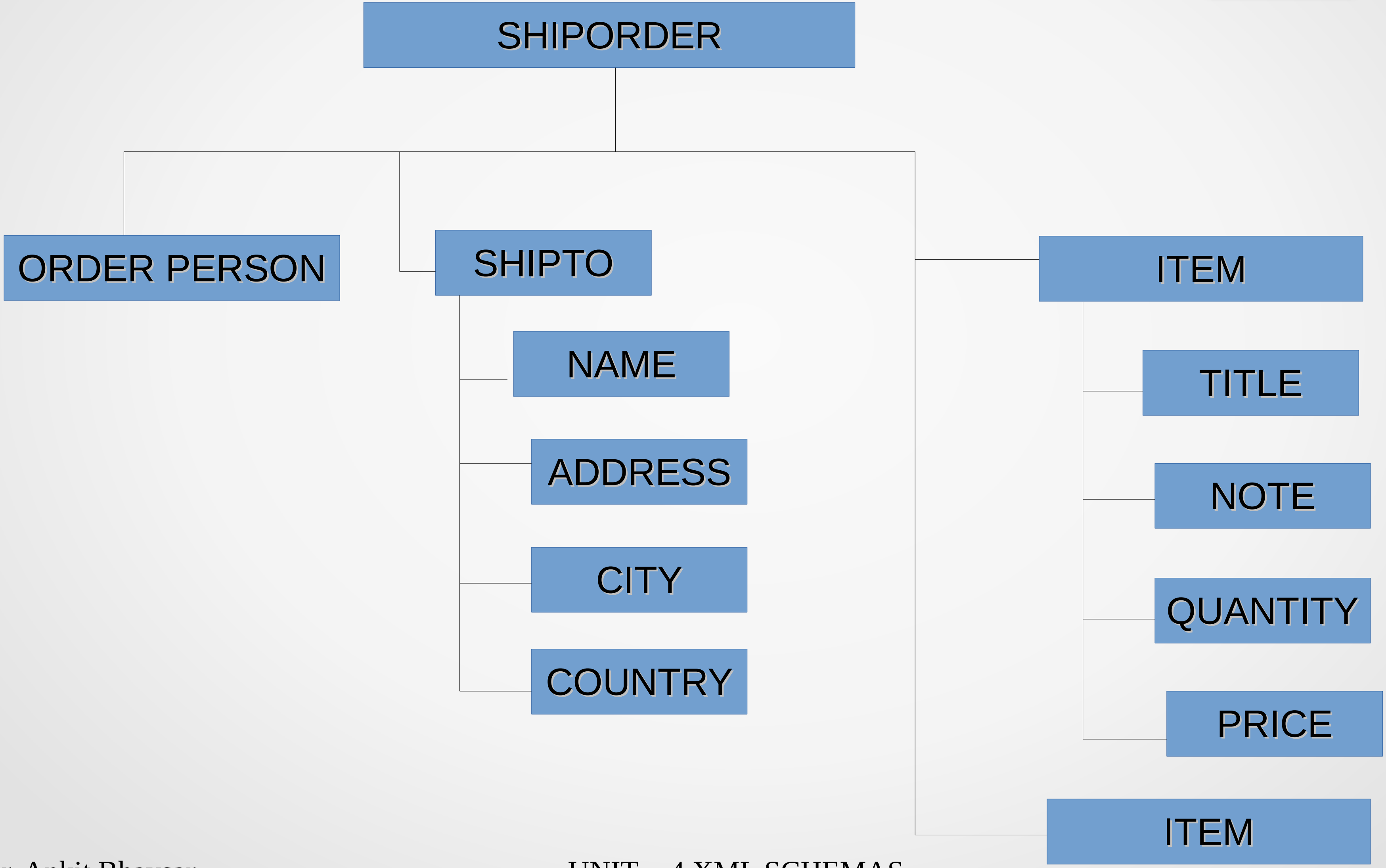
Specifying Element content



Specifying Element content

- DEMO
  - Emp.xml
  - Emp.xsd

Specifying Element content



Specifying Element content

- DEMO
  - shiporder.xml
  - shiporder.xsd

Mixed Content

- Sometime we want to allow text between elements.
- For example we wan to capture information about employee names. The element are
    - Title
    - First Name
    - Last Name
    - Middle Name
  - Here we can ignore “Title” and “Midde Name”
- For this can we can use “Mixed Content”

Mixed Content

- Demo
  - Emp_mix.xml
  - Emp_mix.xsd

Grouping Of Data

- Some times we just want to make sure that an element **exists inside an XML document – where, is not so important.**
- For this we can use the concept of “Grouping Element”
- Schema syntax provide supports for **three grouping constructs :**
  - **Xsd:all**
  - **Xsd:choice**
  - **Xsd:sequence**

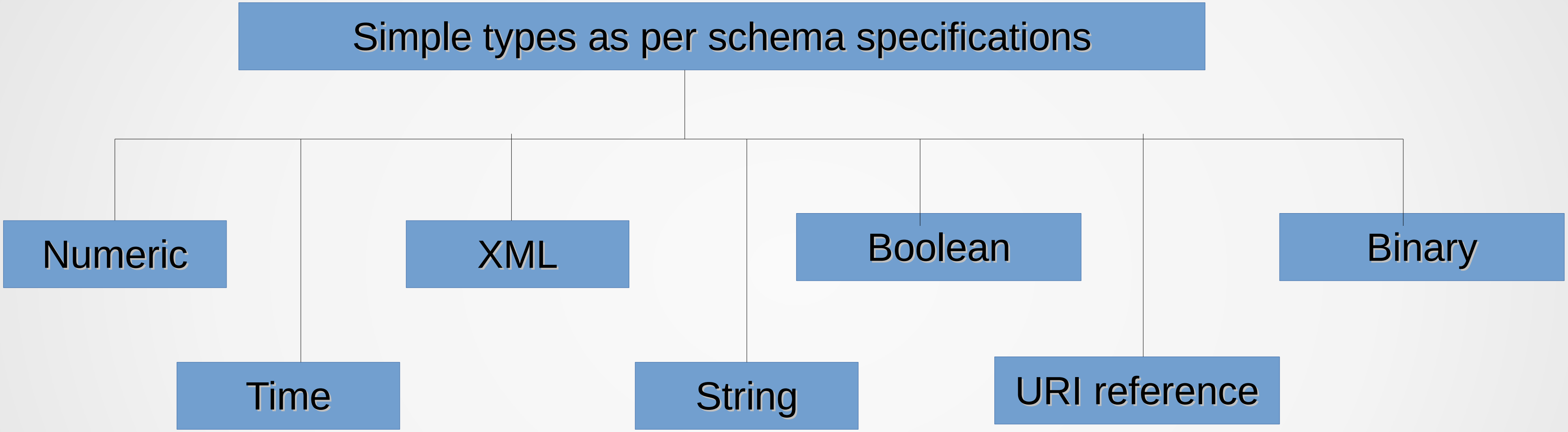
Grouping Of Data

- **Xsd: all -** specifies that **all the elements in a group must occur** at the most once, but their **ordiering is not significant.**
- **Xsd:choice -** allows us to specify that **only one element from the group can appear.**
  - Alternatively, we can also specify that **out of n elements in a group, m should appear in any order.**
- **Xsd:sequence –** it mandates that every **element in a group must appear exactly once** and also **in the same order in which the elements are listed.**

Grouping Of Data

- Demo
  - **xsd:all**
    - card.xml
    - card.xsd
  - **xsd:choice**
    - Result.xml
    - Result.xsd

Simple Types



- XML schemas **offer 44 built-in simple types.**
- The XML schema simple type is **classify into seven categories.**

Simple Type – Numeric Data Types

Data Type Name	Meaning	Example
xsd:float	32 – bit float type	0, 12345.2356
xsd:double	64 – bit double type	0,45.89E-2
xsd:decimal	Arbitrary precision (Big Decimal)	87200.29, -3.124578926
xsd:integer	Arbitrary large or small number	-789253598138965, 24535989326475
xsd:nonPositiveInteger	Integer less than or equal to 0	0, -1, -2

Simple Type – Numeric Data Types

Data Type Name	Meaning	Example
xsd:negativeInteger	Integer less than 0	-1,-2,-3
xsd:nonNagativeInteger	Integer greater than or equal to 0	0,1, 2 ,3
xsd:positiveInteger	Integer greater than 0	1,2,3
xsd:long	8 byte 2's complement integer	2356985668522
xsd:int	4 byte 2's complement integer	-615251, 0, 125369

Simple Type – Numeric Data Types

Data Type Name	Meaning	Example
xsd:short	2 – byte , 2's complement integer	-32767 to +32767
xsd:byte	1 – byte 2's complement integer	-128 to +127
xsd:unsignedLong	8 byte unsigned long	
xsd:unsignedInt	4 byte unsigned integer	
xsd:unsignedShort	2 byte unsigend integer	
xsd:unsignedByte	1 byte unsigned integer	

Simple Type – Time Data Types

Data Type Name	Meaning	Example
xsd:dateTime	Date and time in the formate YYYY-MM-DDTHH:MM:SS	2006-02-25T06:05:33
xsd:date	YYYY-MM-DD	
xsd:time	HH:MM:SS	
xsd:gDay	A day in a month	--01, --23
xsd:gMonth	A month in a year	--02--, --05--
xsd:gYear	A Year	2006

Simple Type – Time Data Types

Data Type Name	Meaning	Example
Xsd:YearMonth	A pecific month in a specific year	2006-02, 2017-05
xsd:gMonthDay	A date without year	--01-20
xsd:duration	Length of time in format	P2006Y01M20DT06H11M03S

Simple Type – XML Data Types

Data Type Name	Meaning	Example
xsd:ID	A unique value for an element or an attribute	T1, M90, G101
xsd:IDREF	Value of another ID type defined else where in the document	
xsd:ENTITY	An XML name, declared as an unpared entity in DTD	
xsd:NOTATION	Usually indicates a file format	
xsd:IDREFS	Reference to a list of ID names	
xsd:ENTITIES	List of entitye names	

Simple Type – XML Data Types

Data Type Name	Meaning	Example
xsd:NMTOKEN	NMTOKEN type	
xsd:NMTOKENS	A list of NMTOKEN types	
xsd:language	Languag name from a list of valid value	
xsd:Name	XML name with or without colons	Student, emp
xsd:QName	Prefixed name	
xsd:NCName	Local name without colons	

Simple Type – String Data Tyes

Data Type Name	Meaning	Example
xsd:string	A unicode character based string of any length.	
xsd:normalized String	A string in which all the carriage returns, linefeeds, and tabs are replaced with a single blank (space) character.	
xsd:token	Same as above, but in addition all leading and tailling spaces are trimmed andconsecutive spaces are converted into a single space.	

Simple Type – Binary Data Types

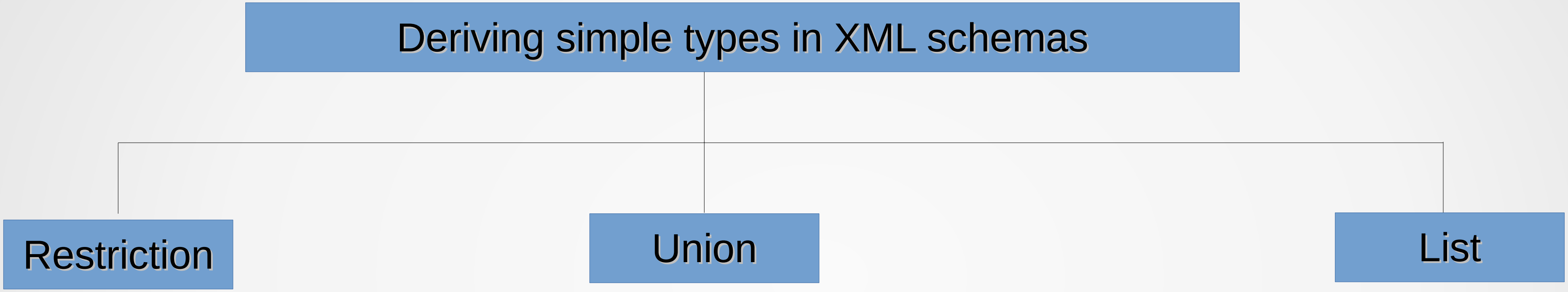
- XML support binary data types.
- But the problem with binary data is that it can have byte patterns that are illegal.
- **This is because some characters such as null have a different meaning, and they cannot be a part of the XML content.**
- We need to encode such illegal characters into a legal form
  - By hexadecimal conversion
  - By base-64 encoding

Simple Type – Other Data Types

- **Boolean Data Type**
  - xsd:boolean
    - it allows one of the four possible value : zero, one, true and false.
- **URI Data Type**
  - xsd:URI
    - It allows us to specify a URI
      - For i.e – http://www.test.com/name.html

Deriving Types

- There are three technique for deriving types



Deriving simple types in XML schemas

Restriction

Union

List

Deriving Types - Restriction

- **Restriction**
  - Restriction allows us to select a subset of values allowed by the base type.
  - We can use an element of type xsd:restriction as a child element of an xsd:simple type element.

Deriving Types - Restriction - Facets

- **Restriction - Facets**
  - A facet allows us to specify more restrictions than what a basic type allows.

Facet	Description
xsd:minInclusive	The minimum value that all the instancees of this type must be grater than or equal to
xsd:maxInclusive	The maximum value that all the instancees of this type must be less than or equal to
xsd:minExclusive	The minimum value that all the instancees of this type must be grater than
xsd:maxExclusive	The maximum value that all the instancees of this type must be less than
xsd:enumeration	A list of allowed values
xsd:whiteSpace	How white spce is treatedin this element

Deriving Types - Restriction - Facets

- **Restriction - Facets**
  - A facet allows us to specify more restrictions than what a basic type allows.

Facet	Description
xsd:pattern	A pattern with which the contents of the element are compared
xsd:length	The length of a string, items in a lis, or bytes in binary data
xsd:minLength	The minimum length
xsd:maxLength	The maximum length
xsd:totalDigits	The maximum number of digits allowed in the element
xsd:fractionDigits	The maximum number of digits allowed in the fractional part of the element.

Deriving Types - Restriction – String

- **Restriction**
  - Xsd:length, xsd:minLegth ad xsd:maxLength these three facests are used for string.
- **Demos**
  - **book_FACET.xml**
  - **book_FACET.xsd**

  - **Emp_FACET.xml**
  - **Emp_FACET.xsd**

Deriving Types - Restriction – White space

- **Restriction - String**
  - The white space facet allows us to specify how we want to deal with white spaces.
  - The xsd:whiteSpace facet allows three possible values,
    - **preserve:** This is the default. It means that the white space in XML doc. Kept as it is.
    - **replace :** replace every Tab, line feed, carriage return character in XML doc. With a single space character.
    - **collapse :** This facet value is a superset of the replace value. After peformaing the job of replace, this facet value further condenses multiple consecutive spaces into a single space.

Deriving Types - Restriction – White space

- **Demos**
  - **Poem_facet.xml**
  - **poem_facet.xsd**

Deriving Types - Restriction – Enumeration

- **Restriction - Enumeration**
  - The enumeration facet in XML schemas allows us to specifty a list of possible values for an element.

```
<xsd:simpleType name="BookCategory">
    <xsd:restriction base="xsd:string">
        <xsd:enumeration value="computer archi"/>
        <xsd:enumeration value="network"/>
    </xsd:restriction>
</xsd:simpleType>
```

Deriving Types - Unions

- Unions allow us to combine simple types to create new simple type.
- **For i.e**
  - Studnet can identify by his/ her Roll No. And /or Name
  - So we can create Union type which have either roll no or the student name.
- **Demos**
  - **union_student.xml**
  - **union_student.xsd**

Deriving Types - Lists

- A list type allows the creation of a list of a particular simple type.
- **For i.e**
  - <emp_list> 2562 2365 3698 4563 7821 </emp_list>
- **Demos**
  - **list_emp.xml**
  - **list_emp.xsd**

Attributes

- <attribute name=”des” type= “xsd:type” use=” “/>
- An attribute occurs only once.
- We can specify whether
  - **Required** : must have
  - **Optional** : may have an attribute
  - **Prohibited** : cannot have an attribute
- i.e

  <attribute name=”designation” type=”xsd:string” use=required” default=”Manager”/>

Grouping Attributes

- If an element have several attributes, then we can group them and provide a reference of this group to the concerned element.

Grouping Attributes

```
   <xsd:element name=”EMPLOYEE”>
       <xsd:complexType>
           <xsd:attributeGroup ref=”empDetails”/>
        </xsd:complexType>
   </xsd:element>
<xsd:attributeGroup name=”empDetails>
   <xsd:attribute name=”empID” use=”required” type=”xsd:ID”/>
   <xsd:attribute name=”name” use=”required” type=”xsd:string”/>
  <xsd”attribute name=”designation” use=”optional” type=”xsd:string”>
</xsd:attributeGroup>
```

Features of Schema

- XML schema uses XML instance syntax
- XML schema allows a rich variety of data types to be used to constrain both element and attribute content.
- XML schema allows us to specify which namespace declarations and definitions belongin.
- In XML schema, type definitions and element and attribute declarations are separated from each other.
- XML schema allows us to specify constraints on the uniqueness of values of a particular type, as well as relationsips between those unique values and value of other type.

- Assignment Submission
  - Theory : 12 / 02 / 2022
  - Practical : 08 / 02 / 2022 (Div B)

    10 / 02 / 2022 (Div C)
- CEC Submission
  - Theory : 12 / 02 / 2022
  - Practical : 08 / 02 / 2022 (Div B)

    10 / 02 / 2022 (Div C)

UNIT 4 COMPLETED