### BUILD XML STRUCTURE FROM UML CLASS DIAGRAM

### a. Assumptions for converting UML to XML:

- 1. Multiplicities of all child attributes are 1 (one and only once instance)
- 2. Every furnishing has exactly 1 room and 1 manufacturer
- 3. Room and manufacturers can have multiple furnishings i.e.. One to Many
- 4. Attributes can be null because empty tags "" are allowed in XML.
- 5. The relationship "Every manufacturer has minimum one furniture" cannot be established due to limitations of XML.
- 6. The XML document is a standalone document, i.e., a document with internal DTD for all the validations so we standalone="yes" has been included in the opening xml tags.

# b. XML Code for UML Class Diagram (Download <u>Here</u>) or From this attachment **9**

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!DOCTYPE root [
<!ELEMENT root (Room*, Manufacturer*, Furnishing*)>
<!ELEMENT Room (length, width)>
<!ATTLIST Room name ID #REQUIRED>
<!ELEMENT length (#PCDATA)>
<!ELEMENT width (#PCDATA)>
<!ELEMENT Furnishing (type)>
<!ATTLIST Furnishing fid ID #REQUIRED>
<!ELEMENT type (#PCDATA)>
<!ATTLIST Furnishing RoomRef IDREF #REQUIRED>
<!ATTLIST Furnishing manufacturerRef IDREF #REQUIRED>
<!ELEMENT Manufacturer (manufacturerName,contact)>
<!ATTLIST Manufacturer mid ID #REQUIRED>
<!ELEMENT manufacturerName (#PCDATA)>
<!ELEMENT contact (#PCDATA)>
]>
<root>
    <Room name="UpperKitchen">
        <length>30ft</length>
        <width>60ft</width>
    </Room>
    <Room name="LowerKitchen">
        <length>50ft</length>
```

```
<width>50ft</width>
</Room>
<Room name="Bedroom1">
   <length>34ft</length>
   <width>43ft</width>
</Room>
<Room name="Bedroom2">
   <length>56ft</length>
   <width>27ft</width>
</Room>
<Room name="Bedroom3">
   <length>77ft</length>
   <width>40ft</width>
</Room>
<Room name="LivingRoom">
   <length>30ft</length>
   <width>60ft</width>
</Room>
<Room name="GuestRoom">
   <length>60ft</length>
   <width>40ft</width>
</Room>
<Room name="StorageRoom">
   <length>40ft</length>
   <width>40ft</width>
</Room>
<Manufacturer mid="M140">
    <manufacturerName>IKEA</manufacturerName>
   <contact>(424) 532-2322, (424) 532-2323
</Manufacturer>
<Manufacturer mid="M141">
    <manufacturerName>Ashley Furniture Industries/manufacturerName>
   <contact>(428) 432-3310
</Manufacturer>
   <Manufacturer mid="M142">
    <manufacturerName>Furniture Industries</manufacturerName>
   <contact>(628) 532-3610
</Manufacturer>
<Manufacturer mid="M143">
   <manufacturerName>Emeco</manufacturerName>
   <contact>(423) 532-2344, emeco@eme.co</contact>
</Manufacturer>
<Manufacturer mid="M144">
   <manufacturerName>Coalesse</manufacturerName>
   <contact>(423) 532-2344
</Manufacturer>
<Manufacturer mid="M145">
   <manufacturerName>Rooms To Go</manufacturerName>
   <contact>(423) 532-2344, rtg@gmail.cs</contact>
```

```
</Manufacturer>
    <Furnishing fid="F12" manufacturerRef="M140" RoomRef="UpperKitchen">
        <type>Double Bed</type>
    </Furnishing>
    <Furnishing fid="F13" manufacturerRef="M142" RoomRef="LowerKitchen">
        <type>Table Unit</type>
    </Furnishing>
    <Furnishing fid="F14" manufacturerRef="M143" RoomRef="LowerKitchen">
        <type>Study Table</type>
    </Furnishing>
    <Furnishing fid="F15" manufacturerRef="M144" RoomRef="StorageRoom">
        <type>Single Bed</type>
    </Furnishing>
    <Furnishing fid="F16" manufacturerRef="M143" RoomRef="GuestRoom">
        <type>Couch</type>
    </Furnishing>
    <Furnishing fid="F17" manufacturerRef="M142" RoomRef="Bedroom1">
        <type>Chairs</type>
    </Furnishing>
    <Furnishing fid="F18" manufacturerRef="M145" RoomRef="Bedroom3">
        <type>Cabinet</type>
    </Furnishing>
    <Furnishing fid="F19" manufacturerRef="M143" RoomRef="GuestRoom">
        <type>Corner</type>
    </Furnishing>
</root>
```

# c. Validating XML using <u>freeformatter</u> online tool provide in the XML module

\*The maximum size limit for file upload is 2 megabytes.

The XML document is valid.

```
XML Input
Option 1: Copy-paste your XML document here
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
 <!DOCTYPE root [
<!ELEMENT root (Room*, Manufacturer*, Furnishing*)>
 <!ELEMENT Room (length, width)>
<IATTLIST Room name ID #REQUIRED>
<!ELEMENT length (#PCDATA)>
 <!ELEMENT width (#PCDATA)>
<!ELEMENT Furnishing (type)>
 <!ATTLIST Furnishing fid ID #REQUIRED>
 <!ELEMENT type (#PCDATA)>
<!ATTLIST Furnishing RoomRef IDREF #IMPLIED>
 <!ATTLIST Furnishing manufacturerRef IDREF #REQUIRED>
<!ELEMENT Manufacturer (manufacturerName,contact+)>
 <!ATTLIST Manufacturer mid ID #REQUIRED>
 <!ELEMENT manufacturerName (#PCDATA)>
<!ELEMENT contact (#PCDATA)>
1>
```

## Instances to prove one-to-many relationship between furnishing and room:

#### Instances to prove one-to-many relationship between furnishing and manufacturer:

#### **Checks Done:**

- ✓ Internal DTD works on all platforms (standalone="yes")
- ✓ Rooms can have multiple furnishings, but furnishing has only 1 room
- ✓ Manufacturers can have multiple furnishings, but furnishing has only 1 manufacturer
- ✓ ALL IDs are Unique, no ID starts with a letter
- ✓ No duplicate attributes can exist, because no attributes are multivalued/categorical
- Missing tags will not be accepted.
- ✓ A key that isn't present in the document, cannot be referred.

#### d. Additional Checks: Test Screenshots and Details

(All tests have been done using <a href="https://www.xmlvalidation.com/">https://www.xmlvalidation.com/</a>)

# 1. Checking foreign key constraints by introducing a key which is not present in the document

The key "M1422" in the manufacturerid tag is not valid key and it was introduced just to check foreign key constraint.

```
An error has been found!

Click on • to jump to the error. In the document, you can point at with your mouse to see the error message.

Errors in the XML document:

• 92: 8 An element with the identifier "M1422" must appear in the document.
```

It is clear from the output that the identifier "M1422" Is missing hence, the XML document has failed to compile.

# 2. Checking foreign key constraints by trying to declare an instance of furnishing with no key (IDREF) and missing values

The manufacturerid attribute in line 95 was omitted and the RoomRef attribute in line 98 was intentionally left blank to test the constraint violations and null values for ID.

```
Furnishing fid="F18" RoomRef="Bedroom3">
95 
4type>Cabinet</type>
97 
Furnishing>
8 
Furnishing fid="F19" manufacturerRef="M143" RoomRef="">
```

```
2 errors have been found!

Click on * to jump to the error. In the document, you can point at the with your mouse to see the error message.

Errors in the XML document:

* 95: 46 Attribute "manufacturerRef" is required and must be specified for element type "Furnishing".

* 98: 61 Attribute value "" of type IDREF must be an NCName when namespaces are enabled.
```

We can conclude from the image above, that omitting an ID attribute or passing empty tag "" in an ID attribute will raise the above shown errors.

#### 3. Checking domain constraints by passing an invalid value for ID field

In line 51, I passed an ID value which starts with a number mid="140", In a valid XML document each id begins with a letter([A-Za-z]) and may be followed by any number of letters, digits ([0-9]), hyphens ("-"), underscores ("\_"), colons (":"), and periods ("."), so the code shall raise an error.

```
<Manufacturer mid="140">
52 <mname>IKEA</mname>
53 <contact>(424) 532-2322</contact>
54 </manufacturer>
```

We can see that a numeric was not accepted and the we got an error message:

```
Click on % to jump to the error. In the document, you can point at with your mouse to see the error message.

Errors in the XML document:

51: 28 Attribute value "140" of type ID must be an NCName when namespaces are enabled.

92: 8 An element with the identifier "M140" must appear in the document.
```

## 4. Checking data integrity by omitting a #REQUIRED tag from an instance(record).

I intentionally removed the child attribute tags <length> </length> and <width> </width> from Room class to check if data integrity is being followed.

```
29 <Room name="Bedroom1">
30 </Room>
```

It can be concluded from the error shown below that, if any required tag is missing, the XML document check will raise an error:

```
An error has been found!

Click on ** to jump to the error. In the document, you can point at ** with your mouse to see the error message.

Errors in the XML document:

** 30: 8 The content of element type "Room" is incomplete, it must match "(length, width)".
```

# e. The binary tree view of the XML is attached below:

