22.7

first normal form:

$employee(employee\_name, child\_name, birth\_year, birth\_month, birth\_day, skill\_type, exam\_year, exam\_city)$

fourth normal form:

$employee(employee\_name)$

$childre(employee\_name, child\_name, birth\_year, birth\_month, birth\_day)$

$skill(employee\_name, skill\_type, exam\_year, exam\_city)$

23.2

```
<!DOCTYPE exercise232 [
    <!ELEMENT emp (ename, children*, skills*)>
    <!ELEMENT children (name, birthday)>
    <!ELEMENT birthday (day, month, year)>
    <!ELEMENT skills (type, exams+)>
    <!ELEMENT exams (year, city)>
    <!ELEMENT ename( #PCDATA )>
    <!ELEMENT name( #PCDATA )>
    <!ELEMENT year( #PCDATA )>
    <!ELEMENT month( #PCDATA )>
    <!ELEMENT day( #PCDATA )>
    <!ELEMENT type( #PCDATA )>
    <!ELEMENT city( #PCDATA )>
  ] >
```

23.3

```
/exercise232/emp/skills/type
```

23.9

a.

```
<parts>
    <part>
        <name> computer </name>
        <subpartinfo>
            <part>
                <name> screen </name>
                <subpartinfo>
                    <part>
                        <name> OLED </name>
                    </part>
```

```
                    <qty> 1 </qty>
                </subpartinfo>
                <subpartinfo>
                    <part>
                        <name> back </name>
                    </part>
                    <qty> 1 </qty>
                </subpartinfo>
        </subpartinfo>
        <subpartinfo>
            <part>
                <name> storage </name>
                <subpartinfo>
                    <part>
                        <name> disk </name>
                    </part>
                    <qty> 20 </qty>
                </subpartinfo>
        </subpartinfo>
    </part>
</parts>
```

b.

Since the name for each part is unique, the name can act as a primary key. Assign a unique subpart_id for each subpart.

$part(part\_name)$

$subpartinfo(subpart\_id, part\_name, qty)$

c.

```
<xs:schema xmlns:xs="http://www.w3.org/XMLSchema">
<xs:element name="parts" type="partsType" />
<xs:complexType name="partType">
    <xs:sequence>
        <xs:element name="name" type="xs:string"/>
        <xs:element name="subpartinfo" type="subpartinfoType" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="subpartinfoType">
    <xs:sequence>
        <xs:element name="part" type="partType"/>
        <xs:element name="quantity" type="xs:string"/>
    </xs:sequence>
</xs:complexType>
</xs:schema>
```