You are given the following XML document (`doc1.xml`):

```
<?xml version="1.0" encoding="UTF-8"?>
<projects>
<project pid="p123">
    <leader>
        <name>Amanda</name>
    </leader>
    <analyst>
        <name>Bob</name>
    </analyst>
</project>
<project pid="p456">
    <leader>
        <name>John</name>
    </leader>
</project>
<project pid="p789">
    <leader>
        <name>David</name>
    </leader>
    <analyst>
        <name>Amanda</name>
    </analyst>
</project>
</projects>
```

Problem 1

Write a DTD D_1 for project/employee documents, enforcing the following constraints:

- Each project is identified by a unique pid.

- Each project involves one or more employees.

- There are only two roles: leader and analyst.

- Each project has *at least* one leader.

- The first employee listed in a project is always a leader.

The document `doc1.xml` should be valid with respect to the DTD D_1.

Problem 2

Write an XQUERY script that transforms documents valid with respect to the DTD D_1 to a format in which projects involving an employee are listed under this employee. In particular, the document `doc1.xml` should be transformed into the following document (`doc2.xml`):

```
<?xml version="1.0" encoding="UTF-8"?>
<workforce>
   <emp roles="leader,analyst" name="Amanda">
      <projects>
          <proj>p123</proj>
          <proj>p789</proj>
      </projects>
   </emp>
   <emp roles="analyst" name="Bob">
      <projects>
```

```
        <proj>p123</proj>
      </projects>
   </emp>
   <emp roles="leader" name="David">
      <projects>
         <proj>p789</proj>
      </projects>
   </emp>
   <emp roles="leader" name="John">
      <projects>
         <proj>p456</proj>
      </projects>
   </emp>
</workforce>
```

Note: you have to make sure that employees are listed in alphabetical order.

Problem 3

Write a DTD for `doc2.xml`.

Problem 4

Write an XQUERY script that will extract from `doc1.xml` all the projects that have no analysts. The output should be formatted as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<noanalysts>
   <pid>p456</pid>
</noanalysts>
```

Submission rules

Test your XQuery code with `http://www.xpathtester.com/xquery`. Test your DTDs with `http://www.validome.org/xml/validate/`. If your code does not work with these websites, it will not be graded. Please embed the DTDs in the original xml files, as discussed in class. Please submit four distinct files: `Project3_P1.xml`, `Project3_P2.xquery`, `Project3_P3.xml` and `Project3_P4.xquery`.
You should submit your work using `submit_cse462`.