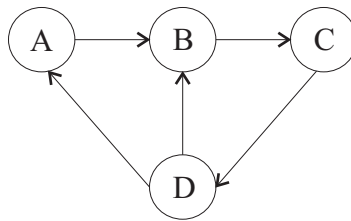


1. (5 pts.) What are the differences between a Web server and an application server?
2. (10 pts.) Explain the functions of a container in an application server? What do containers contain? Which functionalities do the containers offer for the things that they contain?
3. (10 pts.) Explain the similarities and differences between servlets and JSP pages. Consider the languages they are written in, the people that write them, and purposes they serve.

4. (15 pts.) Explain how a crawler works and discuss the challenges for developing an effective and efficient crawler.

5. (10 pts.) Calculate the PageRank of the four nodes in the below graph for three iterations.



6. (15 pts.) Consider the given XML Schema. For each XML file, explain whether it is well-formed and valid. State your reasons.

7. (20 pts.) Suppose that you are designing a system for a movie theater using the J2EE architecture. The movie theater should have the following three functionalities:

- When asked, it can give the names and times of the movies showing in the theater.
- It can suggest movies to the users making sure that it doesn't suggest any movies that the user has seen.
- If a user doesn't like the recommendation, it can recommend an alternative movie.

Explain the Enterprise Java Beans (EJBs) that you would use to implement this system. For each EJB, state its type, why you need it, and whether you could use another type of EJB instead.

8. (15 pts.) For the following XML file, state the XPath queries for each of the following:

```
<root>
  <Customer cid= "C1" name="Ali" city="Istanbul">
    <Order oid="O1" date="21/2/1999" amount="3.5"/>
    <Order oid="O2" date="14/3/2000" amount="13.4"> Satisfied</Order>
  </Customer>
  <Customer cid="C2" name="Mehmet" city="Ankara" >
    <Order oid="O3" date="7/1/2001" amount="100" />
    <Urgency>Important</Urgency>
  </Order>
  <Order oid="O4" date="21/2/2005" amount="10000"/>
</Customer>
</root>
```

- Find  $\langle$ Customer $\rangle$  elements with at least one  $\langle$ Order $\rangle$  containing an  $\langle$ OrderDetail $\rangle$  child with a value attribute greater than 5

- Starting from the root node, return all  $\langle$ Customer $\rangle$  elements that do not have  $\langle$ Order $\rangle$  subelements

- Starting from the root node, return all  $\langle$ Customer $\rangle$  elements with  $\langle$ Order $\rangle$  elements whose amount attribute is greater than 3