



Sri Lanka Institute of Information Technology

B.Sc. Special Honours Degree
in
Information Technology

Final Examination

Year 3, Semester 1 (2017)

SE3020 – Distributed Systems

Duration: 2 Hours

June, 2017

Instructions to Candidates:

- ◆ This paper has **four** questions. Answer **all** Questions.
- ◆ Total Mark 50 (Contributes to 50% of the final grade).
- ◆ The marks allocated for each question may vary.
- ◆ This paper contains **six** pages with the cover page.

Question 01 – Introduction to Distributed Systems and Distributed System Architectures

(14 marks)

- a) Name and **briefly explain three** different characteristics of distributed computing. (3 Marks)
- b) You have been asked to develop a Wireless Sensor network to remotely monitor air quality of a building. Identify **three different** challenges in developing this client and **briefly explain** how you would try to address those challenges. (3 Marks)
- c) Name three different Distributed System **architectural styles** and identify a scenario where each of such architectural styles may be applied. (3 Marks)
- d) You have been asked to develop an online train ticket booking system. Using the system, the users should be able to search for available trains for a particular destination. They should be able to select the number of tickets, the category of the seats (1st, 2nd and 3rd class). They should be able to make the payment via Credit card or they may add the ticket price to their mobile bill. Once they get a confirmation PIN via email or SMS, they may enter the PIN number at the boarding station POS terminal to get the printed ticket.
- i. Using particular Software Architectural style/styles of your choice, draw the **Software Architecture** for the system. (3 Marks)
- ii. Draw an appropriate **System Architecture** for the system. (2 Marks)

Question 02 – Socket Programming, RMI and Asynchronous Communication and Distributed Component Frameworks (12 Marks)

- a) Compare and contrast socket programming and RPC frameworks such as RMI.

(2 Marks)

- b) Give a scenario each where each of the following Distributed communication technologies; Socket programming, Java RMI blocking calls, Java RMI with asynchronous callback functions, Java RMI based polling, would be most suitable. Justify your answers.

(6 Marks)

- c) You have been asked to design and develop an online airline ticketing system. Using the system, the users should be able to search for the available seats in a set of airlines. The users may book ticket(s) using their credit cards. Also, they may be able to later on change their booking or cancel their booking for an additional fee. The system should also support online check-in. The system should be integrated with the systems of ticketing agents and the airlines.

- i. Based on the J2EE specification on Enterprise Java Beans, identify different EJBs that could be used to develop this system. For **each** EJB, write its type, its function and the remote or local interface it may expose. You may use pseudocode to write the interfaces.

(3 Marks)

- ii. Identify **two** non-functional requirements that may be handled by the Application Server in which the EJBs will be deployed.

(1 Mark)

Question 03 – Messaging Services, XML and SOA

(12 marks)

- a) Briefly explain how Messaging middleware can improve the scalability of a distributed system.

(2 Marks)

- b) Compare and contrast XML and JSON as open message formats.

(2 Marks)

- c) An online electronic goods store has a list of electronic items under each category. Each item list may contain a category name and a category ID. Both fields may contain alpha-numeric characters. In a given item list, there may be zero or multiple electronic items. Each item must have the fields; name, company, item no and price, warranty in that particular order. While price is a floating point number, all other fields may have alpha-numeric characters, except warranty which is an integer. For each company, the company name and the manufacturing country may be stored. All those fields may contain alpha-numeric characters as well.

Based on the above information, write an XML schema to represent an item list. The name of the xml document that contains a booklist is *itemlist*. There is only one *itemlist* in a *itemlistdoc* XML document. You need not write the XSL header information (including namespaces)

(4 Marks)

- d) The online electronic store that is mentioned in part c) facilitates searching for items, placing orders via paypal or a payment gateway of a local bank using credit cards. It also has a shipping section to handle shipping of items. The store does not maintain any in-house inventory but connects different suppliers with customers through its online portal.

Briefly discuss how the Service Oriented Architecture can be applied to develop the above system. Explain how the SOA can improve the adaptability and the interoperability of the system.

(4 Marks)

Question 04 – SOA, Web Services and Cloud Computing

(12 marks)

- a) Name and briefly explain the basic components of RESTful web services.

(2 Marks)

- b) Compare and contrast HTTPS with Username/Password and OAuth as two different mechanisms of securing REST APIs.

(2 Marks)

- c) Briefly discuss two advantages and disadvantages of Cloud computing.

(4 Marks)

- d) Identify four different scenarios where Cloud computing may improve the productivity, efficiency, maintainability or profitability of a system, that may be used by personal users or enterprise users.

(4 Marks)

END OF EXAMINATION PAPER