L2 NS – Networks and Distributed Systems
Summative Assignment

Coursework Description and Assessment

You are required to complete all questions. The deadline for submission is the 10th March 2017 (2pm). You should submit your work as a pdf file containing your answers. In your submission, you should also separately include the files of the required programming codes for questions 2 and 3.

Essential background reading

- You should study lecture slides on Socket programming, RMI (Middleware) and Replication.

Assignment

1. This part relates to background concepts about passive replication.

   a) Describe the generic workflow of a passive replication based distributed system. [5 marks]

   b) Explain how passive replication ensures information availability. [5 Marks]

2. Suppose there is a distributed system serving an online game shop. The system comprises a primary server and two backup servers to support passive replication. The system also has a front-end to provide replication transparency. A client (i.e. a game shop customer) can access the distributed system only through the front-end.

   You are required to implement the primary and backup servers, the front-end, and the client programs of the above distributed system. The connection between the client and the front-end should be done by Socket API, while all internal connections among different servers and the front-end should be done by RMI. Both Java and Python are acceptable programming languages for using in this coursework. Your implementation is expected to focus on the networks and distributed system aspects. Other irrelevant features including user input validation, exception handling, data encryption, external file or database and GUI, are not required. You are suggested to implement your work using a text-based user interface and a memory-based data structure (e.g. array) to store and update system information.

   You can assume the distributed system only provides three functions to clients:
   i) placing an order, where each order can contain up to three items,
   ii) retrieving order history, and
   iii) cancelling an order.

   Marks will be given according to the correctness of your implementation in terms of how well they follow the required distributed system features. Mark allocation for each distributed system component is as follows:

   a) Server programs [30 marks]

   b) Front-end program [15 marks]

   c) Client program [15 marks]

3. This part relates to making improvement to the distributed system in (2):

a) Suppose the primary server may fail sometimes. Explain what procedures should be introduced to the distributed system in order to resolve this failure situation. In addition, if the failed primary server recovers, describe what should be done to allow this server to run as part of the distributed system again. [10 marks]

b) Implement your solution to (3.a) by modifying your programs produced for (2). You should provide:

   i) A description of all necessary modifications made to the servers, the front-end and the client programs, in terms of their program codes or how they are executed during runtime. [5 Marks]

   ii) The modified programs (You should add comments to your program codes, highlighting your modification.) [15 marks]

Note: Be aware of plagiarism rules (https://www.dur.ac.uk/learningandteaching.handbook/6/2/4/).