CS 370: Problem Set 4

Section: TR 10-11:50 am

Instructions:
1. I leave plenty of space on each page for you. If you need more sheet, please attach your work right behind the corresponding problem. Most of the problems are designed for you to think about the models and the principles.

First Name:

Last Name:

Group ID:

Score: /

Problem 1 Distributed System

(I) What is the fundamental difference between a fat-client and a thin-client approach to clientserver systems architectures?

(II) Your customer wants to develop a system for stock information where dealers can access information about companies and evaluate various investment scenarios using a simulation system. Each dealer uses this simulation in a different way, according to his or her experience and the type of stocks in question. Suggest a clientserver architecture for this system that shows where functionality is located. Justify the clientserver system model that you have chosen and specify it is thin/fat client approach.

Problem 2 Distributed System: P2P

(I) Give two advantages and two disadvantages of decentralized and semicentralized peer-to-peer architectures

(II) Assume you need to find out the basic protocols for the P2P framework and you need to implement it using your favorite language. The hardest part is probably the protocols implementation. You need to decide on the **set of messages** that the various nodes (computers) will exchange between each other and then focus on the behavior of a single node when it receives each type of message. Furthermore, you would need to **design how the peer would handle each message type**.

Problem 3 Service-Oriented Software Engineering

For the example of the vacation package reservation service, design a workflow that will book ground transportation for a group of passengers arriving at an airport. They should be given the option of booking either a taxi or a hire car. You may assume that the taxi and car hire companies offer web services to make a reservation.

Problem 4 System Engineering

What is a **wicked problem**? Explain why the development of a national medical records system should be considered as a wicked problem. Be thorough, a short description of 2 or 3 lines of explanation is *insufficient*. Please explain from various angles, such as patient records formats among hospitals, privacy issue, new medicine developement technology, information maintenance, and the concern about different requirements from insurers, funding agencies and healthcare management and clinical staff.

Problem 5 SQL: B+ tree

(a) Describe the properties of the nodes (root, intermediate nodes and leaf nodes) of a B+ tree.

(b) Suppose you are asked to implement the node structure of a B+ tree, please briefly describe the structure of your node and how it is instantiated as n varies.

(c) Someone wrote some pseudocode like this for finding value V in a B+ tree:

Algorithm 1 Search Algorithm for B+ Tree

1. C=root
2. While C is not a leaf node {
   Let i be the least value s.t. $V < K_i$.
   If no such exists, set C = last non-null pointer in C
   Else { set $C = P_i$}
3. Let i be the least value s.t. $K_i = V$
4. If there is such a value i, follow pointer P_i to the desired record.
5. Else no record with search-key value K exists.

(I) What is wrong with this algorithm?

(II) Please rewrite the pseudocode but your answer cannot be identical to the solution given in the slide.