Homework Assignment 3
Sample Solution

1. (a) Explain the difference between a name, an identifier and an address of an entity in a distributed system. (b) Give an example of an entity in a distributed system with a particular name, a particular identifier and a particular address.

Based on the answers from the students:
(a):
Name: A generic name that provides a description of some entity. In general, an entity may have multiple names.
Identifier: A unique name that provides a one to one mapping between the identifier and an entity
Address: The name of the location of the access point of an entity. It is used to access an entity.

(b):
An possible example would be a computer connected to a network:
Name: The name of the computer, e.g., "Lab PC"
Identifier: The MAC address of its network interface
Address: Its (possible dynamically assigned) IP address

2. Consider the Chord system as shown in Lecture 5, Slide 13, and assume that node 24 has just joined the system. (a) Draw the finger table of the new node 24. (b) Draw the finger tables of all the other nodes, after node 24 joined the system.

(a-b) The finger tables of all the nodes (including node 24) after node 24 joined the system is the following:

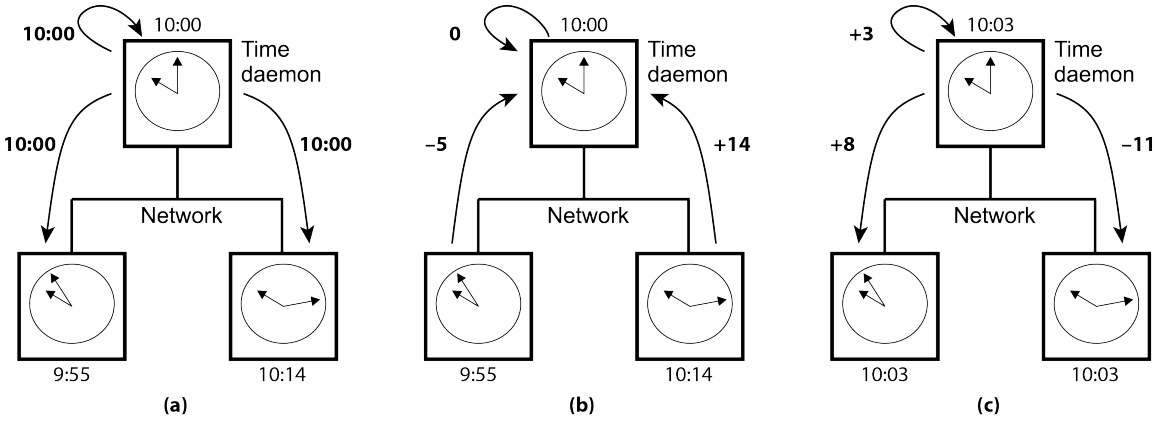
i	N1	N4	N9	N11	N14	N18	N20	N21	N24	N28
0	4	9	11	14	18	20	21	24	28	1
1	4	9	11	14	18	20	24	24	28	1
2	9	9	14	18	18	24	24	28	28	1
3	9	14	18	20	24	28	28	1	1	4
4	18	20	28	28	1	4	4	9	9	14

3. (a) Explain what is meant by name resolution. (b) Explain what is meant by mounting name spaces. (c) Explain how name resolution is used in mounting name spaces.

Possible answers based on the answers from the students:
(a) Name resolution: This means to find the particular address that resolves to a name.
(b) Mounting Name Spaces: This is used to access other name spaces from a given name space. It is done by concatenating multiple paths names or directories to have a final address which contains the whole path name from the given directory.

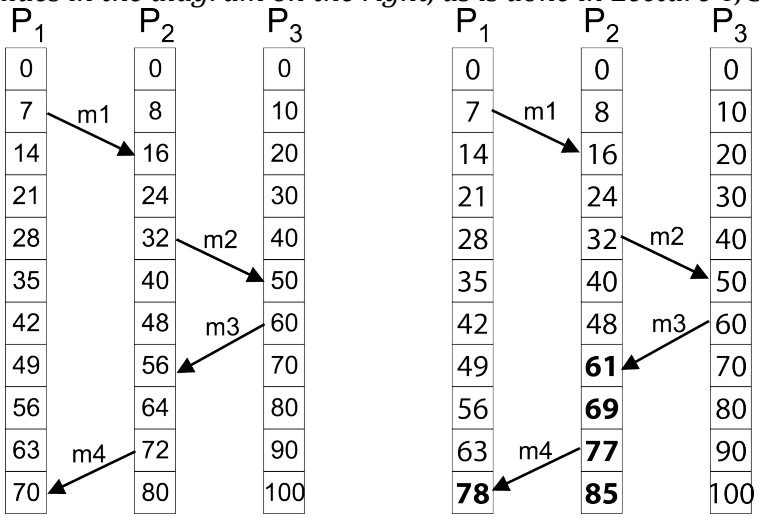
(c) Name resolution in mounting name spaces is used when the name resolution recursively resolve the name one name space at the time.

4. Given a distributed system with a time daemon and machines with physical clocks as shown in the diagram below. Using the Berkeley algorithm for synchronization of physical clocks, draw the three steps of the algorithm, as is done in Lecture 6, Slide 13, and explain the three steps.



Steps, as explained in the lecture:
(a) The time daemon sends its clock and asks all the other machines for their clock values
(b) The machines respond with their deviations
(c) The time daemon computes an average time and tells every machine how to adjust its clock: (0–5+14)/3 = 9/3 = 3 → 10:03

5. Consider three processes, with physical clocks that run at different rates, as shown in the diagram on the left, with exchange of messages as shown by the arrows. Using Lamport's algorithm, show how each process adjusts its logical clock by filling in the logical clock values in the diagram on the right, as is done in Lecture 6, Slide 18.



*6. A distributed system uses vector clocks for causally ordered multicast, as shown in Lecture 6, Slide 24. In the following diagram, fill in the values of the vector clocks and show the point at which process P2 delivers the message m***.*