Homework 3
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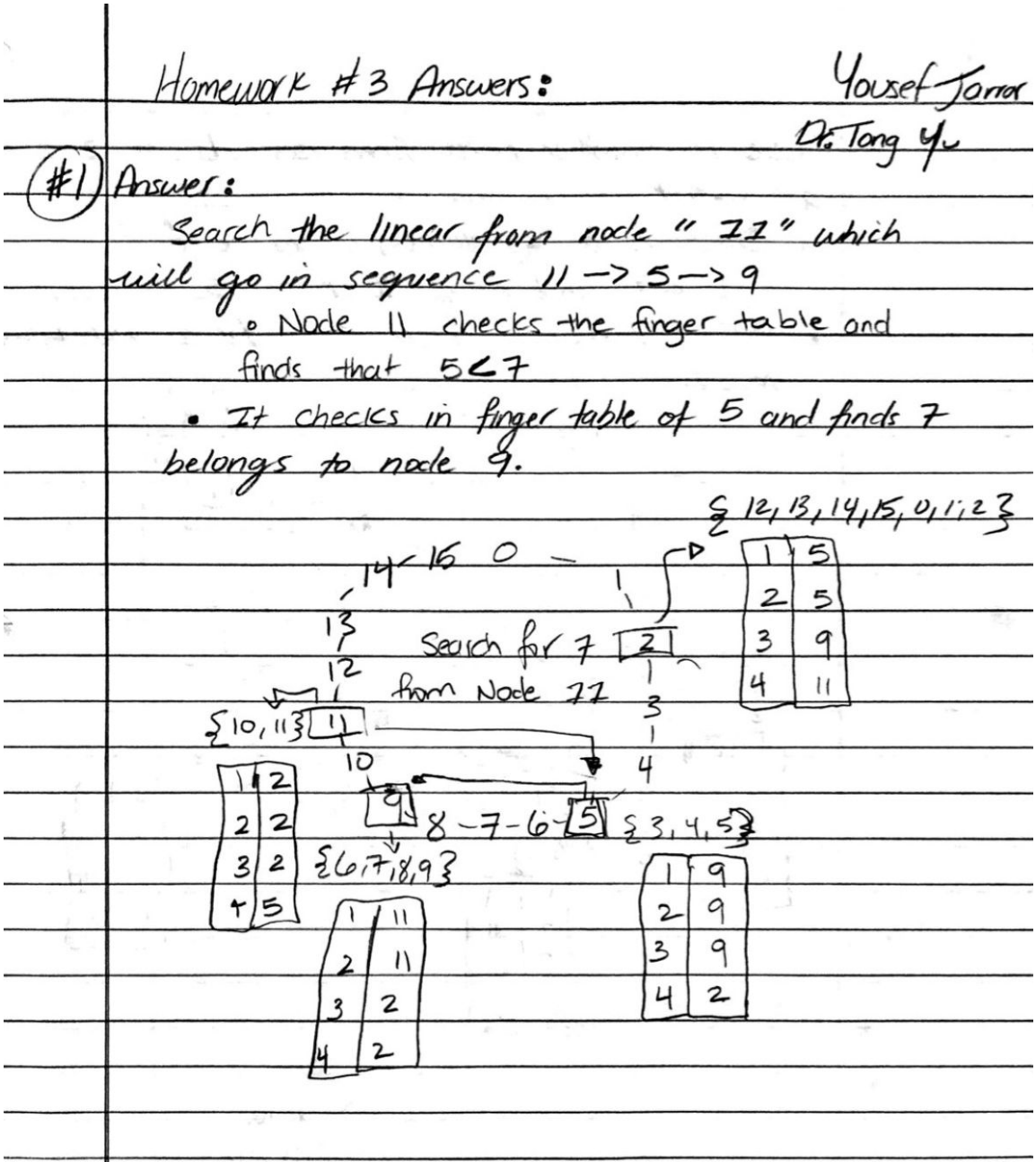
(20 points) #1
A DHT Chord network uses 4 bits (i.e. *m* = 4) to identify machines and keys of entities. At a certain time, machines with identifiers 2, 5, 9, and 11 are attached to and active in the network.

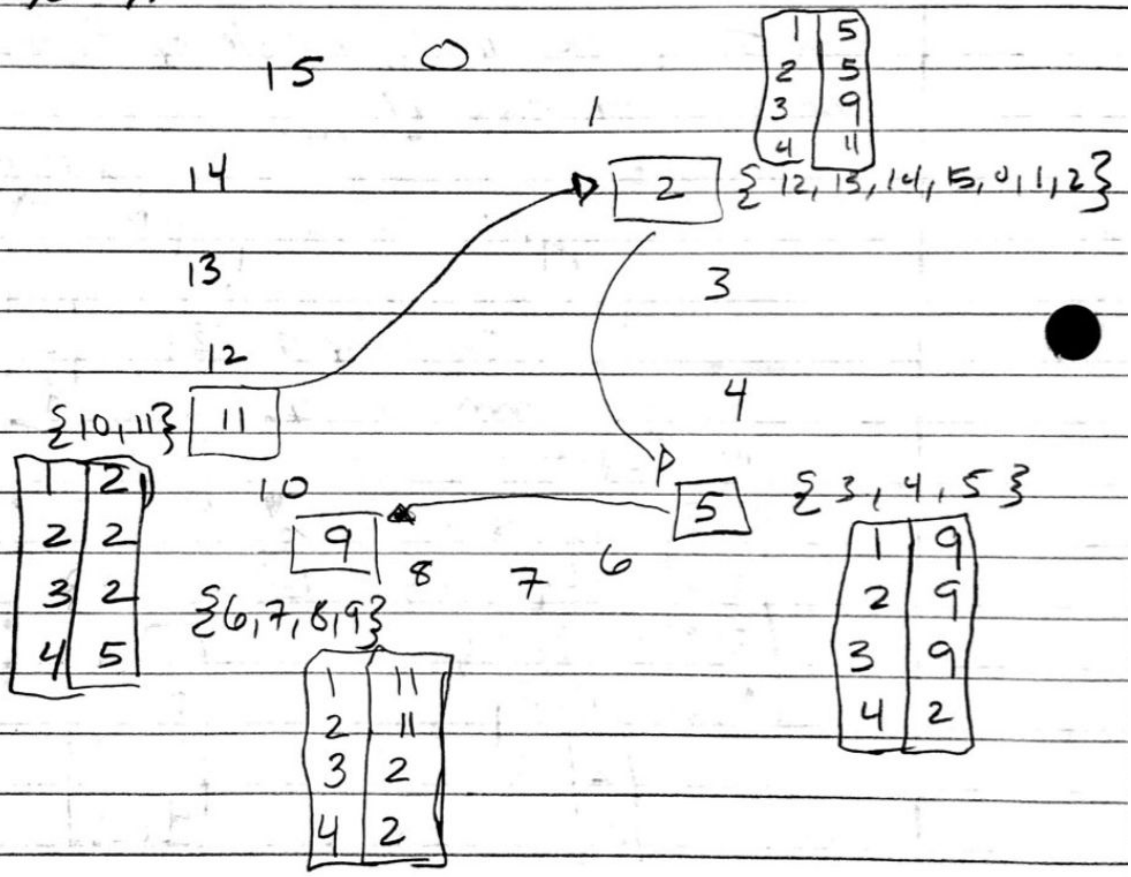
a. Draw a diagram to show the machine ids and keys of the network.

b. Find the finger table of each of the machines.

c. An application running in node 11 is looking for the entity with key value 7. Find the route the system takes to get to the node that has the entity. Show your steps clearly and draw the route on your diagram.



- There is another route from node 11 to 2 as $2 < 7$
  - Check node 2s table, when we find $5 < 7$ and move to node 5
  - check node 5 finger table for 7 which belongs to 9.



(10 points) #2

a. Would you consider a URL such as *http://www.acme.org/index.html* to be location independent? What about *http://www.acme.nl/index.html* ?

b. Consider the behavior of two machines in a distributed system. Both have clocks that are supposed to tick 1000 times per millisecond. One of them actually does, but the other ticks only 990 times per millisecond. If UTC updates come in once a minute, what is the maximum clock skew that will occur?

#2

A: Both of the addresses ARE LOCATION INDEPENDENT because their names can't tell us where the locations are.

- Sometimes domains contain hints to where they belong, but not always.

B: 1000 times/msec = 60,000,000 times/min --- 1

990 times/msec = 59,400,000 times/min --- 2

- So subtracting 2 from 1 we get a skew value

-> Maximum clock skew is 600,000 times/min.

(10 points) #3

If each process uses a different value for d in the Lamport's clock and vector clock equations, will the logical clocks and vector clocks schemes satisfy the total order relation => and the relation:

$a \rightarrow b$ iff $t^a < t^b$

Explain your argument in detail.

(#3) All situations are satisfied b/c: if a, b are in the same process, d value is not affected or immaterial.
if a is in P_i and b is in P_j, then
-> $C_j(b) = \max(C_j(b), tm + d)$ which $tm = C_i(a)$
or ALL K, $C_j(b)[K] = \max(C_j(b)[K], tm[K])$
which $tm[K] = C_i(a)$

(10 points) #4

Suppose Process P1 has events

$e_{11}, e_{12}, e_{13}, e_{14}, e_{15}\ e_{16}\ e_{17}$

P2 has events

$e_{21}, e_{22}, e_{23}, e_{24}, e_{25}, e_{26},$

P3 has events

$e_{31}, e_{32}, e_{33}, e_{34}, e_{35}\ e_{36}$

There are message transits from e12 to e22, e24 to e15, e21 to e32, e35 to e25. Suppose the vector time clocks for e11, e21, and e31 are

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \quad \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \quad \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

respectively.

a) Draw a diagram to show all the transitions and events.

b) Find the vector clocks of all the events.

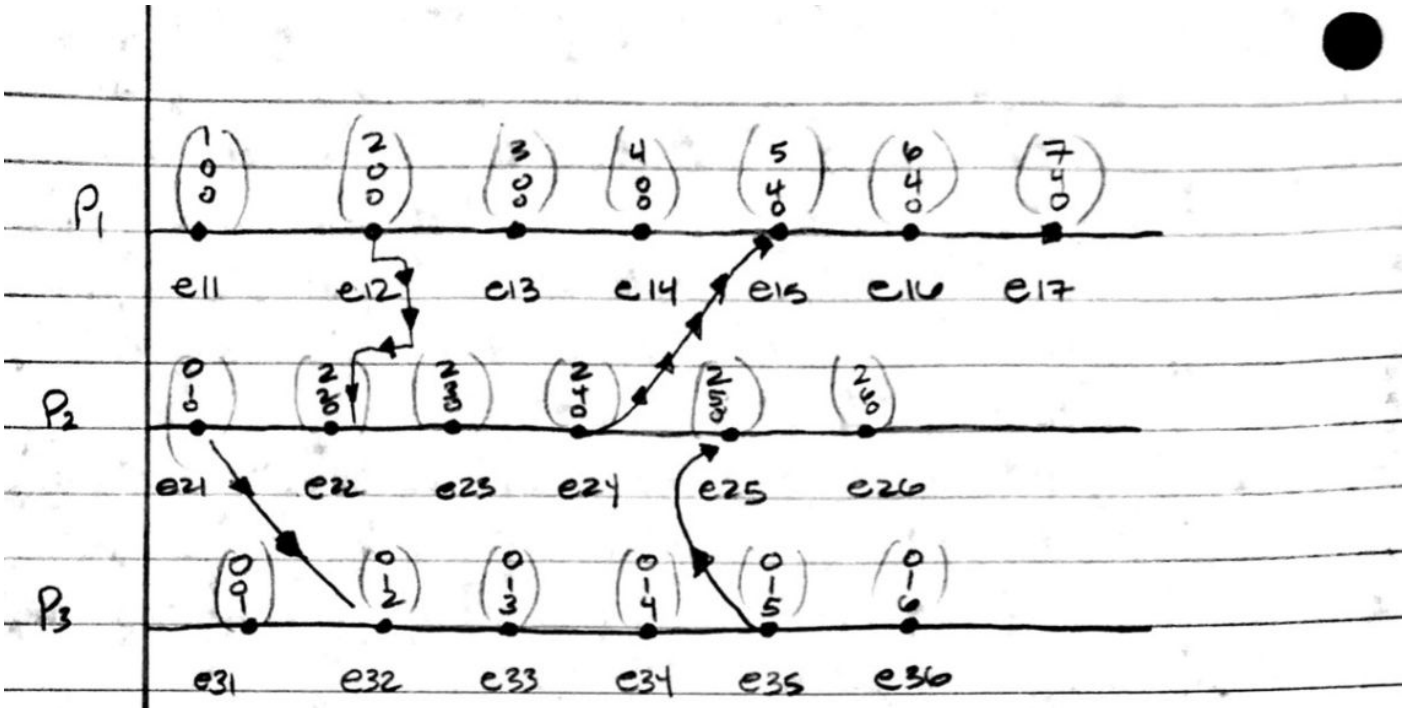
c) Give an example for each of the following:

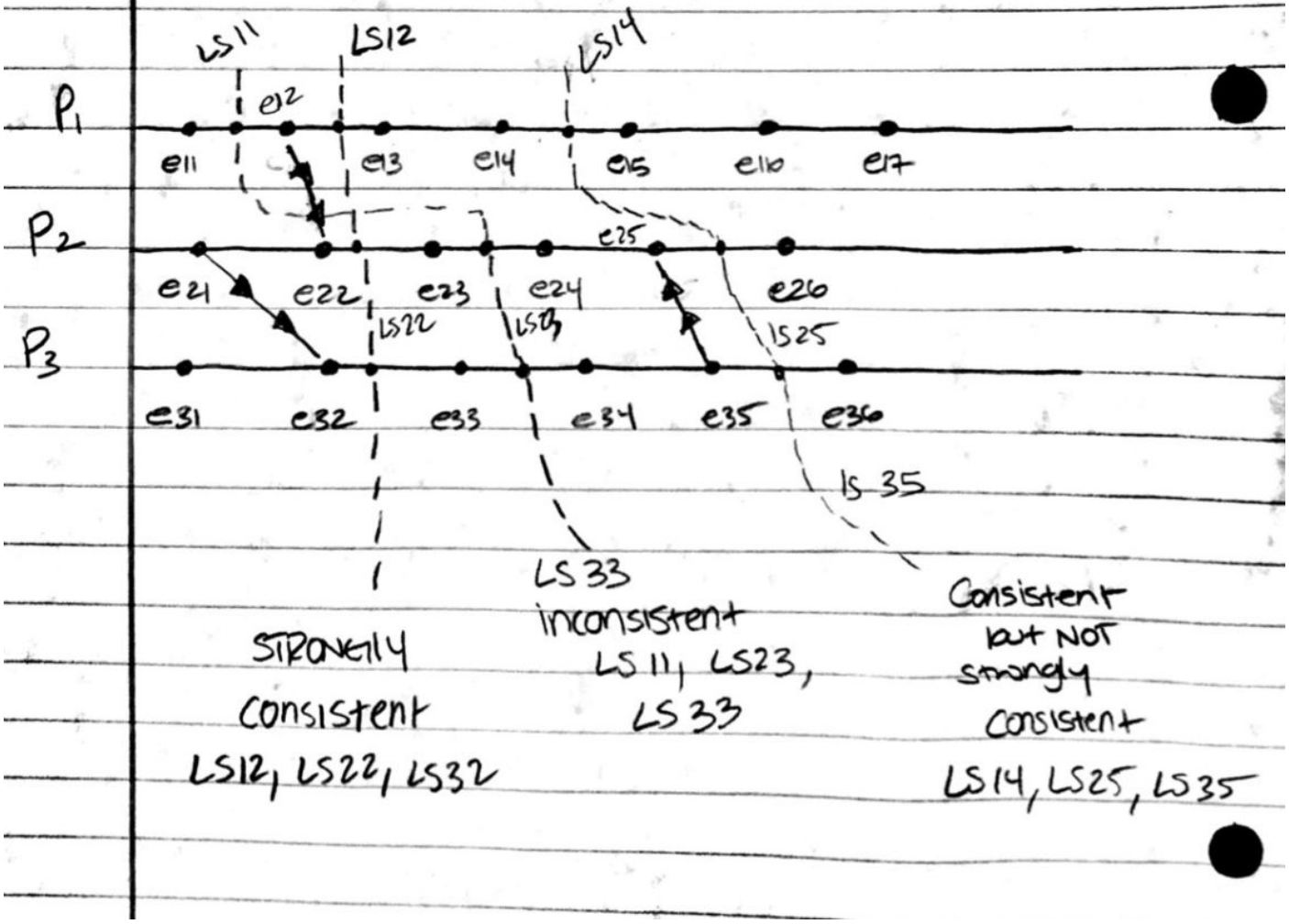
i) a strongly consistent state

ii) a consistent but not strongly consistent state

iii) an inconsistent state

Your global state should be consisted of the the events given (e.g. e_{11}) but should **not** contain any event that is sending (e.g. e_{12}) or receiving a message (e.g. e_{22}).





STRONGLY Consistent
LS12, LS22, LS32

LS33 inconsistent
LS11, LS23, LS33

Consistent but NOT strongly consistent
LS14, LS25, LS35