Homework – 3

Amit

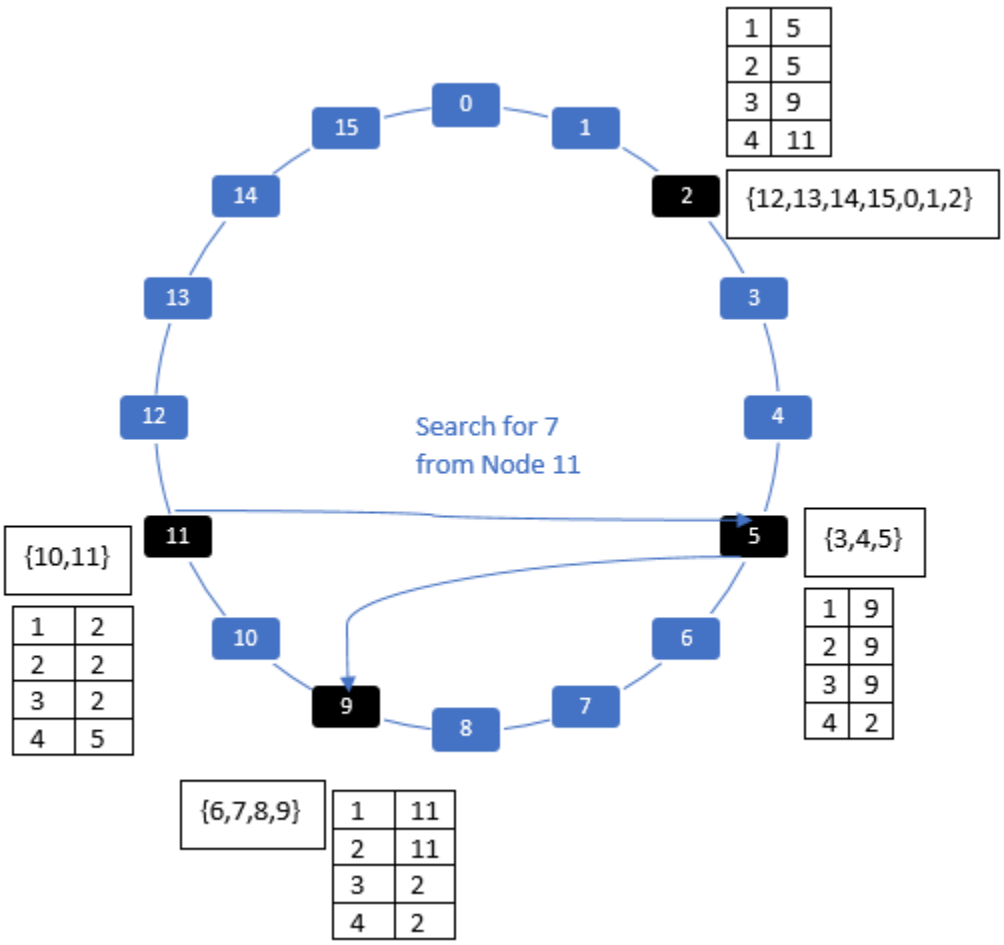
(20 points)

Question 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.

Answer –

Search linear from node 11 will go in sequence as 11-> 5 -> 9.
Node 11 checks finger table and finds 5 < 7
It checks in finger table of 5 and finds 7 belonging to Node 9.



1	5
2	5
3	9
4	11

1	2
2	2
3	2
4	5

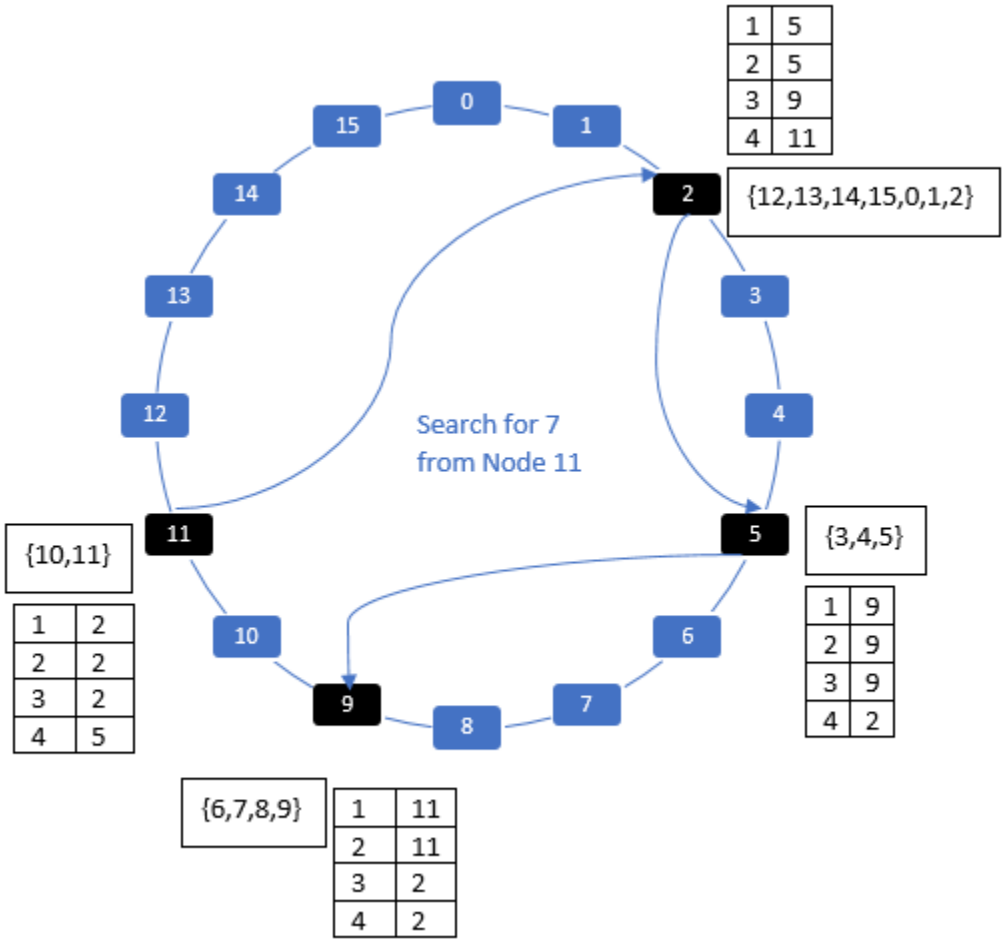
1	9
2	9
3	9
4	2

1	11
2	11
3	2
4	2

There can be one more route from node 11 to 2 as 2<7.

Checking node 2s table we find 5 < 7 and move to Node 5.

Check node 5 finger table for 7 which belongs to 9.



Question 2 (10 points)

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?

Answer –

a. Both addresses are location independent because their names can't tell us where their locations are. Although they have hints: ".org" refers to organization and ".nl" refers to Netherlands, they do not decide the locations.

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 skew value
maximum clock skew is 600 000 times/min

Q 3. (10 points)

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:

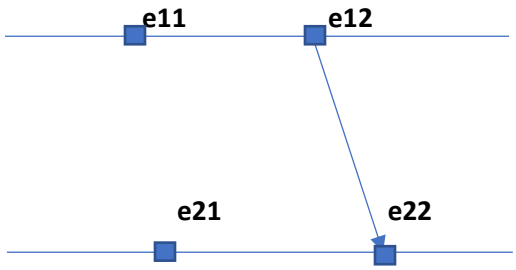
a → b iff ta < tb

Explain your argument in detail

Answer –

They are still satisfied, because: if a, b are in the same process, value d does not affect;

if a is in Pi and b is in Pj, Cj(b) = max(Cj(b), tm + d) which tm = Ci(a) or all k, Cj(b)[k] = max(Cj(b)[k],tm[k]) which tm[k] = Ci(a)



Here e11 is sending message to e12 and then e12 to e22 and their timestamps are shown there. If e11 is happened before e12, that's y the timestamp of e12 is more than e11 where d=1 is added to e12. Similarly, e12 and e22 where timestamp of e22 is more than that of e12 and e11 which happened after them.

Q 4. Suppose Process P1 has events

e11, e12, e13, e14, e15 e16 e17

P2 has events

e21, e22, e23, e24, e25, e26,

P3 has events

e31, e32, e33, e34, e35 e36

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

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

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. e11) but should not contain any event that is sending (e.g. e12) or receiving a message (e.g. e22).

Answer -