CHALMERS
EXAMINATION / TENTAMEN

Course code/kurskod	Course name/kursnamn			
EDA387	Computer Networks			
Anonymous code Anonym kod		Examination date Tentamensdatum	Number of pages Antal blad	Grade Betyg
EDA387-15		2015.1.5	10	4

Solved task Behandlade uppgifter No/nr		Points per task Poäng på uppgiften	Observe: Areas with bold contour are to completed by the teacher. Anmärkning: Rutor inom bred kontur ifylles av lärare.
1	✓	4	
2	✓	5	
3	✓	6	
4		0	
5	✓	8,5	
6	✓	8	
7	✓	5½	
8	✓	4	
9	✓	2	
10			
11			
12			
13			
14			
15			
16			
17			
18			
Total examination points Summa poäng på tentamen		43	31.5

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1) a) The user wants to get the hostname for the given IP address 129.16.2.12.14. from Authoritative DNS server ns1.chalmers.se 1

b). The name of the object is PTR. RR-type

0

c) to ns1.chalmers.se with ip address: 129.16.2.40 it is an authoritative server and it is given in Authority section.

2

d) No. No answer is there in the reply.
Status: NXDOMAIN → means an error : Not existing DOMAIN
Answer: 0 → No answer is given
Flags: rd → recursive answer desired! 1
aa auth. answer

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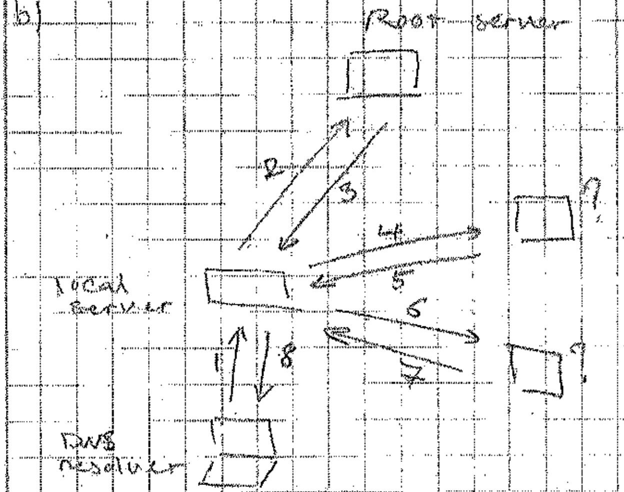
a) The client wants to get the name of the mail server associated with Domain name msn.com.

1

b)



3, 5, 7 → iterative answers

6/8 → recursive answer

3

In step 2 the local server sends a query to one of the root servers and asks for the TLD (Top Level Domain) name server responsible for com. In return with an iterative answer, Root server sends the address in step 3 to the local server. In step 4 local server sends a query for the com TLD server and asks for the address of authoritative DNS server responsible for msn.com. In return it gets the address in step 5 with a iterative answer. Then in step 6 local server asks the authoritative DNS server responsible for msn.com for the name of one of its mail servers. It gets the answer in step 7 and sends the answer to the client with a recursive answer in step 8.

c) The local server sends the answer to DNS resolver (client software) and saves the information for an specific time that the owner specifies with TTL in the answer to the local server. If other query for this address comes from another client within this time, the local server just sends the answer that has saved.

1

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3). a) 1) unicast address
2) multicast address
3) any cast address.

1) unicast address identify one interface. one interface answers to them. *delivering packets to ?*

2) multicast addresses identify a set of interfaces, and each of them gets a copy of the packet ~~an answer~~

3) any cast addresses imply a set of interfaces, all of them gets a copy but just one answers. *vice versa*

b) FF02:0:0:0:0:1:FF00:0/104
FF02::1:FF00:0/104

c) 2001:DB8:0:CD30:0:0:0:0/64
2001:DB8:0:CD30::/64

d) Link-local scope → valid only in the specified link.
site-local scope → valid only in a site of an organization
global scope → valid and can be routed in the Internet.

Address scopes identify the location in the network in which IPv6 addresses are valid and can be routed to the destination.

e) In this case that the interface only needs to communicate with local nodes, there is no need for it to get global address. ?
The interface adds its interface Id which is 64 bits derived from its MAC address to FE80 which is the prefix for the link-local address. It then sends a neighbor solicitation ICMPv6 message in a IPv6 packet to get to know if there is other interface in the link with its address and to know if it is allowed to use this IPv6 address. Also it wants to get

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not question about!

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some of the link layer address of the other interfaces in the link to communicate with. For this reason it sends a multicast neighbor solicitation ICMPv6 message used IPv6 address (destined to IPv6 add) the neighbors interface Id which is a FF02::1:FF XX:XX:XX that is encapsulated in a layer 2 frame with Destination multicast address (same as above) 33:33:FF:XX:XX:XX and its own link layer addr as the source address of layer 2 frame.

In return the destination sends ICMPv6 advertisement message in IPv6 packet with its own source address and destination address set to the address of the interface asked for it in the first place. This packet is also encapsulated in a frame with the source address set to the sender link layer address and the Destination address set to the address of the interface that has asked for. The link layer address is also given as the data portion of layer 2 frame.

No question about

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5) ✓1) induction over
✓2) ≥ (equal to or greater than)
✓ 3) assertion 1
✓ 4) assertion 2
✓ 5) distance 0
✓ 6) delta (Δ)
✓ 7) delta (Δ)
✓ 8) C_1
✓ 9) 1 (one)
✓ 10) 0 (zero)
✓ 11) 1 (one)
✓ 12) assertion 2
✓ 13) ≥
✓ 14) m+1
✓ 15:1) assertion 1
✓ 15:2) ≥ (m ≥ k)
✓ 16) k+1

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6) a) d is the network diameter
n is the number of nodes (2)

How?
b) the upper bound for converge-to-the-min is 2d+1
which only depends on the network diameter. Since the network diameter grows much slower than the number of nodes, the upper bound for converge-to-the-min algorithm grows slower compared to the upper bound for converge-to-the-max algorithm.
So if new nodes be added, it is less happen for converge-to-the-min algorithm to be in the need for more bits for its clock counter. (1)

c) Converge-to-the-max is easier to work with because for converge-to-the-min algorithm the clock values adjust backwards and it would be confusing for other layer like application layer. (1)

d) 1) has a clock which wraps around to 0 value
2) d
3) induction argument (same as the one for unbounded clock-sync algorithm)
4) exists with a clock which wraps around to 0 value
5) d
6) d
7) d
8) case holds (4)

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7) a) we prove it using contradiction.

We first suppose that P_1 does not change the value of x_1 in every round at least once.

we know that all of the processors P_i change the value of x_i to x_{i-1} except for P_1. We start with a configuration in which the value of x_1 has just changed and is different from x_2. In the next round P_2 changes the value of x_2 to x_1. And we name this configuration C_2. Next round causes P_3 to change the value of x_3 to $x_2 = x_1$ and we call this configuration C_3. This keeps happening for other processors and in configuration C_n which happens in the n-1th round, P_n changes the value of x_n to $x_{n-1} = x_{n-2} = \cdots = x_2 = x_1$. Next round which is the nth round, P_1 should change the value of x_1 to $(x_1 + 1) \bmod (n+1)$ because $x_n = x_1$. contradiction happens, so P_1 changes the value of x_1 in every n rounds at least once.

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7)b) By lemma 2.3 we know that for every configuration there exists at least one integer $0 \le j \le n$ such that for every P_i, x_i is not equal to j.

we also know that P_i changes it's value and increases it by 1 mod(n+1). In the worst case which is the case in which x_1 just changed to $x_1 = j+1$, it takes n^2 rounds for P_1 to set the value of x_1 to j.

Also from lemma 2.2 we know that a configuration in which all x variables are equal, is a safe configuration. In 7.a we showed how all the P_i processors change the value of x_i to become all the same as x_1 in n rounds. So we can now say that it takes at most n^2+n rounds for all the processors to assign a value j to all the x_i's. So in $O(n^2)$ rounds starting from every configuration we can reach a safe configuration in which all x variables are the same.

3,5

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8- We prove it using contradiction.

assumptions: 1) all nodes are the same (no unique id are there)
2) there is just one token, and only the node with token can access critical section.

we start with supposing that there is a deterministic way for token circulation. So we need to find a step in which we can brake the symmetry between nodes. All of the nodes are the same and start from one point so we should have an step a between two configuration C_i and C_{i+1} which before this step in C_i all nodes have the same values in their registers and they have the same status. But in configuration C_{i+1} there should be one node with different status (in order for this to get the token). Since the algorithm is deterministic and with a deterministic algorithm, if status and values of registers of two nodes are the same, they should have the same step; we face a contradiction.

steps are
[illegible]

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9- a) a safe configuration c is a configuration that every execution that starts from c is in legal execution (LE).

set of legal executions is a set of executions in which all the processors are doing the task of the system.

1

b) The algorithm is not self-stabilizing. It happens just once and it is not an specification for a self stabilizing system.

If leader leaves or another processor joins with the ability to be the leader, there is no way for the algorithm to stabilize since it has happened once before.

1

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