Third Midterm. Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		30/5/2019	Spring 2019
NAME (in UPPERCASE LETTERS):	FAMILY NAME (in UPPERCASE LETTERS):	GROUP:	DNI/NIE:

Time: 1hour. The quiz will be collected in 20 minutes.

Test (3.5 points). Multiple choice questions. Half value if there is one error and 0 if there are more errors.

1. About the DNS protocol:
- ☐ A "*resource record*" RR of type MX defines the name of the mail server (SMTP server) of the domain.
- ☐ A "*resource record*" RR of type CNAME contains the IP address of the corresponding name.
- ☐ It is possible that when resolving the same name several times different IP addresses may be obtained.
- ☐ Several names may be associated to a unique machine (IP address).

2. About the DNS protocol:
- ☐ All DNS clients (user devices) must know the IP addresses of the "root servers".
- ☐ All DNS clients (user devices) must know the IP address of a DNS server (local or provided by the ISP).
- ☐ A DNS server specifies the names and IP addresses of the DNS servers (authority) of its subdomains.
- ☐ The information provided by a DNS server through the RR records is valid during a certain time defined by the server.

3. Check the correct sentences:
- ☐ A DNS server, an SMTP server and an HTTP server must run in different machines (different IP addresses).
- ☐ The DNS, SMTP and HTTP protocols may use TCP and UDP.
- ☐ When a DNS server does not contain the requested information in the cache it sends a DNS Request message (iterative mode) to another DNS server.
- ☐ Protocols IMAP and POP may be used between the mail client and the server to retrieve the messages.

4. About the SMTP protocol:
- ☐ The protocol establishes a new TPC connection between two servers for each single message.
- ☐ Using a single TCP connection a mail client may send messages to different email receivers.
- ☐ The sender's email client uses the DNS to know the MX address of the receiver.
- ☐ The header and the contents ("*Body*") of a message are separated by a blank line (empty line).

5. About the SMTP protocol:
- ☐ The "DATA" command is used for sending the text of the message. The end of the message is defined by a pre-established sequence of characters ("boundary").
- ☐ The following list contains some of the commands of the protocol: HELO, FROM, SUBJECT and DATE.
- ☐ The protocol may use UDP when sending short messages.
- ☐ The header of the message may include, among other, the fields: From, To, Date, Subject.

6. About MIME:
- ☐ A MIME message may contains several parts. Consecutive parts are separated by a blank line (empty line).
- ☐ MIME is an extension of the message format that allows to include the contents type and allows the transmission of binary information.
- ☐ Some of the MIME "Content Type" are: text, image, audio.
- ☐ Some of the MIME "Content-Transfer-Encoding" are: "quoted-printable" and "base64"

7. About the HTTP protocol:
- ☐ It uses the commands GET and POST when requesting contents from the server. The POST command includes the data the server needs to process the request.
- ☐ An HTTP 1.1 (persistent) may establish simultaneous TCP connections with different servers.
- ☐ For downloading a complete HTML page, an HTTP 1.1 (persistent) client is always faster than an HTTP 1.0 (no persistent) one.
- ☐ A "Proxy cache" may use the command Conditional GET with the "if-modified-since" and/or "if-none-match" attributes.

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Name:	**Surname:**	**Group**	**DNI**

Duration: 1h. The quiz will be collected in 20 minutes. Answer in the same questions sheet.

Problem 1 (3 points)

Suppose that in the outgoing mail queue of a mail server of the domain x.cat there are 500 messages that the same user sends to users in 100 different domains. Assuming that the minimum number of SMTP connections is opened and all names must be resolved, answer the following questions, justify the answer briefly.

1. (0.75 points) How many SMTP connections should be started?

2. (0.75 points) How many DNS resolutions should the outgoing mail server do? What types of resouce records will be requested in the resolution?

3. (1.5 points) Suppose that of these 500 messages, 2 are sent to the domain y.cat, to the users a@y.cat and b@y.cat. Suppose that the two messages have the subject "Thursday at 1:00 p.m.", and the body of the message is empty. Write the SMTP dialog that will have the domain server x.cat to send the messages of these users. Suppose that the dialogue is as brief as possible. Put a line sent by the server in each row of the following table (only the one that sends the server of the domain x.cat, not the answers from the remote server). Include the lines of the full email message that are sent as data. Use only the rows you need. If you need any additional information, invent a value and say below what it is.

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Problem 2 (3.5 points)

A user downloads a web page through the Internet from one single HTTP server. The web page consists of several objects, including the main HTML file, 10 images and one video. The size of each object is given in the following table in terms of bytes (B) and maximum segment size (MSS):

Object	Size
HTML file (x1)	460kB (316 MSS)
Image (x10)	5.2kB (4 MSS)
Video (x1)	146kB (100 MSS)

Assume the following:

- the round-trip-time (RTT) from the web browser to the local name server (NS) is 1ms.
- the local NS has already cached any *A register* needed.
- the RTT from the web browser to the HTTP server is 100ms.
- the web browser advertises a TCP window equal to 256 MSSs and remains constant along the TCP connection(s).
- there is no congestion along the path from client to server and vice versa.
- TCP disconnection is immediately initiated by the server after the last byte of data and it does not require any extra time.
- the processing time at the web server is negligible.

Answer the following two questions in the next table for the scenarios that are given: (*i*) *value of the TCP window* in MSS units at the time when the object (HTML file, first image, video) download starts, (*ii*) *time to receive* each of the objects measured from the time that the web browser sends the corresponding HTTP request, (*iii*) *time for the download to start* measured from the time the user requests the web page until the web browser sends the first HTTP request to the web server, and (*iv*) *total time* for the web browser to receive the complete web page measured from the time the user requests it. Note that to compute the times, the evolution of the TCP window needs to be taken into account.

A) (1.5 points) The web browser uses HTTP 1.0 based on non-persistent TCP connections and just one connection is active at every time.

***i)* Value of the TCP window (MSS)**			***ii*) Time to receive (ms)**			***iii*) Time for the download to start (ms)**	***iv)* Total download time (ms)**
HTML file	**First image**	**Video**	**HTML file**	**Each image**	**Video**		

Justification of the answer (if needed):

B) (1.5 points) The web browser uses HTTP 1.1 based on persistent TCP connections without pipelining and just one TCP connection is active at every time.

***i)* Value of the TCP window (MSS)**			***ii*) Time to receive (ms)**			***iii*) Time for the download to start (ms)**	***iv)* Total download time (ms)**
HTML file	**First image**	**Video**	**HTML file**	**Each image**	**Video**		

Justification of the answer (if needed):