Third exam of Computer Networks (XC), Degree in Informatics Engineering		19/12/2019	Fall 2019
NAME:	SURNAME:	GRUP	ID

Duration: 1h. The test will be collected in 20 minutes. Please use the tick boxes for your answers.

Test. (3 points) Each question counts 0.5 points if no error, 0.25 if one error, 0 if more than one error.

1. About name resolution:

✓ When a DNS resolver queries a NS for a record for which the server is authoritative, the NS server answers it without querying other servers.

✓ A DNS resolver might force to get authoritative answers only.

✓ A NS which provides for iterative resolution, performs resolution using the information within its own configuration file.

✓ A NS which provides for recursive resolution might query other NSs for the answer.

2. About DNS:

✓ Hostnames and IP addresses are not required to match one-to-one.

✓ The DNS consists of a hierarchy of domains with a common root distributed in several servers.

☐ NSs do not require DNS root server configuration provided that they perform iterative resolution only.

✓ NSs do require DNS root server configuration whenever they perform recursive or iterative resolution.

3. An email server is sending messages in its output queue. One of the messages is sent TO two users, in CC to other 3 users, and in BCC to another user, all six recipients are in the same domain. How many SMTP transactions needs the email server to perform?

☐ Three SMTP transactions, one for the users in the TO field, another for the users in the CC field, and another for the user in the BCC field.

☐ Six SMTP transactions, one for every recipient.

✓ One single SMTP transaction for all the recipients.

☐ Always two SMTP transactions, as recipients in the TO and in the CC fields with those in the BCC field cannot be mixed.

4. An email server is sending messages in its output queue. There are ten messages pending to send to recipients of two different domains. Which of the following statements are true?

☐ The email server resolves the IP address of the email server from one of the domains and perform one single SMTP transaction for all the messages.

✓ The email server resolves the IP address of the two email servers and perform two SMTP transactions.

☐ The email server always resolves the IP address of each email server and perform one SMTP transaction for every message to be sent.

☐ The email server resolves the IP address of the two email servers and perform ten SMTP transactions.

5. In HTTP:

☐ The GET method is mainly used to retrieve meta-data in response headers as not response body is sent.

☐ The POST method is used to apply modifications to an existing object/entity in the server.

✓ The POST method is used to send a new object/entity to the server.

✓ The PUT method is used to send a new object/entity or to apply modifications to an existing object/entity in the server.

6. In HTTP/1.1: Persistent connections with pipelining:

✓ The client might issue new requests even if previous objects have been not completely downloaded.

☐ The client issues a new request after the previous object has been completely downloaded.

☐ The client always creates a TCP connection for every object.

☐ The server closes the TCP connections after every object has been downloaded.

Tercer control de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		19/12/2019	Tardor 2019
NOM (en MAJÚSCULES):	**COGNOMS (en MAJÚSCULES):**	**GRUP:**	**DNI:**

Duració: 1 hora en total. El test es recollirà en 20 minuts.

Problema 1 (3,5 punts)

A la vista del missatge al dors, respondre a les preguntes següents:

A) (0,75 punts) Quins protocols de correu i rol poden tenir mail.isoc.org, mx1.upc.es, mbox.upc.es?
mail.isoc.org: servidor SMTP de l'originador del missatge.
mx1.upc.es: servidor SMTP del domini upc.es.
mbox.upc.es: servidor SMTP i bústia de correu del destinatari del missatge (servidor d'IMAP o POP).

B) (0,5 punts) Quins registres DNS han resolt el client de correu per enviar-lo (la primera transferència de l'enviament)?
Només ha hagut de resoldre registre A de mail.isoc.org.

C) (0,75 punts) Fes una llista de parts MIME, indicant tipus (Type) i delimitador (Boundary), indentat amb "." i "( )" per agrupar:

```
multipart/mixed 16A5 (
.multipart/alternative 65E8 (
..text/plain
..multipart/related E5B8 (
...text/html, 8bit
...image/png )
.application/pdf )
```

D) (0,5 punts) Quin efecte té "multipart/alternative"?
Fa que el client pugui triar l'alternativa més adequada a presentar entre les que s'envien en el missatge.

E) (0,5 punts) Quin efecte pot tenir "Content-Transfer-Encoding: quoted-printable" sobre el contingut?
Converteix caràcters no ASCII en seqüències =XY amb XY un codi hex.

F) (0,5 punts) Quants bytes tindrà l'arxiu "1x1.png"? (si hi ha 128 lletres en el contingut codificat)
Base64 codifica 6 bits a cada lletra, per tant 128*6/8 = 96 bytes.

```
Return-Path: <sender@isoc.org>
Received: from mx1.upc.es by mbox.upc.es with SMTP id AAXY3
     for <dest@upc.edu>; Wed, 11 Dec 2019 15:25:03
Received: from mail.isoc.org by mx1.upc.es with SMTP id xBBEP1
     for <dest@upc.edu>; Wed, 11 Dec 2019 15:25:01
Received: from dync-3.isoc.org by mail.isoc.org with SMTP id C8413
     for <dest@upc.edu>; Wed, 11 Dec 2019 15:15:25
To: dest@upc.edu
From: The sender <sender@isoc.org>
Subject: test
Message-ID: <5aedea3f@isoc.org>
Date: Wed, 11 Dec 2019 15:15:25
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="16A5"

This is a multi-part message in MIME format.
--16A5
Content-Type: multipart/alternative; boundary="65E8"


--65E8
Content-Type: text/plain; charset=utf-8
Content-Transfer-Encoding: quoted-printable

A _test_


--65E8
Content-Type: multipart/related; boundary="ECB3"


--ECB3
Content-Type: text/html; charset=utf-8
Content-Transfer-Encoding: 8bit

<html><body><p>A <u>test</u> <img src="cid:part1.29EE"></p></body> </html>

--ECB3
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-ID: <part1.29EE>
Content-Disposition: inline; filename="1x1.png"

iVBORw0KGgoAAAANSUhEUgAAAAEAAAABAQMAAAAl21bKAAAAA1BMVEUAAACnej3aAAAAAXRS
TlMAQObYZgAAAApJREFUCNdjYAAAAAIAAeIhvDMAAAAASUVORK5CYII=
--ECB3--

--65E8--

--16A5
Content-Type: application/pdf
Content-Transfer-Encoding: base64
Content-Disposition: attachment; filename="test.pdf"

JVBERi0xLjUKJcOkw7zDtsOfCjIMCBvYmoKPDwvTGVuZ3RoIDMgMCB0ZpbHRMQolJUVPRgo=
--16A5--
```

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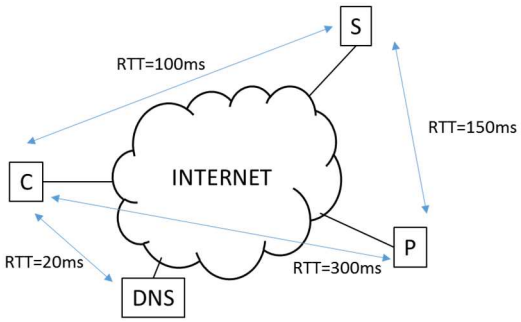
Problema 2 (3,5 punts)

Un client HTTP C accedeix al servidor S i descarrega una pàgina web. La pàgina web (index.html) conté una imatge local del "logo" i 2 imatges que estan allotjades en el servidor P. La figura mostra el valor del RTT ("*round-trip time*") entre els equips. Per tal de simplificar suposem que el temps d'establiment de la connexió TCP és d'un RTT.

Els temps de descàrrega de cada objecte, un cop establerta la connexió TCP, inclou l'enviament de la comanda GET i la transmissió del fitxer corresponent i és el següent: pàgina principal (index.html) 300ms, imatge del logo 150ms, i cada una de les imatges 2000ms. El temps de descàrrega inclou el temps de la desconnexió TCP si s'escau. El client només pot tenir simultàniament una connexió TCP amb S i una altra amb P.



El servidor DNS conté la informació necessària per poder contestar immediatament. Suposem que el client comença a enviar comandes un cop ha rebut tot el fitxer "index.html". Es demana calcular el temps total de descàrrega de la pàgina completa amb les imatges, per a cada un dels casos següents. Completar les taules indicant la seqüència dels protocols i connexions (DNS, TCP, HTTP) amb el seu temps associat. A la columna "Q/GET" indicar el nom del servidor a la "Query" del DNS o el fitxer corresponent de la comanda GET (per exemple: index, logo, img1, img2).

A) (1 punt) El client utilitza HTTP no persistent.
B) (1 punt) El client utilitza HTTP persistent (amb *pipelining*).
C) (1 punt) El client utilitza HTTP no persistent i pot establir un màxim de 8 connexions TCP en paral·lel.

A

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
TCP		100
HTTP	Logo	150
DNS	P?	(20)
TCP		300
HTTP	Img1	2000
TCP		300
HTTP	Img2	2000

Temps total: 5270ms

B

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
HTTP	Logo	150
DNS	P?	(20)
TCP		300
HTTP	Img1	
HTTP	Img2	2000

Temps total: 2870ms

C

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
HTTP	Logo	150
DNS	P?	(20)
TCP		
TCP		300
HTTP	Img1	
HTTP	Img2	2000

Temps total: 2870ms

Nota: La resolució DNS del servidor P es pot solapar amb la descàrrega del logo. Si no, cal afegir 20ms.

D) (0,5 punts) Indicar com canvia el temps total de descàrrega en els casos anteriors si cada imatge està en un servidor diferent (img1 en P1 i img2 en P2, i ambdós servidors estan al mateix lloc).
A) no canvia B) igual que no persisitent C) no canvia
Com són dos servidors diferent les connexions TCP/HTTP es fan en paral·lel.

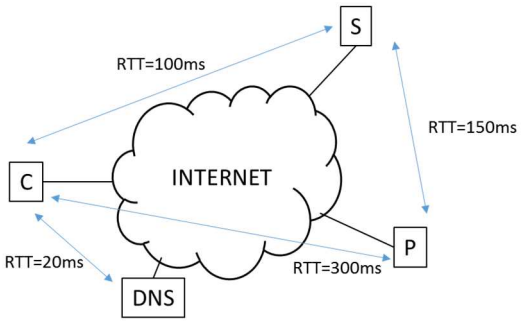
Third Midterm. Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		19/12/2019	Fall 2019
NAME (in UPPER-CASE LETTERS):	FAMILY NAME (in UPPER-CASE LETTERS):	GROUP:	DNI/NIE:

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

Problem 2 (3.5 points)

An HTTP client C connects to server S and downloads a web page. The web page (index.html) contains a "logo" as an embedded image and 2 images that are hosted in server P. The figure shows the RTT ("*round-trip time*") between the devices. To simplify, let's consider that the TCP connection setup takes one RTT.

The download time for each object, once the TCP connection is established, includes sending the GET command and the transmission time of the corresponding file and is: home page (index.html) 300ms, image of the logo 150ms, and 2000ms for each external image. The downloading time includes the TCP termination of the connection, if needed. The client only supports one TCP connection with S and one with P simultaneously.



The DNS server contains all the required information needed to resolve the queries. Let's assume that the client starts sending commands once it has received the "index.html" file completely. Calculate the total downloading time for the complete page including the images for the following cases. Complete the following tables including the sequence of the protocols and connections (DNS, TCP and HTTP) together with their corresponding time. In column "Q/GET" put the name of the server for the DNS "Query" or the name of the corresponding file for the GET command (i.e.: index, logo, img1, img2).

A) (1 point) The client uses non persistent HTTP.
B) (1 point) The client uses persistent HTTP (with *pipelining*).
C) (1 point) The client uses non persistent HTTP but it may establish up to 8 TCP connections in parallel.

A

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
TCP		100
HTTP	Logo	150
DNS	P?	(20)
TCP		300
HTTP	Img1	2000
TCP		300
HTTP	Img2	2000

Total time: 5270ms

B

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
HTTP	Logo	150
DNS	P?	(20)
TCP		300
HTTP	Img1	
HTTP	Img2	2000

Total time: 2870ms

C

Protocol	Q/GET	Time
DNS	S?	20
TCP		100
HTTP	Index	300
HTTP	Logo	150
DNS	P?	(20)
TCP		
TCP		300
HTTP	Img1	
HTTP	Img2	2000

Total time: 2870ms

Note: DNS resolve for server P may overlap with the logo's download. If this is not the case, add 20ms.

D) (0.5 points) If each image is stored in a different server (img1 in P1 and img2 in P2, and both servers are co-located), comment on the changes in total downloading time in the previous three cases.
A) It does not change. B) It is the same as non-persistent. C) If does not change.
As there are two different servers for the images TCP/HTTP connections may run in parallel.