Apellidos:_____ Nombre:_____

Problem DNS-TCP-EMAIL

1. A student (alumno@gmail.com) delivers an email to a teacher (profe@it.uc3m.es) of the university. The machine the student is using for that is called pc.gmail.com. His email client has configured a MTA called smtp.gmail.com as SMTP server. That MTA is the sole MTA in the domain gmail.com. Write down the SMTP command sequence between pc.gmail.com and smtp.gmail.com, being the email the following:

   ```
   Date: Tue, 19 Dec 2013 10:00:00 +0200
   From: Yo <alumno@gmail.com>
   To: profe@it.uc3m.es
   Subject: Informacion
   X-Mailer: MyMailer

   ¡voy a aprobar este exámen y todos los demás!
   ```

   (Solution) A possible solution would be:

   ```
   S: 220 smtp.gmail.com
   C: HELO pc.gmail.com
   S: 250
   C: MAIL FROM: alumno@gmail.com
   S: 250 OK
   C: RCPT TO: profe@it.uc3m.es
   S: 250 OK
   C: DATA
   S: 354 Start mail input, end with <CRLF>.<CRLF>
   C: Date: Tue, 19 Dec 2013 10:00:00 +0200
   C: From: Yo <alumno@gmail.com>
   C: Subject: Informacion
   C: X-Mailer: MyMailer
   C: To: profe@it.uc3m.es
   C:
   C: ¡voy a aprobar este exámen y todos los demás!
   C: .
   S: 250 OK
   C: QUIT
   S: 221 ...
   ```

2. Once that email is sent it fails since there are some non NVT asscii characters and the email client has disabled MIME. The RFC822 header length is 130 bytes and the length of the body of the message is 47 bytes. Inside the email body there are three characters non NVT ascii (¡,á,á). Calculate how log would the message be when using MIME to encode it with QP and Base 64.
   Solution QP: We know that out of the 47 characters, 3 are non-NVT ASCII. Therefore, the total, if each character encoded with QP occupies 3 bytes, would be $44 + 3 \times 3 = 53$. B64: We add one byte of padding to make it a multiple of 3 (we would have 48). For every 3 characters, we get 4 in Base64, resulting in $48 \times 4/3 = 64$.

3. Suppose that after enconding the message with MIME several attachments are added to it. Afer that, the total lenght of the email (headers+body+attachments) is 12,002929 MB (((12*1024)+3)*1024 bytes). Suppose that the email is sent raw over a TCP connection (NOT USING SMTP) with MSS equal to 1024, WIN (announced window) equals to 4KB (4*1024 bytes) and ssthresh=24*1024*1024 bytes. How many RTTS would it take to deliver the message over that TCP connection?
   Solution The *ssthresh* is very high, and the advertised window is 4 segments (which will limit me). In slow start: I have to send 1 segment, receive its ACK (and my window will be 2), then I will send 2 segments, and upon receiving the ACKs, the window will be 4 (I have already reached the limit). I have sent 3 segments and consumed 2 RTTs to reach WIN. From there onward, I send windows of 4 segments until completing the remaining 12×1024, and for each window, 1 RTT is consumed. Therefore, the RTTs are: $2 + (12 \times 1024)/4$.

4. Once the teacher receives the message he decides to download it using POP3. Write down the POP3 sequence of commands for conneting, authenticating, knowing how many messages are there in the maibox, download and delete it (message should be permanently deleted).
(Solución) Una posible solución es:

```
C: <opens connection>
S: +OK POP3 server ready <1896.697170952@pop3.uc3m.es>
C: APOP ChuckNorrisPuedeDividirPorCero c4c9334bac560ecc979e58001b3e22fb
S: +OK 1 messages (N octets)
C: LIST
S: +OK 1 message (N octets)
S: 1 N
S: .
C: RETR 1
S: +OK N octets
S: <mensaje enviado por el servidor>
S: .
C: DELE 1
S: +OK message 1 deleted
C: QUIT
S: +OK After quit everithing will be commited to mailbox
C: <cierra conexión>
```

5. How does the outbound MTA of google (smtp.gmail.com) find out to which MTA should be the message delivered if it goes to profe@it.uc3m.es? If the email would have had several recipients (within the RFC822 To: header). What would the MTA of google (smtp.gmail.com) do?
Solution A possible solution is:
First question: with an MX-type DNS query on the domain to which the email is addressed.
Second question: if the addresses correspond to the same domain, proceed as in the previous question, except it will send an RCPT TO command per recipient to the destination MTA. If the recipients are in different domains, it will perform as many MX queries as there are different domains in the "To"field, open as many SMTP/TCP connections as there are different domains in the "To"field, and in each connection, it will send as many RCPT TO commands as there are recipients in the domain corresponding to the MTA it connects to.