|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name**:** |  | | | | Number: |  |
| **On True/False questions cross the right answer.** | | | | Teacher: J. Florêncio □ J. Silva □ N. Cruz □ | | **Duration: 1 Hour** |
| Example: T ⃞ | | F ⃞ |

1. Consider the different technologies used on residential Internet access networks:
   1. The DSL technology used the traditional analogue telephone line V
   2. Cable modems share the data channels between multiple subscribers V
   3. Gigabit Passive Optical Network (GPON) uses FDM on the upstream channel F
   4. The bandwidth usage on packet switching is more efficient than on circuit switching V
2. Consider OSI and TCP/IP models:
   1. TCP/IP has 5 layers V
   2. The protocols of the transport layer are executed only between routers F
   3. Routers need to interpret the network layer during the routing process V
   4. Internet guarantees that packets are delivered without errors and with the same order as the one used by the sender F
3. Consider HTTP
   1. HTTP clients (browsers) usually establish a TCP connection with the server on port 80 V
   2. On the HTTP GET messages, the URL is sent on the body of the HTTP message F
   3. The command HEAD requests information on a document without requesting the document contents V
   4. With the POST method, the client can send files to the server V

Consider the following HTTP message:

GET /o-isel/isel/contactos.html HTTP/1.1.

Host: www.isel.pt.

Accept: text/html,application/xhtml+xml,application/xml;q=0.9,\*/\*;q=0.8.

User-Agent: Mozilla/5.0

Accept-Language: en-us.

If-Modified-Since: Fri, 28 Oct 2016 19:20:15 GMT.

1. Write the URL that the user inserted on the browser:

1. What happens if the content wasn’t modified since 28 October 2016 at 19:20:15 GMT?
2. Consider the process of sending an e-mail message:
   1. On the communication between client to server, SMTP messages are transported on UDP segments, destined to port 25F
   2. E-mail forwarding is defined by the e-mail address present on the header of the message F
   3. The local e-mail server makes a DNS request of type MX in order to obtain the destination e-mail server IP address using the domain part of the e-mail address V
   4. The client may use the SMTP protocol to obtain the e-mail messages from its mailbox F
3. Consider IMAP and POP3 protocols:
   1. POP3 allows to check for e-mail messages on the server mailbox V
   2. The POP3 server is the user device F
   3. IMAP allows to create a folder tree on the server V
   4. IMAP servers maintains a state (read, unread, flagged, etc.) for e-mail messages between logins V
4. Consider that your device wishes to establish a connection with the server www.mit.edu. Assuming that all caches are empty, and that your device uses a DNS server (*forwarder*) present on the local network:
   1. The forwarder makes a type A question on the name www.mit.edu to the authoritative server of mit.edu V
   2. The forwarder asks the root server for a type A record of the name [www.mit.edu](http://www.mit.edu) V
   3. The root server answers with the name and IP address of the authoritative server of the TLD “edu” V
   4. The DNS server for the domain mit.edu returns to the root server the IP address of the name [www.mit.edu](http://www.mit.edu) F
5. Consider the retransmission protocols
   1. The protocol Stop-and-Wait send an ACK for each received frame V
   2. Selective-Repeat discards frames received out of order F
   3. Go-Back-N has a timer for each sent and unconfirmed message F
   4. Go-Back-N with a send window for 100 frames, needs at least 200 distinct identifiers for sent messages F

Two devices have a distance of 30Km between themselves and are connected through a wireless channel with a 10Gbps connection. The used protocol used 5000 bytes frames. The bit error rate on the channel is BER=10-6 and the propagation velocity is Vp=3×108 m/s. Determine:

1. The protocol efficiency if you use Selective Repeat with N=10?
2. Considering the configuration of the previous question, what should be the sending and reception window in order to achieve maximum efficiency?
3. What would the efficiency value be on the same conditions as the previous question?
4. Calculate the internet checksum for the word ISEL (I=0x49, S=0x53, E=0x45, L=0x4C).

0x8E9F

1. Consider UDP
   1. The datagram transfer is made after connection establishment messages F
   2. Messages can arrive out of order V
   3. UDP detects errors on the payload V
   4. Datagrams with the same destination port, but different source IP addresses, are directed to the same application on the destination V
2. Consider TCP
   1. Provides a reliable message transfer between devices V
   2. Two sockets are required in order to identify a TCP connection V
   3. After the reception of 3 duplicate ACKs the sender repeats the transmission of the segment following the ACKed segment V
   4. The WINDOW field allows to open multiple windows on the same TCP connection F
3. The following table presents a data transfer between two devices using TCP. Fill in the missing fields on columns ACK, SYN, FIN, SEQ Number, ACK Number and Length.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **Destination** | **ACK** | **SYN** | **FIN** | **SEQ Number** | **ACK Number** | **Length** |
| 20.0.0.1 | 7.7.7.7 |  | X |  | 3999 |  | 0 |
| 7.7.7.7 | 20.0.0.1 | X | X |  | 1999 | 4000 | 0 |
| 20.0.0.1 | 7.7.7.7 | X |  |  | 4000 | 2000 | 0 |
| 7.7.7.7 | 20.0.0.1 | X |  |  | 2000 | 4000 | 1000 |
| 20.0.0.1 | 7.7.7.7 | X |  |  | 4000 | 3000 | 1400 |
| 20.0.0.1 | 7.7.7.7 | X |  |  | 5400 | 3000 | 1200 |
| 7.7.7.7 | 20.0.0.1 | X |  |  | 3000 | 6800 | 800 |
| 7.7.7.7 | 20.0.0.1 | X |  | X | 3800 | 6800 | 0 |
| 20.0.0.1 | 7.7.7.7 | X |  |  | 6800 | 3801 | 0 |
| 20.0.0.1 | 7.7.7.7 | X |  | X | 6800 | 3801 | 0 |
| 7.7.7.7 | 20.0.0.1 | X |  |  | 3801 | 6801 | 0 |

1. What is the minimum MSS needed for the transfer?
2. What is the minimum WINDOW field value that allows the transfer from 20.0.0.1 to 7.7.7.7?
3. What is the minimum WINDOW field value that allows the transfer between 7.7.7.7 and 20.0.0.1?