

**OLLSCOIL NA hEIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK**

**COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK**

**Summer Examination 2010
Second Science**

**Computer Science
CS2505 – Network Computing**

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You may use a calculator.
Attempt all four questions.
This examination is worth 70 module marks.

Time allowed: 1.5 hours

Question 1: General Networking Concepts [10 marks]

Each sub-question below is worth 2 marks. Answer either *True* or *False* in each case.

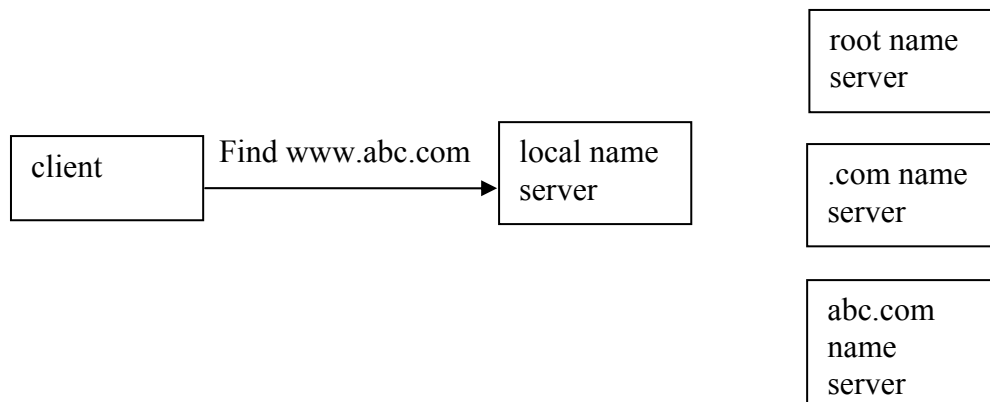
- a) UDP provides reliable delivery.
- b) HTTP uses TCP as its underlying transport protocol.
- c) A DNS server can map host names to geographic coordinates.
- d) TCP uses the sliding window mechanism to achieve flow control.
- e) Peer to peer is more scalable than client-server for file distribution.

Question 2: Networking Fundamentals [20 marks]

- a) What are the five layers of the Internet protocol architecture? List the principal responsibilities of each layer. [10 marks]
- b) Suppose a 2Mb/s link is being set up between the earth and a new lunar colony. The distance from the moon to the earth is approximately 240,000 miles and data travels over the link at the speed of light – 186,000 miles per second. How long does it take to transfer a 30KByte file from the Moon to the Earth? Assume that in order to request a file from the Moon requires an initial $2 \times \text{RTT}$ of "handshaking" before the file can be transmitted. [10 marks]

Question 3: Application Layer [20 marks]

- a) Expand the acronym DNS. Copy the following figure into your answer book and use it to explain how the name of host www.abc.com is resolved to its corresponding IP address. [10 marks]



- b) Suppose a user clicks on a link using a web browser, resulting in the download of a HTML file. Further suppose that the HTML file includes links for *two* small image files on the same server, and that these two image files are then downloaded by the browser immediately after receiving the initial HTML file. For each of the cases below, calculate *using time sequence diagrams* the number of round trip times (RTTs) that elapse from when the user clicks on the URL to when the download of all *three* files is complete. Only consider delays due to HTTP exchanges, so ignore delays due to TCP. In each case however you are asked to state the total number of TCP connections that are opened. [10 marks]
- Nonpersistent HTTP with no parallel TCP connections.
 - Nonpersistent HTTP with parallel TCP connections.
 - Persistent HTTP with no pipelining.
 - Persistent HTTP with pipelining.

Question 4: Transport Layer [20 marks]

- a) Explain the purpose of the *port* field in Internet transport protocol headers. Illustrate using an example. [5 marks]
Justify why an application programmer might decide to use UDP rather than TCP? Consider all performance-related factors that impact this decision. [5 marks]
- b) You are asked to specify a simple (unidirectional) reliable transport layer protocol that must be able to deal with bit errors but not lost packets. Give the sender and receiver finite state machines for such a protocol. Assume that bit errors only affect packets from the sender. [8 marks]
Explain how you would change your protocol if bit errors can affect packets from sender and receiver. [2 marks]