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

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

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CS2505 – Network Computing

Dr. H. Purchase
Professor C. J. Sreenan

Answer all Questions.
Total Marks 80

1.5 hours

The use of electronic calculators is permitted.
Please clearly label your answer to each question and sub-question.

PLEASE DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO

ENSURE THAT YOU HAVE THE CORRECT EXAM PAPER

Question 1: General Networking Concepts [20 marks]

a) For each sub-question below answer either *True* or *False*. *[10 marks]*

i. Link bandwidth is usually measured in milliseconds.

ii. HTTP is an example of a request-response protocol.

iii. DSL typically offers asymmetric bandwidth.

iv. A "bottleneck" link constrains the achievable end-to-end throughput.

v. UDP provides flow control.

b) Copy the following table into your answer book, then, for each item on the left side, draw a link to the most appropriate protocol listed on the right side. *[10 marks]*

Web browsing		*DASH*
Email access		*DNS*
Video streaming		*TCP*
Reliable transport		*HTTP*
Name resolution		*POP*

Question 2: Networking Fundamentals [20 marks]

a) Draw one or more diagrams as needed to show the general structure of the Internet. Use labels to highlight the edge and core of the Internet, and the concept of a tiered "network of networks". *[10 marks]*

b) Suppose a 10Mb/s link is being set up between the earth and a new lunar colony. The distance from the moon to the earth is approximately 386,000 kilometres and data travels over the link at the speed of light − 300,000 kilometres per second. How long does it take to transfer a 500KByte file from the Moon to the Earth? Assume that in order to request a file from the Moon requires an initial 2*RTT of "handshaking" before the file can be transmitted. *[10 marks]*

Question 3: Application Layer [20 marks]

a) In regard to the use of HTTP caching proxies:

i. Draw a diagram of a local network that includes a HTTP proxy, two end-hosts and router. Use arrows to show the path taken by packets from each host to/from the router. *[3 marks]*

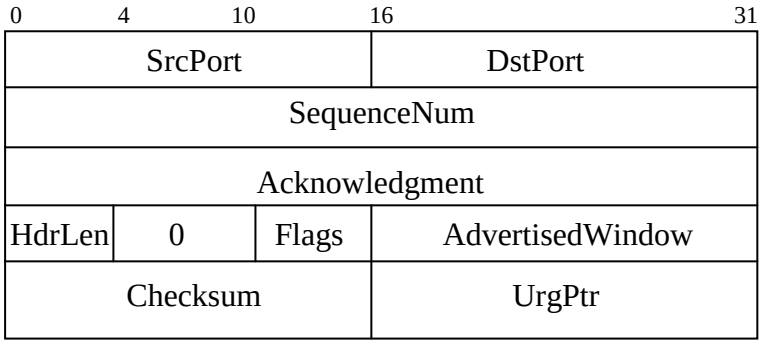
ii. Using a time-sequence diagram, show how a HTTP proxy ensures that a cached object is not stale before it returns it to the browser in response to a cache hit. *[5 marks]*

iii. Many companies specify that their web pages are not to be cached. Why? *[2 marks]*

b) Using a labeled diagram, show the basic operation of a playout buffer in a video streaming client. *[4 marks]*
When streaming video it sometimes happens that the playback stalls because the local client buffer is empty. How might this situation be avoided? *[6 marks]*

Question 4: Transport Layer [20 marks]

a) The figure below shows the TCP header (without options). For each field briefly explain how its value is determined and how it is used. *[10 marks]*



b) In regard to reliable delivery, explain the difference between stop-and-wait protocols and pipelined protocols. *[4 marks]*
In the context of the Selective Repeat protocol, use an example to illustrate the problems that can occur if the range of sequence numbers is too small relative to the window size. *[4 marks]*
For a given window size W, what is a suitable range of sequence numbers (1,..,n)? *[2 marks]*