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

**COLAISTE NA hOLLSCOILE, CORCAIGH**
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**Semester 2 - Summer 2015**

# CS2505 – Network Computing

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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.

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**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. BitTorrent is a *pure* peer-to-peer system.

ii. 10000 Kb/s is a lower data rate than 1 Gb/s.

iii. Cloud computing servers are considered to be part of the network edge rather than the network core.

iv. UDP uses a checksum for demultipexing a datagram to the correct socket.

v. DNS is an application-layer protocol.

b) Expand the following acronyms: DHT, RTT, NAK, HTTP, CDN. *[10 marks]*

**Question 2: Networking Fundamentals [20 marks]**

a) In regard to encapsulation:

i. Why is it considered good practice to minimise the size of packet headers? *[2 marks]*

ii. Draw a diagram showing the encapsulation of a HTTP message as it passes through a network link. *[4 marks]*

b) Give an equation to express how long it takes for a packet of size *L* bytes to be delivered over a link of distance *D* kilometres, with data rate *R* bits/sec, and propagation speed *S* metres/sec. *[6 marks]*

c) Imagine a 2 Mb/s network link that uses time division multiplexing (TDM), with 20 sending computers, each allocated one slot per second.

i. If just one computer is actively sending, what is the maximum data rate it can achieve? *[4 marks]*

ii. If instead of using TDM we used statistical multiplexing, what would be the maximum data rate the sending computer could achieve over the link? *[4 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. *[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*) In regard to video streaming:

*i.* Explain the need for a playout buffer in a video streaming player. *[4 marks]*

*ii.* A DASH player operates by requesting video in chunks from a server. In making each such request, briefly explain the *three* key decisions that the player must make. *[6 marks]*

**Question 4: Transport Layer [20 marks]**

a) In regard to reliable delivery:

i. You are asked to specify a simple unidirectional stop-and-wait reliable transport layer protocol to operate over a link that can corrupt packets but never loses a packet. Give the sender and receiver finite state machines for such a protocol. Assume that bit errors can only affect data packets (i.e. from the sender). *[8 marks]*

ii. Briefly explain how you would change your protocol if bit errors can affect packets from both sender and receiver. *[2 marks]*

*b)* The figure below shows the TCP header (without options).

i. What is the maximum size of the receive window? *[2 marks]*

*ii.* To what initial value does the client set the Sequence Number field? *[3 marks]*

*iii.* Does the server need to use the same initial Sequence Number as the client? *[2 marks]*

iv. How does a recipient interpret the *value* of the Acknowledgement Number? *[3 marks]*