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

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

Summer Examination 2011
Second Science

Computer Science
CS2505 – Network Computing

Dr. Carron Shankland
Professor J. Bowen
Professor C. J. Sreenan

You may use a calculator.
Attempt all four questions.
This examination is worth 80 module marks.

Time allowed: 1.5 hours

Question 1: General Networking Concepts [20 marks]

a) Each sub-question below is worth 2 marks. Answer either *True* or *False* in each case. *[10 marks]*

i. The Internet is based on the use of circuit-switching.

ii. DSL-based broadband access links are dedicated for use by a single residence.

iii. HTTP encodes messages using binary rather than ASCII text.

iv. Congestion is said to occur when queues in routers overflow.

v. Port numbers in TCP and UDP are 32 bits in length.

b) Give concise definitions for the following terms: link bandwidth, throughput, latency, router, protocol. *[10 marks]*

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) Calculate the transmission delay *and* the propagation delay for sending a packet of 1000 *bytes* over a link that is 2000 kilometres long and operates at 2 Mb/s. Assume bits propagate at 2×10^8 metres/second. Give your answers in milliseconds. *[10 marks]*

Question 3: Application Layer [20 marks]

a) Discuss the role of caching at the application later, using examples of its use in DNS and HTTP. Be sure to address the issues of (i) when it is appropriate to store data in a cache and (ii) consistency of the cached data with that at the origin server. [10 marks]

b) Distributed Hash Tables (DHTs) are used to enable peer-to-peer file distribution protocols. Consider a circular DHT with node identifiers in the range [0, 15]. Suppose there are seven peers with identifiers 1, 3, 4, 5, 8, 12 and 14.

i) The following (key,value) pairs should be stored in the DHT: (2,1), (6,5), (7,15) and (15,5). Which peers will store which (key,value) pairs? *[6 marks]*

ii) Suppose that peer 3 learns that peer 5 has left the DHT. How does peer 3 update its successor state information? Which peer is now its first successor? Which is its second successor? *[4 marks]*

Question 4: Transport Layer [20 marks]

a) List several different services that a transport layer could provide to the application-layer. State which of these services is provided by TCP, by UDP, and by neither TCP nor UDP. Identify diverse application types that would benefit from using the various services you identify. *[10 marks]*

b) TCP uses a sliding-window protocol. Consider two hosts, A and B, with an open TCP session. A sends a segment with sequence number 2600 and after some time receives a segment from B with sequence number 22500 and acknowledgment number 3600 and Receive/Advertised Window set to 10000.

i) How many bytes were received and confirmed by host B? *[4 marks]*

ii) Is there a relationship between the values of the two sequence numbers? Explain your answer. *[4 marks]*

iii) How will host A interpret the value of the Receive/Advertised Window field?*[2 marks]*