

EXAMINATIONS — 2004  
END OF YEAR

**COMP 306**  
**DATA COMMUNICATIONS**

**Time Allowed:** 3 Hours

**Instructions:** 180 marks in total. Allocate approximately 1 minute per mark.  
There are five questions, each worth 36 marks.  
Answer all questions.  
Paper foreign to English language dictionaries are allowed.  
Electronic dictionaries and programmable calculators are not allowed.

## Question 1. Application Layer

[36 marks]

(a) [3 marks] How do applications access the transport layer?

(b) [13 marks] Multiplexing.

- i. How are TCP connections multiplexed between multiple clients and a server. Demonstrate using an example. Be sure to specify all information needed to correctly identify all parties involved.
- ii. What aspect of the standard solution to multiplexing could be considered poor design?

(c) [10 marks] HTTP.

- i. Show the HTTP/1.0 header that a browser would generate to request the URL `http://www.mcs.v` for the **first** time.

Also show the matching server HTTP/1.0 response header that would be generated in response to this request.

- ii. Show the HTTP/1.0 header that a browser would generate to request the URL `http://www.mcs.v` for the **second** time.

Again show the matching server HTTP/1.0 response header that would be generated in response to this request.

(d) [10 marks] SOAP, (Simple Object Access Protocol) is an XML (eXtensible Markup Language) application layer protocol that can be used to perform Remote Method Invocations.

- i. What is a Remote Method Invocation?
- ii. Suggest why SOAP might use HTTP as a transport protocol, rather than directly using TCP.

## Question 2. Transport Layer

[36 marks]

(a) [6 marks] Which of the following terms best describes the TCP/IP protocol suite? Justify your answer.

1. Pyramid
2. Spherical
3. Hourglass
4. Cylindrical

(b) [20 marks] TCP 3 Way Handshaking.

- i. Show how the sequence numbers are communicated between the client and the server in the TCP 3 Way Handshake.
- ii. How does the 3 way handshake eliminate spurious connection requests. Show by the use of examples.
- iii. Why do we have to be careful when selecting the initial sequence numbers, that a TCP connection will use, after a machine has crashed.

(c) [10 marks] Pipelined Error Recovery

The designers of TCP chose not to utilise GoBackN or Selective Repeat for pipelined error recovery.

- i. Detail how TCP pipelined error recovery differs from Selective Repeat and GoBackN.
- ii. Do these differences improve efficiency? In either case, justify your answer.

### Question 3. Routing Layer

[36 marks]

- (a) [3 marks] State the primary difference between linkstate and distance vector routing algorithms.
- (b) [8 marks] Consider a broadcast algorithm that uses link state information. How is the broadcast message routed efficiently through the network.
- (c) [12 marks] Mobile IP.
- Draw a diagram showing how MobileIP works. Be sure to include all participants and show how they interact.
  - Briefly describe how a mobile device registers in a new network.
  - When a mobile device moves to yet another network, what happens to the information stored in the previous network?
- (d) [13 marks] Adhoc Routing.
- Consider the network given in Figure 1. Assume that no routes have been established. Show the steps that the AODV algorithm takes in finding a route between nodes A and G.
  - What happens when node G is removed from the network? Demonstrate using the routing table at node E as an example.

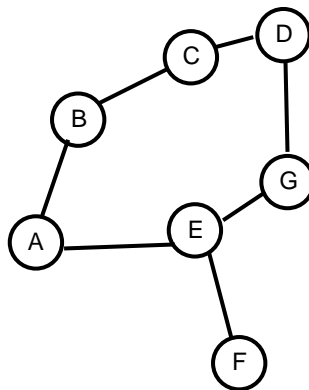


Figure 1: Connection graph. Links indicate which nodes are in contact. All links are symmetric.

## Question 4. Multimedia

[36 marks]

(a) [6 marks] Streaming.

- i. What is meant by the term — streaming?
- ii. Which transport protocol is used most often in streaming multimedia?
- iii. Why?

(b) [5 marks] Jitter.

- i. What is jitter?
- ii. How is jitter removed from streaming multimedia?

(c) [10 marks] RTP.

- i. What is RTP and what does it do?
- ii. What functions does RTP *not* provide?
- iii. Draw the RTP header and outline the purpose of each field.

(d) [15 marks] Beyond Best Effort.

- i. How do initiatives such as Intserv and Diffserv hope to overcome the problems introduced by the best effort IP layer in today's Internet?
- ii. Which two algorithms are typically used to police and schedule QoS traffic. Explain briefly how each algorithm works.
- iii. What are the alternative actions we can use when an application misbehaves in a policed system.

**Question 5. Security**

[36 marks]

(a) [2 marks] What is the difference between secrecy and integrity?

(b) [4 marks] What does it mean for an algorithm to be secure?

(c) [10 marks] Ciphers.

i. What type of cipher is a Caesar cipher?

ii. What sort of techniques would a cryptographer use to break such a cipher?

iii. What can be done to eliminate these types of attack?

(d) [12 marks] Compare DES and RSA by listing the major features of each, giving the advantages and disadvantages of each approach.

(e) [8 marks] How does public key certification from a certification authority solve the problem of authentication?

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