

**EXAMINATIONS — 2006**  
**END-YEAR**

**COMP306**  
**COMPUTER NETWORKS**

**Time allowed:** THREE HOURS

**Instructions:** The examination contains 5 questions, you must answer all questions  
Each question is worth 30 marks.

The exam consists of 150 marks in total.

The number of marks for each part of a question are shown.

Paper foreign to English language dictionaries are allowed.

Electronic dictionaries and programmable calculators are not allowed.

## Question 1 Assorted Short Questions

[30 marks]

- (a) [2 Marks] Why are iterative DNS queries preferred over recursive queries?
- (b) [2 Marks] What is a canonical name with respect to the DNS?
- (c) [2 Marks] What is meant by an impure name?
- (d)[4 Marks] How is a public-key digital signature generated?
- (e) [2 Marks] Why does an email client send outgoing email to its SMTP server rather than directly to the recipient's SMTP server?
- (f) [3 Marks] What is a "protocol"?
- (g) [4 marks] Briefly describe congestion control and its key parameters in TCP.
- (h) [4 marks] Briefly describe the operation of the data link control mechanism CSMA/CD.
- (i) [3 marks] What features make RTP particularly suitable for real time transport such as voice or video?
- (j) [4 marks] Describe how jitter is removed from streaming multimedia.

## Question 2 Security

[30 marks]

(a) Explain the following terms

- i. [2 Marks] Cryptography
- ii. [2 Marks] Steganography

(b) [4 Marks] What is the difference between Transposition and Substitution Cyphers?

(c) [2 Marks] What type of alphabetic cypher is a Caesar Cypher?

(d) [2 Marks] What type of alphabetic cypher is a Vigenère Cypher?

(e) Cryptanalysis

- i. [3 Marks] Identify and outline the technique devised by Al-Kindi that is best used to crack a Caesar Cypher?
- ii. [5 Marks] How was this method modified by Babbage to crack the Vigenère Cypher?

(f) Authentication

- i. [3 Marks] How does a nonce solve the problem of a replay attack?
- ii. [7 Marks] Explain the key distribution problem when using public key encryption for authentication. Be sure to indicate how this is resolved by a CA.

### Question 3 Transport Layer

[30 marks]

- (a) [2 marks] What is the role of the transport layer?
- (b) [3 marks] Explain in what way TCP is not considered a pure GoBackN algorithm?
- (c) [2 marks] Why are the Source and Destination IP addresses usually required in a UDP datagram?
- (d) [5 marks] Why are the Source and Destination IP addresses needed for a TCP segment?
- (e) TCP connection
  - a. [2 marks] What mechanism is used to set up a TCP connection?
  - b. [4 marks] Why is the mechanism needed?
  - c. [8 marks] Outline how the mechanism works.
- (f) [4 marks] What is flow control and how is it achieved by TCP?

**Question 4 Routing**

**[30 marks]**

(a) [4 marks] State the primary differences between the link-state and distance-vector routing algorithms.

(b) [8 marks] Consider a broadcast algorithm that uses link-state information to achieve broadcast delivery. Briefly discuss how a broadcast message is routed efficiently through a network using link-state information. Given the network in figure 1 below, draw the broadcast topology from node A, given that each link has equal cost.

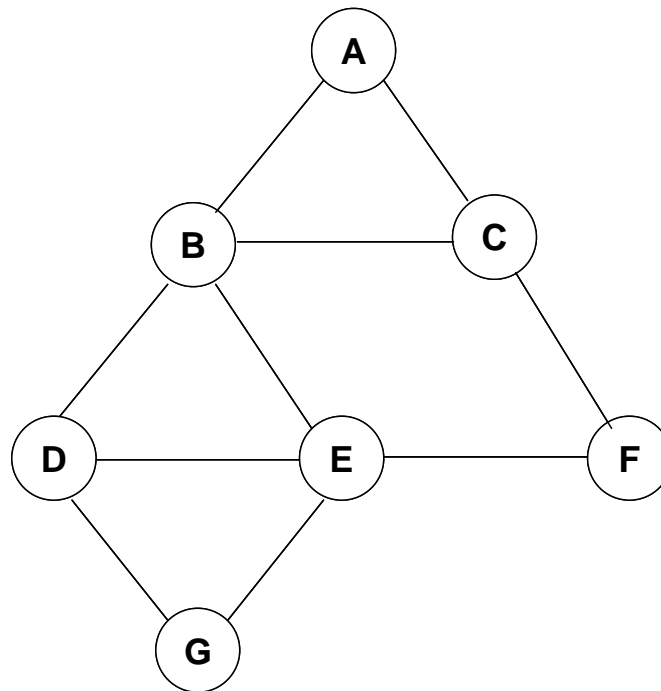


Figure 1

(c) [10 marks] A centre based tree (CBT) is an alternative mechanism for creating an efficient broadcast mechanism.

(i) [4 marks] Briefly discuss how the CBT algorithm operates.

(ii) [6 marks] Assume that node E is used as the core of a CBT; draw the flow of control information and the resulting CBT tree for the network shown in figure 1 above.

(d) [8 marks] Identify the key components in Mobile IP. Discuss registration in the context of Mobile IP and how information changes as a mobile host moves from one network to another network.

**Question 5 The Internet Protocol**

**[30 marks]**

(a) [8 marks] What are the functions of the network layer in the TCP/IP protocol stack? In your answer you should include a brief discussion on the role of ICMP (Internet Control Management Protocol).

(b) [14 marks] Discuss the key aspects of the Internet Protocol implemented in hosts and routers. In your answer you can refer to the IP headers for version 4 given in figure 3 and/or the IP version 6 header shown in figure 3.

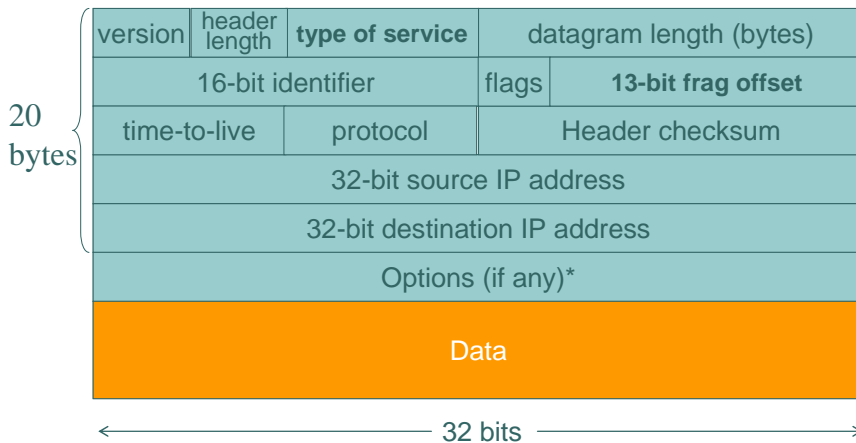


Figure 2, IPv4 header

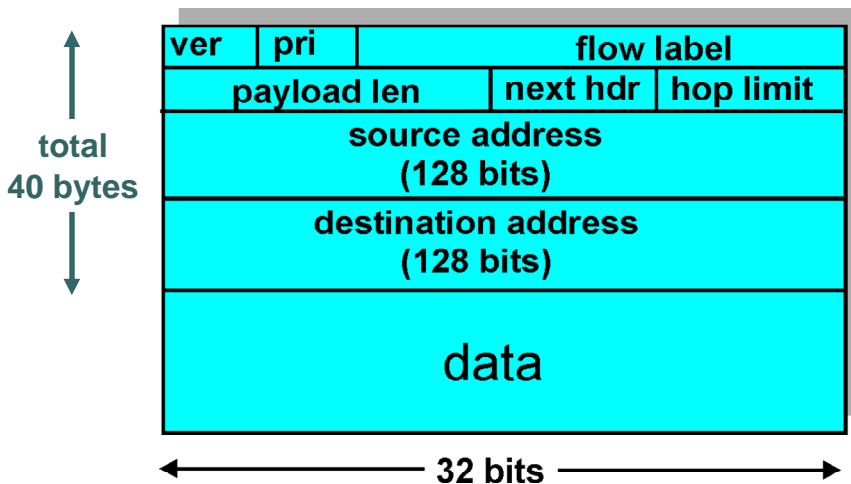


Figure 3, IPv6 header

(c) [8 marks] Briefly discuss the arguments for and against the Integrated Services (IntServ) and Differentiated Services (DiffServ) approaches to enabling quality of service (QoS) in the Internet.

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