


0. (a) (i) Explain the operation of the *binary exponential back-off algorithm* as used in the CSMA/CD protocol employed by Ethernet. [4]
- (ii) The encoded bit stream shown below is detected on an Ethernet LAN.
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- Decode the information if: (1) Manchester Coding, and (2) Differential Manchester Coding, is used. [4]
- (iii) A 100 Mbps CSMA/CD local area network (not Ethernet) has equally spaced nodes and a total length of 1.5 km. The signal propagation speed in the cable is 2×10^8 m/s. There are no repeaters. What is the minimum frame length (in bits) that is required for correct operation of the CSMA/CD protocol? [3]
- (b) Four stations, A, B, C and D exist within in an IEEE 802.11 wireless network. A is within range of B and C, but not D. D is within range of B and C, but not A.

- (i) Explain what is meant by the *hidden station problem* [2]
- (ii) Station A wishes to send to C using the ‘Multiple Access with Collision Avoidance for Wireless’ (MACAW) protocol that features ‘virtual channel sensing’. With the aid of a timing diagram (for A, B, C and D) explain the operation of the protocol. [7]
- (iii) Why may the successful throughput of a frame in this type of network be increased by fragmenting the frame into smaller parts? [2]
- (iv) How is collision avoidance maintained if other stations set a network allocation vector (NAV) only for transmission of the first of a number of fragments and its corresponding ACK frame? [3]