



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN COMPUTER ENGINEERING

SCE 507: DATA COMMUNICATIONS

DATE: Wednesday, 18th April, 2012

TIME: 8.00 a.m. – 10.00 a.m.

INSTRUCTIONS

Attempt Questions ONE and any other TWO questions.

QUESTION ONE

a) Comment on the inventions of the following technologies.

(i) Radio

(ii) Telephony

(3 marks)

b) Here is a list of four non-proprietary Internet applications. Give application layer protocols and underlying transport layer protocols that they use.

Application	Application layer protocol	Underlying transport layer protocol
E-Mail		
Remote terminal access		
Web		
File Transfer		

(4 Marks)

c) List three categories of multiple access protocols as used in LANs and also list two protocols in each category.

(6 Marks)

d) Define the following general terms used when discussing protocols.

- (i) Peers
- (ii) IDU
- (iii) SDU
- (iv) PDU

(4 Marks)

e) Name the four classes of members of the CCITT.

(4 Marks)

f) Explain circuit switching and packet switching as used in communication networks. Also provide four differences between the two.

(6 Marks)

QUESTION TWO

a) In the context of *generic* layered architectures, briefly distinguish between the following.

- (i) Entities and SAPs (1 mark)
- (ii) Protocols and services (1 mark)
- (iii) PCI and ICI (1 mark)
- (iv) Encapsulation and fragmentation (1 Mark)

b) Give six advantages of using fibre optics over coaxial and twisted pair cables.

(6 Marks)

c) What is the channel capacity for a teleprinter channel with a 300 Hz bandwidth and a signal-to-noise ratio of 3 dB?

(4 Marks)

d) A digital signalling system is required to operate at 9600 bps.

- (i) If a signal element encodes a 4-bit word, what is the minimum required bandwidth of the channel? (3 marks)
- (ii) Repeat part (a) for the case of 8-bit words. (3 Marks)

QUESTION THREE

a) For a network shown in Figure Q3 below:

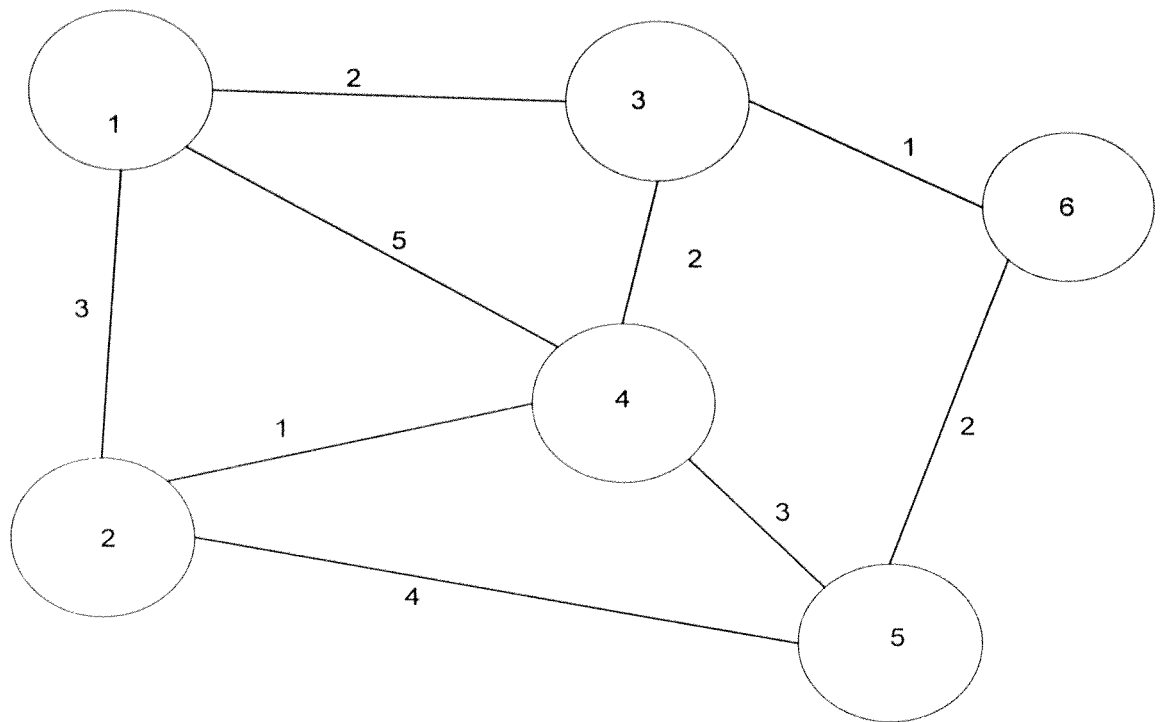


Figure: Q3

- (i) Use the Dijkstra's algorithm to find the set of shortest path from node 2 to other nodes. (6 Marks)
 - (ii) Draw the corresponding shortest path tree for node 2. (3 Marks)
 - (iii) Find set of associated routing table entries at node 2. (3 Marks)
- b) (i) Describe the difference between simplex, half duplex, and full duplex communications. (3 Marks)
- (ii) What is the difference between asynchronous and synchronous transmissions? Compute their respective efficiencies in transmitting blocks of 40, 80 and 1200 characters. What inference do you make? A character has 8 bits and you need 10 special characters for each synchronous transmission. (5 Marks)

QUESTION FOUR

- a) Define the term network topology. (2 Marks)
- b) A LAN of seven nodes is to be constructed. Draw the following five alternative network topologies for the LAN, stating the span (maximum distance) measured in hops for each topology: binary tree, star, ring, mesh, bus. (5 Marks)

- c) Suppose a bus topology is chosen for the seven-node LAN in part (b) and that individual links between pairs of nodes comprise 500 m segments of coaxial cable operating at 10 Mb/s with a velocity of propagation 2×10^8 m/s. What is the maximum possible delay (in μ s) between the initial transmission of a packet from one node to another and the arrival of its acknowledgement, assuming fixed packet and acknowledgement sizes of 3000 bits and 300 bits respectively? Assume further that transmitted data does not have to be retransmitted by intermediate nodes. (7 Marks)
- d) What is the minimum possible delay (in μ s) for the network in part (c)? Explain the similarity or difference in terms of the relative contribution to the overall delay of transmission times and propagation times in LANs. (4 Marks)
- e) Briefly explain the relative contributions to the overall delay of transmission times and propagation times that are typical in WANs. (2 Marks)

QUESTION FIVE

- a) Given the data-word 1001 and the divisor 1011,
- Show the generation of the codeword at the sender site (using binary division). (3 Marks)
 - Show the checking of the codeword at the receiver site (assume no error). (3 Marks)
- b) Find the minimum Hamming distance for the following cases:
- Detection of three errors. (1 Mark)
 - Correction of three errors. (1 Mark)
 - Detection of 4 errors or correction of 3 errors. (1 Mark)
 - Detection of 5 errors or correction of 3 errors. (1 Mark)
- c) Give and briefly explain FOUR design factors in choosing a transmission medium. (4 Marks)
- d) (i) In the RS-232-C standard, how are ones and zeroes transmitted? How are control signals represented? (2 Marks)
- (ii) Which RS-232-C signals are used only in synchronous transmission? Which of these signals are generated by the DTE and which by the DCE? What is the purpose of these signals? (4 Marks)