



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL INFORMATICS AND INNOVATIVE SYSTEMS
UNIVERSITY EXAMINATION FOR THE DEGREE OF SCIENCE
COMPUTER SECURITY & FORENSICS
1ST YEAR 2ND SEMESTER 2013/2014 ACADEMIC YEAR
CENTRE: MAIN

COURSE CODE: IIT 3121

COURSE TITLE: DATA COMMUNICATION PRINCIPLES

EXAM VENUE: LR 2

STREAM: BSc. Computer Security & Forensics

DATE: 9/12/2013

EXAM SESSION: 11.30 – 1.30 PM

TIME: 2 HOURS

Instructions:

- 1. Answer question 1 (Compulsory) and ANY other 2 questions.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Question 1

- a) Using diagram(s), Compare OSI Model and TCP/IP Model. (8 Marks)
- (i) Which layer of the OSI model ensures reliable, end-to-end communications? (2 Marks)
- (ii) Which layer of the OSI model provides routing functionality? (2 Marks)
- (iii) Which layer of the OSI model translates the data from upper-layer protocols into electrical signals and places them on the network media? (2 Marks)
- b) How is the transmission of a single character differentiated from the transmission of the next character in asynchronous transmission? (2 Marks)
- c) Explain two reasons why most communication systems use serial mode as compared to parallel communication mode. (2 Marks)
- d) Briefly explain the difference between hub, bridge, switch and a router. Among the listed devices, which the device(s): (8 Marks)
- e) Any periodic signal can be represented as a sum of sinusoids, known as a Fourier series:1

$$x(t) = \frac{A_0}{2} + \sum_{n=1}^{\infty} [A_n \cos(2\pi n f_0 t) + B_n \sin(2\pi n f_0 t)]$$

Given that $f_0 = 1/T$ and A_0 is not equal to zero. Write equations which would be used to calculate the coefficients:

A₀

A_n

And

B_n

(3 Marks)

- f) Define the following terms as used in Data Communication: (3 Marks)
- I. Little endian
- II. Asynchronous data transmission
- III. Simplex Communication

Question 2

- a)** Why is multiplexing so cost-effective? (2 Marks)
- b)** Explain how interference avoided by using frequency division multiplexing? (3 Marks)
- c)** Define the term echo cancellation as used in data Communication. (3 Marks)
- d)** What is the meaning of upstream and downstream with respect to subscriber lines. (2 Marks)
- e)** Explain how synchronous time division multiplexing (TDM) works. (2 Marks)
- f)** A character-interleaved time division multiplexer is used to combine the data streams of a number of 110-bps asynchronous terminals for data transmission over a 2400-bps digital line. Each terminal sends asynchronous characters consisting of 7 data bits, 1 parity bit, 1 start bit, and 2 stop bits. Assume that one synchronization character is sent every 19 data characters and, in addition, at least 3% of the line capacity is reserved for pulse stuffing to accommodate speed variations from the various terminals.
- i.** Determine the number of bits per character. (3 Marks)
 - ii.** Determine the number of terminals that can be accommodated by the multiplexer. (3 Marks)

Question 3

- a)** Explain five factors that can be used in evaluating or comparing the various digital-to-digital encoding techniques. (10 Marks)
- b) i)** What is meant by differential encoding? (2 Marks)
- ii)** Describe two multilevel binary digital-to-digital encoding techniques. (2 Marks)

- iii) Define biphase encoding and describe two biphase encoding techniques. (2 Marks)
- iv) Explain the function of scrambling in the context of digital-to-digital encoding techniques. (3 Marks)
- v) What function does a modem perform in a communication network ? (1 Mark)

Question 4

- a) How is the transmission of a single character differentiated from the transmission of the next character in asynchronous transmission? (2 Marks)
- b) Explain one major disadvantage of asynchronous transmission? (2 Marks)
- c) How is synchronization provided for synchronous transmission? (3 Marks)
- d) Define a parity bit? (2 Marks)
- e) What is the CRC? (2 Marks)
- f) Why would you expect a CRC to detect more errors than a parity bit? (2 Marks)
- g) List three different ways in which the CRC algorithm can be described (3 Marks)
- h) In an (n, k) block ECC, what do n and k represent? (2 Marks)
- i)
- j) What is the role of a DCE in a communication network (2 Marks)

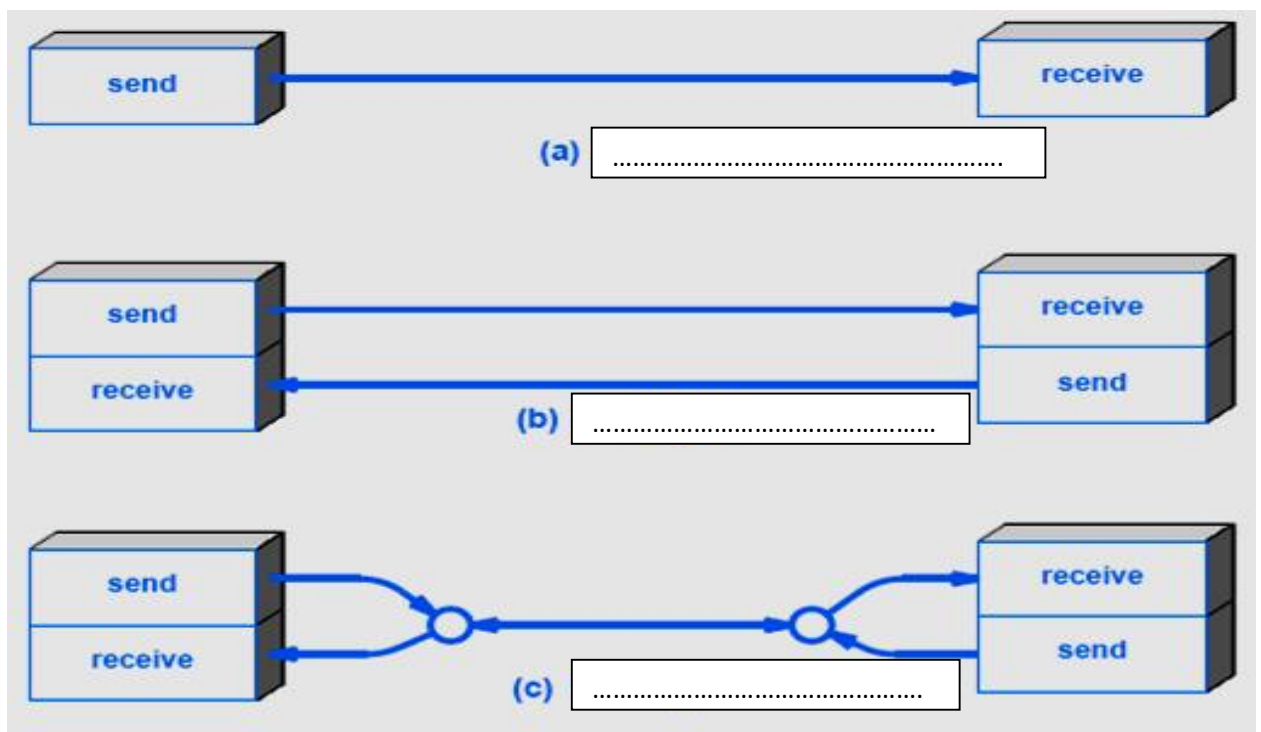
Question 5

- a) Explain Five requirements for effective communications over a data link network. (10 Marks)
- b) Define flow control. (2 Marks)
- c) Describe stop-and-wait flow control. (1 Marks)
- d) Explain two reasons for breaking a long data transmission up into a number of frames. (2 Marks)

- e) Describe sliding-window flow control. (2 Marks)
- f) Define error control. (1 Marks)
- g) Explain two common ingredients for error control for a link control protocol. (2 Marks)

QUESTION 6

- a) i) define data communication as used in data transmission (2 Marks)
- b) Differentiate between synchronous and asynchronous data transmission (4 Marks)
- c) Identify the following communication channels and give an example of each of a communication device using this mode of communication (6 Marks)



- d) Explain four data transmission media . (4 Marks)