

2506/306
2507/306
DATA AND COMPUTER
NETWORKS
June/July 2018
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES & ENGINES OPTION)
(AVIONICS OPTION)
MODULE III

DATA AND COMPUTER NETWORKS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable Scientific calculator.

Answer FIVE of the EIGHT questions in this paper.

All questions carry equal marks.

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) Define the following terms as applied in data communication:
- (i) bandwidth;
 - (ii) data rate;
 - (iii) noise;
 - (iv) error rate.
- (4 marks)
- (b) In reference to data communication, differentiate between point-to-point and multi-point links, stating an example in each case. (4 marks)
- (c) Draw a block diagram of a typical data communication model and explain its constituents. (8 marks)
- (d) With the aid of a block diagram describe a distributed network. (4 marks)
2. (a) (i) Distinguish between asynchronous and synchronous transmission with respect to data communication.
- (ii) With the aid of a block diagram, explain parallel transmission as applied to data communication. (8 marks)
- (b) Draw a block diagram of a pulse code modulation (PCM) and state functions of each block. (8 marks)
- (c) A noiseless channel has a bit rate of 265 kbps with a bandwidth of 20 kHz. Determine the number of signal levels required for the channel. (4 marks)
3. (a) Describe the Huffman FEC (forward error correction technique) method as used in data transmission. (4 marks)
- (b) (i) Explain the checksum error detection technique.
- (ii) A total of 128 capital A letters are sent across a communication link, given that the 7 bit ASCII code for the capital letter A is 1000001_2 . Calculate the checksum to send for error detection. (10 marks)
- (c) A signal travels through a cable from a point A to point B. Determine:
- (i) the attenuation of the signal if at point B, the power is found to have reduced by a half;
 - (ii) the power of the signal at a point 5 km away from point B, if the power at B is 2 mW. (Assume attenuation of the cable is in decibels per kilometer (dB/km)). (6 marks)

4. (a) Define the following terms in relation to data communication:
- (i) packetization;
 - (ii) encapsulation.
- (4 marks)
- (b) Contrast packet switching and circuit switching. (4 marks)
- (c) With the aid of a block diagram, explain the operation of a virtual circuit network. (6 marks)
- (d) (i) Explain routing table as applied in datagram network. (2 marks)
- (ii) Two buildings are connected using a T-1 line leased from a communication service provider which has two 2×4 I/O switches. Each I/O switch has 2 outputs folded into the input port to allow communication. Draw a schematic diagram to realise this. (4 marks)
5. (a) Explain the following as applied in multiplexing:
- (i) channel;
 - (ii) pulse stuffing.
- (4 marks)
- (b) Outline **three** distinguishing features between synchronous time division multiplexing and statistical time multiplexing. (6 marks)
- (c) A voice channel of 2800 Hz bandwidth is used for transmission of data over a telephone line with a signal to noise ratio of 20 dB. Determine the channel capacity in bits/sec. (6 marks)
- (d) In a multiplexed system, there are eight sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame. Determine:
- (i) data rate of each source (in kbps);
 - (ii) duration of each character in each source (in mS).
- (4 marks)

6. (a) Outline **two** functions of each of the following standard bodies concerned with data communication:
- (i) Communications Authority of Kenya (CAK)/CCK;
 - (ii) Institute of Electrical and Electronic Engineers (IEEE).
- (4 marks)
- (b) (i) With the aid of a diagram in each case, explain the following LAN topologies:-
- (I) bus topology;
 - (II) ring topology.
- (ii) Outline **two** demerits for each case in b (i).
- (16 marks)
7. (a) Outline **four** functions of each of the following LAN hardware devices:-
- (i) Network Interface Card (NIC);
 - (ii) hub;
 - (iii) switch;
 - (iv) bridge.
- (8 marks)
- (b) A 1 Mbps link transmitting bits of frame length 8000 bits, established between two ground stations via a Geo stationery relay, at an altitude of 36,000 km. Determine the:
- (i) length of the link in bits;
 - (ii) number of frames for the link;
 - (iii) total time for transmission of the frame.
- (12 marks)

8. (a) (i) Differentiate between lossy and lossless data compression techniques.
(ii) Explain the run length encoding data compression method. (6 marks)
- (b) Highlight the difference between intraframe and interframe MPEG compression standard. (2 marks)
- (c) (i) Describe coding efficiency as applied to data compression.
(ii) Table 1 shows data obtained from a data compression using Shannon-Fano codes.

Table 1

Message	Uncompressed for messages	Codes probability of occurrence	Compressed codes for messages				
A	000	0.4	0				
B	001	0.2	1	0			
C	010	0.2	1	1	0		
D	011	0.1	1	1	1	0	
E	100	0.06	1	1	1	1	0
F	101	0.04	1	1	1	1	1

Using the table, determine the:

- (I) average number of bits per source message;
(II) coding efficiency.
- (iii) Outline **two** demerits of using Shannon-Fano coding in data compression. (12 marks)

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