

DCO2310

Tutorial Solutions

for

Data Communications

CHOI yiu kuen (01/05/2001)

1 Tutorial One

The questions choices below only provide you an overall concept on data communications. Some of the questions may be beyond your knowledge. They are set to arise your interest and to test your fundamentals on data communications. It is also set as a measurement of how well you have performed. When you have finished week 14 lecture, you can re-iterate this tutorial questions to test your achievement because of this course.

Give an overview of this course and do the following multiple choices

- 1). Computer-to-computer order processing through a network is an example of
 - A). e-commerce.*
 - B). intranetworking.
 - C). Computer Processing.
 - D). Internet.

- 2). The scope of network connectivity includes
 - A). hardware.
 - B). software.
 - C). data bases.
 - D). all of the above.*

- 3). The device that permits electrical digital signals to be transmitted to a server over regular telephone lines is a
 - A). multiplexer.
 - B). modem.*
 - C). cluster controller.
 - D). front-end processor.

- 4). The modem does not
 - A). produce sounds similar to those you hear on the touch tone telephone.
 - B). collect signals from low speed terminals and transmit them over a single line.*
 - C). modulate electrical digital signals. into analog signals
 - D). demodulate analog signals into digital signals

- 5). The common internetworking cable for connecting a few P5 computers together to share the resources is
 - A). thick coaxial cable (also called thick wire).
 - B). thin coaxial cable (also called thin wire).
 - C). Category 5 8-core telephone cable. * (RJ45B)
 - D). Optical fibre.

- 6). The external modem is connected to a microcomputer via
 - A). an armshaking procedure.

- B). microwave link.
 - C). 12-2 electrical cord.
 - D). a serial interface port (V.24 or Recommended Standard 2322). *
- 7). Of the following communications channels, which does not provide a physical link between terminal and computer?
- A). optical fiber
 - B). microwave *
 - C). telephone lines
 - D). coaxial cable
- 8). In practice, communications channels are often made up of several transmission media. Which of the following is an unlikely connection between two computers?
- A). microwave, satellite, telephone lines
 - B). microwave, satellite, coaxial cable
 - C). coaxial cable, telephone lines, optical fiber
 - D). none of the above *
- 9). A regular telephone line can transmit up to
- A). 4.8K bps.
 - B). 22.8K bps.
 - C). 36K bps.
 - D). 56K bps *
- 10). A WAP protocol is a protocol between
- A). business to business ordering.
 - B). a mobile phone and Internet servers. * (WAP means wireless application protocol and is designed to support Modified HTML and mobile phone)
 - C). Netscape 4.6 and HTTP servers.
 - D). none of the above.
- 11). To obtain the organised information from the Internet, you would prefer to use the _____ service.
- A). Yahoo Search Engine
 - B). Specialised Portal *
 - C). one to four Search Engine.
 - D). any of the above.
- 12). To use QuickTime to see a clip video through the Internet, which of the following you need to concern with.
- A). data transmission rate *
 - B). contents of video clip
 - C). originality of the video clip

D). all of the above.

13). The procedure in which a computer checks terminals to determine whether a message is ready to be sent is called

- A). polling. *
- B). synchronization.
- C). contention.
- D). handshaking.

14). Which of the following is not a common-use communications protocol?

- A). XMODEM (Protocol for PC file transfer)
- B). M.15 *
- C). X.25 (Part of your City Link Plus)
- D). HTTP (HyperText Transfer Protocol)

15). Connectivity is an important concern with

- A). EFT. (Electronic Fund Transfer)
- B). EDI. (Electronic Data Interchange)
- C). e-commerce.
- D). All of the above.*

2 Tutorial Two

- 1). Data communications is constituted by what two major components.

Telecommunication + Computer

- 2). Give two reasons to explain why data communications is expected to dominate the IT market for the next five years.

1) covers wider area 2) share more resources

- 3). List **Two** requirements for a cluster network.

1) Single host or cluster hosts

2) load sharing amongst processor(s)

- 4). What are the advantages of having networks?

Share resources, share data and cover wider area

- 5). What is the technical difference between a loop and a ring network?

Loop: a point-to-point network. The data can either circulate in clock wise or anti clock wise direction.

Ring: Broadcast, send message(s) to all stations

- 6). List **two** different network type for point to point topology.

Star, Loop or Tree

- 7). List the **THREE** essential data communication components.

1) DTE: data terminating equipment (equipment to the DCE)

2) DCE: Data circuit equipment (the end of a network boundary such as the telephone jack.)

3) Data link: linking DTE and DCE

3 Tutorial Three

Short Questions

- 1). What is the maximum data rate for a voice-grade line with a bandwidth of 4K Hz and a S/N ratio of 10000 to 1?

$W \log_2 (1 + S/N) = 4 \times 10^3 (\log_{10} 10^4) / (\log_{10} 2) = 5.3 \times 10^4 \text{ bit/s}$

- 2). For the above question, what is the maximum data rate if the S/N ratio is now enhanced to 50 dB?

$50 \text{ dB} \rightarrow S/N = 10^5. \text{ Hence, the maximum data rate } 6.6 \times 10^4 \text{ bit/s}$

- 3). List an advantage and disadvantage for serial transmission.

Adv: extended distance (heoretically, can up to anywhere in the world)
Dis: Limited speed (up to 56K bps for regional use of 9600 bps for IDD use)

- 4). Briefly explain why a pair of modems is required to transmit the digital signals over a long telephone wire. (Why not a single modem?)

One to modulate the signal from digital to analog and the other reverse this process by converting from analog to digital signal so that they can be processed by computers.

- 5). How many frequencies are required for a 2-wire full duplex operation using frequency shift keying modulation (FSK)? (full duplex means capable of simultaneous transmission and reception.)

4: Tx : 2 and Rx : 2. For instance, Tx includes two frequencies to differentiate binary 0 or 1.

- 6). For the same question, how about the case for 4-wire full duplex? (A pair for transmission and another for reception. Think about why a pair (two cores) is needed for the transmission of signal, why not a core. Note that you cannot use a single core to transmit data. You should use two cores. One for signal and the other is for signal return.)

2 only as it can reuse the same frequencies using two different communication channels.

4 Tutorial Four

Short questions

- 1). A two-level signal having a baud rate of 50 symbols/second is now extended to 8 levels, what will be the new baud rate?

Same. There is no change.

- 2). A string of “**abc**bc**aaaa**ff**def**” is now transmitting to a remote computer using data compression. If ASCII is now used, what will be the total size in bits? Suggest a method to compress this string with lesser string size. (Hint : use a single bit for the majority characters and then more bits for less dominant characters.)

Use a single bit, before $14 \times 7 = 98$ now $5 \times 1 + 2 \times 3 + 1 \times 5 + 2 \times 4 + 1 \times 5 + 3 \times 2 = 36$
Improvement = $(98 - 36)/98 = 60\%$. The bit pattern is as follows:
Bit pattern: a (5 characters) 1 bit, b(2) : 3 bits, c(2) : 4 bits d(1) 5 bits, e(1) : 5 and f(3):2

- 3). A string of “**C**ITY**U**bbbbb**b**cccc**d**_____ff**gh**” is now transmitting, use a compression algorithm to reduce the transmission size with reference to “**C@#**” algorithm for the same character pattern. The first c refers to character, @ stands for the same character follows, # refers to the number of characters. (Hint : This is one of the methods used in FAX transmission.) Using this approach, what will be the new transmission pattern?

CITYUb@6c@5d@3 total characters: 14
original characters: 19

True or False

- 4). ENQ/ACK is commonly known as XON/XOFF (F)
- 5). A start bit is a space (T)
- 6). A space stands for +12 volts (T)
- 7). Synchronous transmission is known as start/stop transmission(F)
- 8). ASCII is designed not for data communications (F)
- 9). Modulation is not required for analog signal over voice network.(T)
- 10). Four-core modem is required for half duplex modem.(F)

5 Tutor Five

Short Questions

- 1). Find out the transmission bandwidth for a video signal, the width and height are 200 and 150 pixels respectively with 128 color patterns and 16 level intensities. Further assume that 25 frames per second is acceptable to the user.

Bandwidth: $200 \times 150 \times (7 + 4) \times 25 = 8.25 \times 10^6$ bits = 8.25M bytes per second.
--

- 2). Find out the above transmission bandwidth using the Real Video in the Netscape if the signal is now compressed using 150:1 algorithm. Determine the transmission bandwidth saved.

The bandwidth becomes 0.055M bps = 55K bps (That is played by the 56K bps modem) interesting?

- 3). If the speed of a modem operating at 56K bps is used to support a compressed voice channel, how many it can support?

The compressed voice is around 8K bps (mobile phone at 9600 bps). The number of voice channel is: 7 users.
--

- 4). If the above problem support a voice channel and graphics/text using IE Explorer, determine the remaining bandwidth for graphics/text usage.

The remaining graphics/text is $56 - 8 = 48$ K bps In fact that is untrue. A 56K bps modem means the downward stream (from server to your browser) is 56K bps while the upward stream (from browser to server) is still 33.6K bps. That is why on overage the transmission rate is around 44K to 48K bps while accessing CityU using city link plus.)
--

True or False

- 5). If KLN is used to replace Kowloon, the percentage save is 5/8. (T)
- 6). Private key is changed on regular basic.(T)
- 7). VCD uses MPG compression.(T)

6 Tutorial Six

- 1). Power stations are usually linked up with microwave for telemetry and voice communication, explain why several 100-pair underground cables are still required for several locations. (Think about contingency)

It is used for backup purpose. In case the microwave link is down, the system can still rely on the cable.
--

- 2). List **THREE** advantages and disadvantages of Frequency Division Multiplexing.

See lecture notes

True or False

- 3). Telephone wire can carry more data than a microwave link. (F)
- 4). Coaxial cable supports TV signals only (F) voice and data as well
- 5). Optical fiber is the most expensive communication medium. (T)
- 6). Point-to-point network configuration is only valid in terminal to host communication (F)
- 7). Multidrop configuration is designed to reduce the line cost for low volume traffic (T)
- 8). For band limited signal, a guard band is required for frequency division multiplexing.(T)
- 9). Cluster controller must be a pair between terminals and host.(F)
- 10). The widely used multiplexer makes use of time division multiplexing.(T)
- 11). External clock is not available in an asynchronous modem.(T)

7 Tutorial Seven

- 1). Match OSI seven layers in column A to the description/characteristics in column B. Each column in A may match a few columns in B.

	Column A		Column B
7	Application	A	Message flow control between end-to-end hosts(5)
6	Presentation	B	Compress and Decompress files (6)
5	Session	C	Frame sequencing checking(2)
4	Transport	D	Cyclic redundancy error detection (1) or (2)
3	Network	E	To be connected to a synchronous modem (1)
2	Data link	F	Manage host-to-host communication services (4)
1	Physical	G	Concerns with strings of bits (1)
		H	Addresses physical device in the network (2)
		I	Route the packet to targeted machine (3)
		J	Message segmentation and blocking (4)
		K	Convert ASC II into EBCDIC format (6)
		L	file transfer or Telnet (7)
		M	Manage message dialogue (5)
		N	Handle network congestion (3)
		O	Maintain a transmission error free environment (2)

8 Tutorial Eight

Short Questions

- 1). What is the function of the 150 ms turnaround time for a half duplex modem (ie. time difference between RTS and CTS going on)?

To provide sufficient time for the sender to inform the receiver that the channel is ready for data reception.

- 2). How to decide which communication device transmits the data first? (Host or modem)

Host (DTE) not the DCE(modem)

- 3). Explain why computer will not check the signal of Request To Send (RTS) for full duplex modem.

As two channels (Tx and Rx) are provided. No need to check the channel (for single channel only)

- 4). Explain why four specifications are needed to specify the requirements of the physical layer. Why not three specifications?

as it needs to check 1) physical : size, the same size 2) electrical: voltage level
3) functional: understand the pins functions for user to communicate 4) procedural: proper procedures to exchange data.

True or False

- 5). The RS-232-D is defined for asynchronous modem only. (F)
- 6). The maximum speed defined over the RS-449 is 10 Mbps.(T)
- 7). The maximum speed defined over the RS-232-D is 20 Kbps.(T) without modem
- 8). The advantage of using current loop is its higher speed. (F)
- 9). For full duplex IBM PC to IBM PC connection, at least four wires are required.(F, 3)
Remember the Semester A' S laboratory.

9 Tutorial Nine

BSC

1). How to ensure the message is not duplicated?

Use sequence number

2). How to ensure that the remote is not receiving the data correctly?

use ACK or NAK

3). How are frames delineated (to identify the frame) in BSC? (What character, PAD, STX, ETX...)

PAD

4). Use what method to fix the problem of duplicated frames? (sequence number, control characters, time-out)

Sequence number

5). What is the function of the EOT character?

End of Transmission (To indicate that this is the last frame)

True or False

6). The response to ACK is NAK. (F)

7). To delay for a while is TTD.(T)

8). To indicate this is the start of message is to send STX.(T)

10 Tutorial Ten

HDLC

- 1). List the **FOUR** types of supervisory frames.

RR, RNR, REJ and SREJ

- 2). List the **THREE** modes defined by HDLC.

Normal response mode, asynchronous response mode and asynchronous balance mode

- 3). What is the function of the F-bit for the frame from secondary node?

Indicate the last frame from secondary device

- 4). What is a problem of having a large window size for a machine supporting over 32 communication lines and frame size of 2K bytes? (Think about the buffer size for 32 lines with 7 frames)

Buffer problem: $2K \times 32 \times 7 = 448K$ (this is no longer a problem right now.)

True or False

- 5). UA is sent in response to DISC in Set Normal Response Mode. (T)
- 6). RNR is only used to respond to RR. (F)
- 7). Information frame must be responded by Receive Ready. (RR)(F can be I)
- 8). REJ is sent against all the invalid frames due to transmission error. (T)

11 Tutorial Eleven

True or False

- 1). Circuit switching is limited by the block size of message transmitted.(F)
- 2). CityU' s internal network consists of ATM switches operating at 625M bps.(T)
- 3). DataPak by Hong Kong Telecom is a packet switching network.(T)
- 4). FAX network is a message switching network. (F) circuit switching
- 5). Packet Switching is faster than message switching in terms of response time.(T)
- 6). A low-end machine has higher chance of having the problem of data congestion.(F)
- 7). Virtual circuit over datagram reduces the message re-sequencing loading of host.(T)

Short Questions

- 8). What is the disadvantage offered by flooding algorithm?

Reduce message lost, no need to configure machines

- 9). Explain why IBM/SNA uses static routing algorithm instead of dynamic routing.

There is a central host and various cluster controllers. Central host is used to store the routing information.

- 10). What is the meaning of hybrid in routing?

Combines fixed and adaptive

- 11). In what application you can apply the method of packet discarding?

packet can be updated later or less important (voice packet or video packet)

- 12). Assume that you talk to your friend over a digitized line, a random noise occurs and destroys a few packets. How would you expect to recover from the conversation?

Ask your friend to repeat (retransmit)

12 Tutorial Twelve

- 1). List the objectives of transport layer.

Maintain end to end communication across a network
--

- 2). Why there are a few class definition in transport layer?

Because of different network types and requirements: For example, voice (PSTN) and TCP/IP (data) is quite different. You allow the voice to be broken but the data network
--

- 3). If a machine is configured to support digitized voice, what type will be?

Type A

- 4). Using a pair of modems with error correction over a voice network, what is the type of this network?

Type B

- 5). Two PCs are connected together using Pro-Comm for file transfer. If one of them is configured as a x-modem protocol while the other is y-modem, what will be the outcome?

Incompatible, no transfer is allowed.

13 Tutorial Thirteen

1). What is bit error rate?

totally received error/totally transmitted data

2). Which loopback test verifies the whole information channel?

end to end test

3). What is the idea of local digital loopback?

to test the local link, local modem whether they are functional.

4). What is the function of PAD?

To convert dumb terminal (ASCII) into synchronous message format.

5). What do the following standards define? (invalid as it is about X.25 which was removed from the course)

V.24___define between terminal and modem_____

X.28___define between terminal and PAD_____

6). What are some advantages of X.25 packet switching networks?

reliable, as there is no need to worry about the data sent/received.

7). How to verify respective communication channels are working properly? (Using digital loopback, remote loopback.....)

by use of end to end test

8). List the components required to design a reliable network.

see lecture notes

9). List three redundancy methods and point out the cheapest method.

line, modem and computer. The cheapest is modem

True or False

10). X.25 defines the first two layers of the ISO model. (F)

11). X.28 defines the interface between the terminal and the Host. (F)

12). The data link layer of X.25 is SDLC only. (F)(HDLC)

13). X.25 defines the internal subnet protocols to include datagrams. (F, no such definition)

14 Tutorial Fourteen

This is last tutorial session. The following questions review what you have learnt in this course. That is why some are related to early chapters. The format of questions is close to the examination question.

- 1). Communication is defined as:
 - A). processing encoded information using computers
 - B). the change of electromagnetic signals
 - C). the transfer of information from one place to another*
 - D). electrical signals for physical layer

- 2). One of the following is not regarded as a point to point network topology.
 - A). Star
 - B). Ring*
 - C). Irregular
 - D). Tree

- 3). Select the **INCORRECT** statement about channel capacity. It is
 - A). related to the maximum data rate for a transmission medium
 - B). concerned with the quality of a communications channel
 - C). quantified by the bandwidth of transmission medium
 - D). measured in terms of decibels*

- 4). To code data is
 - A). to avoid the cross talk during transmission.
 - B). to increase the information transmission rate.*
 - C). to reduce the transmission error.
 - D). to reduce the computation error.

- 5). Half duplex in transmission channel is defined as:
 - A). Either party can send data to the other at the same time
 - B). Either party can send data to the other alternatively
 - C). Both parties can send and receive data, but not at the same time *
 - D). Only one party can send data to the other

- 6). One of the following statements about Asynchronous transmission is **INCORRECT**.
 - A). Data is transmitted as blocked.*
 - B). There is no synchronization between sender and receiver.
 - C). Data bit is guarded by start & stop bits.
 - D). The transmission speed is relatively lower than synchronous transmission.

- 7). Which of the following transmission media is immune from electromagnetic interference?
 - A). Category 3 shielded cable

- B). Optical fiber*
 - C). Coaxial cable
 - D). Category 5 twisted cable
- 8). One of the communications devices is operated manually and doesn't require any sophisticated software.
- A). PABX
 - B). Protocol converter
 - C). Patch panel*
 - D). Hub
- 9). Bit stuffing in HDLC is used to
- A). increase line utilization.
 - B). avoid the occurrence of a flag bit pattern. *
 - C). detect an occurrence of an error.
 - D). reject an incorrect information message.
- 10). Choose the **INCORRECT** statement about network management.
- A). To monitor the network's performance
 - B). To validate the quality of communications software*
 - C). To diagnose faults
 - D). To reconfigure the network in the event of failure
- 11). Select an **INVALID** statement about HDLC operation
- A). To disconnect a link is to issue **DISC**
 - B). To reject a corrupted frame is to send UA *
 - C). To initialize a link is to issue SNRM for normal response mode
 - D). To acknowledge an Information frame is to send RR
- 12). The following conditions will produce a FRMR except
- A). A supervisory frame with data
 - B). Information field not a multiple of 8 bits
 - C). An unnumbered frame with bad FCS*
 - D). An unnumbered frame with 2 bytes of data
- 13). The function of **EOT** in BSC is to
- A). notify the receiver that this is the last message
 - B). indicate that the data transfer action is complete *
 - C). indicate that this is the end text
 - D). initialize the data transfer
- 14). Switching techniques include all except
- A). Circuit switching

- B). Cell switching
 - C). Packet switching
 - D). Telephone switching *
- 15). One of the following is not a characteristic of circuit switching
- A). Connection is dedicated
 - B). Circuit set-up time is relatively large
 - C). Charging is usually based on distance/connect time
 - D). not ideal for bursty traffic *
- 16). The following are characteristics of **packet switching** except one of them. Which?
- A). Caters for different line speed
 - B). Delay is lower than circuit switching *
 - C). Greater line efficiency
 - D). is the most popular method in Internet
- 17). One of the following is not a method of controlling the congestion
- A). Preallocation
 - B). Discarding
 - C). Flow control
 - D). enhancing the computation power*
- 18). X.25 defines only the following layer(s) *invalid
- 1). Physical layer
 - 2). Data link layer
 - 3). Network layer
- A). 1 only
 - B). 2 and 3 only
 - C). 1 and 3 only
 - D). All of them *
- 19). To terminate an established X.25 circuit is to
- A). send a disconnection request*
 - B). send a clear request packet
 - C). send a disconnection frame
 - D). send a clear confirmation packet
- 20). Which of the following statistics is usually collected per line basis EXCEPT
- A). Messages in/out
 - B). Number of retries
 - C). Polls sent

D). terminal utilization *

21). One of the following is not a goal of datacommunication testing.

- A). Increase system availability
- B). Minimize system down time
- C). Isolate the failing component
- D). Test the communication software quality*

22). Select the **CORRECT** statement about remote digital loopback

- 1). It is used to test the remote modem
- 2). It is used to test the local modem
- 3). It is used to test the data link

- A). 1 only
- B). 2 and 3 only
- C). 1 and 3 only
- D). All of them *