DeVRY UNIVERSITY
DATA AND FIBER OPTIC TELECOMMUNICATIONS ECT215
Spring 2005

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                (Use the ECT215 shortcut.)

TEXT: Wheeler, <u>Electronic Communications for Technicians</u> - Prentice Hall
CREDIT HOURS: 4.0

Major topics covered:

I.   Network topologies - Fiber Optics - Digital Modulation - Noise Effects - Serial Data
     Formats

II. Asynchronous/Synchronous Communication - UARTs - Serial interfacing: RS232D
     Standard

III. Error Checking and Correction - Layer 2 Protocol - Networking Fundamentals - PSTN
     architecture

This course addresses data communications concepts, network devices, and topologies. The
basics of the public switched telephone network (PSTN) and digital switching are included.
Fiber-optic systems are covered with a focus on system-level testing and troubleshooting.

ATTENDANCE

Daily class attendance is required. *You are responsible for the material presented in all class
sessions, regardless of your presence or absence*. <u>Absence of more than 8 class sessions is
cause for dismissal from the course, with a grade of F</u>. You are expected to be on time for
every class meeting. If you will not be able to make it to class on time, please call the
instructor in advance to make arrangements.

HOMEWORK

Homework is due at the beginning of class (xx00 UTC). *Late homework is not accepted for
any reason*. Homework carries the weight of one major exam (100 points) in the course.
Failure to do homework will do severe damage to your grade. (UTC=Universal Coordinated
Time, or Standard World Time.)

Homework Performance Standards

- For problems involving calculations, <u>all work must be shown</u>. If a numerical answer is obtained without doing a calculation, state clearly that this is the case. For example: "By inspection, the potential is <u>25 Volts</u>."

- When showing work for numerical problems, all defining equations will be stated first. The last step in the problem will be substitution of values into the equations. For example:

  Given V = 20V and R = 5 Ohms, find the current I.

  $$I = \frac{V}{R}$$ (Comment: The defining equation, Ohm's law, is stated.)

  $$I = \frac{20V}{5\Omega} = \underline{\underline{4A}}$$ (Comment: Note that units are clearly displayed for the answer.)

- When a numerical answer is given, it must be <u>boxed</u> or <u>underlined</u> and have <u>correct units</u> attached.

- No credit will be given for any problems that have not been worked according to these instructions, or any additional instructions given by the instructor.

- The homework solutions are intended as an example of proper work. You can access them from the instructor's web site.

GRADING

There are 3 major exams, an unspecified number of quizzes given at random intervals, various homework assignments, labs, and a final examination given in the 15th week of the course. Your grade will be determined as follows:

2 Best Major Exams @ 100 points each:	200 points	(Sum of two best test scores)
Labs	100 points	(A percentage)
Quizzes / Homework	100 points	(A percentage)
Final Exam (Comprehensive):	<u>150 points</u>	
	550 points total for course	

Note: The lowest of the three major exams is "dropped" and does not count in the final grade calculation. No makeup exams are given. All examinations will be announced at least 1 week prior to administration. All students must take the final exam. <u>A passing grade in lecture and laboratory is necessary in order to pass the course</u>.

DETERMINATION OF LETTER GRADE FOR THIS COURSE

90 - 100 % = A   80 - 89 % = B   70 - 79 % = C   60 - 69 % = D

<60 % = F

PLAGIARISM AND OTHER FORMS OF CHEATING

Copying the work of another, and claiming it to be your own is <u>plagiarism</u>. This includes (but is not limited to) copying others homework, copying from a lab manual or textbook, or collusion. The minimum penalty for cheating in any form is a grade of zero for the element involved; in some cases, failure of the course and/or expulsion from the Institute will also result. *All cases of misconduct will be documented and forwarded to Student Services for disciplinary consideration*. The DeVry Student Handbook contains complete information on this topic.

MISCELLANEOUS INFORMATION

EMERGENCY PROCEDURES - Each classroom has a plaque (located near the door) with instructions for evacuation in the event of an emergency. The instructor will remain in charge of your class group should the situation arise.

FOOD or DRINK are not allowed in the classrooms and labs at DeVry.

<u>ECT-215 Tentative Lesson Plan Outline</u>

Topic	Textbook Reading Assignment
Digital Data System	Chapter 14 pp. 503-509
Networks	Chapter 14 pp. 509-516
Modems/Digital Modulation	Chapter 14 pp. 517-533
Fiber Optics	Chapter 16 pp. 611-652
(Exam #1)	
Serial Data Formatting	Chapter 14 pp. 533-540
UART Operation (HD-6402)	Chapter 14 pp. 540-549
RS232D Standard	Chapter 14 pp. 556-561
OSI Model	Chapter 14 pp. 562-565
(Exam #2)	
Error Checking & Correction	Chapter 14 pp. 549-555
	Handout "Error Detection Methods"
Layer 2 Protocol:	
BISYNC,HDLC/SDLC	Handout
(Exam #3)	
LAN/WAN Introduction	Handout
Networking Hardware	Handout
Internet Basics	Chapter 14 pp. 565-569
IP Addressing & Subnets	Handout, "Networking Fundamentals"

ECT-215 Homeworks

Number	Description
1	Chapter 14 problems 1-29
2	Chapter 16 problems 1-15,17-20,35-39
3	Chapter 14 problems 30-38,44-47
4	Syllabus content: HOMEWORK 4: ERROR DETECTION & CORRECTION
5	Syllabus content: HOMEWORK 5: DATA LINK PROTOCOLS
6	Syllabus content: HOMEWORK 6: IP ADDRESSING

OBJECTIVES FOR ECT215 DIGITAL/DATA COMMUNICATIONS

1. Given the block-diagram of a baseband data communications system, describe the function of each block, identify if it is half or full duplex, and identify if it is asynchronous or synchronous.

2. Given the 7-layer stack of the ISO-OSI model, describe briefly the function of each layer and the flow of information through the layers.

3. Given the block diagram of an Ethernet type Local Area Network that includes repeaters, bridges, and routers, analyze and describe the role of each block in the network.

4. Given a specific application (voice or LAN), draw a simple premise-wiring plan showing both horizontal and vertical wiring, hubs, etc. Specify the appropriate category of cable.

5. Compare and contrast sources of noise in a data communications system and their differing impacts on system performance, including "burst" noise and "random" noise.

6. Using a written narrative and appropriate sketches, compare and contrast the use of ARQ in half duplex to its use in full duplex.

7. Given the frequency range of a baseband signal, determine an appropriate sampling rate.

8. Compare and contrast fiber-optic lines to copper lines in terms of signals, bandwidth, speed, connectorization, and splicing.

9. Given a loss-budget along with the costs and specifications of various types of connectors, splices, and cables, determine the most cost-effective fiber-optic cabling system that meets the specification for loss.

10. Given requirements for a fiber-optic link, determine the most cost-effective E/O an O/E methods.

11. Given a layer-2 protocol (e.g. HDLC), identify and describe its functionality in terms of framing, flow-control, and link control.

12. Compare and contrast circuit-switching to packet-switching in the PSTN system in terms of the fixed plant required, the quality of service, and the cost.

ECT215 Digital/Data Communications
              HOMEWORK # 4: ERROR DETECTION AND CORRECTION

1. Define the following terms:

    (a) Data Block
    (b) BCC
    (c) LRC
    (d) Redundancy (what does it have to do with error detection?)
    (e) Lateral Parity
    (f) Longitudinal Parity
    (g) Checksum
    (h) Cyclic Redundancy Check
    (i) Forward Error Correction (FEC)
    (j) ACK
    (k) NAK

2. What is the primary difference between an ERROR DETECTING and a
   FORWARD ERROR DETECTING system?

3. What is the advantage of a 2's complement checksum over a standard
   or "normal" checksum?

4. Calculate a normal 8-bit checksum for the following message:
   "I THINK HOMER IS OK."

   The Quote (") marks are NOT part of the data. Don't forget the
   spaces, which have a value of 20H!

   EXPRESS IN HEXADECIMAL. SHOW ALL WORK.

5. Repeat exercise 4, but use EVEN LONGITUDINAL PARITY; FORM AN 8-BIT
BCC.

   EXPRESS IN HEXADECIMAL. SHOW ALL WORK.

6. A CRC system has the following generator polynomial:

          3
   G(x) = X +   X   +   1

   (a) How long will the BCC be, in bits?
   (b) Calculate the BCC for data A5H.
   (c) Calculate the BCC for data E7H.

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│ You can use the program "Checksum.exe" from the instructor's web │
│ site to check your work on problems 4 and 5.   │
└───┘

1. Given: STANDARD SELECT, IBM 3270 PROTOCOL
         POLL LIST = { 4,1,3,2 }

         HOST WANTS TO SAY "GO JUMP IN THE LAKE" TO TERMINAL #4
         TERMINAL #1 HAS NOTHING TO SAY
         TERMINAL #2 WANTS TO SAY "THANKS FOR THE LUNCH"
         TERMINAL #3 HAS NOTHING TO SAY
         TERMINAL #4 WANTS TO SAY "YOU'RE A MUD FARMER" TO THE HOST

   Draw: An action diagram showing all messages that would be sent on
the multi-drop network. Use "P" for Poll and "S" for Select.

   Use a straightedge when making the diagram - draw neatly.

2. Two host systems are connected using 3270 on a point-to-point
network. The following events are scheduled for each host:

KC HOST: EVENT @ 14:00. Three message blocks will need to be sent:

Block 1: "THIS IS LINE 1"
Block 2: "THIS IS LINE 2"
Block 3: "THIS IS THE LAST LINE"

LA HOST: EVENT @ 13:55. A single message block needs to be sent:

Block 1: "WE'RE SERIOUS ABOUT DONUTS"

3. List the three types of HDLC data blocks, and give the purpose of
   each one.

4. Draw the structure of an information frame, using block notation.

5. Which part of the HDLC frame structure identifies the frame type?

6. An HDLC transmitter sends frames numbered 2,3,4. The receiver
   responds with an S-frame with NR=4. Explain the meaning of this
   transaction, and state what will happen *next* on the network.

7. What are "outstanding" frames? How many are allowed under HDLC?
   What is the advantage of windowing when compared to simpler protocol
   such as IBM-3270?

1. Define the term "network."

2. What are the two parts of an IP address?

3. In the notation "208.128.98.254 / 24", what is the value of the subnet mask in:
    a) Binary
    b) Hex
    c) Decimal

4. Identify the network and host addresses in the following. Give your answers in decimal:

    a) 24.236.11.8 / 16
    b) 208.128.98.1 / 24
    c) 240.0.0.1 / 28

5. What are "unroutable" IP address blocks used for?

6. What is the function of a gateway on a network?

7. Explain how a host determines whether it will send packets directly to another host on the network, or the gateway.

8. What is the function of a router?

9. What is the difference between UDP and TCP?

10. Issue the following command from a COMMAND window under either UNIX or WINDOWS:

    ```
    ping localhost
    ```

    Copy the result (use the clipboard to paste it into your homework) and <u>comment on what happened</u>.

11. Issue the following command from a COMMAND window under either UNIX or WINDOWS:

    ```
    ping microsoft.com
    ```

    Copy the result (use the clipboard to paste it into your homework) and <u>comment on what happened</u>.

12. Issue the following command from a COMMAND window under WINDOWS:

    ```
    tracert yahoo.com -d
    ```

    The "-d" switch prevents *traceroute* from performing a name lookup on each host, which speeds up the process. Copy the result (use the clipboard to paste it into your homework) and <u>comment on what happened</u>.