# INT478E:
# Network Architecture and Data Communications I
# Midterm Exam Three

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* You have 50 minutes for this exam.
* YOU MUST SHOW YOUR WORK.
* Include the units for numerical answers.
* Indicate your answers by underlining them or  circling  them.
* This exam is open book and open notes.
* You may use a calculator.
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**Name:** _____ [5 points]

Useful Information:

| | |
|---|---|
| $B = f_{max} - f_{min}$ | 10^15     peta     P |
| $M = L = 2^n$ | 10^12     tera     T |
| $R = rn$ | 10^9     giga     G |
| bit time $= 1/R$ | 10^6     mega     M |
| | 10^3     kilo     k |
| $T = 1/f$ | 10^0 |
| X in dB $= 10 \log(X)$ | 10^-1     deci     d |
| $C = 2B \log_2(1 + S/N)-$ | 10^-2     centi     c |
| $Y = A \sin(2\pi f + \phi)$ | 10^-3     mili     m |
| | 10^-6     micro     $\mu$ |
| $SNR = 10 \log(S/N)$ | 10^-9     nano     n |
| $\log_n(x) = \log_{10}(x)/\log_{10}(n)$ | 10^-12     pico     p |
| | 10^-15     femto     f |

$$\%overhead = \frac{non\text{-}info\ bits}{total\ bits}$$

$$\%throughput = \frac{info\ bits}{total\ bits}$$

Time to travel from a to b:
t1 = distance / velocity

Time to put bits on a line:
t2 = number of bits / data rate

Total time of transmission:
t = t1 + t2

1.  [15 points] Clearly define (explain the meaning of)
**three** of the following:

| | |
|---|---|
| a.  Packet Switching | g.  Least Cost Routing |
| b.  Circuit Switching | h.  A Reliable Transmission Protocol |
| c.  DLCI | i.  Virtual Call |
| d.  Flooding | j.  Permanent Virtual Circuit |
| e.  Adaptive Routing | k.  BECN |
| f.  Hop count | l.  CIR |

A)  _____

B)  _____

C)  _____

2.  [15 points] Compare and contrast X.25 with Frame Relay?

3. [10 points] Draw an X.25 packet and label the fields. Your packet should be an information packet, not a control packet.  Draw the packet as it exists at level three (not level two).  Use 7-bit sequence numbers in your packet.

4. [6 points] What are the advantages of using a packet switched network instead of a circuit switched network?

5. [10 points] Using a 1.544 mega bit per second satellite link, with 27,500 km between transmitter (base station) and receiver (satellite), how much time passes from the beginning of transmission until the end of reception for a 63,999 byte packet?

More useful info:
- 8 bits = 1 byte
- 1000 m = 1 km
- your signal travels at 2.75 x 10^8 meters per second

Use the following diagram for questions six and seven.
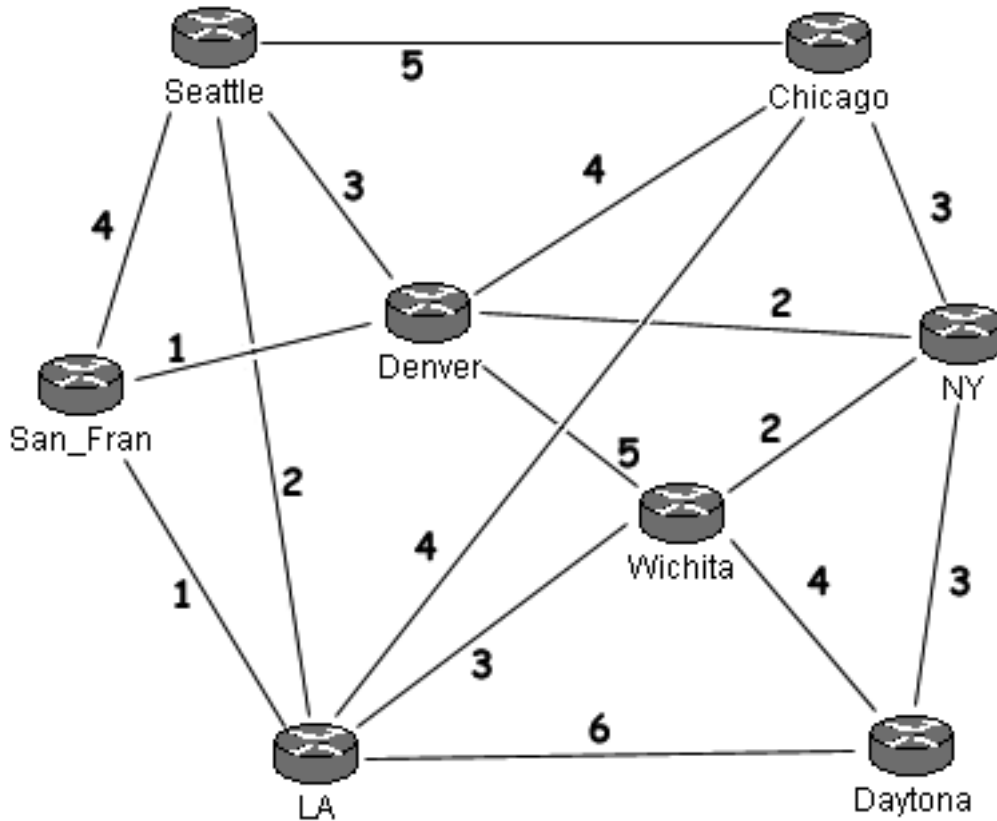


6. [4 points] What is the least cost path for the following connections:

A) Seattle to Wichita

B) Daytona to Denver

C) NY to LA

D) The link between LA and Chicago fails.  Now what is the least cost route between LA and Chicago?


7. [5 points] Traffic from Denver, heading to LA, is creating congestion in San_Fran. San_Fran raises the cost of the link to LA to prevent this.  At what cost must San_Fran set this link, so that Denver traffic does not pass through San_Fran?

8. [5 points] How is flow control handled at layers 2 and 3 in the X.25 protocol suite?

9. [6 points] What transmission methods take advantage of the following protocols?  Also, identify what layer of the OSI model each of the following operates at.

A) LAP-D:  layer _____

B) LAP-F:  layer _____

C) LAP-B:  layer _____

10. [5 points] Which would you rather use, an X.25 connection or a Frame Relay connection, and why?

11. [8  points] Match the items on the left with items on the right as they relate to Frame Relay.

| | |
|---|---|
| A) This frame passed through congestion | 1) _____ Received a frame with BECN bit set to 1 |
| B) Reduce transmission rate | 2) _____ Implicit congestion notification |
| C) System determines that congestion is in network because of frame loss | 3) _____ Received a frame with the FECN bit set to 1 |
| D) DE bit set to 1 | 4) _____ Exceeded the CIR |

12. [6 points] Describe an ISDN Basic Rate Interface (BRI) connection.