Name: ____________________
Are you a graduate student ____ or an undergraduate student ____

Department of Computer Science & Engineering
Wright State University

CEG 402/602 Winter 2003 Final

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<tr>
<th>PROBLEM</th>
<th>POINTS</th>
<th>SCORE</th>
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<td>TOTAL</td>
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Instructions:

2. Answer the questions to the point but succinctly.
3. Show all your work carefully for both full and partial credits.
4. Write clearly. Illegible writing will not be given credits.
5. You will be given credits only for what appears on your exam.

PLEDGE: No aid given, received, or observed.

Signature: ______________________________
1. (25 points, 5 points each)  **Briefly** answer the following questions:
   a. Describe why an application developer may choose to run an application over UDP rather than TCP. Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so, how?

   b. Why does UDP even exist? Would it not have been enough to just let user processes send IP packets?

   c. Are there any circumstances when connection-oriented service will deliver packets out of order? Explain.
d. Both UDP and TCP use port numbers to identify the destination entity when delivering a message. Give two reasons for why these protocols invented a new abstract ID (port numbers), instead of using process IDs, which already existed when these protocols were designed.

e. In Selective Repeat protocol, if the receiver receives a packet with sequence number in \([\text{rcv\_base-N}, \text{rcv\_base-1}]\), what is the proper action that should be taken and why?

f. Find an example of a pattern of six errors that cannot be detected by the use of horizontal and vertical parity checks.

2. (10 points) A large number of consecutive IP addresses are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request 4000, 2000, 4000, and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the \(w.x.y.z/s\) notation.
3. (20 points) Suppose nodes A and B are on the same 10Mbps Ethernet segment, and the propagation delay between the two nodes is 22.5 usec.
   a. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not?
   b. Suppose A and B send frames at the same time, the frame collide, and then A and B choose different values of $K$ in the CSMA/CD algorithm. Assuming no other nodes are active, can the retransmissions from A and B collide? Why or why not?
4. (10 points) A TCP machine is sending full windows of 65,535 bytes over a 1-Gbps channel that has a 10-msec one-way delay.
   a. What is the maximum throughput achievable?
   b. What is the line utilization?

5. (10 points) Use the Dijkstra’s algorithm to find the least cost paths from node A to all other nodes and their corresponding path costs in the network. Show all steps to get credits.