# CSCI 604

# Unit 2

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| Teacher: | George Rudolph |  |
| Subject: | Networking, Internetworking, Interprocess Communication |  |
| Objective 1: | Understand the underlying networks’ characteristics that impact distributed computing |  |
| Objective 2: | Understand addressing, routing and various protocols layered upon the internet |  |
| Objective 3: | Understand the characteristics of protocols for communication between distributed processes |  |

Some problems are borrowed or adapted from your text.

## C Level Maximum 50 points

1. Make flash cards of on key terms in Networking, Internetworking and Interprocess Communication. (10 pts)
2. Describe the OSI network stack. (5 pts)
3. Illustrate the structure of an TCP/IP packet and a UDP packet. (5 pts)
4. Describe the structure of an HTTP header, and show what happens when a browser successfully requests a page from a web server. (5 pts)
5. What is a mime type? What is it used for? (5pts)
6. Describe and illustrate the SSH protocol. (5 pts)
7. Illustrate a scenario that shows how it possible for a sequence of packets to get out of order when going across a WAN. Also illustrate why this cannot happen in a LAN. (10pts)
8. Two flow control algorithms mentioned in your text are (Clark, 1982) and (Nagle, 1982). Write pseudocode for each algorithm on a flyer that you create. (10pts)
9. Draw a picture illustrating how a device translates a symbolic name (such as a URL) to an IP Address and then to an Ethernet Address. (5pts)
10. Figure 3.7 in your text shows a WAN. Figure 3.8 shows routing tables for each of the nodes in the WAN. Show the sequence of changes to the routing tables that will occur after link 3 is broken. (10pts)
11. List 5 “Principles” of networking (5pts)
12. List three technologies for external data representation and marshaling data. With each one, show an example message. (10pts)
13. Sun XDR aligns each primitive value on a 4-byte boundary. CORBA CDR aligns a primitive value of size n on an n-byte boundary. Illustrate this and outline the trade-offs in choosing the sizes occupied by primitive values. (10pts)
14. Devise a scenario in which multicasts sent by different are delivered to two group members in different orders. Assume that some form of retransmission is in use. Messages that are not dropped arrive in order.  
    How can recipients remedy the situation? (10 pts)
15. As discussed in section 4.6, MPI offers variants of a send operation, which assumes that the reader is ready to receive at the time a message is sent. What optimizations are possible if this assumption is correct? What are the repercussions if this assumption is false? (10 pts)
16. Create a flyer that highlights the features and advantages of an overlay network. Include example software that uses overlay networks. (5 pts)
17. Draw a poster illustrating the architecture and usage of Skype, as described in your text. (10pts)

## B Level 15 points—Choose Two

Typically, you will write a lab report for these items.

1. Write and demonstrate a (distributed) program that computes and reports the latency and data transfer rate between two computers that you have access to on an internet. This could be two computers at home, borrowing a friend’s laptop, computers in a lab, etc.
2. A client sends a 200 byte request message to a service, which produces a response containing 5000 bytes. Write and demonstrate a program that measures the total time required to complete the request/response in each of the following cases:
   1. Using connectionless datagram communication, such as UDP.
   2. Using a connection, such as TCP/IP.
   3. When the server and client are on the same machine.
3. The programs in Figures 4.5 and 4.6 are available at [www.cdk5.net/ipc](http://www.cdk5.net/ipc). Modify them so that the client repeatedly takes a line of user input and writes to a stream, the server reads from the stream and prints out the result of each read.
4. Write an algorithm in pseudocode to describe the serialization procedure described in section 4.3.2 of your text. The algorithm should show when handles are defined or substituted for classes and instances. Describe the serialized form that your algorithm would produce when serializing an instance of the following class *Couple.*

*class Couple implements Seralizable {*

*private Person one;*

*private Person two;*

*public Couple (Person a, Person b) {*

*one = a;*

*two = b;*

*}*

*}*

## A Level 20 points—Choose One

1. Compare connectionless UDP and connected TCP/IP communication for implementing each of the following protocols. No code is required in answering this question.
   1. Virtual/remote terminal access
   2. FTP
   3. User location/finger
   4. Browsing/HTTP
   5. RPC

In each case, which do you think is better? (Research hint: Look for papers that discuss these protocols and their design. You do not have to have references that discuss each one.)

1. Binary data cannot be represented in XML directly. Explain why not. Describe how binary data is handled in a system that uses XML messages. Do you think this is a serious limitation?
2. Compare Google Hangouts and Skype (Skype as described in your text), focusing on their respective system models. Which do you think is better?

F: < 60 D: < 70 C: < 80 B: < 90 A: >= 90