

# CSE-556 Internetworking Fall 2002

## Laboratory Assignment 3

### Objective

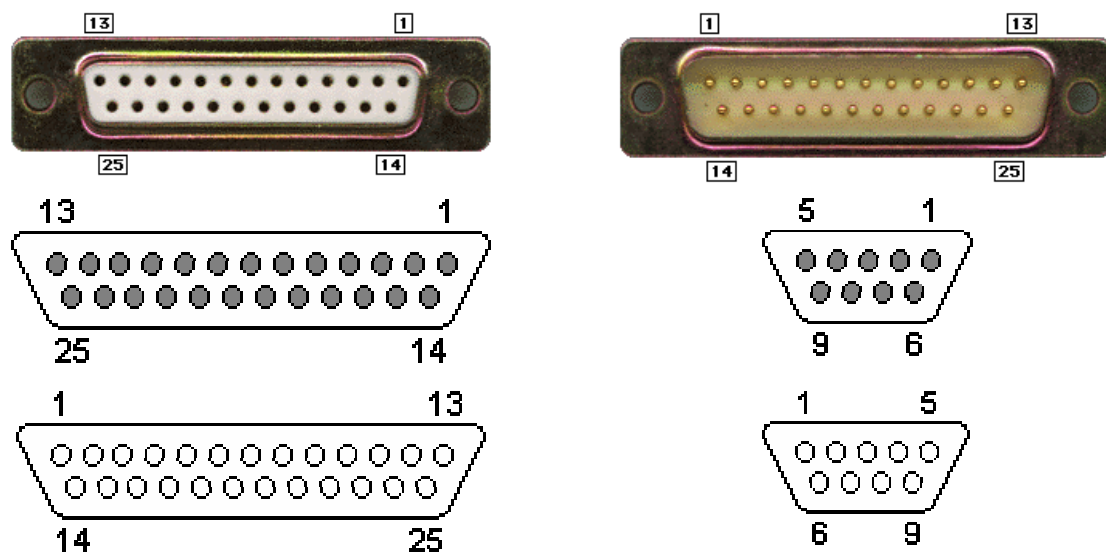
The objective of this Laboratory Assignment is to get familiar with networking cables by making an RS-232 Null Modem Cable and 10/100BaseT Ethernet Crossover Cable.

### Theory

Cables and connectors are part of the physical layer of a network. Various standards exist for use in different types of networks and connecting various networking devices with each other. Two commonly used physical layer standards are the RS-232 interface and 10BaseT physical layer for the Ethernet local area network.

### RS-232 Standard and DB9/25 Connectors

In Personal Computers the serial ports on the PC (COM 1 and COM 2) are based in the RS-232 standard. RS-232 specifies the interface between ports on a DTE and DCE. Normally these ports use DB9 and DB25 type connectors. These are shown in the figure below:



### The Null Modem Cable

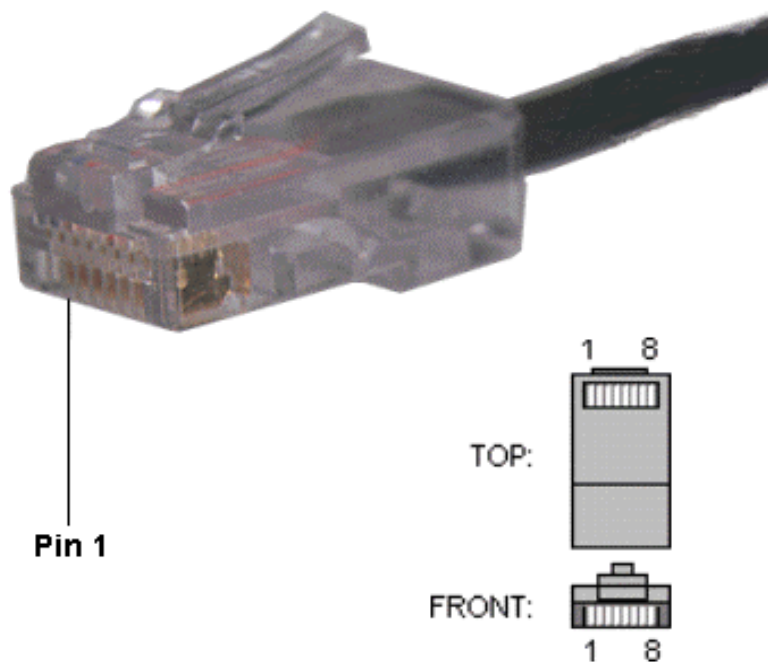
The purpose of a null-modem cable is to permit two RS-232 "DTE" devices to communicate with each other without modems or other communication devices (i.e., "DCE"s) between them. To achieve this, the most obvious connection is that the TD signal of one device must be connected to the RD input of the other device (and vice versa). Also, however, many DTE devices use other RS-232 pins for out-of-band (i.e., "hardware") flow control. One of the most common schemes is for the DTE (the PC) to assert the RTS signal if it is ready to receive data (yes, it DOES sound backwards, but that's how it works), and for the DCE (the modem) to assert CTS when it is able to accept data. By connecting the RTS pin of one DTE to the CTS pin of the other DTE, we can simulate this handshake.

Also, it is common convention for many DTE devices to assert the DTR signal when they are powered on, and for many DCE devices to assert the DSR signal when they are powered on, and to assert the CD signal when they are connected. By connecting the DTR signal of one DTE to both the CD and DSR inputs of the other DTE (and vice versa), we are able to trick each DTE into thinking that it is connected to a DCE that is powered up and online. As a general rule, the Ring Indicate (RI) signal is not passed through a null-modem connection. RS-232 signals used in Null Modem connection are shown in the table below:

|                           | 25 Pin | 9 Pin |   | 9 Pin | 25 Pin |     |
|---------------------------|--------|-------|---|-------|--------|-----|
| FG (Frame Ground)         | 1      | -     | X | -     | 1      | FG  |
| TD (Transmit Data)        | 2      | 3     | - | 2     | 3      | RD  |
| RD (Receive Data)         | 3      | 2     | - | 3     | 2      | TD  |
| RTS (Request To Send)     | 4      | 7     | - | 8     | 5      | CTS |
| CTS (Clear To Send)       | 5      | 8     | - | 7     | 4      | RTS |
| SG (Signal Ground)        | 7      | 5     | - | 5     | 7      | SG  |
| DSR (Data Set Ready)      | 6      | 6     | - | 4     | 20     | DTR |
| DTR (Data Terminal Ready) | 20     | 4     | - | 6     | 6      | DSR |

### 10BaseT Standard and RJ45 Connectors

The RJ-45 connector is commonly used for network cabling and for telephony applications. It's also used for serial connections in special cases. RJ45 Connector is shown in the figure below:



## The Crossover Cable

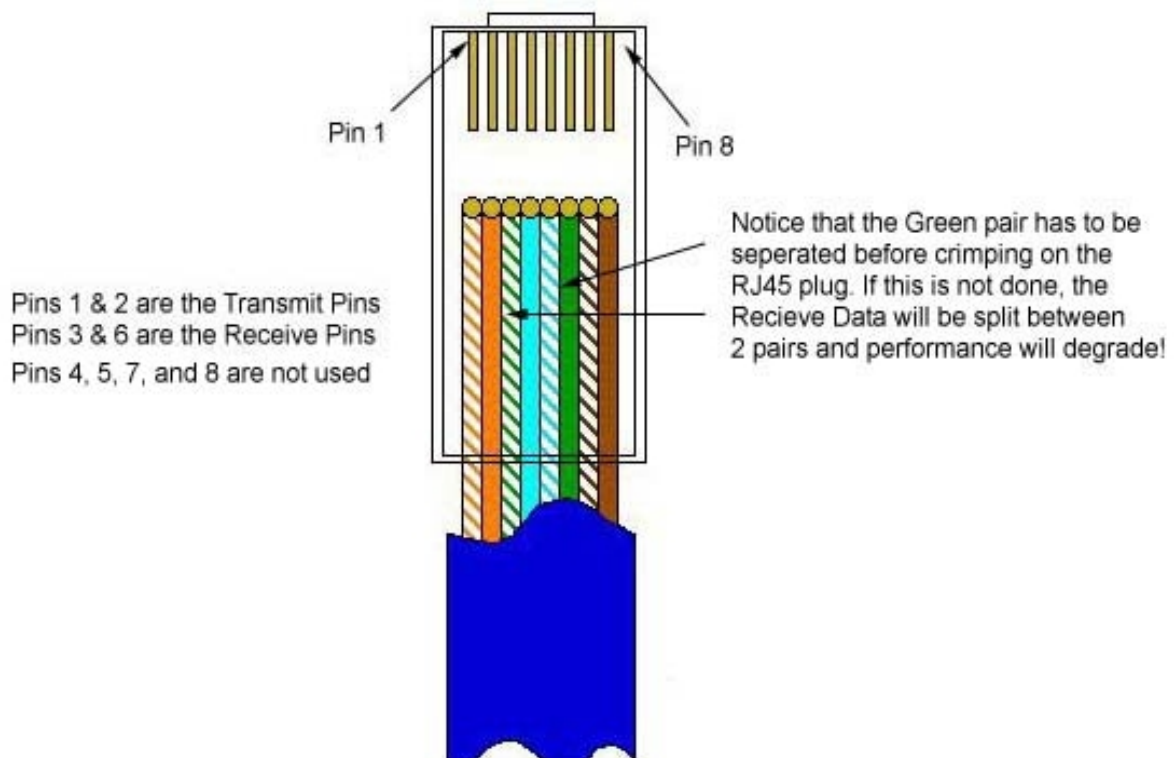
In general, the patch cords that you use with your Ethernet connections are "straight-through", which means that pin 1 of the plug on one end is connected to pin 1 of the plug on the other end. In this particular case it is not then important to wire them as above. Pin 1 is Pin 1 etc. However for the sake of uniformity it may be best to wire your cables with the same color sequence.

Cross-Over cables are "crossed" end to end data cables aren't. If you have a network hub that has an uplink port on it then you do not need to make (or purchase a cross-over cable). Just switch the port on the hub to the 'uplink' mode.

If your hub does not have an 'uplink' port on it then the only way to cascade another hub or attach a cable modem is to use a cross-over cable. It helps for future reference to mark or attach a tag to the cross-over cable so that you do not attempt to use it as a 'normal' patch lead at some time in the future.

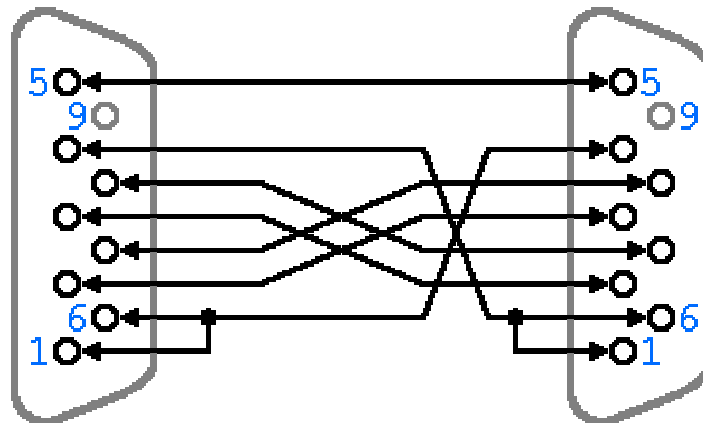
Please note that it is very important that a single pair be used for pins 3 and 6. If one conductor from one pair is used for pin 3 and a conductor from another pair is used for pin 6, performance will degrade.

The normal connections for the RJ45 connector for use in Ethernet are shown in the figure below:



## Lab Assignment

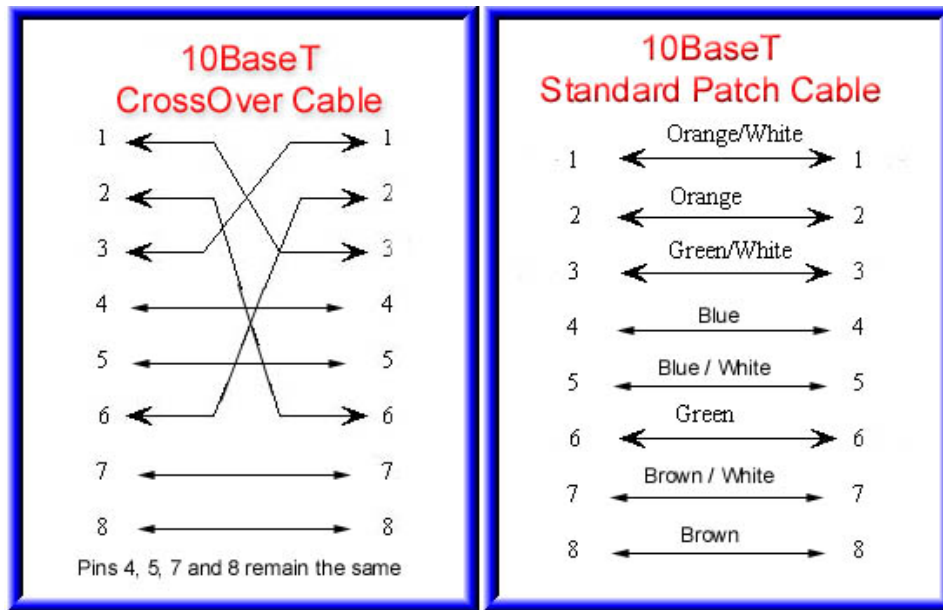
1. Make a RS-232 Null Modem Cable using the pin-out shown below:



Use DB-9 female connectors at both ends. Test your cable using a DMM.

Describe below the steps you undertook to achieve this task.

2. Make a 10BaseT Ethernet Crossover cables using the pin-out shown in the figure below:



Test your cables using a Cable Tester.

Describe below the steps you undertook to achieve this task.