How to Set Up a Wireless Network

How to configure a wireless network for a computer science programming contest using PC^2

Checklist:

The procedure to set up a wireless network is not difficult at all. The following are things you will need to buy or to understand to build a network:

- Purchase a wireless router (no cable modem needed)
- Purchase a switch with at least 8 ports, preferably 16 ports
- Select the computer where you are going to install PC^2 and purchase or get Ethernet cables from your IT department to connect this computer, the wireless router, and judges computer(s) to the switch
- Have a laptop or some other computer with wireless capabilities handy to test the network
- Understand what an IP address is and be able to manually assign an IP address to the computer with PC^2 on it
- Very basic understanding of what a DHCP server is and its purpose
- Electricity for all of the computers and devices used in the contest which includes all of the computers teams bring along with enough plugs for their monitors and printers. (Allow two plugs per team and if they need more they should bring their own power strip)

Choosing a Wireless Router

There are many brands of wireless routers on the market. The concern is to find one with at least the wireless "n" standard which is more than adequate for the type of network being created. It needs to have a built in DHCP server capability. The router should have four or more Ethernet ports. Most suitable brands and models of the type router needed for this network will have four Ethernet ports. There is no need for a cable modem! The network being built is a stand-alone network with no external connections. Do not purchase a router/cable-modem combo, but instead you will need to purchase a router/switch combo.

Cisco Linksys E3000 Wireless Router

For illustration purposes, a Cisco Linksys E3000 wireless router/switch is typical of what you are seeking. Other suitable Linksys routers include the E1200-NP, E2500, and EA6200 models. Netgear also makes several suitable models as well.

Cisco Linksys E3000 Wireless Router

Notice on the back there are 4 (blue) Ethernet ports (the switch part of the router) along with a yellow port labeled "Internet". You will not be using the Internet port except maybe for initial access to the device according to the setup instructions that come with the router.

Initial setup

Follow the directions that come with the router to gain programming access to it. In the case of the E3000, it comes with a cd (or a downloadable version of the software from the Internet) that installs a program called Cisco Connect. Following the instructions, it automatically detects and sets the router up with basic information. It will ask for a network "SSID", which is simply a name you assign to the network, along with an administrative password for advanced setup access.

Initial setup (cont.)

Once the device has the basic settings installed then access the advanced setup area. A browser, such as Internet Explorer, is used to connect to the E3000 as instructed. Once the SSID and password you set up are entered into the login area, it will open directly to the page where the DHCP server info is displayed. On other devices the software or browser may have links that will lead to the DHCP server settings page.
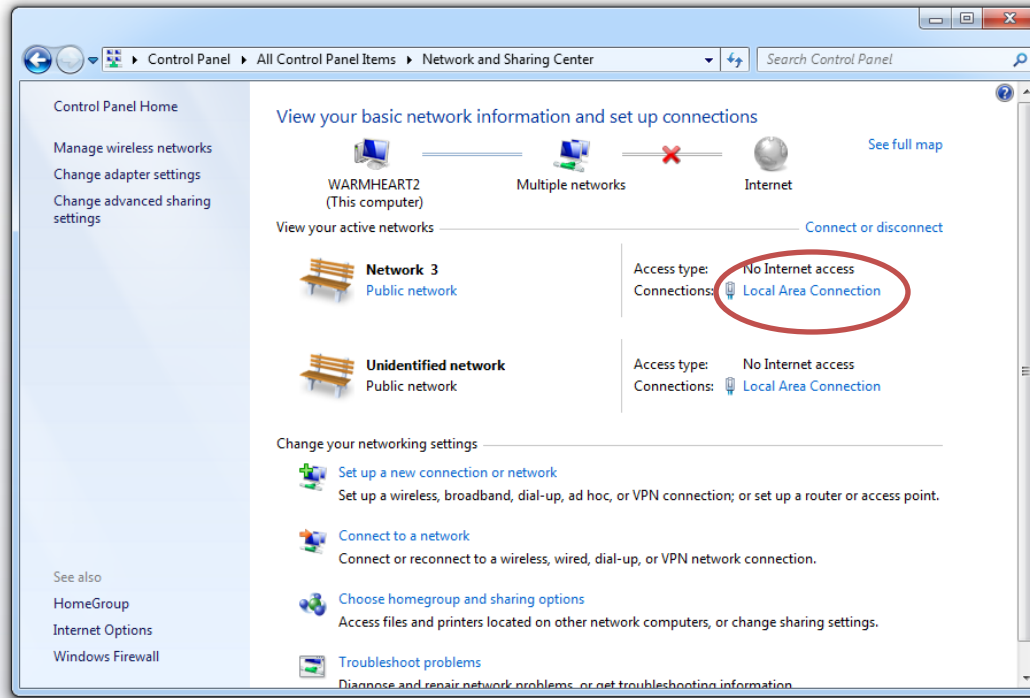
IP Addresses

It is not necessary to know a lot about IP addresses other than every computer that connects to a network must have its own IP address assigned to it to work. Since this network is a stand-alone network, the actual network portion of the IP address used (the first 3 numbers of the address in this case) is insignificant. Just use the default network assigned by the wireless router. What does matter is the DHCP server settings in the wireless router. A DHCP server is nothing more than a part of the software that is running on the wireless router.

DHCP Server Settings on the Wireless Router

At the middle of this display is seen the Network and DHCP Server Setting area. The router address is set by the software. The only number that changes in the IP addresses assigned to computers connecting to the network is the last number. It can be in the range of 1 to 254. Make sure the DHCP server is "Enabled". Then set the Start IP Address at 50 and change the Max Users to 150. After saving these settings, the address range changes to those that will be assigned automatically to computers that connect to the network by the DHCP server, in this case 50 to 199. 1 through 49 are not part of this "pool" of addresses and can be used manually for special needs computers. Only one of these "reserved" IP addresses will be assigned and that will be to the PC^2 server. It is suggested that 2 be used since 1 is set for the router. That means the PC^2 server computer would need to have the IP address 192.168.1.2 assigned to it manually. Make sure this address is used for the server address when setting up the PC^2 ini file for use on the team and judges computers.

Manually Assigning an IP Address to a Computer

The procedure for assigning an IP address manually varies by computer operating system but they all have the same basic information. In Windows7, go to Control Panel and then go to the Network and Sharing Center. Find the blue "Local Area Connection" link and click on it.

# Manually Assigning an IP Address to a Computer
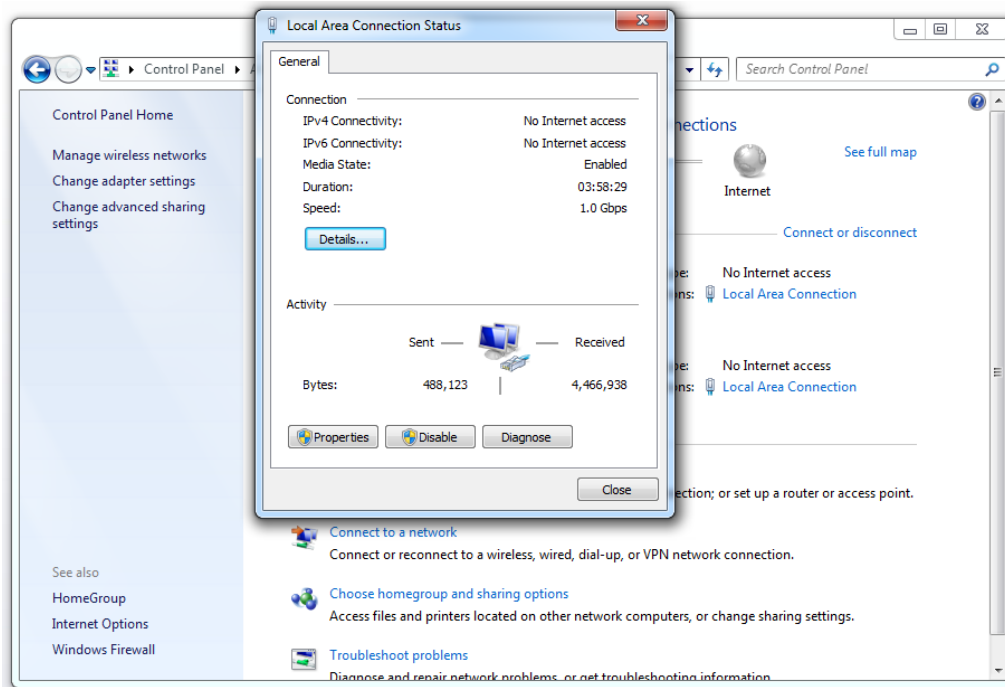
The window that pops up shows the status of your connection. Click on the "Properties" button.

Manually Assigning an IP Address to a Computer
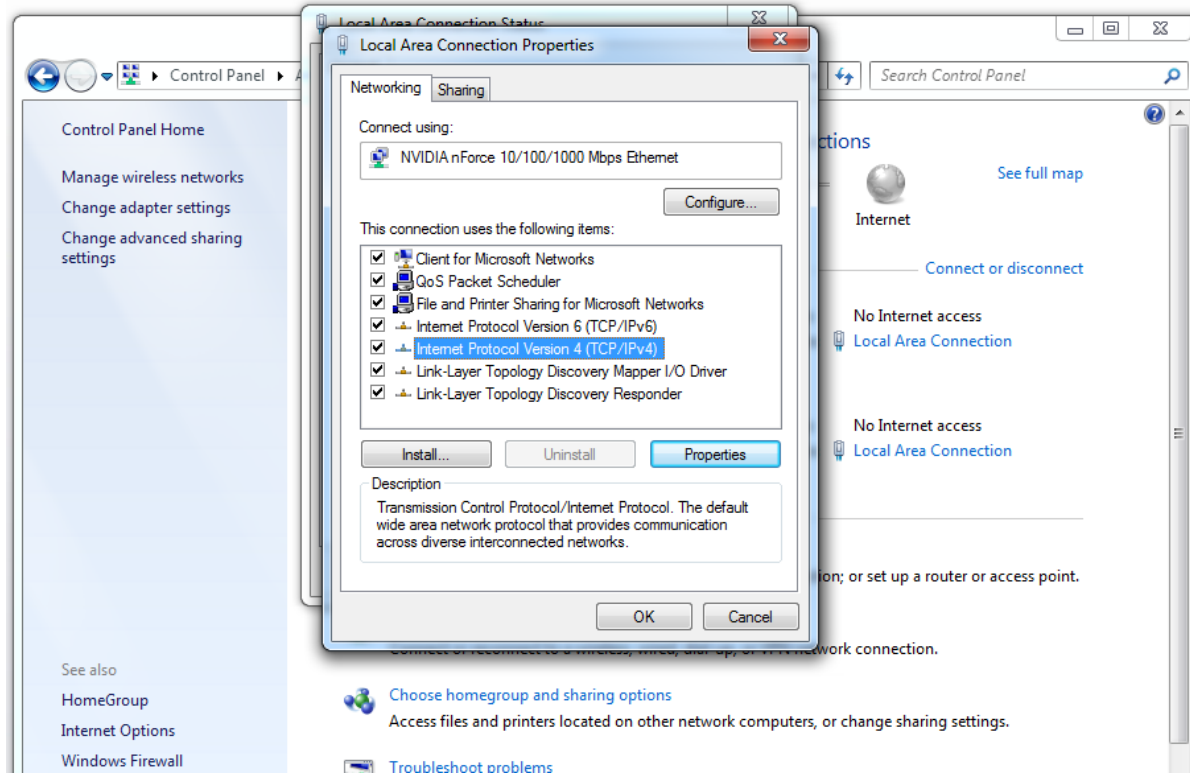
In the next popup you will see a list of items with checkmarks beside them. Highlight "Internet Protocol Version 4" and then click on the "Properties" button. (Be careful not to uncheck the box next to it.)

Manually Assigning an IP Address to a Computer
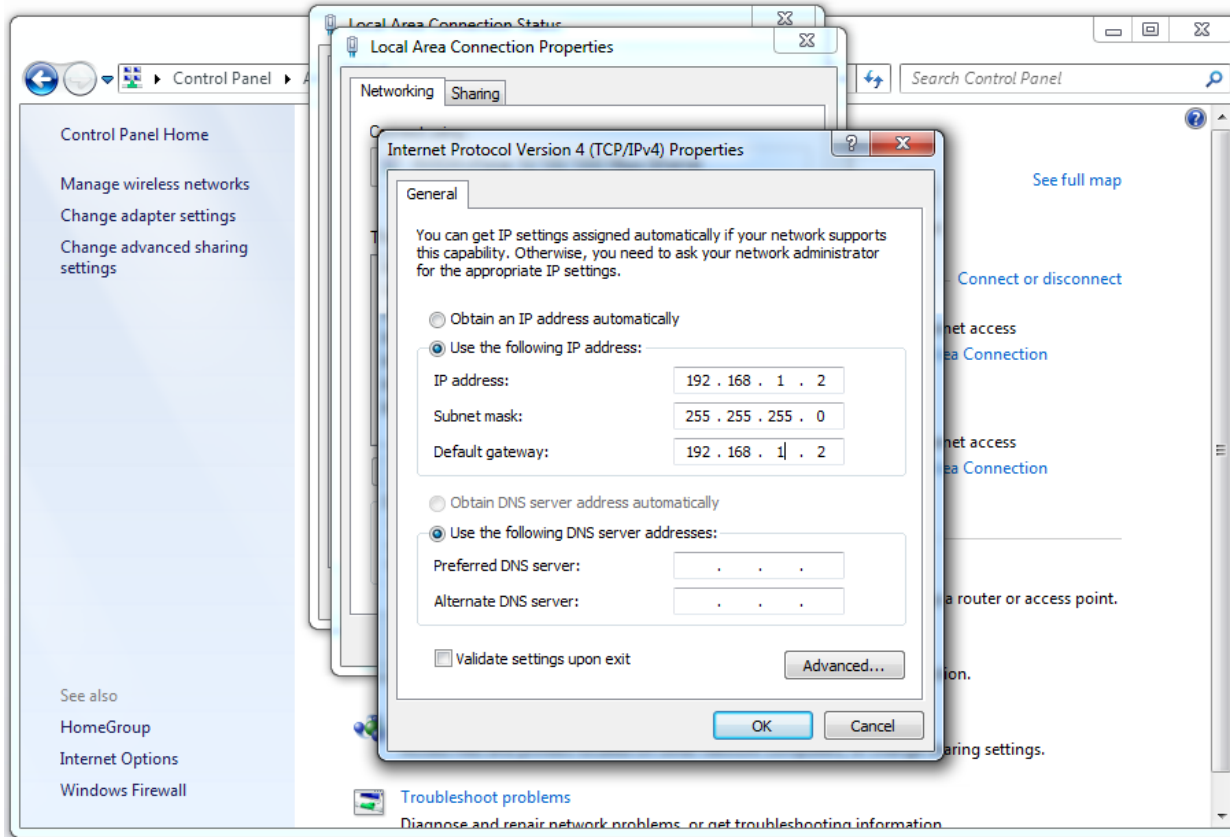
When this window appears click on "Use the following IP address:" and enter the information as shown in this picture. The default gateway is not important except, in this case, it points all computers in the network to the computer where PC^2 is located. This would normally be the IP address of the router that leads to the Internet. Now, select "Obtain DNS server address automatically". We are not using DNS so no addresses will be entered. The PC^2 server is the only computer you should have to install an IP address manually. The judges computers can use DHCP assigned addresses. The reason we assign an address to the PC^2 server is the address must not be a randomly assigned address every time it connects to the network. All of the team computers that connect to PC^2 use a specified IP address in the team PC^2 software that matches the manually assigned address we just assigned to the computer containing PC^2.

16 Port Switch from Netgear available for around $60.00

Using a switch like this, connect a cable from one of the four Ethernet ports on the wireless router (NOT the yellow Internet port) to one of the ports on the switch. Then connect the PC^2 computer to another port on the switch and then the judges computers to other ports. Excess ports, if any, could be used to connect team's computers that cannot connect to the network by wireless for some reason. It might be prudent to have some long Ethernet cables on hand for just that case.

Network Layout

Depending on the size of the contest (the number of teams) and the physical location, the layout can be simple or complex. Usually the PC^2 computer and judges computers are at the front of the room with the router and switch close by. The student area is the rest of the room. The room could be a large classroom or even the cafeteria or some other large area. The diagram on the next page shows a simple network layout that is very efficient. Any team computers that needed to be connected by cable would be located closer to the switch.

If the room is very large, it is possible to use a long cable to connect the wireless router to the switch and move the wireless router closer to the center of the room by itself so that everyone will have no trouble connecting.

Simple Wireless Contest Layout

Judges Area

| PC2 computer |

| Judge computer |

| Judge computer |

| Judge computer |

| Wireless Router |

| Switch |

Student Area
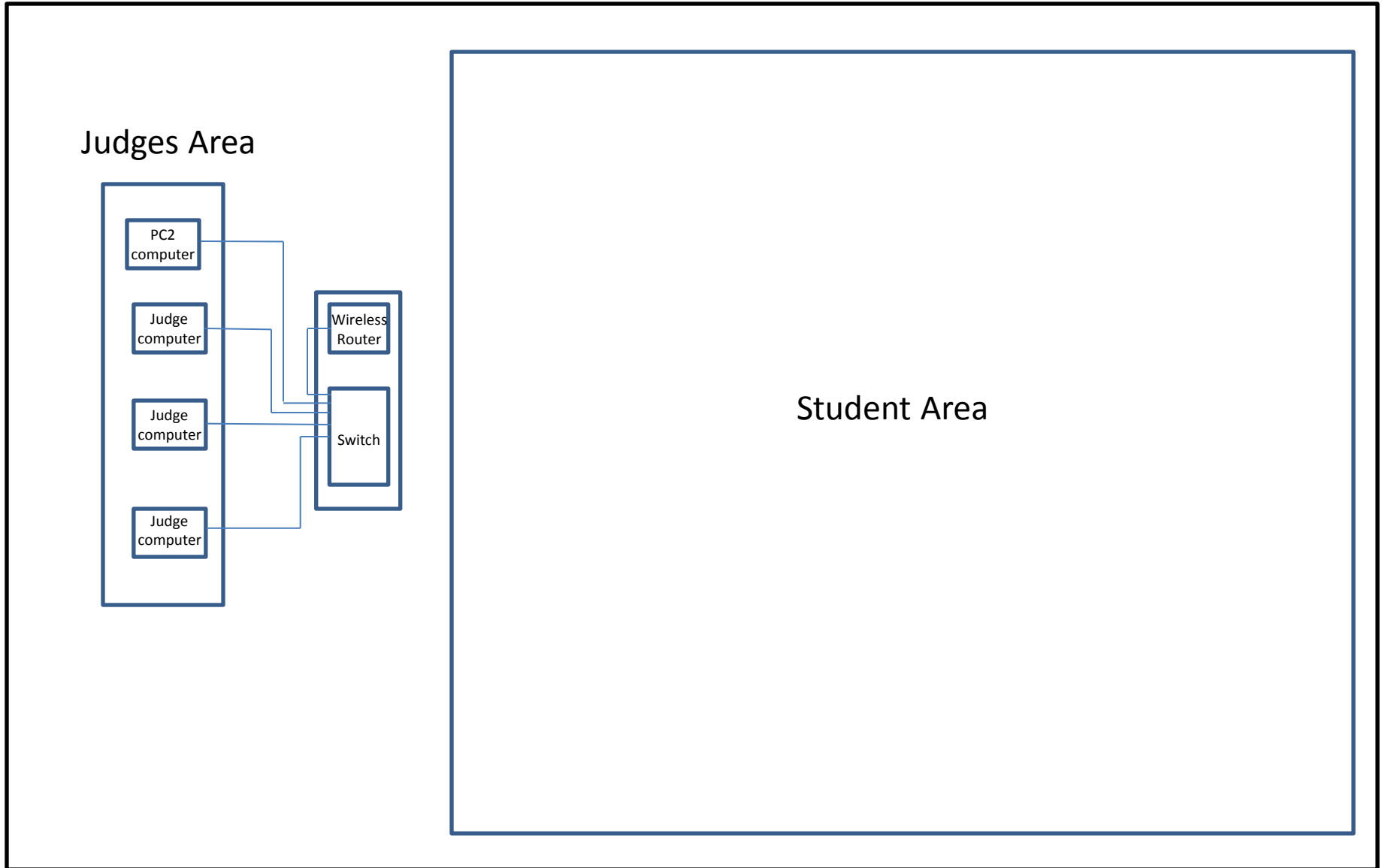
Electricity

Electricity will be another major concern for your contest. It will be necessary to work with the campus/district electrician to find out what is available and what, if anything, needs to be done. At the least several power strips and heavy duty extension cords will be needed. Again, the size of the contest and the electrical capabilities of the site will determine the needs in this area. A blown fuse would have a very negative impact on the competition.

Very Small Contest with Wired Network

For a contest with 14 or less teams, it is possible to create what is called a peer-to-peer network using only the 16 port switch. Simply manually assign an IP address to each computer as shown earlier and connect them to the switch with Ethernet cables of varying lengths dependent upon the layout. The range of 192.168.1.1 through 192.168.1.16 would be suitable. A subnet mask of 255.255.255.0 would be used on all of the computers. Use the IP address of the PC^2 server as the default gateway on all computers. As long as each computer has its own address, without duplication, the network will function normally. One port would be used for the PC^2 server and another for the judge's computer. That leaves 14 ports for teams. If there are 15 teams, it is possible to use the PC^2 server computer to judge as well.

Summary

- A wireless router must be purchased. It does not need to have a cable modem as part of it. It should have 4 Ethernet ports and a DHCP server.
- A switch with at least 8 ports, preferably 16, must be purchased along with cables.
- The router must be setup with its basic settings and then the DHCP server must be configured.
- Once the wireless router is set up and a wireless computer can connect, install the cabling to connect the wireless router and the PC^2 server to the switch.
- Connect any judges computers to the switch.
- Test the network with a wireless computer for access to the PC^2 contest setup and actually login as a team and submit a problem or two with correct and incorrect answers. Test the judges machines as well.
- Electricity! Make sure it is available and will handle the load of all the devices including monitors.
- ASK! There are a lot of people around the state that run contests and will be more than willing to help you get started! Give them a call!
- Make sure teams coming to your wireless networked contest understand their computers must be able to connect to a public network such as those found at quick food restaurants for them to work on this network. School owned computers may not work because of network restrictions placed on them by their district's network policies.
- A wired network can be an alternative when conducting a small contest.