

IT 280 Study Guide
Summer 2013

Don Colton
Brigham Young University-Hawai'i

August 1, 2013

This is the **Official IT 280 Study Guide** for the IT 280 Computer Networking class taught by Don Colton, Summer 2013.

This study guide is focused directly on “what” and “when.” It talks about the description and grading of the exams and labs. It tells what is required for each one.

UPDATES: As we go through the semester, this study guide will be updated from time to time so it reflects the latest information on due dates, deadlines, and requirements.

There is also a textbook. It tells “why” and “how.” Its role is explaining things and telling how to make things work.

The textbook is “Networking 101: An Introduction To Networking,” by Don Colton. It is available in PDF form, free.

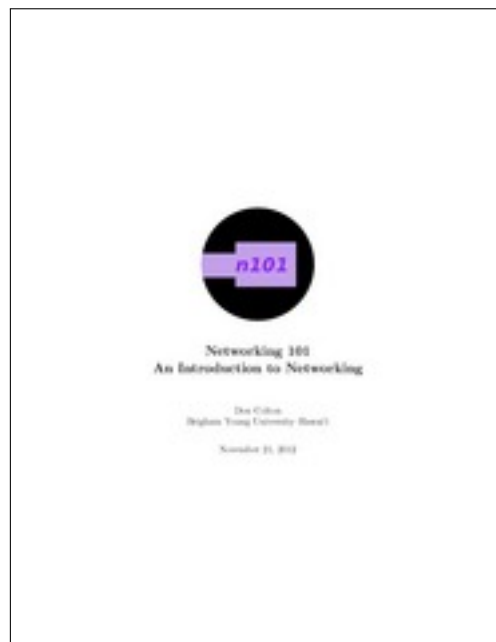
Free textbook:

<http://n101.tk/>

Alternate URL for textbook:

<http://n101.doncolton.com/>

The textbook is 99% stable, but new material is occasionally added and chapter numbering may even change. The index is good.



Contents

1	Overview	3
2	SN: Skill with Numbers	5
3	SS: Skill with Subnets	7
4	SV: Skill with VLSM	8
5	L1: Ethernet Cable	9
6	L2: Router Configuration	10
7	L3: Wi-Fi Site Survey	16
8	L4: Dia - Network Diagramming	19
A	Appendix	21

Chapter 1

Overview

As we go through the semester, this study guide will be updated from time to time so it reflects the latest information on due dates, deadlines, and requirements.

There are three skills tests. There are four labs. Each is described by a chapter in this study guide.

The phrase “due date” means the date by which you should have the assignment done so that you can consider yourself to be caught up with your classwork.

The word “deadline” means the date beyond which you cannot receive credit for your work unless you beg and grovel and have a really good excuse. And maybe not even then. A lot of work might never get done if it weren’t for “the last minute.” Accordingly we have a last minute, and it is called the deadline.

The period of time between the due date and the deadline is sometimes called the “grace period.”

The “grading label” is a short code that is used both in this study guide and in the gradebook to identify and track grades for activities.

Learning Objectives

This study guide (with the accompanying textbook) provides support for the following learning objectives. By the conclusion of this course, students

should be able to do these things.

- **Internet:** Explain how the Internet works. This includes topics such as connecting to the Internet, using the domain name system and using dynamic host configuration.
- **Home Networking:** Properly set up a home network. List and explain the different objects, media, and devices used in a home network that is connected to the Internet through an ISP. Design, install, configure, and manage a simple LAN, install services, and connect the LAN to the Internet.
- **Wireless Networking:** Design, install, configure, and manage a simple wireless LAN. This includes channel selection, WEP/WPA, SSID, and antenna considerations.
- **Security:** Explain what security typically exists and how to get more. Includes password selection, firewalls, and issues with opening up ports for gaming.
- **Theory:** Explain the following basic concepts: OSI 7-layer stack, protocol data units (packets, frames, etc.), udp, tcp, arp, and ports.
- **IPv4 Addressing:** Explain network masks, subnetting, address classes, private IP addresses, MAC addresses, collision domains, broadcast domains, and what a LAN is.
- **Power Tools:** Demonstrate the use of common network applications and utilities including ping, traceroute, ipconfig, dig, nmap, ssh, telnet, ftp, and Wireshark.

Chapter 2

Task SN Skill with Numbers

Networking uses several different number bases, with the most important one being binary.

This exam consists of 40 questions. There is a practice test with many more questions. As you answer each question, it will tell you whether you got the answer right nor not, and will let you try again until you do get it right.

To study for this test, use the Networking 101 textbook. The training for this is currently in section 18.4, Converting Between Bases, that starts on page 161.

If future changes to the textbook cause this to move, you can look in the textbook index for “convert”. You will find the following entries:

- convert binary to decimal
- convert binary to hex
- convert binary to octal
- convert decimal to binary
- convert hex to binary
- convert octal to binary

20 Easier Questions

There are 5 questions that ask you to convert a number from binary into base 8 (octal).

There are 5 questions that ask you to convert a number from base 8 (octal) into binary.

There are 5 questions that ask you to convert a number from binary into base 16 (hexadecimal, or hex).

There are 5 questions that ask you to convert a number from base 16 (hex) into binary.

20 Harder Questions

There are 10 questions that ask you to convert a number from binary into base 10 (decimal).

There are 10 questions that ask you to convert a number from base 10 (decimal) into binary.

Chapter 3

Task SS

Skill with Subnets

Networking uses IP addresses. The currently prevailing scheme is called IPv4, and divides the IP address into two parts: the network address and the host address. Subnetting divides the IP address into three parts: the network, the subnet, and the host.

This exam consists of 40 questions. There is a practice test with many more questions. As you answer each question, it will tell you whether you got the answer right nor not, and will let you try again until you do get it right.

Chapter 4

Task SV Skill with VLSM

This will be explained later in the semester. It is worth 50 points of pure extra credit.

Chapter 5

Task L1

Ethernet Cable

- Status: Officially Assigned.
- Discussed: Mon, May 13.
- Due Date: Mon, May 13, 09:40.
- Deadline: Wed, May 29, 08:40.
- Grading Label: **L1**

Summary: Construct a working cat5 cable.

Section 10.5 of the textbook provides background.

I will provide 8P8C (RJ45) ice cubes, cable, a cutter-crimper, and a cable tester. Most people complete the task in class within an hour, but some do not. You are allowed to borrow the equipment and return it later.

Grading Rubric (Rules for Grading)

20 Cable works as verified by cable tester.

20 Cable ends are neat (1/2 inch of wire).

Chapter 6

Task L2

Router Configuration

- Status: Officially Assigned.
- Discussed: May 20 (first time)
- Due Date: Mon, Aug 12, 23:59
- Deadline: Mon, Aug 19, 23:59
- Grading Label: **L2**

6.1 BEFW11S4 Router

We will be using the Linksys BEFW11S4 home router.

<http://support.linksys.com/en-us/support/routers/BEFW11S4> has documentation.

6.2 Wiring

Our first task is to insert the router between our ISP (the school) and our lab computer. Before we do this, we must make sure the lab computer is properly logged in.

Set the router on your desktop. Plug it into its power supply.

Find the cable from the ISP (the school) to your lab computer.

(ISP) ~~old-cable~~ (Lab Computer)

Unplug the cable from the computer and plug it into the Internet port on the router. This port is sometimes labeled WAN (Wide Area Network) or Uplink.

(ISP) ~~old-cable~~ (Router) (nothing) (Lab Computer)

Next, run a cable from one of the four downlink ports (labeled 1, 2, 3, 4) on the router, right back into the network port on the lab computer.

(ISP) ~~old-cable~~ (Router) ~~new-cable~~ (Lab Computer)

When we are done, we will return the wiring to its original configuration.

6.3 Reset The Router

Unless you know the router's administrative password, it will be necessary to reset the router. This gets rid of any passwords and other settings that others may have established. It gives us a clean slate to work with.

Find the red button on the back of the router. It is recessed slightly. Use a pencil or pen (or some other appropriate tool) to hold down the reset button for about ten seconds.

While you are holding down the reset button, if possible, watch the lights on the front of the router. After about ten seconds they will flicker once or twice. This is a signal to you that the reset has been accomplished. If you cannot watch the lights, just hold the reset for a few more seconds to increase your chances of success.

If you are working with a different router, and the reset method is not obvious, do a Google search for "(router model) reset" for advice.

6.4 Find Your Gateway's IP Address

On the lab computer, run the ipconfig command. You are looking for the IP address of your gateway. If you did a reset, it will be:

```
192.168.1.1
```

If you are using a different router, similar rules apply.

6.5 Browse to the Gateway

The gateway is running its own mini-webserver. This webserver gives you the way to manage the configuration of the router.

On your lab computer, open a browser. In the URL space, type in the IP address of the gateway.

The router will respond by requiring you to authenticate (log in). For the BEFW11S4 router, the username and password are as follows:

Username: (just leave this blank)

Password: admin

If you are working with a different router, and you do not know the default password of that router, do a Google search for “(router model) default password” for advice.

6.6 Establish A New Password

Select the Administrative tab. You should see a way to key in a new administrative password. Do it. This will keep others from changing your configurations and taking control of your router.

After saving your new password, the router will require you to log in again because your old password is no longer correct.

6.7 Explore The Settings

You can look ahead to the graded task (the last section of this chapter) to see what things will be required of you.

You should explore the settings available to you through the web interface to the router. See if you can figure out what they do. Ask questions in class about the configuration options.

6.8 MAC Address Cloning

Some ISPs will tie a connection to a specific MAC address. If you want to change computers, you would need to wait for the old MAC address to expire. This can take several minutes (or possibly much longer).

To avoid this problem, many routers provide the ability to clone the MAC address of the computer you are using, and then present that MAC address when talking to the ISP.

You may be required to do this. Even if you are not required, it does not hurt, and is probably a good idea.

6.9 Use The Internet

The purpose of being connected is to use the Internet. Make sure the lab computer can browse the Internet. You already know it can reach the router. Going beyond the router will prove that the router is working.

6.10 Establish A Wi-Fi Hotspot

Create a suitable password for your Wi-Fi access point. It will probably need to be at least eight characters long.

Create a suitable SSID (Service Set Identifier) for your Wi-Fi access point. It can be up to 32 characters long.

6.11 The Graded Task

You will be working with the teaching assistants in GCB 103. They are probably available evenings, Tuesday through Thursday, maybe 7 PM to 9 PM. But check in GCB 103 for the correct times.

Print out the next page, write your name on the sheet, and take it to the teaching assistants.

The TA will fill in the other top blanks of the sheet. Then they will give you a router to work with.

Complete the activities on the sheet and have the TA check your work. They should sign the sheet.

Bring the sheet to me so I can record your credit.

1 Teaching Assistant Selections

Use the BEFW11S4 router provided by Bro Colton via the TA.

The teaching assistant (TA) should randomly select values for the following items. Write the values selected in the blanks below.

- (1) _____ Specify a LAN network number (third quad) between 2 and 255.
- (2) _____ Specify the Router Inside IP Address (last quad) between 2 and 99.
- (3) _____ Specify an Administrative Password to be used.
- (4) _____ Specify a Wi-Fi Password to be used (8+ chars).
- (5) _____ Specify a Wi-Fi SSID to be used.
- (6) _____ Specify a Wi-Fi Channel (1-11) to be used. (Not 6.)

2 Router Configuration

Use a laptop provided by the student, or a computer provided by the TA. The student demonstrates each item to the TA, or the TA verifies the item. The TA should initial the blank at the start of the line. When all items are verified, the TA should sign below. Where (1) through (6) are mentioned, replace them by the values specified above.

_____ (1a) Reset the router. Prove that this was done by showing the router configuration.

Call for the TA to verify the item above.

_____ (2a) Set the router network to 192.168.(1).0.

_____ (2b) Set the router internal IP address to 192.168.(1).(2).

_____ (2c) Set the administrative password to the value (3) shown above.

_____ (2d) Set the Wi-Fi password to the value (4) shown above.

_____ (2e) Set the Wi-Fi SSID to the value (5) shown above.

_____ (2f) Set the Wi-Fi channel to the value (6) shown above.

_____ (2g) Activate Logging.

Call for the TA to verify the items above and below.

_____ (3a) Demonstrate that the laptop has an IP address issued by the router.

_____ (3b) Demonstrate that the laptop is connecting through the router to the Internet, and that several different web sites can be visited successfully.

_____ (3c) Demonstrate that Logging has occurred.

TA certifies that the lab was completed. Student or TA returns the form to the instructor.

_____ TA Signature

_____ TA Name

_____ Date

Chapter 7

Task L3

Wi-Fi Site Survey

- Status: Officially Assigned.
- Discussed: Mon, Aug 12
- Due Date: Mon, Aug 19, 23:59
- Deadline: Mon, Aug 26, 23:59
- Grading Label: **L3**

A Wi-Fi Site Survey is checking for Wi-Fi signals that already exist in various places.

Your task is to visit several locations and record your findings. Then you will report the things you found interesting.

What is interesting? It depends on your purpose.

Are you planning to set up a new hotspot? Then you do not want to conflict with the channels already in use.

Are you planning to connect to free Wi-Fi with your laptop? Then you want something that is unlocked and has a strong signal. (Some businesses provide Wi-Fi to their customers: food places, laundries, doctors, hospitals, anyplace that keeps you waiting around, or wants to keep you around.)

Are you just looking for amusing WAP names? Then that would be interesting all by itself.

I am told that the visits and recording can be done in an hour or two, and the write-up is not terribly hard. Do not procrastinate.

This lab is to be done alone. You can travel in a group, but do not share your results. Make this your own work.

Scanning.



BYUH-Secure.



(Hidden)



I will check out a Hotspot Finder to you in class. I will show you how to use it. Step one: Basically you just go someplace, turn it on, let it find all the hotspots, and then you write down the results. Step two: summarize your results and report them.

You may already own a Wi-Fi Hotspot Finder. It might be built into your laptop or cell phone. You are welcome to use it instead of the one I make available.

You will need a paper and something to write with.

7.1 Submitting Your Work

You must submit your work using my DCQuiz platform, the L3 assignment. It is basically one question: What is your report? Paste it in, plain text, make sure it is complete, and submit it for grading.

Work that is submitted early will be graded early, and if you did not get full credit, you will have an opportunity to update your report for more credit.

Notice that the deadline is Kuhio day, which is a holiday. The due date is actually a week earlier.

7.2 Visits

On Campus: Visit at least five places that students might like to study. Make a note of your findings.

Off Campus: Visit at least two places around your neighborhood, or around Laie. Make a note of your findings.

7.3 Data

The Hotspot Finder gives information about each hotspot it detected. Following are examples of the information you can pay attention to and record.

Count: The finder may display something like “1/15”, “2/15”, etc. The bottom number tells how many wireless networks were found. The top number tells which of those networks you are reading about.

SSID: Each reading will tell the SSID, something like “BYUH-Setup” or “BYUH-Secure” or “(Hidden)”. There may be other possibilities. Some of these are very amusing.

Security: Each reading may display something like “WEP” or “WPA” or “unlocked icon”. There may be other possibilities.

ABG: Each reading may display something like “A” or “B” or “G” or “N”. These refer to 802.11(b) and related networking standards. There may be other possibilities.

Bars: Each reading will display signal strength, 0, 1, 2, 3, or 4 bars. There may be other possibilities.

Channel: Each reading will tell what channel is in use. It may be something like “CH1” or “CH11” or “CH48” or “CH149”. There may be other possibilities.

Chapter 8

Task L4

Dia - Network Diagramming

- Status: Officially Assigned.
- Discussed: Mon, Aug 19
- Due Date: Mon, Aug 26, 23:59
- Deadline: Fri, Aug 30, 23:59
- Grading Label: **L4**

Purpose: To give you a way to create a network diagram.

Summary: Using the network described below, construct a one-page diagram. Email a PDF of your diagram to me.

You are supporting 4 routers and 6 work groups.

Router r1 connects to: r2 r3.

Router r2 connects to: r1 r3 r4.

Router r3 connects to: r1 r2 r4.

Router r4 connects to: r2 r3.

Work group Frankfurt has 10 users and connects to router r1.

Work group Karachi has 5 users and connects to router r2.

Work group Lima has 39 users and connects to router r3.

Work group Paris has 15 users and connects to router r3.

Work group Quebec has 15 users and connects to router r4.

Work group Vienna has 47 users and connects to router r1.

We will use the Dia Diagram Editor. It is similar to Microsoft Visio. Dia is available free for Mac, Windows, and Linux (including Ubuntu).

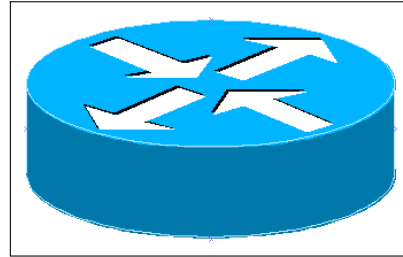
Google search “dia diagram editor tutorial” for instructions.

The required email subject line is:

Subject Line:

Also include it280, L4, your name, and today’s date on your diagram.

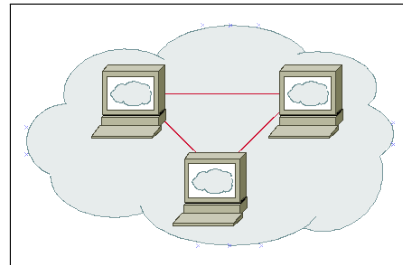
Use this symbol for each router. You can find it on the “Cisco - Switch” symbol sheet. Put a text label on each router that tells its designated name.



Use this symbol for each switch. (Put a switch between each router and its workgroup.) You can find it on the “Cisco - Switch” symbol sheet.



Use this symbol for each workgroup. You can find it on the “Cisco - Computer” symbol sheet. Put a text label on each workgroup that tells its designated name (location) and group size.



Connect the symbols with lines that indicate their wiring relationship to one another.

Appendix A

Appendix

A.1 Seeing Your Grade

<https://dcquiz.byuh.edu/> is where I maintain my online grade books.

There will be several grade books. One will have your overall grade. Another will have your effort points.

Each grade is identified by a short label.

A.2 Emailing Me

At times you may want to email me regarding this class, or I may ask you to email something to me.

If you follow these instructions, you will receive an instant reply letting you know that I received your email, and that I will respond to it.

Here are the rules.

To: Preferred destination is doncolton2@gmail.com but you could also use don.colton@byuh.edu. They both end up the same place.

Subject: The subject line is important.

For email in general, it looks like this:

it280 (normal subject line of your choice)

The it280 gets it past my spam filter and helps me organize my work flow.

Trust me, some days I get a lot of email. I don't want yours to be lost or overlooked.

The (normal subject line of your choice) is whatever you want it to be.

For email I requested, it looks like this:

```
it280 (item) (lastname, firstname)
```

The (item) is usually a program identifier, or the words "study time" or "lab 4".

The (lastname, firstname) is the name by which you are known on my roll sheet. We will agree on that name early in the semester.

I often reply with "done" so you know I updated your study points.

Email is not 100% reliable. Maybe your email was lost. Maybe my reply was lost. If you do not receive the first reply almost instantly, it probably means I did not get it. Check your sent mail, fix if necessary, and try again. Do you have the correct email address for me? Did you put "it280" at the start of the subject line?