COMS W1004              MW 4:10-5:25 PM

Columbia University                          Spring 2014

**Homework 5: Problem Set**

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**Circle the range that includes your UNI:**

Group 1 (aa3473-am4051)  Group 8 (kea2134-lvt2107)

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Group 3 (ay2289-cme2133) Group 10 (msv2121-pc2627)

Group 4 (cmh2194-emh2213) Group 11 (pfa2103-sc3719)

Group 5 (emm2224-hv2169) Group 12 (sch2148-tat2133)

Group 6 (hwk2106-jk3667) Group 13 (tb2498-zn2116)

Group 7 (jl4161-kdj2109)

Do the following exercises in Schneider and Gersting:

Chapter 7: 6, 11, 12, 16(use Dijkstra's Algorithm), 20 (8 points each)

6.

a. Assume there are one million books in your campus library. Approximate (to the nearest order of magnitude) how many bytes of data there are if all these books were stored online and accessible across a computer network.

For a library of a major academic research university (~1million books) there would need to be approximately **1 terabyte** (1012) of data if these books were all stored online. As seen on page 226 of Schneider and Gersting.

b. How long does it take to transfer the entire collection of books if the data rate of the transmission medium is 10 Mbps, the speed of the original Ethernet? How long does it take if we have a line with a speed of 1 Gbps? (This value represents the time needed to download your entire campus library)

Using the power of 2 as seen on page 225 of Schneider and Gersting

1TB = 240 bytes

1. 10Mbps = 1.25MB/s = 1.25(220) bytes per second (240bytes)(1sec/1.25\*220bytes)(1min/60secs)(1hr/60mins)(1day/24hrs)= **9.709 days**
2. 1Gbps = 0.125GB/s = 0.125(230) bytes per second

(240bytes)(1sec/0.125\*230bytes)(1min/60secs)(1hr/60mins)(1day/24hrs)= **0.0948 days**

11.

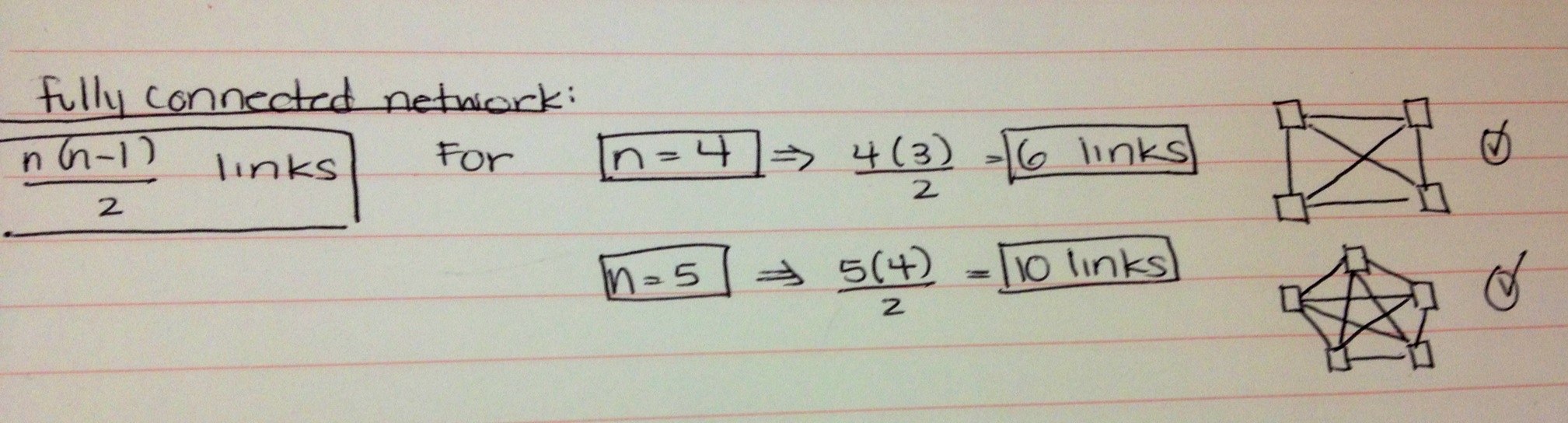
a. Assume there is a wide area network with N nodes, where N≥2. What is the *smallest* number of point-to-point communication links such that every node in the network is able to talk to every other node? (Note: A network in which some nodes are unable to exchange messages with other nodes because there is no path between them is called *disconnected*.)

The smallest number of point-to-point communication links such that every node in the network is able to talk to every other node will be **(n-1)** links. This case does not regard the definition of disconnected.

b. If you are worried about having a disconnected network, what type of interconnection structure should you use when configuring your network?

The type of interconnection structure that should be used when configuring the network with the intent to avoid having a disconnected network is a completely connected network (every node is connected to every other node). Thus, through examples, it would take links.

For example, for 4 nodes there should be 6 links and for 5 nodes there should be 10 links.



12. In Exercise 11, you determined the minimum number of links needed to ensure that every one of the N nodes in a network can communicate with every other node. However, most networks have far more than this minimum. What are the advantages of having these “extra” links in the network?

As seen in exercise 11, for N≥2, part (a) shows that the shortest number of links is **(n-1),** yet a fully connected network has links. The latter is an example of a situation in which networks have far more than the minimum. The advantages of having these “extra” links in the network include the ability to identify the root of errors/crashes/faults, and to send messages directly to the intended destination. In the case that there is a fault in one of the links, this fault will not affect the rest of the network because there is more than one possible path to get to the destination.

16.

a. How many simple paths (those that do not repeat a node) are there from node A to G?

There are 7 simple paths from node A to G:

1. A-B-C-G
2. A-B-E-C-G
3. A-B-E-D-C-G
4. A-D-C-G
5. A-D-E-C-G
6. A-C-E-B-C-G
7. A-F-G

b. What is the *shortest path* from node A to node G? What is the overall delay?

Using, Dijkstra’s algorithm I found that the shortest path from node A to node G is

**A-D-E-C-G with a distance of 10**.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **A** | 0 | x | x | x | x | x | x | x |
| BA | ∞ | 5 | 5 | x | x | x | x | x |
| **CE** | ∞ | ∞ | ∞ | 9 | 9 | 8 | x | x |
| **DA** | ∞ | 6 | 6 | 6 | x | x | x | x |
| **ED** | ∞ | ∞ | ∞ | ∞ | 7 | x | x | x |
| FA | ∞ | 3 | x | x | X | x | x | x |
| **GC** | ∞ | ∞ | ∞ | ∞ | ∞ | 11 | **10** | x |

c. If node E fails, does that change the shortest path? If so, what is the new shortest path?

Yes, if node E fails, then it changes the shortest path **to A-B-C-G, A-D-C-G, or A-F-G with a distance of 11.**

20. What are the advantages of breaking up a single logical message into a number of fixed-sized packets and then sending each one of those packets independently through the network?

The advantages of breaking up a single logical message into a number of fixed-sized packets and then sending each one of those packet independently through the network are

1) avoiding or adjusting to errors: if one link or node crashes or is too busy, then the packets are automatically routed to another path instead, and if a packet is damaged, then only the damaged packet must be resent as opposed to the entre message, and

2) network efficiency because the bandwidth is used to the full capacity and is not wasted via reserved circuits.

Notes from book: If you send a long message, the source node may “chop” it into N separate packets (such as the first 1,000 characters) and send each packet independently through the network. When the destination node has received all N packets, it reassembles them into a single message. The exact route is determined by the network, not the user, based on which path can deliver the message most quickly. If the message is large, it may be broken up into multiple packets, and each one may take a different route.

Problem (10 points): Read about the W3C, its mission, and how it is related to the ISOC. Write one page discussing and criticizing the W3C's function and performance.

The World Wide Web Consortium (W3C) is an international community that works together towards the development of Web standards. W3C’s vision for the Web involves “participation, sharing knowledge, and thereby building trust on a global scale.”[[1]](#footnote-1) W3C’s purpose and goals are to lead the World Wide Web (WWW) to its full potential through the development standard protocols and guidelines.[[2]](#footnote-2)

The Internet Society (ISOC) announced in December 2009 its’ support of W3C’s evolution as an organization that creates open Web standards. The ISOC and W3C work together because their communities overlap significantly and they are driven by similar underlying values. The result of this partnership will advance the evolution of W3C by strengthening W3C as a community forum for the standards of HTML, CSS, SVG, and other standards, and through the provision of staff expertise in complementary areas and money donation.[[3]](#footnote-3)

Currently there are criticisms against W3C’s policies toward HTML5. Some critics claim that W3C is letting themselves be controlled by larger organizations, as opposed to, following their standards and mission statement. In particular, well-known companies such as Netflix, Google, Microsoft, and the BBC are fighting against W3C’s integration of Digital Restrictions Management (DRM) into HTML5.[[4]](#footnote-4) DRM is the imposition of technological restrictions toward user’s actions toward digital media. For example, programs that do not allow a user to share music, play video games without Internet connection, or reading an eBook on another device. Such actions would be possible if these technological restrictions were lifted. These restriction benefit large organizations because it allows them access to the user’s media viewing tendencies. W3C could improve their performance/decrease their criticisms if they discontinue their work with SOPA (Stop Online Piracy Act) because adding DRM to HTML5 demeans their open standards principles.[[5]](#footnote-5) In order to combat SOPA, an alternative (or a better start towards fighting piracy) is the Online Protection and Enforcement of Digital Trade Act (OPEN). This bill proposes that the International Trade Commission (ITC) be in charge of enforcing the bill as opposed to the courts. The opposition towards this bill looks at the cost of bringing cases to the IC and the questions of the ITC’s ability to enforce online piracy.[[6]](#footnote-6) I think that the Internet is a source of freedom of speech and should be shared with the general public, up until the point where it shows an existential threat to the network or security.

Notes for the paper (You can ignore this. It is for my reference only):

1. What is the ISOC?

The Internet Society (ISOC) is a global cause-driven organization that is dedicated to ensuring that the Internet stays open, transparent and defined by the people. They are the world’s trusted independent source of leadership for Internet policy, technology standards, and future development. More than simply advancing technology, they work to ensure the Internet continues to grow and evolve as a platform for innovation, economic development, and social progress for people around the world. They champion public policies that enable open access, facilitate the open development of standards, protocols, administration, and technical infrastructure of the Internet, and organize events and opportunities that bring people together to share insights and opinions. They establish and promote principles that are intended to persuade governments to make decisions that are right for their citizens and each nation’s future. The ISOC conducts a great range of activities under three main categories, namely standards, public policy, and education.[[7]](#footnote-7)

1. How are the ISOC and W3C aligned?

Both organizations are dedicated to promoting open standards that drive how people use the Internet and the Web. Open standards are critical to ensuring the long-term growth and broad availability of the Internet and Web. Sometimes referred to as the “Internet Model,” this terms describes a set of development and operating values shared among many of the key communities and organizations that have been central to the development and ongoing evolution of the Internet. These values include: open technical standards, freely accessible processes for technology and policy development, and transparent and collaborative governance.[[8]](#footnote-8)

1. What is the benefit of this partnership?

The open Internet has become an invaluable platform for innovation. Collaborative efforts are directly responsible for the success of this platform; these efforts ensure that the various parts of the system interoperate. These core standards enable people around the world to make creative use of the global network. The ISOC’s support will enable W3C’s evolution which will strengthen W3C as a community forum for building consensus around future Web standards for HTML, CSS, SVG, and other standards. ISOC support will allow W3C to evolve its structure to ensure we continue to forge solid working relationships with the increasing numbers of developers and users, worldwide.[[9]](#footnote-9)

1. The difference between the Web and the Internet?

Internet: a global system of interconnected computer networks that interchange data by packet switching using the standardized Internet Protocol Suite. A network of networks.

Web: an information space in which the items of interest, referred to as resources, are identified by global identifiers called Uniform Resource Identifiers (URI). An information space. The first three specifications for Web technologies defined URLs, HTTP, and HTML.

1. http://www.w3.org/Consortium/mission#vision [↑](#footnote-ref-1)
2. http://www.w3.org/Consortium/mission [↑](#footnote-ref-2)
3. http://www.internetsociety.org/faq-about-internet-society-and-w3c [↑](#footnote-ref-3)
4. http://www.webcitation.org/6FfDzuVEN [↑](#footnote-ref-4)
5. Ibid [↑](#footnote-ref-5)
6. http://mashable.com/2012/01/18/googles-alternative-to-sopa-open/ [↑](#footnote-ref-6)
7. http://www.internetsociety.org/faq-about-internet-society-and-w3c [↑](#footnote-ref-7)
8. http://www.w3.org/2009/11/isoc-w3c-faq [↑](#footnote-ref-8)
9. http://www.internetsociety.org/faq-about-internet-society-and-w3c [↑](#footnote-ref-9)