COMP 189: Homework #2

Assigned Jan 21, 2022
Due Jan 28, 2022

65 points total

Instructions: *For each problem, show all your work (required for credit). For answers requiring written answers, while no more than five or six sentences are expected, sufficient justification must be given for any position, opinion, or perspective taken.*

Submission Instructions: *submit your solutions in PDF format through MyCourses Assignments.*

Technical Exercises

1. Changing IP Addresses (12 pts)

Each of your internet capable devices has a different IP address - and, in fact, your laptop (or tablet) receives a new IP address whenever it accesses the internet through different providers. In this problem, you'll sample some of the many IP addresses that identify "you" during the day.

Whenever you're asked to determine the IP address use the website whatsmyipaddress.com (or something like it).

Grab your internet-enabled phone (if you don't have one, find someone who does). Turn the phone's wi-fi off so that the phone is accessing the internet through the cell provider. Record the IP address and ISP of the phone as IP1. Now log the phone onto a wi-fi network. Record the IP address and ISP of the phone as IP2. Finally, turn the wi-fi off so that the phone is, again, accessing the internet through the cell provider. Record the IP address and ISP of the phone as IP3. (3 pts)

> IP1: 204.48.94.174, Videotron Ltee
> IP2: 2001:18c0:49f:5600:e87a:83bf:741e:3377: Cogeco Cable
> IP3: 204.48.94.174, Videotron Ltee

Why did the IP address of the phone change when you changed its connection to wifi? Be precise - where is the IP address coming from? What does it mean that the IP address changed? (3 pts)

> The IP address on my phone changed when connecting to internet and LTE because when my phone is connected to WI-FI, it is using the ISP modem in my house as the gateway for internet instead of the mobile provide. When my phone is using its mobile network, it's assigned an IP address provided by the mobile provider whereas when connected to the modem, its IP address is provided by Cogeco Cable. So, when the IP address changes, my phone will send and receive packets from different locations.

Suppose your computer sent a request for Google's homepage (think TCP protocol) JUST before you toggled your wifi. Would you receive Google's response? Using a diagram (like the very first one we looked at in class) illustrate and explain why or why not Google's response will reach you. (6 pts)

This depends on how quick my device is able to connect to WIFI. Assume for example, my device is able to connect very quickly to the WIFI, then I will not receive the response since TCP guarantees all packets be received and I will no longer be able to re-request nor receive the missing packets since my device is no longer connected to the same internet. On the other hand, if I am not quick enough to connect to the new internet before all packets are received, then I will receive Google's response with all packets.
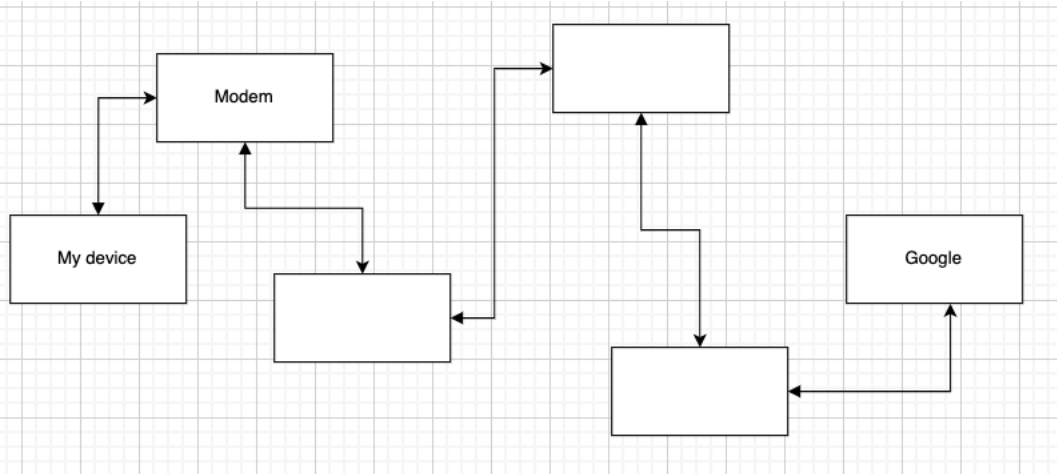
The illustration above demonstrates the flow of packets from my device to the modem, to Google before connecting to WIFI. We notice that my device will be able to send and receive packets from Google as my device is still connected to the internet with a path to Google's Server.
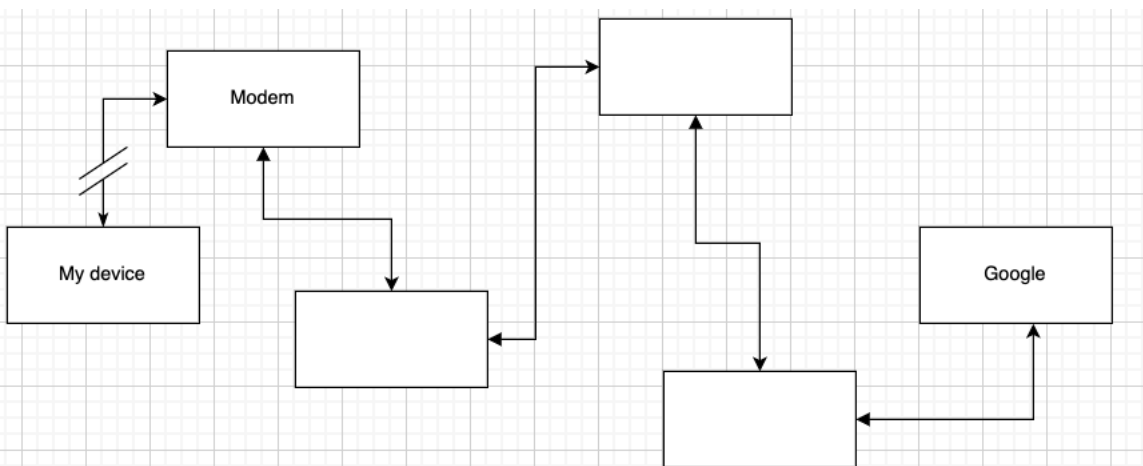
Now, we use a similar illustration above but this time after my device has connected to the WIFI. We notice that my device will no longer be able to send and receive packets from Google as my device is not able to contact the modem from before. The modem then realizes these packets cannot reach their destination since it is non-existent so they don't get received.

2. Number systems (10 pts)
An engineer has invented a computer that uses a base-5 system for representing numbers. For the sake of representation and quite confusingly she has chosen to use these symbols (in increasing numeric value): 3, G, &, 2, F. Answer the following questions about this representation system.

a. How many values can be represented by a single character in the base-5 system?

> There are 5 possible values listed above: 3, G, &, 2 and F. Each of the characters will represent the following in base 10.
> 3 → 0_{10}
> G → 1_{10}
> & → 2_{10}
> 2 → 3_{10}
> F → 4_{10}

b. What is the maximum numeric value that can be represented by two symbols in the base-5 system?

> The two characters representing the highest values are FF.
> → $FF_5 = 44_5 = 4x5^1 + 4x5^0 = 24_{10}$

c. Convert $G\&F23_5$ into its binary equivalent.

> $G\&F23 = Gx5^4 + \&x5^3 + Fx5^2 + 2x5^1 + 3x5^0 = 1x5^4 + 2x5^3 + 4x5^2 + 3x5^1 + 0x5^0 = 990_{10}$
> 990_{10} → X_2:
> 990/2 = 495 R 0
> 495/2 = 247 R 1
> 247/2 = 123 R 1
> 123/2 = 61 R 1
> 61/2 = 30 R 1
> 30/2 = 15 R 0
> 15/2 = 7 R 1
> 7/2 = 3 R 1
> 3/2 = 1 R 1
> 1/2 = 0 R 1
> → 1111011110_2

d. Convert $\&\&2F3_5$ into its decimal equivalent.

> → $\&\&2F3 = \&x5^4 + \&x5^3 + 2x5^2 + Fx5^1 + 3x5^0$
> = 2*5^4 + 2*5^3 + 3*5^2 + 4*5^1 + 0*5^0
> = 1595_{10}

e. Convert 75_{10} into this base-5 representation.

> 75/5 = 15 R 0
> 15/5 = 3 R 0
> 3/5 = 0 R 3
> Take remainders from bottom to top: 300_5

3. ASCII Representation (10 pts)

Answer the following questions about ASCII representation.

a. What ASCII character does 0001 0000_2 denote?

> 0001_2 = SOH
> 0000_2 = NUL
> 0001 0000_2 = SOHNUL

b. Express "January" in binary.

$J = 1001010_2$
$a = 1100001_2$
$n = 1101110_2$
$u = 1110101_2$
$a = 1100001_2$
$r = 1110010_2$
$y = 1111001_2$
"January" $= 1001010\ 1100001\ 1101110\ 1110101\ 1100001\ 1110010\ 1111001_2$

c. What are the table indices of "a", "A", "h", "H", "q", and "Q"?

a = 097
A = 065
h = 104
H = 072
q = 113
Q = 081

d. Using insights gained from the previous question, devise an easy arithmetic rule (using only + or -) for converting alphabetic characters from upper to lower-case and visa versa (in the ASCII table). Show that your method works on the string "January".

We notice that each character's upper and lower case is separated by 32. For example, if "A" is number 65 in the ASCII table, then it's lower case "a" is number 65 + 32 = 97 in the ASCII table. From this we can create the following algorithm:
Upper case to lower case letters: indice + 32
Lower case to upper case letters: indice - 32

So "January" becomes:
J = 074 + 32 = 106 = j
a = 097 -32 = 65 = A
n = 110 – 32 = 78 = N
u = 117 – 32 = 85 = U
a = 097 - 32 = 65 = A
r = 114 – 32 = 82 = R
y = 121 – 32 = 89 = Y

4. HTML Markup (14 pts)
Find and use the HTML tags in order to achieve the text effects described. *(2 pts each)*

a. "I **really** like COMP 189.'"

I really like COMP 189

b. "You want me to take classes by *Zoom*!?"

You want me to take classes by <i>Zoom</i>!?

c. "He shouted: (the rest of the text in font size 22) RUN FOR YOUR LIFE!!!"

He shouted: RUN FOR YOUR LIFE!!!

d. A bulleted list of the following items: "bits", "bytes", and "words".


```
    <li>bits</li>
    <li>bytes </li>
    <li>words </li>
  </ul>
```

e. The following text with the underlined portion linked to http://www.mcgill.ca: "I like my school a lot."

```
  I like <u><a href=http://www.mcgill.ca>my school</a></u> a lot.
```

f. Find two different ways of using HTML tags to make a word in a sentence bigger than the text around it.

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  You could use the header tags <h1> through <h6> as well as <font size>
  Example:
      -    This <font size=24>word</font> is bigger than the rest
      -    This <h1>word</h1> is bigger than the rest
```

g. Make a three column, four row table listing three of the classes in your course schedule. First column is class name, second column is instructor, and third column is the number of credits. The first row should be a header row - and all text in this row should be larger and bold.

```
<table>
  <tr>
    <th><font size=24><b>Class Name</b></font></th>
    <th><font size=24><b>Instructor</b></font></th>
    <th><font size=24><b>Credits</b></font></th>
  </tr>
  <tr>
    <td>COMP 189</td>
    <td>Derek Ruths</td>
    <td>3</td>
  </tr>
  <tr>
    <td>COMP 551</td>
    <td>Reihaneh Rabbany</td>
    <td>4</td>
  </tr>
  <tr>
    <td>ECSE 420</td>
    <td>Dennis Giannacopoulos</td>
    <td>3</td>
  </tr>
</table>
```

5. Make a contribution to Wikipedia (5 pts)

Go find a wikipedia page on a topic you care about - or create a page if it doesn't already exist. Contribute something - at least a paragraph. As proof of your edit, include a printout of the edit page (not the *edited* page - the page showing the edit, like what we saw in class for Exxon).

6. Collision Domains (6 pts)

1. Define a collision domain.

   A collision domain is when many of the devices transmitting on the same network create a collision with each other. This collision occurs when two or more computers share the same network and the packets they send and receive at the same time collide with one another.

2. When a collision occurs, all computers sending at that time back off for a random amount of time. Why is it important that the amount of time be random?

   This random time is important because it gives every computer experiencing this collision an equal chance to send information before another. Computers with the smallest wait times proceed in the network first which satisfies exponential back off.

3. Explain where collisions can occur in a cable internet configuration?

   Collisions occur when multiple devices are connected to the same ethernet domain or WIFI network and they try to send packets to the gateway at the same time.

Discussion

1. Anonymity (3 pts)

Your friend claims that he is anonymous while browsing websites on his computer. Based on content covered in class, why is this technically incorrect?

This is technically incorrect because the IP address of the device he is using is still visible to the public network. Websites that this friend go on can access this IP address and determine which ISP or VPN this device is connected to.
So, even though his IP address does not display his personal information like his name, he is still not completely anonymous.

2. Honeypots (5 pts)

In terms of catching software pirating, what is a honeypot? What is entrapment? Would the use of honeypots by law-enforcement officials to catch pirating be considered entrapment? Justify your position.

Honeypot: A website that seems to be an illegal site where you can get pirated content and software but is operated by law enforcements secretly.

Entrapment: A practice in which a law enforcement agent or agent induces a person to commit a crime where that person would have normally not committed.

The use of honeypots by law-enforcement officials to catch pirating is considered as entrapment since they are creating a bait for people to get illegal content from their webpages. This works because people can go on the honeypot website, install their software and content and even if they think they are anonymous, they can still be found using their IP address like mentioned above.