

Homework #0

Due Time: 2019/2/22 (Fri.) 22:00

Contact TAs: vegetable@csie.ntu.edu.tw

Account

You will complete part of this homework on the CSIE machine: `nasa-hw0.csie.ntu.edu.tw`.

- For CSIE students, use your workstation account and password to login.
- For non-CSIE students, request for an account by filling out this form: <http://bit.ly/2FEAvBt>
- How to login?
 - On Linux or Mac OS X:
`ssh <your_account>@nasa-hw0.csie.ntu.edu.tw (140.112.30.160)`
 - On Microsoft Windows: [even more simple](#).

Submission

- Compress all your files into a file named **HW0_[studentID].zip** (e.g. `HW0_bxx902xxx.zip`), which contains two folders named **[studentID]_NA** and **[studentID]_SA** respectively.
- **Folder [studentID]_NA** should contain a pdf file named **na.pdf** of all your answers in *Network Administration Part*.
- **Folder [studentID]_SA** should contain a pdf file named **sa.pdf** and a text file named **flags.txt**.
- Submit on NTU COOL (<https://cool.ntu.edu.tw>). If you can't access the course on NTU COOL, fill the form first: <https://goo.gl/forms/3ytAQfHwaHsUBAs02>.

Instructions and Announcements

- Discussions with others are encouraged. However, you should write down your solutions **in your own words**. In addition, for **each and every** problem you have to specify the references (the URL of the web page you consulted or the people you discussed with) on the first page of your solution to that problem.
- Problems below will be related to the materials taught in the class and may be far beyond that. Try to search for additional information on the Internet and give a reasonable answer.
- Some problems below may not have standard solutions. We will give you the points if your answer is followed by reasonable explanations.
- **NO LATE SUBMISSION OR PLAGIARISM IS ALLOWED.**

Network Administration

True or False

In each of the following question, please specify if the statement is **true or false** and **briefly explain why**. (2 points per question)

1. A DNS server stores its records locally.
2. TCP is preferable over UDP in all cases since it provides reliable data transfer while UDP doesn't.
3. VPN may increase download speed in certain cases.
4. NAT is necessary for devices with private IP to connect to devices with public IP.
5. DHCP is necessary in configuring private IP of a device.
6. A device can have only one IP at a time.
7. Each IP will be associated with only one device.
8. A 1Gbps network connections gaurantees a connection speed of 1Gbps for any user at any time.
9. A firewall basically filters traffic according to configured rules.
10. Wifi connections over WEP and WAP have known security problems while WPA2 have no known vulnerabilities.
11. Traffic between devices inside the same LAN will not pass through any router or switch.
12. 5G wireless band (802.11ac Wi-Fi) is preferable over 2.4G band in all cases due to its faster speed.

Short answer

Each question is worth 5 points.

1. The five layer internet protocol stack is essential for understanding the internet. List the five layers, briefly explain what each layer does, and give one example of service provided for each layer.
2. IPv4 is facing address exhaustion problem nowadays. Briefly explain what IPv4 exhaustion is, why it is happening, and illustrate 2 real-world workarounds for this problem.
3. *DoS attacks* are becoming more and more common. Please briefly explain what *DoS* and *DDoS* are.
4. Explain what a *MAC address* is and its usage.

Command line utility

Each task is worth 3 points.

1. Perform a DNS query for `csie.ntu.edu.tw` from a network outside NTU and show the delegation path from the root name servers for the query.
2. Trace the routing path from `nasa-hw0.csie.ntu.edu.tw` to `google.com` and show the AS# of each hop.
3. List all Internet interfaces of `nasa-hw0.csie.ntu.edu.tw`.

System Administration

Many CSIE students want to take NASA courses. However, being an excellent administrator is not that easy. One must be brave, patient and not afraid of failure. Before taking the courses, let's first take an adventure during the winter vacation! Hopefully it will be greatly enjoyable!

Starting the journey

Theseus, founder of Athens, son of Aegeus and slayer of Minotaur once traveled in a ship of thirty oars. The ship was later preserved by the Athenians and given the name "Ship of Theseus".

We are about to board the Ship of Theseus and track down the epic of Theseus, so hang on tight. During the trip, you need to collect flags. That is, you have to find strings like `NASA{xxx}`. How much you complete will decide your priority to take the course. Please write down all the linux commands that you used in each step in a pdf file, and the flags (e.g. `NASA{I am a sample.}`) that you find in a .txt file, formatted as followed:

```
1 NASA{I_AM_FLAG_0}
2 NASA{I_AM_FLAG_1}
...
```

Hint: During the trip, if you delete some important files accidentally, type `Ship_of_Theseus` to restart the adventure.

1. Welcome aboard! (5 points)

The ship is about to start, with all those decayed planks and rotton parts, I wonder how many of you will be able to stay safe and sound until the very end of our journey.

Hints: hop onto `nasa-hw0.csie.ntu.edu.tw` and done.

2. The Oracle (5 points)

"The bulging mouth of the wineskin, o best of men, loose not until thou hast reached the height of Athens", as Oracle of Pythia advised Aegeus. Only the wisest man can interpret oracles right. Ask "**Pittheus**", king of Troezen, to help you.

Hints:

- Read the description above again and again.
- In Linux, who is the wisest **man**?

3. Know thy place (3 points)

Bloodline is important for Athenians, and even more important for Athenian heroes. Now, do you know your ancestors all the way to the root?

Hints: Where are you?

4. Sandals and Sword (5 points)

Before leaving, Aegeus buried his “sandals” and “sword” under a “big_rock”, and told Aethra when Theseus is big enough, have him remove the “big_rock” and take the “sandals” and “sword” to his room as evidence of his royal parentage.

Hints: I think moving them to another place is easy.

5. Hargghh MATE! (3 points)

The captain requests you to be with him immediately. He can be found in the “master_room”.

Hints: Can you see the captain ?

6. Sinking ship (8 points)

The captain has noticed that the ship is sinking slowly and suspects that some parts of the ship needs to be repaired. He hands you the blueprint of the ship and demands you to find the broken parts plus repair it before the ship sinks.

Maybe you can start by getting rid of the “BUGS” in the ship and then look for the “broken_plank”

Hints:

- “BUGS” could be upper letter or lower letter.
- [This link](#) may help you.

7. Handy man (5 points)

You see the shores on the far horizon, but the ship is in no condition to last for a distance so long. If you just had some tools to mend the ship... and it happens to be that you do have a handful of tools! However, the “toolbox” is locked up and sealed tightly, maybe you should try to find the “KEY” to open it...

Hints:

- Ask The old man first.
- Toolbox is in the master room

8. King of the Labyrinth (8 points)

The ship has stopped at the shores of Labyrinth, created by the master craftsman Daedalus. You hear Minotaur roar and see a monstrous figure in the distance. Slay the beast before it is too late.

Hints: Can you stop the program running ? Easy, huh ?

9. Voyage back (8 points)

Minotaur slain, glory and fame to Theseus! Now the ship will travel on back to Athens. Theseus broke his promise with Aegeus for not changing on a white sail, resulting in Aegeus’ death. Will you be able to find the “white_mast” and rise it in time?

Hints:

- Don't give up.
- **Find** it anywhere in this machine.

10. Ship of Theseus (12 points)

Congratulations! You have done well to come so far. Now here's an additional **bonus problem** for you to try to tackle.

Over years, the ship of Theseus caught attention of philosophers. They argued over the topic that if all the parts of the ship of Theseus was to be replaced one by one, until finally, no original part of the old ship is left.

Can the repaired ship still be counted as the original ship?

Hints:

- Play with our mini pong game while you think about this question.
- Hope you can find the answer before the end of winter break ($\phi \omega \phi$).