

HW 1 - ns-3 Introduction

Zeel Vasant Satasiya - 016053024

Overview of Networks, the Internet, and Wireshark

First Submission Due: Friday, February 24th, 11:59pm Pacific Time Revision

Due Dates will be updated after the grades are released

What you will learn

- Wireless communication basic concepts
- Basics of using the ns-3 simulator

Task 1

[LP 1] Enumerate 3 advantages brought by wireless communication (when compared with wired networking), and 3 issues specific to wireless networking.

Advantages:

Enable long distance communication

Better scalability

Facilitates mobility

Disadvantages:

Frequency usage have restrictions

Reduction in strength of signal

Easier to hack (not secure)

[LP 2] Consider a group of people in a room. In this group, there are pairs that want to talk with each other. If more than one person talks at the same time, interference may make discussion difficult to understand. Describe briefly (4-5 sentences) two protocols that allow conversations to take place. These do not have to be standard protocols that are currently used in networks. You are only expected to reason about the problem and come up with your own solution.

- 1. A specified order should be defined for people to have chance to talk. The next one can only start speaking once the other person has finished talking to avoid interference.**
- 2. Before someone starts to talk, they should check for a random (but within a defined frame) amount of time to see if someone starts to talk. After this wait if no one speaks, the person waiting can go ahead.**

Task 2 - ns-3 simulations

[LP 1] Download ns-3 and setup github to share your code with the instructor. Instructions to download ns-3 are attached in the assignment specification. Instructions for github setup are provided in page 3 of the attachment.

Follow the tutorial until Chapter 6. Run first.cc, second.cc, and third.cc, modifying them in myfirst.cc, mysecond.cc, and mythird.cc, as described in the tutorial.

```
-- Configuring done (1.0s)
-- Generating done (1.7s)
-- Build files have been written to: /Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Special Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/cmake-cache
[ 0%] Building CXX object scratch/CMakeFiles/scratch_myfirst.dir/myfirst.cc.o
[ 1%] Linking CXX executable "/Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Special Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/build/scratch/ns3.39-myfirst-debug"
Finished executing the following commands:
cd cmake-cache; /opt/homebrew/bin/cmake --build . -j 7; cd ..
(base) + ns-3.39 git:(master) ./ns3 run scratch/myfirst
At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
(base) + ns-3.39 git:(master) █
```

```
[ 1%] Linking CXX executable "/Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Special Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/build/scratch/ns3.39-mythird-debug"
Finished executing the following commands:
cd cmake-cache; /opt/homebrew/bin/cmake --build . -j 7; cd ..
(base) + ns-3.39 git:(master) ./ns3 run scratch/mysecond
At time +2s client sent 1024 bytes to 10.1.2.4 port 9
At time +2.0118s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.0118s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.02161s client received 1024 bytes from 10.1.2.4 port 9
(base) + ns-3.39 git:(master) █
```

```
(base) + ns-3.39 git:(master) ./ns3 run scratch/mythird
At time +2s client sent 1024 bytes to 10.1.2.4 port 9
At time +2.01828s server received 1024 bytes from 10.1.3.3 port 49153
At time +2.01828s server sent 1024 bytes to 10.1.3.3 port 49153
At time +2.02652s client received 1024 bytes from 10.1.2.4 port 9
(base) + ns-3.39 git:(master) █
```

```
(base) + scratch git:(master) cd ..
(base) + ns-3.39 git:(master) ./ns3 run scratch/myfirst
[ 0%] Building CXX object scratch/CMakeFiles/scratch_myfirst.dir/myfirst.cc.o
[ 0%] Linking CXX executable "/Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Special Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/build/scratch/ns3.39-myfirst-debug"
UdpEchoClientApplication:UdpEchoClient(0x7fbbcbf39cb0)
UdpEchoClientApplication:SetDataSize(0x7fbbcbf39cb0, 1024)
UdpEchoClientApplication:StartApplication(0x7fbbcbf39cb0)
UdpEchoClientApplication:ScheduleTransmit(0x7fbbcbf39cb0, +0ns)
UdpEchoClientApplication:Send(0x7fbbcbf39cb0)
UdpEchoClientApplication:Send(): At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
UdpEchoClientApplication:HandleRead(0x7fbbcbf39cb0, 0x7fbbcbf3a280)
UdpEchoClientApplication:HandleRead(): At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
UdpEchoClientApplication:StopApplication(0x7fbbcbf39cb0)
UdpEchoClientApplication:DoDispose(0x7fbbcbf39cb0)
UdpEchoClientApplication::~UdpEchoClient(0x7fbbcbf39cb0)
(base) + ns-3.39 git:(master) export 'NS_LOG=UdpEchoClientApplication=level_all|prefix_func'
UdpEchoServerApplication=level_all|prefix_func'
(base) + ns-3.39 git:(master) export 'NS_LOG=UdpEchoClientApplication=level_all|prefix_func'
(base) + ns-3.39 git:(master) ./ns3 run scratch/myfirst
UdpEchoClientApplication:UdpEchoClient(0x7f992870b140)
UdpEchoClientApplication:SetDataSize(0x7f992870b140, 1024)
UdpEchoClientApplication:StartApplication(0x7f992870b140)
UdpEchoClientApplication:ScheduleTransmit(0x7f992870b140, +0ns)
UdpEchoClientApplication:Send(0x7f992870b140)
UdpEchoClientApplication:Send(): At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
UdpEchoClientApplication:HandleRead(0x7f992870b140, 0x7f992870c570)
UdpEchoClientApplication:HandleRead(): At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
UdpEchoClientApplication:StopApplication(0x7f992870b140)
UdpEchoClientApplication:DoDispose(0x7f992870b140)
UdpEchoClientApplication::~UdpEchoClient(0x7f992870b140)
(base) + ns-3.39 git:(master) export 'NS_LOG=UdpEchoClientApplication=level_all|prefix_func|prefix_time'
```

```
(base) ➤ ns-3.39 git:(master) ✖ export NS_LOG=""
(base) ➤ ns-3.39 git:(master) ✖ ./ns3 run scratch/myfirst
At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
(base) ➤ ns-3.39 git:(master) ✖ export NS_LOG=FirstScriptExample=info
(base) ➤ ns-3.39 git:(master) ✖ ./ns3 run scratch/myfirst
Creating Topology
At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
(base) ➤ ns-3.39 git:(master) ✖
```

[LP 2] Copy myfirst.cc into myfirst-hw1.cc. Make the following changes:
Add the data rate for the channel, and packet size of the hello message as command line arguments. Run the following experiment:

1. For data rates 512bps, 1Kbps, 512Kbps, and 1Mbps, change the packet size to 128, 256, and 1024. Set the delay for the point to point channel as 1ms.
2. You may not see a response to a client hello in some cases. What change should you make to ensure that you can see the server's reply no matter how long the client hello takes? Make the change and proceed to the next step.

Ans: While trying to run the experiment for 512kbps data rate and 1024 packet size, I observed that the server did not receive the packet from client. To ensure that server's reply is seen we can increase the Client and server app stop time from 10 seconds to a larger time like 30 sec or 60 sec. For safer side I took 60 sec.

3. Report the time at which the server receives the message for each of the experiments in a table (see solution template below).

| Pkt size\Data rate | 512bps | 1Kbps | 512Kbps | 1Mbps |
|--------------------|----------|---------|----------|----------|
| 128 | 4.46975s | 3.265s | 2.00347s | 2.01094s |
| 256 | 6.46975s | 4.289s | 2.00547s | 2.00329s |
| 1024 | 18.4698s | 10.433s | 2.01747s | 2.00943s |

Time at which message was received at the echo server

| Pkt size\Data rate | 512bps | 1Kbps | 512Kbps | 1Mbps |
|--------------------|----------|---------|----------|----------|
| 128 | 6.9395s | 4.53s | 2.00694s | 2.00453s |
| 256 | 10.9395s | 6.578s | 2.01094s | 2.00658s |
| 1024 | 34.9395s | 18.866s | 2.03494s | 2.01886s |

Time at which message was received at the echo client

Snapshot of DataRate= 1kbps

```
ns-3.39 git:(master) ✖ ./ns3 run "scratch/myfirst-hw1 --DataRate=1kbps --PacketSize=256"
Datarate: 1kbps
Creating Topology
At time +2s client sent 256 bytes to 10.1.1.2 port 9
At time +4.289s server received 256 bytes from 10.1.1.1 port 49153
At time +4.289s server sent 256 bytes to 10.1.1.1 port 49153
At time +6.578s client received 256 bytes from 10.1.1.2 port 9
PacketSize: 256%
ns-3.39 git:(master) ✖ ./ns3 run "scratch/myfirst-hw1 --DataRate=1kbps --PacketSize=1024"
Datarate: 1kbps
Creating Topology
At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +10.433s server received 1024 bytes from 10.1.1.1 port 49153
At time +10.433s server sent 1024 bytes to 10.1.1.1 port 49153
At time +18.866s client received 1024 bytes from 10.1.1.2 port 9
PacketSize: 1024%
ns-3.39 git:(master) ✖ ./ns3 run "scratch/myfirst-hw1 --DataRate=1kbps --PacketSize=128"
Datarate: 1kbps
Creating Topology
At time +2s client sent 128 bytes to 10.1.1.2 port 9
At time +3.265s server received 128 bytes from 10.1.1.1 port 49153
At time +3.265s server sent 128 bytes to 10.1.1.1 port 49153
At time +4.53s client received 128 bytes from 10.1.1.2 port 9
PacketSize: 128%
ns-3.39 git:(master) ✖
```

| Pkt size\Data rate | 512bps | 1Kbps | 512Kbps | 1Mbps |
|--------------------|--------|-------|---------|-------|
| 128 | | | | |
| 256 | | | | |
| 1024 | | | | |

Time at which message was received at the echo server

Time at which message was received at the echo client

[HP 1] Copy mysecond.cc into mysecond-hw1.cc. Make the following changes:
Add another echo client application to the left-most p2p node (n0), and another echo server application to the right-most CSMA node (n4). Answer the following questions:

1. Comment on the port number attribute of the echo server and client. Should you pay special attention to it while setting up your new server and client? Why?

The servers and clients that are running on the same node, port numbers are the ones that will be the factor to distinguish between multiple servers and multiple clients. So , if we are setting up new server and client on the same node, the port numbers should be different.

```
[(base) → ns-3.39 git:(master) × ./ns3 run scratch/mysecond-hw2 ]
[ 0%] Building CXX object scratch/CMakeFiles/scratch_mysecond-hw2.dir/mysecond-
hw2.cc.o
[ 0%] Linking CXX executable "/Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Spe
cial Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/build/scratch/ns
3.39-mysecond-hw2-debug"
msg="Failed to bind socket", +1.000000000s 4 file=/Users/zeelsatasiya/Documents/
SJSU/3rdSem/297 Special Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.
39/src/applications/model/udp-echo-server.cc, line=96
NS_FATAL, terminating
libc++abi.dylib: terminating
Command 'build/scratch/ns3.39-mysecond-hw2-debug' died with <Signals.SIGABRT: 6>
```

2. Report the time at which a message is received at the server and the client with 1 and 2 applications running.


```

[ (base) → ns-3.39 git:(master) × ./ns3 run scratch/mysecond-hw2 ]
[ 0%] Building CXX object scratch/CMakeFiles/scratch_mysecond-hw2.dir/mysecond-
hw2.cc.o
[ 0%] Linking CXX executable "/Users/zeelsatasiya/Documents/SJSU/3rdSem/297 Spe
cial Topics/HW1/cmpe297-f23-zeel-satasiya/ns-3-allinone/ns-3.39/build/scratch/ns
3.39-mysecond-hw2-debug"
At time +2s client sent 1024 bytes to 10.1.2.4 port 9
At time +2s client sent 1024 bytes to 10.1.2.4 port 10
At time +2.0118s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.0118s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.0119s server received 1024 bytes from 10.1.1.1 port 49154
At time +2.0119s server sent 1024 bytes to 10.1.1.1 port 49154
At time +2.02161s client received 1024 bytes from 10.1.2.4 port 9
At time +2.02329s client received 1024 bytes from 10.1.2.4 port 10
[ (base) → ns-3.39 git:(master) × ]

```

[HP 2] Copy mythird.cc into mythird-hw1.cc. Make the following changes:

Instead of the placing the echo server in the CSMA nodes, place it in one of the mobile WiFi stations. Record the mobility of the echo server as well.

1. You will now record the throughput of the application using a FlowMonitorHelper. We suggest that you set up a flow monitor as shown in the attached file called myfirst-mon.cc (lines 71 – 93)

```
/NodeList/7/$ns3::MobilityModel/CourseChange x = 8.9534, y = 1.60648
/NodeList/6/$ns3::MobilityModel/CourseChange x = 5.02196, y = -0.648165
[/NodeList/6/$ns3::MobilityModel/CourseChange x = 4.74117, y = 0.311605
/NodeList/7/$ns3::MobilityModel/CourseChange x = 9.87961, y = 1.22947
/NodeList/6/$ns3::MobilityModel/CourseChange x = 4.00924, y = 0.992987
/NodeList/7/$ns3::MobilityModel/CourseChange x = 10.7557, y = 0.74725
At time +2s client sent 1024 bytes to 10.1.3.2 port 9
At time +2.00764s server received 1024 bytes from 10.1.3.3 port 49153
At time +2.00764s server sent 1024 bytes to 10.1.3.3 port 49153
At time +2.01387s client received 1024 bytes from 10.1.3.2 port 9
/NodeList/6/$ns3::MobilityModel/CourseChange x = 3.69502, y = 0.043637
/NodeList/7/$ns3::MobilityModel/CourseChange x = 9.83619, y = 1.1404
/NodeList/6/$ns3::MobilityModel/CourseChange x = 2.7377, y = 0.332672
/NodeList/7/$ns3::MobilityModel/CourseChange x = 10.519, y = 1.87102
/NodeList/6/$ns3::MobilityModel/CourseChange x = 3.71944, y = 0.522915
[/NodeList/7/$ns3::MobilityModel/CourseChange x = 11.3836, y = 1.36861
/NodeList/6/$ns3::MobilityModel/CourseChange x = 3.95246, y = 1.49539
/NodeList/7/$ns3::MobilityModel/CourseChange x = 12.3524, y = 1.12091
/NodeList/6/$ns3::MobilityModel/CourseChange x = 4.64994, y = 0.778785
/NodeList/7/$ns3::MobilityModel/CourseChange x = 12.5336, y = 2.10437
/NodeList/6/$ns3::MobilityModel/CourseChange x = 4.91076, y = 1.74417
/NodeList/7/$ns3::MobilityModel/CourseChange x = 13.2939, y = 1.45484
/NodeList/6/$ns3::MobilityModel/CourseChange x = 5.90237, y = 1.61494
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.2, y = 1.03179
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.89131, y = 1.46659
/NodeList/7/$ns3::MobilityModel/CourseChange x = 15.0164, y = 1.60925
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.86355, y = 1.70057
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.0709, y = 1.9346
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.14259, y = 1.00759
/NodeList/7/$ns3::MobilityModel/CourseChange x = 15.0694, y = 1.88085
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.17634, y = 1.2652
/NodeList/7/$ns3::MobilityModel/CourseChange x = 16.0468, y = 1.66922
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.45105, y = 2.22672
/NodeList/6/$ns3::MobilityModel/CourseChange x = 5.51046, y = 1.88718
/NodeList/7/$ns3::MobilityModel/CourseChange x = 16.9015, y = 1.15015
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.5021, y = 1.75807
/NodeList/7/$ns3::MobilityModel/CourseChange x = 16.8099, y = 0.154352
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.22636, y = 2.44759
/NodeList/7/$ns3::MobilityModel/CourseChange x = 15.8117, y = 0.0955978
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.44826, y = 1.47252
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.917, y = -0.351204
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.0303, y = 0.564059
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.9251, y = -1.35117
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.0508, y = -0.43573
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.0494, y = -0.868407
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.51038, y = 0.452409
/NodeList/7/$ns3::MobilityModel/CourseChange x = 13.6017, y = -1.76262
/NodeList/6/$ns3::MobilityModel/CourseChange x = 8.23744, y = 1.13898
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.23784, y = 1.16717
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.0011, y = -2.67941
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.8681, y = 2.09631
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.9832, y = -2.491
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.45389, y = 3.00649
/NodeList/7/$ns3::MobilityModel/CourseChange x = 14.1151, y = -2.98745
/NodeList/6/$ns3::MobilityModel/CourseChange x = 7.29685, y = 2.46851
/NodeList/7/$ns3::MobilityModel/CourseChange x = 13.4278, y = -3.71378
/NodeList/6/$ns3::MobilityModel/CourseChange x = 6.82778, y = 1.58535
Flow 1 (10.1.3.3 -> 10.1.3.2)
Throughput: 1.10105 Mbps
Flow 2 (10.1.3.2 -> 10.1.3.3)
Throughput: 1.35192 Mbps
```

2. Run the new code and report the throughput:

a) from the echo client to the server:

Flow 1 (10.1.3.3 -> 10.1.3.2)

Throughput: 1.10105 Mbps

b) from the echo server to the client:

Flow 2 (10.1.3.2 -> 10.1.3.3)

Throughput: 1.35192 Mbps

3. From the command line, change the number of WiFi devices to the number: 9 + the last digit of your SJSU ID. E.g., if your SJSU ID is 11100111, run the experiment for 9+1 = 10 devices. Now report the following:

a) Final position of the echo server in (x,y) format: **x = 11.6464, y = 27.6716**

b) Final position of the echo client in (x,y) format: **x = 6.4614, y = 39.4934**

c) Throughput from echo server to client: **Flow 1 (10.1.3.13 -> 10.1.3.12)**
Throughput: 1.26837 Mbps

d) Throughput from echo client to server: **Flow 2 (10.1.3.12 -> 10.1.3.13)**

Throughput: 1.41585 Mbps

e) IP address of the echo server: **10.1.3.13**

f) IP address of the echo client: **10.1.3.12**

```
/NodeList/16/$ns3::MobilityModel/CourseChange x = 9.72162, y = 30.2724
/NodeList/17/$ns3::MobilityModel/CourseChange x = 6.85423, y = 40.2672
/NodeList/16/$ns3::MobilityModel/CourseChange x = 10.0517, y = 29.3285
/NodeList/17/$ns3::MobilityModel/CourseChange x = 6.68257, y = 39.282
/NodeList/16/$ns3::MobilityModel/CourseChange x = 10.8053, y = 28.6712
/NodeList/17/$ns3::MobilityModel/CourseChange x = 6.77843, y = 40.2774
/NodeList/16/$ns3::MobilityModel/CourseChange x = 10.5591, y = 29.6404
/NodeList/17/$ns3::MobilityModel/CourseChange x = 6.7071, y = 41.2748
/NodeList/16/$ns3::MobilityModel/CourseChange x = 11.2892, y = 28.9571
/NodeList/16/$ns3::MobilityModel/CourseChange x = 10.75, y = 28.1149
/NodeList/17/$ns3::MobilityModel/CourseChange x = 7.01776, y = 40.3243
/NodeList/16/$ns3::MobilityModel/CourseChange x = 11.6464, y = 27.6716
/NodeList/17/$ns3::MobilityModel/CourseChange x = 6.4614, y = 39.4934
Flow 1 (10.1.3.13 -> 10.1.3.12)
Throughput: 1.26837 Mbps
Flow 2 (10.1.3.12 -> 10.1.3.13)
Throughput: 1.41585 Mbps
(base) → ns-3.39 git:(master)
```

REFERENCES:

<https://www.nsnam.org/docs/release/3.39/tutorial/html/tweaking.html>

<https://www.nsnam.org/docs/release/3.39/tutorial/html/conceptual-overview.html>

<https://www.nsnam.org/docs/tutorial/html/building-topologies.html>

Submission Instructions

- The written part of the completed homework should be in pdf format. Name your file “hw1- answers-<your SJSU ID>”.pdf, e.g., hw1-answers-11100111.pdf.
- Compress your files myfirst-hw1.cc, mysecond-hw1.cc, mythird-hw1.cc, and hw1-answers-<your SJSU ID>.pdf in a zip file called hw1-<your SJSU ID>.zip, e.g., hw1 - 11100111.zip, and submit on Canvas.
- Commit and push your code in github every time you make changes. Your activity on github will be checked to finally assign your grade. Having your code go from 0% to 100% in a short time will attract unnecessary attention.

Specifications

Both tasks have components labeled [LP] and [HP]. If you complete ALL the LP components satisfactorily, you will receive a grade of “low pass” on the homework. If you complete ALL the LP components and at least 1/2 HP components satisfactorily, you will receive a grade of “high pass”. If you do not meet the criteria for a “low pass”, the submission will be marked as “revision needed”.

Note the following statements from the syllabus:

If a student receives a “low pass” or “revision needed” grade, the student may revise and resubmit their homework assignment by using one “token”.

For homework assignments, if the student fails to submit their assignment by the posted deadline, their submission will receive a grade of “revision needed”. If they fail to submit the assignment by the revision deadline, the submission will receive a grade of “fail”.

At most two tokens may be used for the one-day deadline extensions (one token for each one-day extension), including the revision deadlines. Tokens will be automatically removed from your wallet if you submit late and/or resubmit.

VERY IMPORTANT: Include ALL the references you used for this assignment, including names of classmates you discuss with. Failure to cite your sources counts as an act of academic dishonesty and will be taken seriously without zero tolerance. You will automatically receive a “fail” grade in the homework and further serious penalties may be imposed.

NOTE: You can look for help on the Internet but refrain from referencing too much. Please cite all your sources in your submission.

When you submit your assignment, you automatically agree to the following statement. If you do not agree, it is your responsibility to provide the reason.

“I affirm that I have neither given nor received unauthorized help in completing this homework. I am not aware of others receiving such help. I have cited all the sources in the solution file.”