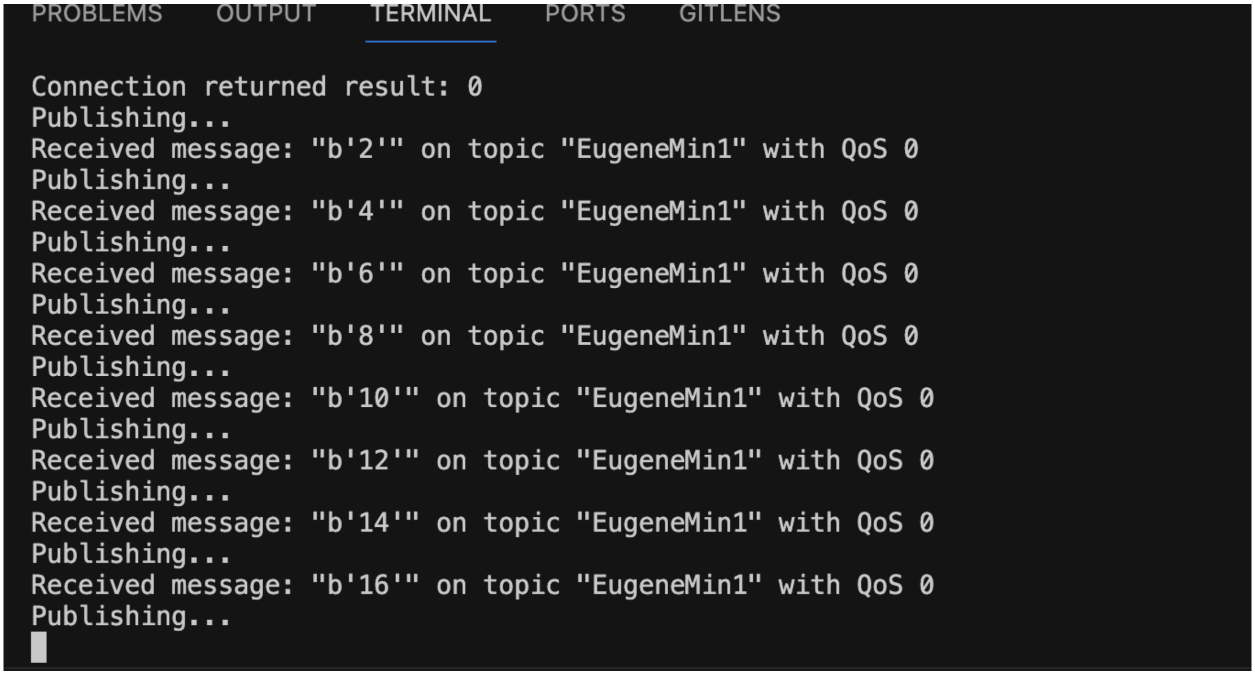
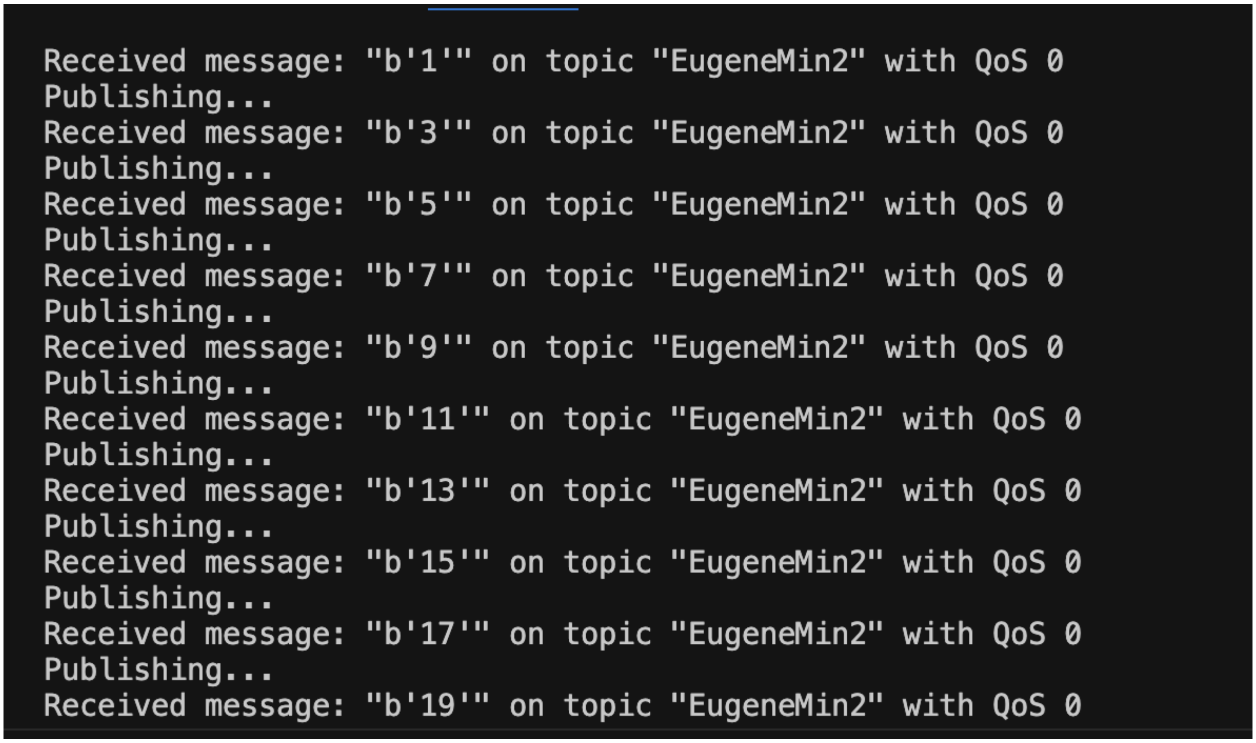
Part 1:
Figure 1 and Figure 2 demonstrates the two way communications systems I set up using Sender_1.py and Sender_2.py.



```
Connection returned result: 0
Publishing...
Received message: "b'2'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'4'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'6'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'8'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'10'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'12'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'14'" on topic "EugeneMin1" with QoS 0
Publishing...
Received message: "b'16'" on topic "EugeneMin1" with QoS 0
Publishing...
```

Figure 1: First sender output



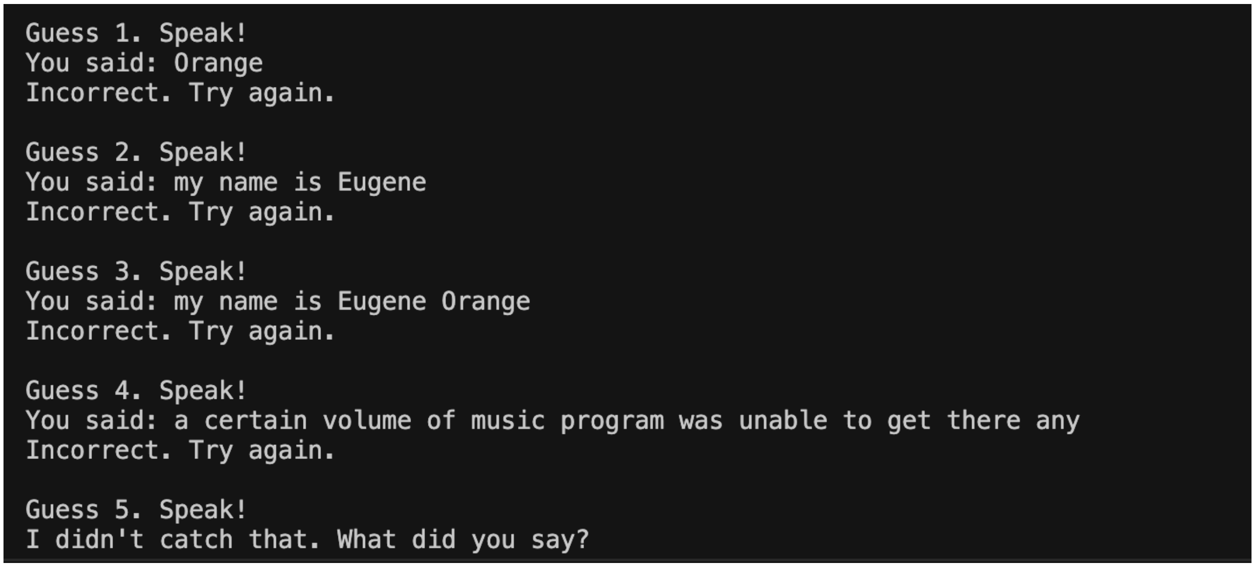
```
Received message: "b'1'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'3'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'5'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'7'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'9'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'11'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'13'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'15'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'17'" on topic "EugeneMin2" with QoS 0
Publishing...
Received message: "b'19'" on topic "EugeneMin2" with QoS 0
```

Figure 2: Second sender output

Consider how to use MQTT for the project. Based on your experiences, what is made possible using MQTT? What seems fairly difficult using MQTT? If you were to use MQTT, what would be a reasonable communications lag time be? Would you prefer to use a different method of transmitting data?

MQTT allows for any user to be able to access a network without the hassle of having to handle the user on the other side through its subscriber-publisher interface. MQTT seemed to have trouble with large data frames and also its lag time because it also has to go through the client then to our machine. A reasonable communications lag time that I would expect from my experience using MQTT is quite fast for just sending one int. I made the lag time down to .02 seconds for the two way communication system I set up. I think a more dedicated stream of communication to a device would be a better method because we are not scaling our game to many people. However, if many people are playing and we need them to listen in, MQTT is a useful tool.

Part 2:
For very different words, the program was able to detect it well. When I did similar sounding words like sound and found or letters, the program was able to decipher it pretty well. I was able to get a pretty long phrase, even whole sentences. Sometimes, longer phrases helped with error correction, because it could not detect the single letter “a” and deciphered it as “hey”, however when I said “the letter A”, the program could decipher the letter “a”. In this way, we can use longer phrases for error detection. I played music and at a certain volume of music the program was unable to decipher any words thinking the music was also my voice. When I turned the music off, it had correctly understood my phrase, but it just could not detect end of phrase. A way to minimize the noise is to limit our range to human voice levels of frequency or adjust to someone’s voice accordingly.



```
Guess 1. Speak!
You said: Orange
Incorrect. Try again.

Guess 2. Speak!
You said: my name is Eugene
Incorrect. Try again.

Guess 3. Speak!
You said: my name is Eugene Orange
Incorrect. Try again.

Guess 4. Speak!
You said: a certain volume of music program was unable to get there any
Incorrect. Try again.

Guess 5. Speak!
I didn't catch that. What did you say?
```

Figure 3: Example Output of the Task

Write some short bullet points with some individual thoughts on how this applies to your project:
(a) What can you do with your given speech program in the project?
With the speech program without a large presence of sound, we can detect a lot of various different phrases and words for the project, which could be used to control our character's actions.
(b) How complex do you want your speech recognition to be? How complex can you reasonably expect your speech recognition to be?
We are expecting our speech recognition to dictate commands without very complicated phrases. The reason we are trying to limit the complexity of the speech recognition is because it takes a while for speech to be processed, so we can not expect too much complexity in the fear of slowing down the gameplay.

(c) What level of speech accuracy do you need? In other words, how quickly do you need an accurate recognition? Does a missed recognition hurt the progress of the game?
We need very accurate speech accuracy to ensure that the correct move is played in our game. We do not need a very quick accurate recognition, however, because the player can take time to decide their move. The missed recognition will hurt the progress of the game because a player may make a move that would be negative to the team's mission of defeating the boss.

(d) Do you need specific hardware, specific conditions, etc. to have a reasonable confidence that it works well enough?
The hardware seems sufficient in detecting our speech with the laptop microphones. However, definitely with noise, it was harder to detect a phrase especially because the computer was not sure when an end of phrase occurred if there was too much volume. We definitely need to do some processing of the audio file to better understand our player's voice.