



WIRELESS TECHNOLOGY

ARQ PROTOCOL SIMULATION GUIDE AND GRAPH OUTPUT

MIDTERM REPLACEMENT ASSIGNMENT

➤ BY GROUP 7

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WIRELESS TECHNOLOGY

GETTING STARTED

To use this program, you will need to have Python 3 and Anaconda installed on your computer. You can download Python 3 from the official website: Python and Anaconda from the official website: **[Anaconda]** (<https://www.anaconda.com/products/distribution>).

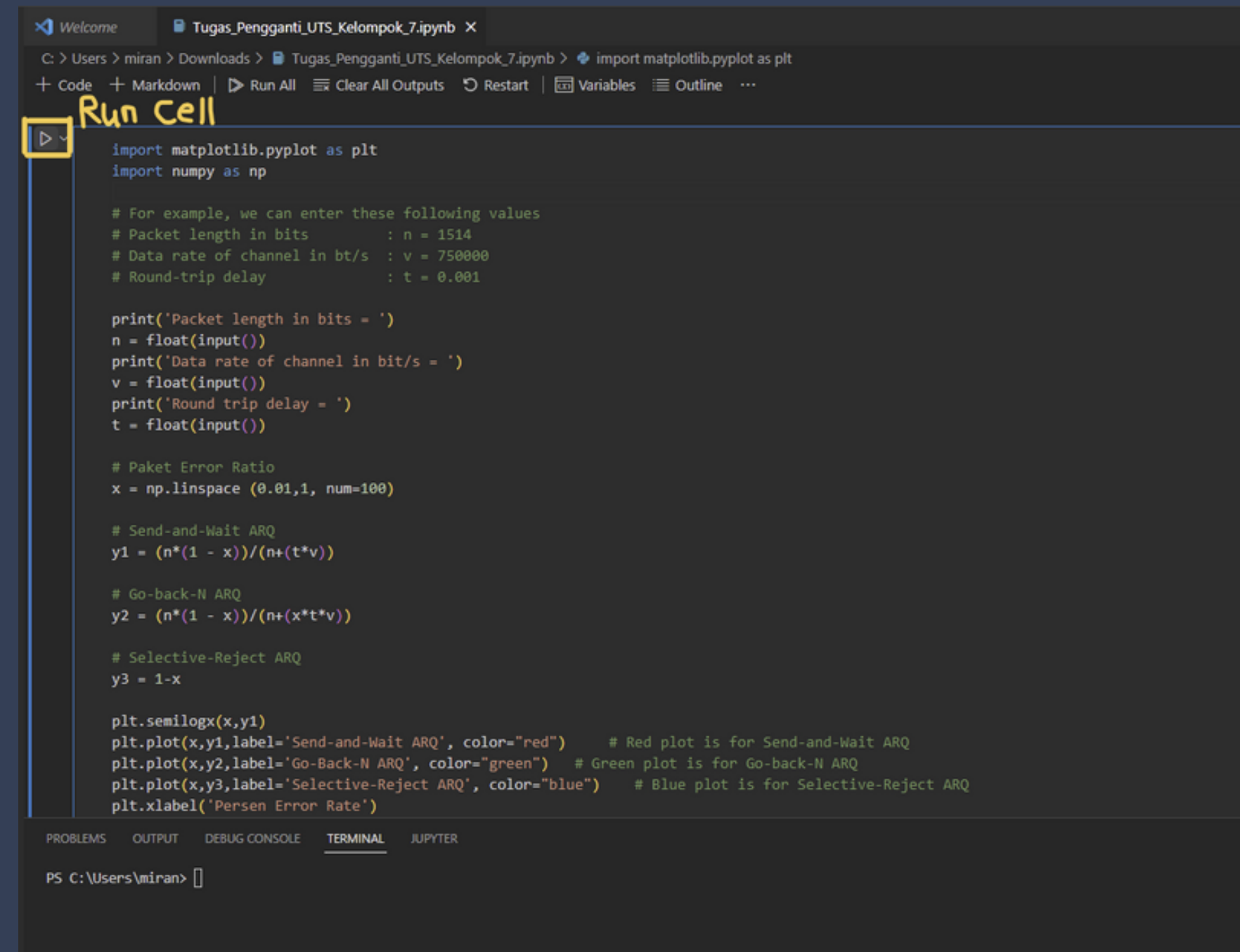
Aside from that, you need to install the Matplotlib and Numpy. You can install the two libraries from their official website: **Matplotlib** and **Numpy** .

RUNNING THE PROGRAM

You can also run the program through Google Colaboratory through this [link](#) or

To run the program, open File Explorer and navigate to the directory where the program is saved. Then, open the program with Visual Studio Code:

1) Run the first cell



```
import matplotlib.pyplot as plt
import numpy as np

# For example, we can enter these following values
# Packet length in bits      : n = 1514
# Data rate of channel in bt/s : v = 750000
# Round-trip delay          : t = 0.001

print('Packet length in bits = ')
n = float(input())
print('Data rate of channel in bit/s = ')
v = float(input())
print('Round trip delay = ')
t = float(input())

# Paket Error Ratio
x = np.linspace (0.01,1, num=100)

# Send-and-Wait ARQ
y1 = (n*(1 - x))/(n+(t*v))

# Go-back-N ARQ
y2 = (n*(1 - x))/(n+(x*t*v))

# Selective-Reject ARQ
y3 = 1-x

plt.semilogx(x,y1)
plt.plot(x,y1,label='Send-and-Wait ARQ', color="red")    # Red plot is for Send-and-Wait ARQ
plt.plot(x,y2,label='Go-Back-N ARQ', color="green")    # Green plot is for Go-back-N ARQ
plt.plot(x,y3,label='Selective-Reject ARQ', color="blue")    # Blue plot is for Selective-Reject ARQ
plt.xlabel('Persen Error Rate')
```

RUNNING THE PROGRAM

2) Enter the three value required: Packet length, channel data rate, and round trip delay (you can refer to the comment example in the code):

```
Go Run Terminal Help Tugas_Pengganti_UTS_Kelompok_7.ipynb - Visual Studio Code

Welcome Tugas_Pengganti_UTS_Kelompok_7.ipynb X
C: > Users > miran > Downloads > Tugas_Pengganti_UTS_Kelompok_7 Press 'Enter' to confirm your input or 'Escape' to cancel
+ Code + Markdown | Interrupt Clear All Outputs Go to Restart Variables Outline ...

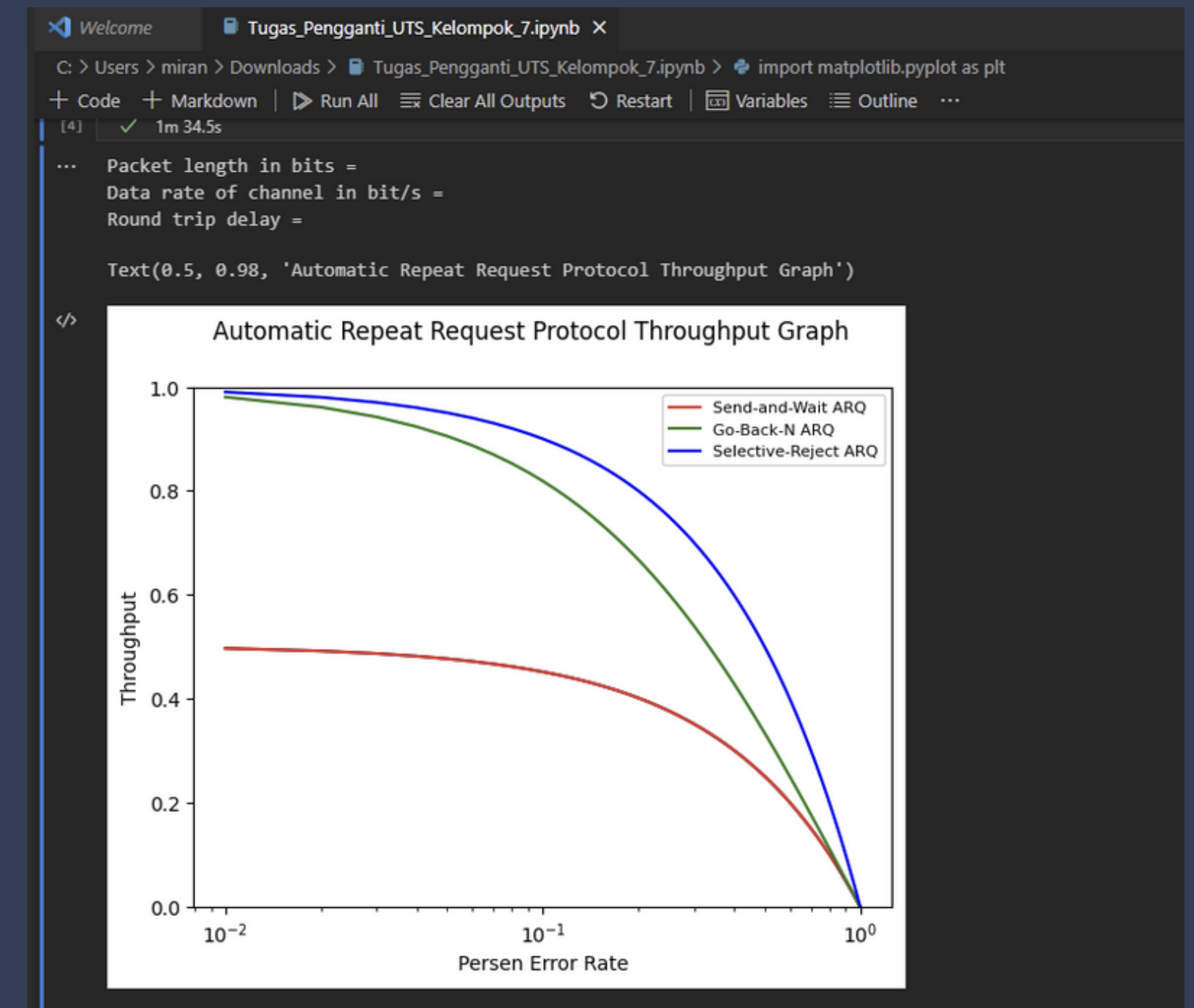
plt.semilogx(x,y1)
plt.plot(x,y1,label='Send-and-Wait ARQ', color="red") # Red plot is for Send-and-Wait ARQ
plt.plot(x,y2,label='Go-Back-N ARQ', color="green") # Green plot is for Go-back-N ARQ
plt.plot(x,y3,label='Selective-Reject ARQ', color="blue") # Blue plot is for Selective-Reject ARQ
plt.xlabel('Persen Error Rate')
plt.ylabel('Throughput')
plt.ylim((0,1))
plt.legend(fontsize="8", loc='upper right')

plt.suptitle("Automatic Repeat Request Protocol Throughput Graph")

# x axis values

[4] 94s
... Packet length in bits =
```

3) Click enter to display the graph output of the ARQ



RUNNING THE PROGRAM

4) To get the delay average, click run on the second cell

```

Run Cell
# Calculating ARQ Method Delay
# Transmission delay for Send-and-Wait ARQ
d1 = y1 / x
# Transmission delay for Go-Back-N ARQ
d2 = y2 / x
# Transmission delay for Selective Reject ARQ
d3 = y3 / x

#Plot for Delay
plt.semilogx(x,d1)
plt.plot(x,d1,label='Send-and-Wait ARQ', color="red")    # Red plot is for Send-and-Wait ARQ
plt.plot(x,d2,label='Go-Back-N ARQ', color="green")    # Green plot is for Go-back-N ARQ
plt.plot(x,d3,label='Selective-Reject ARQ', color="blue")    # Blue plot is for Selective-Reject ARQ
plt.xlabel('Persen Error Rate')
plt.ylabel('Delay')
plt.ylim(0, 10)
plt.xlim(0.1, 1)
plt.legend(fontsize="8", loc='upper right')
plt.suptitle("Automatic Repeat Request Protocol Delay Graph")

```

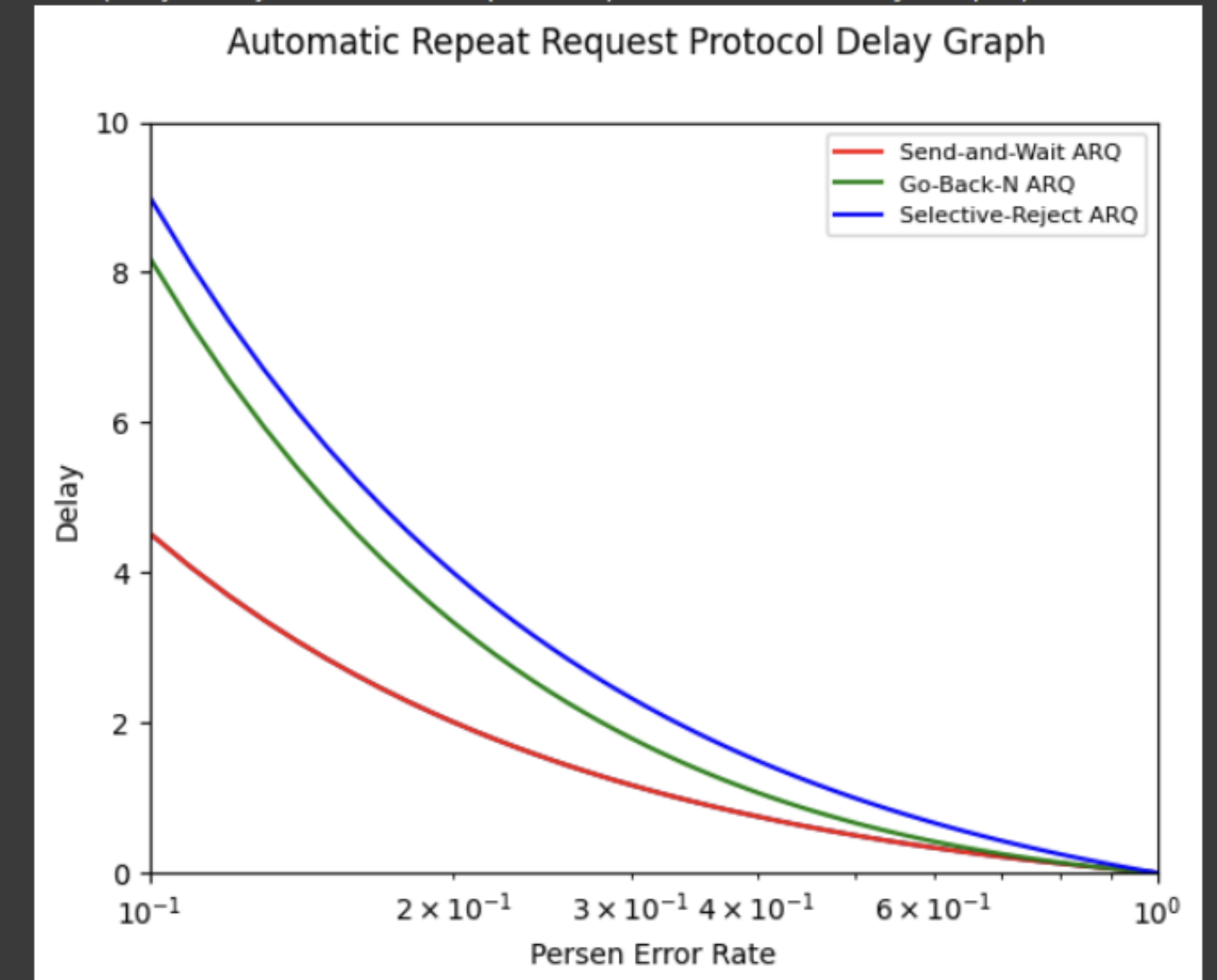
5) The delay graph will then be shown when the run cell button has been clicked

```

plt.ylim(0, 10)
plt.xlim(0.1, 1)
plt.legend(fontsize="8", loc='upper right')
plt.suptitle("Automatic Repeat Request Protocol Delay Graph")

```

Text(0.5, 0.98, 'Automatic Repeat Request Protocol Delay Graph')



RESULT

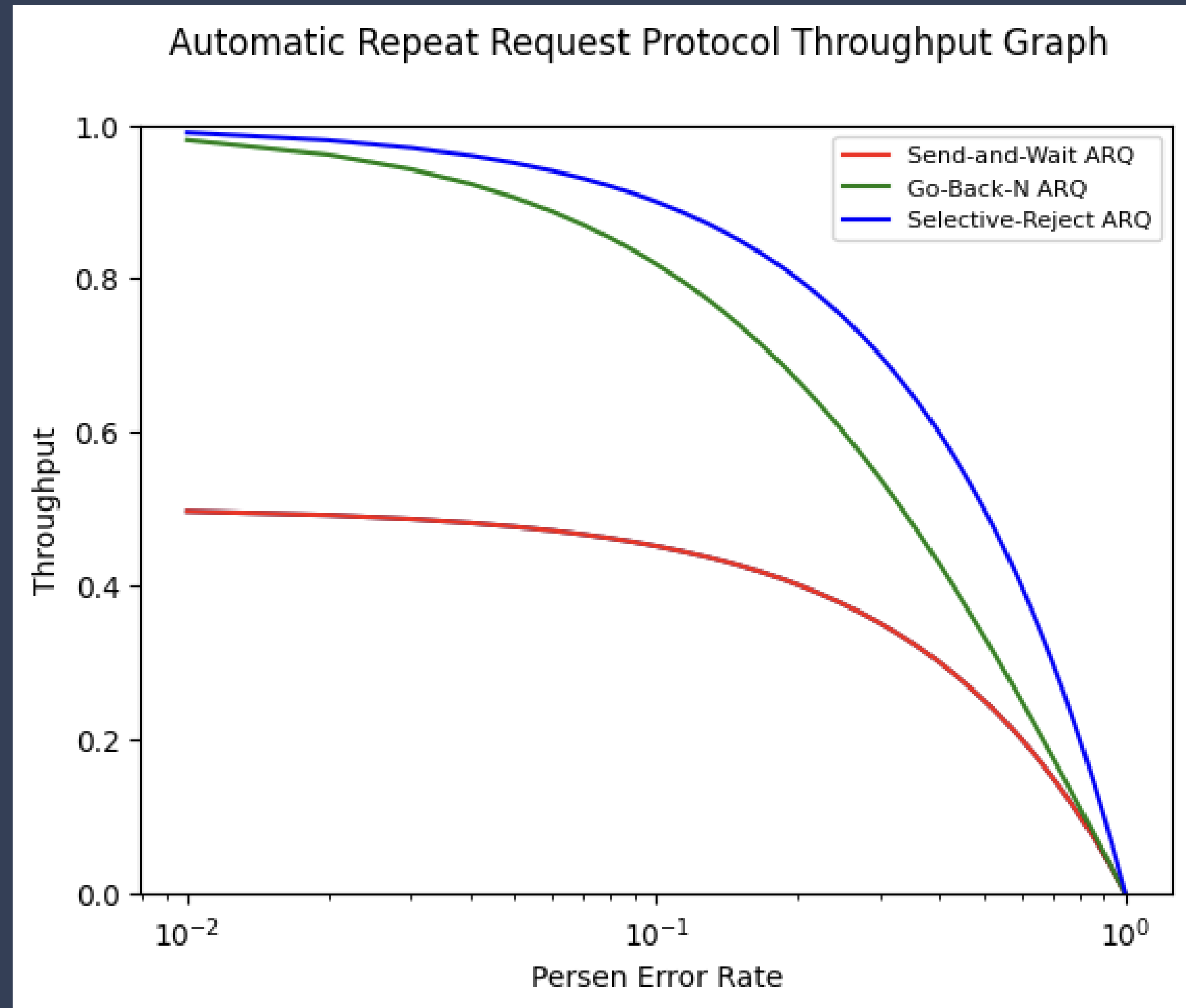
ARQ PROTOCOL THROUGHPUT GRAPH

Packet length in bits = 1514

Data rate of channel in bit/s = 750000

Round trip delay = 0.002

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RESULT

ARQ PROTOCOL DELAY AVERAGE GRAPH

Packet length in bits = 1514

Data rate of channel in bit/s = 750000

Round trip delay = 0.002

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