An-Najah Nation University
Faculty of Engineering

جامعة النجاح الوطنية
كلية الهندسة

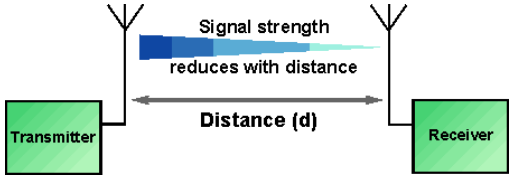
Computer Engineering Department
Data Structures and Algorithms (10636211)

HW 1

ILOs [3]	Due to 5/3/2022 Midnight	10 points

[Signal Path Loss Calculation]

Background:
When a signal (like a sound or voice signal) is transmitted from an antenna through the air, it loses some of its power while it is traveling until it reaches the receiver antenna side (see the figure below). This loss in power is called **"Path Loss".** Scientists found an experimental formulation of path loss (PL) which is measured using certain units that are called "decibels" (dB). This formulation is valid only in the Carrier Frequency within the range from 150 MHz to 1500 MHz (MegaHertz).



For small and medium-sized cities, **PL** can be formulated as follows:

PL = A + C*Log(**Distance**).
where
A = 69.55 + 26.16 * Log (**Carrier_Frequency**) - 13.82 * Log(**Base_Station_Height**) – B.
B = [1.1 * Log (**Carrier_Frequency**) - 0.7] * **Mobile_Station_Height** – 1.56 * Log (**Carrier_Frequency**) + 0.8.
C = 44.9 - 6.55 * Log (**Base_Station_Height**).

Carrier_Frequency is in MHz, **Distance** is in Km, **Base_Station_Height** is in m, and **Mobile_Station_Height** is in m.

Problem:
Write a complete C program that takes input data and outputs the corresponding path loss value in dB. Your program MUST validate the input for the Carrier Frequency such that it is within the acceptable range. If an invalid Carrier Frequency value is entered, the program outputs an appropriate error message.

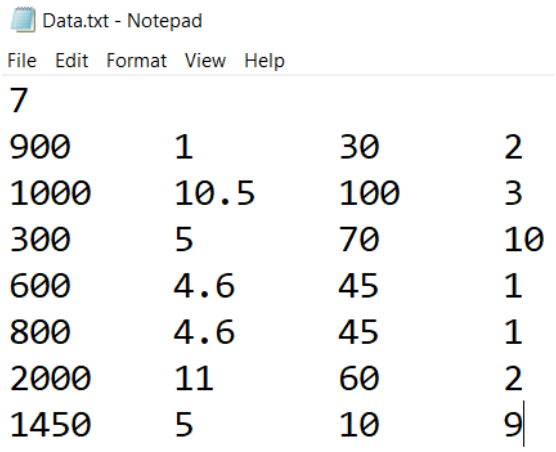
Homework requirements:

- First, you must ask the user to enter the name of the file.
- If the file is correct, read the file and produce the result as an output file with the information in the table and the Summary. Ask the user what the name of the output file is to save the data. Make sure the data is well-spaced and organized well in the file.

- You must define a data structure called **PathLoss**, with member variables as above with (A, B and C) only, no functions. Define an **array** with the suitable size of the data read from the input file. Make all calculations required to produce the result file.

- Don't use any class! you can define any suitable functions you want.

The sample data file:
The first line contains the number of readings. Each column represents the data entry as explained before.



The output file result:

Carrier_Frequency	Distance	Base_Station_Height	Mobile_Station_Height	Path Loss
900	1	30	2	125.1285
1000	10.5	100	3	148.9438
300	5	70	10	114.6046
600	4.6	45	1	143.1381
800	4.6	45	1	146.4640
2000	11	60	2	**NotValid**
1450	5	10	9	144.3711

Summary:
The average PL = 205.6625 dB
The max PL = 146.4640 dB
The min PL= 114.6046 dB

Reference:
http://www.rfwireless-world.com/Terminology/Okumura-Hata-Model-basics.html