

Computer Networks

Homework 1 (Due: 4th February, 2023)

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Step1: Finding the Path Loss Exponent (20 points)

The purpose of this step is to find out the **path loss exponent** of an unknown environment. Use any programming language/tools to solve your problem. Describe the outcomes in a report while submitting.

- First download the **WiFi Analyzer app** in your smartphone. Check whether the app is able to identify your WiFi AP and can collect the received signal strength (RSSI). The **time graph** will show you the signal strength variation with time.
 - Now use your AP as a transmitter and your smartphone as a receiver. Vary the distance in between these transceivers and at every positions record ~5-10 RSSI samples at different smartphone orientations (say 4)..
 - Plot all these points in a graph where the RSSI values are in y-axis (dBm), and the distances are in x-axis (in log scale)
 - Draw a best fit straight line corresponding to this log-log plot. Find out the **slope** of this line, divide it by 10 and take the absolute value, which is your **path loss exponent**.
 - Also find out the **variance** of these RSSI samples, w.r.t. the best fit line.
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Step 2: Range Estimation (20 points)

The purpose of this step is to find out the distance/range from the path loss exponent that you have found in the last step. Use any programming language/tools to solve your problem. Describe the outcomes in a report while submitting.

- Now use the obtained path loss exponent for estimating some distances, using the following formula (I have ignored the noise term). Assume d_0 as 1 meter, and find $P_r(d_0)$. Then record $P_r(d)[dBm]$ and estimate the distance d from the corresponding equation.
- However, due to the noise there will be some errors in range/distance estimation. So, calculate the distance error by comparing with the actual distance. Repeat this experiment for 5 different distances, and report the average error.

$$\begin{aligned} P_r(d)[dBm] &= P_t(d)[dBm] - [P_L(d_0)]dB - 10n \log_{10} \left(\frac{d}{d_0} \right) \\ &= P_r(d_0)[dBm] - 10n \log_{10} \left(\frac{d}{d_0} \right) \end{aligned}$$
