

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING
COMPUTER ENGINEERING DEPARTMENT
COE-241 – Data and Computer Communication
Matlab Programming Assignment #2: Microwave Link Design
Due Date Sun Dec 4th, 2014 – In Class.

Problem [100 points] It is desired to design a Matlab tool that aids telecom engineers in provisioning a microwave link and compute its cost between two cities. The following specifies the expected inputs:

1. Distance between the two cities, d_{total} in kilometers
2. The telecom transceiver specifications:
 - a. The effective system temperature for the microwave transceiver, T , in Kelvin
 - b. The total transmit power, P_t , in Watts
 - c. The transmit and receive antenna gains G_t and G_r , respectively, in dBs
 - d. The bandwidth of the telecom system, B , in MHz and the carrier frequency at which the system is operating, f_c , in GHz
 - e. The required capacity for the link, R , in Mbits per second
3. The cost for the towers: Tower type-A (end towers) cost $C_A = 200$ KSAR, and Tower type-B (intermediate towers) cost $C_B = 100$ KSAR. The towers include the transmitter/receiver systems

The tool should produce the following outputs:

1. The tool should first echo the main input parameters to the user
2. The needed signal-to-noise ratio, SNR , for the receiver to operate at the required parameters
3. The required receive power at the receiver site and the distance in kilometers.
4. Check if the required link capacity is possible or not – if not possible, the tool should suggest modification to enable the required setup.
5. The maximum possible separation between the transmitter and receiver, d_{max} taking into account output (3) and the earth curvature.
6. The number of type-A towers and type-B towers required to cover the distance d_{total} .
7. The overall cost for the required towers

The expected submission items:

1. A word file that contains the following sections:
 - a. A section on the computation/formulas/logic used to compute the needed output parameters
 - b. A section on the two design that contains a detailed flow chart. The section should contain a table listing the important system inputs/outputs variable names, math symbol, and explanation of the variable
 - c. A section showing sample runs of the tool for different input scenarios
 - d. A section containing the listing of the Matlab code for the tool.

The developed Matlab code should be very organized and well documented. Use variable names identical or very close to the mathematical variable used in this problem statement. The documentation should clearly specify the sections of the code that correspond to the computation of different parameters.

Students are encouraged to cooperatively discuss the problem and the Matlab know-how, however, each student must write and submit his *own* code. The submitted codes will be inspected for similarities.

It is required to zip the word file together with the Matlab code and submit the zipped file by email to ashraf@kfupm.edu.sa and Ahmad Azmi Abo Naser g201203480@kfupm.edu.sa. The name of the zip file should contain the following pattern: sXXXXXX_LastName_FirstName_ProgAssig2.zip. sXXXXXX is the student number. The subject line of the email should be: COE 241-141: submission for programming assignment # 2”.

To import figures into your word document, go to the Matlab figure Edit menu and select “copy figure”. Paste (special) the figure into the word file as “Picture (Enhanced Metafile)”. Please do not paste as any other format.

Students must ALSO submit a hardcopy of the programming assignment solution and the used Matlab code.

Problem [bonus - 30 points]: Up to 30 points bonus points are allocated if:

1. The tool uses a graphical user interface to take in the inputs and to display the outputs.
2. The tool validate the user input (e.g. does not allow negative distance/bandwidth/etc. input).