KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-241 – Data and Computer Communication

Assignment 1 – Due date: Feb 9th, 2016

Student Name:
Student Number:

Problem #	Maximum Mark	Mark
1	50+10	
Total	50 + 10	

Problem 1:

Consider the square-wave signal shown in the figure below. Assume $A = 2$ volts and $T = 0.5$ seconds.

1. (5 points) Write a mathematical representation for $s(t)$?
2. (2 points) Calculate the fundamental frequency, f_0?
3. (10 points) Compute the Fourier Series Expansion for signal $s(t)$. Specify clearly the constants A_0, A_n, and B_n, and the expansion for the signal $s(t)$.
4. (3 points) Compute the DC component of $s(t)$?
5. (2 points) Does $s(t)$ contain frequencies lower than the fundamental frequency? What is (are) these frequencies and specify the terms containing these frequencies?
6. (2 points) Does $s(t)$ contain frequencies higher than the fundamental frequency? What is (are) these frequencies and specify the terms containing these frequencies?
7. (6 points) Compute the total power for $s(t)$?
8. (10 points) In a table similar to that used in the class notes examples, find n^* such that $s\_e(k = n^*)$ contains at least 95% of the total power in the original $s(t)$.
9. (10 points) Specify, i.e. write mathematical expression for, the power spectral density function for the signal $s(t)$.
10. (bonus 10 points) Plot the power spectral density function for the signal $s(t)$ using stem plots similar to the ones given in the class notes. Label your axes properly.

The student must show ALL the derivation or mathematical steps leading to the answer. For the parts where plots are required, the code or original excel sheet are required and should be included in the submission.

Compare your solution to the answer given in the textbook (10th edition – textbook pages 99-105) – beginning of chapter 3 on the subject of bandwidth.