

***KING FAHD UNIVERSITY OF PETROLEUM & MINERALS***  
***COLLEGE OF COMPUTER SCIENCES & ENGINEERING***  
***COMPUTER ENGINEERING DEPARTMENT***  
**COE-241 – Data and Computer Communication**  
**Matlab Programming Assignment #1: Fourier Series Expansion**  
**Due Date Sun Sept 29<sup>th</sup>, 2013 – In Class.**

**Problem [100 points]** It is desired to reproduce textbook Figure 3.4 on page 71 and also Figure 3.7 on page 75. Let the signal period  $T = 1/f_0$  be equal to 1 time unit and the time variable  $t$  range from 0 to 2.0 time units as shown in the textbook figure.

Use the same  $x$ -axis and  $y$ -axis *ranges*, *grid lines (if any)*, and *grid lines* shown in the textbook. Use the labels “ $t$  – time unit” and “signal amplitude” for the  $x$ -axis and  $y$ -axis, respectively.

No.	Plot To Be Reproduced	Corresponding Signal
1	Figure 3.4 – part (a); page 71	$s_1(t) = \sin(2\pi f_0 t)$
2	Figure 3.4 – part (b); page 71	$s_3(t) = \frac{1}{3} \sin(2\pi(3)f_0 t)$
3	Figure 3.4 – part (c); page 71	$s_{1-3}(t) = (4/\pi) \left[ \sin(2\pi f_0 t) + \frac{1}{3} \sin(2\pi(3)f_0 t) \right]$
4	Figure 3.7 – part (a); page 75	$s_{1-5}(t) = (4/\pi) \left[ \sin(2\pi f_0 t) + \frac{1}{3} \sin(2\pi(3)f_0 t) + \frac{1}{5} \sin(2\pi(5)f_0 t) \right]$
5	Figure 3.7 – part (b); page 75	$s_{1-7}(t) = (4/\pi) \left[ \sin(2\pi f_0 t) + \frac{1}{3} \sin(2\pi(3)f_0 t) + \frac{1}{5} \sin(2\pi(5)f_0 t) + \frac{1}{7} \sin(2\pi(7)f_0 t) \right]$
6	Figure 3.7 – part (c); page 75	$s(t) = \text{square}(2\pi f_0 t)$

Write a Matlab code to *reproduce* the required plots using the functions defined in the above table. How many sinusoidal terms should be added to obtain the square function?

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 each part of this programming assignment.

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.

Generate the required outputs and import them into an organized Microsoft word file along with comments on the obtained results. Zip the word file together with the Matlab code and submit the zipped file by email to [ashraf@kfupm.edu.sa](mailto:ashraf@kfupm.edu.sa). The name of the zip file should contain the following pattern: sXXXXXX\_LastName\_FirstName\_ProgAssig1.zip. sXXXXXX is the student number.

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.