KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-341 – Data and Computer Communication
Assignment 1 – Due date: Feb 20th, 2012

Student Name:
Student Number:

Problem #	Maximum Mark	Mark
1	20	
2	10	
3	10	
4	20	
5	80 + 20	
6	20 + 20	
Total	160	

Problem 1 (20 points) Consider Figure 1.5 shown in the textbook. The figure presents a simplified view of the Internet. In the context of the figure and the textbook material in section 1.5, answer the following:

a) What are the backbone ISP and regional ISP and what are the differences between them?

b) What is “”Private Peering”?

Hint: Student may want to “google” these terms in addition to the material discussed in textbook.

Problem 2 (10 points) Textbook Problem 2.4 (page 55).

Problem 3 (10 points) Textbook Problem 2.7 (page 56).

Problem 4 (20 points) Explain/Define the four service primitives for the OSI Layered model. Explain (in a diagram similar to that shown in slides), how these primitives can provide *connectionless* or *unguaranteed* (*unreliable*) delivery service.

Problem 5 (80 points + 20 points bonus) Consider the periodic signal $s(t)$ shown in the figure below. Assume $A = 1$ volts and $T = 1$ second.

a) (5 points) Write a mathematical representation for $s(t)$.

b) (5 points) Is $s(t)$ analog or discrete and why? What is the period of the function $s(t)$? What is the fundamental frequency for $s(t)$?

c) (5 points) Compute the DC component of $s(t)$.

d) (5 points) Compute fmin and fmax and determine the bandwidth of $s(t)$.

e) (5 points) Compute the energy and power of $s(t)$.

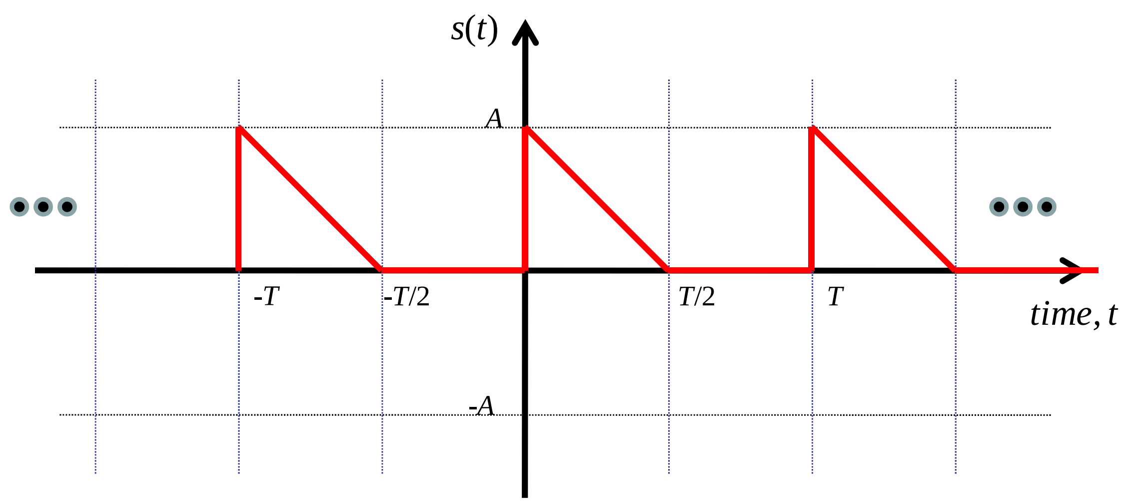
f) (30 points) Find the Fourier series expansion of $s(t)$.

g) (5 points) Specify the terms containing frequencies lower than the fundamental frequency and those containing frequencies higher than the fundamental frequency.

h) (10 points) Compute the power using the Fourier Series expansion and show that is it equal to that obtained in part (e)

i) **(20 points - bonus)** $s(t)$ has infinite bandwidth (line spectrum) and it is required to truncate it such that it has a limited bandwidth but still has 95% of the original power. What terms of the original series expansion should be included? Produce a table similar to that in slides shown in class on Fourier Series Expansion (slide 78). Show the percent of power as the number of terms in $s\_e(n = k)$ are increased.

j) (10 points) What is the new bandwidth and power of the new truncated series?



Problem 6 (20 points + 20 points bonus): Consider the signals given in the following table:

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	$s(t) = \text{square}(2\pi f_0 t)$

a) (20 points) Compute the power for each of these signals. State your observations.

b) **(20 points bonus)** Plot the approximate power spectral density function for the signal $s(t)$.