American University of Beirut

Faculty of Engineering and Architecture

Department of Electrical and Computer Engineering

EECE 200-Introduction to Engineering – Fall 2013

Homework 2

Problem 1 (IEEE and Ethics): [16 points]

Visit the website of Institute of Electrical and Electronics Engineers (IEEE) and answer that questions that follow:
http://www.ieee.org/index.html

a. What is the mission and vision of IEEE? [2 points]
   mission: IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity.
   Vision:IEEE will be essential to the global technical community and to technical professionals everywhere, and be universally recognized for the contributions of technology and of technical professionals in improving global conditions.
   The IEEE is engaged in an enterprise-wide strategic planning process. [1 point each]

b. How many regions does IEEE have? To which region does Lebanon section belong? [2 point]
   10 regions, Lebanon is Region 8

c. Name 3 societies of IEEE including their publications. [6 points]

IEEE Antennas and Propagation Society, IEEE Antennas and Propagation magazine
….. [1 pt for each society, 1 point for each publication]

Check IEEE code of ethics at the following website:
http://www.ieee.org/portal/pages/iportals/aboutus/ethics/code.html

d. List 4 items from the code and give examples of how we can apply 2 of them to our real life. [6 points]

4 of the following 10: [1 point for each, 1 point for each example

1. to accept responsibility in making decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. to be honest and realistic in stating claims or estimates based on available data;
4. to reject bribery in all its forms;
5. to improve the understanding of technology, its appropriate application, and potential consequences;
6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. to avoid injuring others, their property, reputation, or employment by false or malicious action;
10. to assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

Problem 2 (Circuits and Electronics): [15 points]

a. What is the main chip used in iPhone 5, name 2 other chips on this phone. [3points]
   System chip: Apple A6, Graphics processor:, memory, amplifiers, A/D, D/A…. [1 point each]

Intel recently released the 4th generation Intel® Core™ i3 processor. The chip has 1.4 billion transistors in 2013.

b. Suppose that at some time in the future, Intel will release the chip with 16 billion transistors. In what year will this occur? [6points]

The number of transistors in a chip in year Y_2 is given by:
$N_2=2^{(Y2-Y1)/2}*N_1$ where N_1 is the number of transistors in a chip in year Y_1 ($Y_1<Y_2$).
So $\ln(N_2)=(Y_2-Y_1)/2*\ln(2)+\ln(N_1)$
$Y_2=2\ln(N_2/N_1)\ /\ln(2)+Y_1$
$Y_2=2[\ln(16/1.4)\ ]/\ln(2)+2013$
Y2=2020

c. Moore's Law says that the number of transistors doubles every two years, how many transistors would be on this chip in the year 2030? [6points]

$N_2=2^{(Y2-Y1)/2}*N_1$

$Y_2-Y_1=2030-2013=17$, then $N_2=2^{8.5}*1.4$billion

In 2030 we will have about 506.85 billion transistors on a single Pentium chip.

Problem 3 (Computer Hardware): [16 points]

Consider the following expression:

$$O=[(X'+Y)\oplus(Z'+Y)]+[(Y.Z)\oplus X]'$$

a. Find the truth table of the following expression (output O in terms of three inputs X, Y, and Z). [10 points]

X	Y	Z	X'+Y	Z'+Y	(X'+Y) ⊕(Z'+Y)	Y.Z	(Y.Z) ⊕X	[(Y.Z) ⊕X]'	[(X'+Y) ⊕(Z'+Y)]+[(Y.Z) ⊕X]'
0	0	0	1	1	0	0	0	1	1
0	0	1	1	0	1	0	0	1	1
0	1	0	1	1	0	0	0	1	1
0	1	1	1	1	0	1	1	0	0
1	0	0	0	1	1	0	1	0	1
1	0	1	0	0	0	0	1	0	0
1	1	0	1	1	0	0	1	0	0
1	1	1	1	1	0	1	0	1	1

b. Write the following expression in terms of AND, OR, NAND, NOR, NOT and XOR gates. [6points]

[(NOT X OR Y) XOR (NOT Z OR Y)] OR NOT[(Y AND Z) XOR X]

Problem 4 (Communications and Signals): [18 points]

The following audio signal **Y (t) =2 sin (3500t)** Volts is to be transmitted via a communication link using digital communication system. (Indicate units whenever necessary).

a. What are the two main steps in Analog to Digital conversion? [2 points]
Sampling, Quantization [1 point each]

b. What is the minimum sampling rate required to sample this signal? Why? [1 point]
2*Fmax=2* (3500/2*pi) = 1114Sample/sec

c. If the signal is sampled at a rate of 1500 samples/sec. Find the values of the first five samples, starting with t=0. Show all your calculations. [5 points]
t1=0; Y (t1) = 2sin(0)= 5V
t2=1/sampling rate=1/1500 s; Y (t2) =2sin (3500*(1/1500))= 1.446V
t3=2/1500 s; Y (t3) =2sin (3500*(2/1500)) = -1.99 V
t4=3/1500 s; Y (t4) =2sin (3500*(3/1500)) = 1.314 V
t5=4/1500 s; Y (t5) =2sin (3500*(4/1500)) = 1.826 V
(Angle is in radians)

The samples are quantized to 128 discrete levels that correspond to full range of +/- 2Volts (All zeros is -2V and all ones is +2V).

d. If 128 quantization levels are used, what is the required bits/sample of the A/D converter? [1 point]
7 bits/ sample

e. Find the binary representation of the first five samples starting at t=0. Show all your calculations. [5 points]

T	Value of the sample(V)	Corresponding level	Binary representation of the level
t1=0	0	63	0111111
t2=1/1500	1.446	110	1101110
t3=2/1500	-1.99	0	0000000
t4=3/1500	1.314	106	1101010
t5=4/1500	1.826	122	1111010

f. Identify two ways for improving the quality of A/D conversion. What disadvantage does each way have? [4 points]

1. Increase the sampling rate, which will give us a better quality of the digital signal but a larger size of the file (due to a larger number of samples with the same number of bits)

2. Increase the number of quantized levels, which will also make the file larger (due to an increase in the number of bits used to store the data digitally, while the number of samples remains the same).

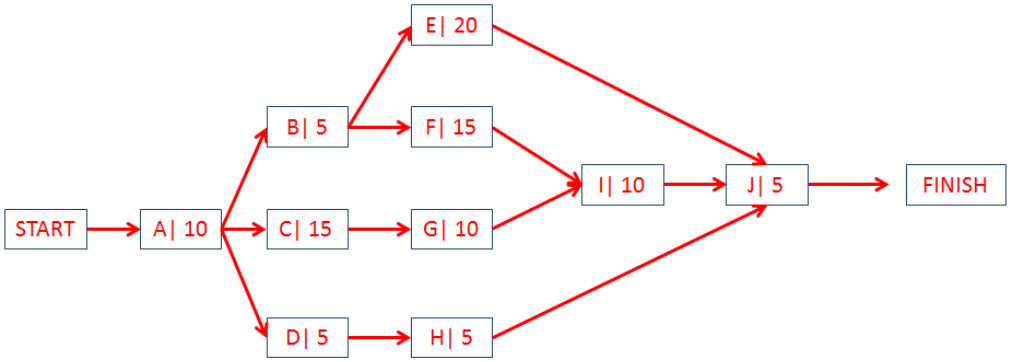
An increase in the sampling rate means better

Problem 5 (Project Management): [35 points]

Consider the following list of activities for an engineering project along with the expected duration in days. The activities are shown in the table below:

Activity	Predecessor	Duration
A	None	10
B	A	5
C	A	15
D	A	5
E	B	20
F	B	15
G	C	10
H	D	5
I	F,G	10
J	E, I, H	5

a. Show the network diagram representation of this project. [4 points]



b. Identify the paths from start to end of the project and the duration of each path. [4 points]

PATH	DURATION
A B E J	10+5+20+5=40
A B F I J	10+5+15+10+5=45
A C G I J	10+15+10+10+5=50
A D H J	10+5+5+5=25

c. Find the earliest start and the earliest finish of each task. [10 points: 0.5 Point for each]

d. Find the latest start and latest finish of each task. [10 points: 0.5 Point for each]

e. Find the float time (slack time= LS-ES=LF-EF). [2.5 points: 0.5 Point for each]

TASK	Earliest Start (ES)	Earliest Finish (EF)	LS	LF	Float time =LS-ES
A	0	10	0	10	0
B	10	15	15	20	5
C	10	25	10	25	0
D	10	15	35	40	25
E	15	35	25	45	10
F	15	30	20	35	5
G	25	35	25	35	0
H	15	20	40	45	25
I	35	45	35	45	0
J	45	50	45	50	0

f. Indicate the critical path based on observations from part (b). Justify. [1.5points]

A-C-G-I-J 10+15+10+10+5=50 longest path

g. Indicate the critical path based on observations from part (e). Justify. [2 points]

Tasks with 0 slack: A C G I J

Critical path: A-C-G-I-J

h. Find the minimum project completion time. [1 point]

50 DAYS