American University of Beirut
Faculty of Engineering and Architecture
Department of Electrical and Computer Engineering
EECE 200-Introduction to Engineering –Fall 2011-2012

Homework 2

Problem 1 (IEEE and Ethics): [20 points]

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

a. What is the mission and vision of IEEE? [4 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. [2points each]

b. How many IEEE sections are there? In how many regions? To which region does Lebanon section belong? [6 points]

333 sections. 10 regions. Lebanon is Region 8.[2 points each]

c. How, in your opinion, is IEEE using the advancement of technology for the progress of humanity? Support your explanation with two examples. [4 points]

publications, conferences, awards, education and careers, standards,
IEEE creates an environment where members collaborate on world-changing technologies – from computing and sustainable energy systems, to aerospace, communications, robotics, healthcare, and more.
IEEE is a leading developer of international standards that underpin many of today's telecommunications, information technology and power generation products and services
Technology is constantly evolving. In order to quickly respond to new innovations, IEEE has a variety of technical committees and activities.
Industry professionals and their employers will value IEEE as a major resource to achieve success. (2pts for explanation) (2pts for examples)

Check IEEE code of ethics at the following website:

http://www.ieee.org/portal/pages/iportals/aboutus/ethics/code.html

a. Choose 3 items from the code that you believe are the most important and provide real life examples of how to abide by them. [6 points]

3 of the following 10:

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 (Communications and Signals): [15 points]

The following audio signal Y(t)=3cos(4000t) 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? [1 point]

Sampling, Quantization

b. What is the minimum sampling rate required to sample this signal? Why? [1 point]

2*Fmax=2* (4000/2*pi) = 1272.2 Sample/sec

c. If the signal is sampled at a rate of 2000 samples/sec. Find the values of the first five samples, starting with t=0. Show all your calculations. [5 points]

t1=0; Y (t1) = 3cos(0)= 3V
t2=1/sampling rate=1/2000 s; Y (t2) =3cos (4000*(1/2000))=-1.248 V
t3=2/2000 s; Y (t3) =3cos (4000*(2/2000)) = -1.961 V
t4=3/2000 s; Y (t4) =3cos (4000*(3/2000)) = 2.88 V
t5=2/2000 s; Y (t5) =3cos (4000*(4/2000)) = -0.436 V
(Angle is in radians)

The samples are quantized to 256 discrete levels that correspond to full range of +/- 3Volts (All zeros is -3V and all ones is +3V).

d. If 256 quantization levels are used, what is the required bits/sample of the A/D converter? [1 point]

8 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	3	255^{th}	11111111
t2=1/2000	-1.248	74^{th}	01001010
t3=2/2000	-1.961	44^{th}	00101100
t4=3/2000	2.88	250^{th}	11111010
t5=4/2000	-0.436	109^{th}	01101101

f. Identify two ways for improving the quality of A/D conversion. What disadvantage does each way have? [2 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 3 (Computer Hardware): [15 points]

Consider the following expression:

O= {[(X+Y)'⊕Z] + [(Z.Y) +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)'	(X+Y)'⊕Z	Z.Y	X'	(Z.Y)+X'	[(X+Y)'⊕Z]+ [(Z.Y)+X']	{[(X+Y)'⊕Z]+ [(Z.Y)+X']'}
0	0	0	1	1	0	1	1	1	0
0	0	1	1	0	0	1	1	1	0
0	1	0	0	0	0	1	1	1	0
0	1	1	0	1	1	1	1	1	0
1	0	0	0	0	0	0	0	0	1
1	0	1	0	1	0	0	0	1	0
1	1	0	0	0	0	0	0	0	1
1	1	1	0	1	1	0	1	1	0

b. Write the following expression in terms of AND, OR, NAND, NOT, NOR, and XOR gates.
[5points]

[(X NOR Y) XOR Z] NOR [(Z AND Y) OR (NOT X)]

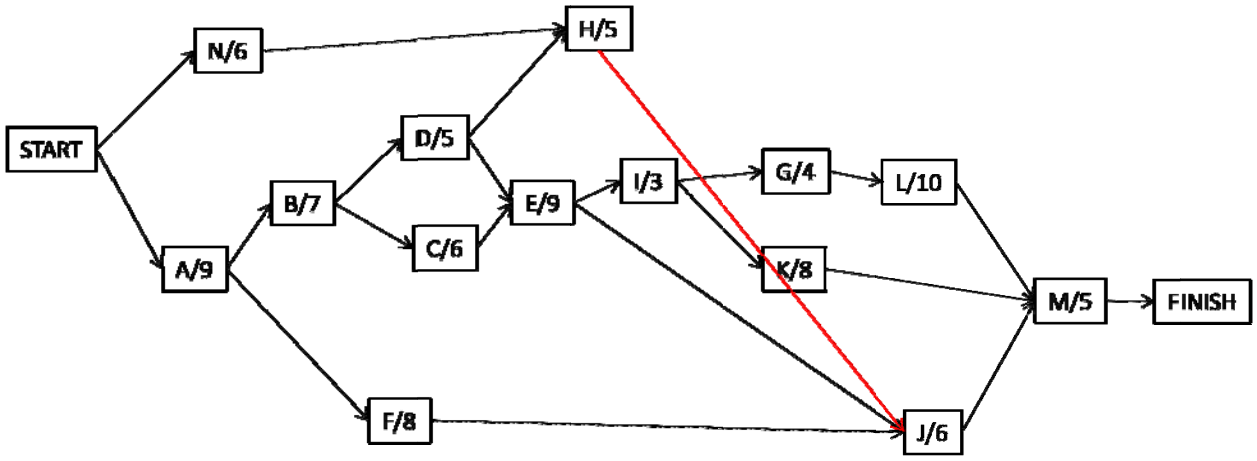
Problem 4 (Project Management): [35 points]

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

Activity	Predecessor	Duration
N	None	6
A	None	9
B	A	7
C	B	6
D	B	5
E	C,D	9
F	A	8
G	I	4
H	D,N	5
I	E	3
J	E, F,H	6
K	I	8
L	G	10
M	J, K, L	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. [5 points]

PATH	DURATION
N-H-J-M	5+6+6+5=22
A-B-D-E-I-G-L-M	9+7+5+9+3+4+10+5=52
A-B-D-H-J-M	9+7+5+5+6+5=37
A-B-D-E-I-K-M	9+7+5+9+3+8+5=46
A-B-D-E-J-M	9+7+5+9+6+5=41
A-B-C-E-I-G-L-M	9+7+6+9+3+4+10+5=53
A-B-C-E-I-K-M	9+7+6+9+3+8+5=47
A-B-C-E-J-M	9+7+6+9+6+5=42
A-F-J-M	9+8+6+5=28

c. Find the earliest start and the earliest finish of each task. [7 points]
d. Find the latest start and latest finish of each task. [7 points]
e. Find the float time (slack time= LS-ES=LF-EF). [7 points]

TASK	Earliest Start (ES)	Earliest Finish (EF)	LS	LF	Float time =LS-ES
N	0	6	31	37	31
A	0	9	0	9	0
B	9	16	9	16	0
C	16	22	16	22	0
D	16	21	32	37	16
E	22	31	22	31	0
F	9	17	34	42	25
G	34	38	34	38	0
H	21	26	37	42	16
I	31	34	31	34	0
J	31	37	42	48	11
K	34	42	40	48	6
L	38	48	38	48	0
M	48	53	48	53	0

f. Indicate the critical path based on observations from part (b). Justify. [2points]
A-B-C-E-I-G-L-M longest: 53

g. Indicate the critical path based on observations from part (e). Justify. [2 points]
Tasks with 0 slack: A,B,C,E,G,I,L,M
Critical path: A-B-C-E-I-G-L-M
h. Find the minimum project completion time. [1 point]
53

Problem 5 (Circuit and Electronics): [15 points]

a. Name three ICs found inside a cellular phone. [3points]
Amplifier, microprosessor, DSP, A/D,D/A, Timers, etc.,,,,

Assume that the Pentium chip had 35million transistors in 2010.
b. Suppose that at some time in the future, a Pentium chip is released with 1.6 billion transistors.

In what year does this occur? [6points]

The number of transistors in a chip in year Y2 is given by:
N2=2(Y2-Y1)/2*N1 where N1 is the number of transistors in a chip in year Y1 (Y1<Y2).
So ln(N2)=(Y2-Y1)/2*ln(2)+ln(N1)
Y2=2ln(N2/N1)/ln(2)+Y1
Y2=2ln(1600/35)/ln(2)+2010
Y2= 2021

c. If Moore's Law said that the number of transistors would quadruple every two years, how many transistors would be on a Pentium chip in the year 2045? [6points]

In 2045 we will have about 1.2×10^{18} transistors on a single Pentium chip.

let n=2045-2010, then nb of transistors= 4^(n/2) * 35*10^6 transistors