Assignment 2

Based on a Previous Final Exam

ELEC-4601: Microprocessor Systems

Department of Electrical and Computer Engineering, Carleton University

Instructor: Maitham Shams   **Due Date:** 6 December 2011 in Box

Last Name: _____

First Name: _____

ID: _____

1	2	3	Total
/20	/15	/25	/60

[1] (20 marks) **Error Detection and Correction**

In the extended Hamming code, one creates $(n + k + 1)$-bit words. When reading the data, the check bits C and the overall parity P are calculated. Using this concept, find the original data (if possible), if the following $(n + k + 1)$-bit words are read.

a) 0 1 1 0 0 0 1 0 1 0 0 1 1 1 0

a) Original Data: _____

b) 1 0 0 0 1 0 0 0 1 1 1 0 1 1 1

b) Original Data: _____

c) 0 1 0 0 0 1 1 0 1 1 0 0 0 0 1

c) Original Data: _____

d) 0 1 1 1 1 0 0 0 1 1 0 0 0 1 0

d) Original Data: _____

[2] (15 marks) **Computer Performance**

You want to decide between two code sequences that implement the same program for a particular machine.There are four classes of instructions with the following number of clock cycles per instruction (CPI).

Class	CPI
A	1
B	2
C	3
D	4

The two code sequences use the following numbers of each instruction class for an application.The numbers given are in *millions* of instruction.

Code	A	B	C	D
1	4	5	3	1
2	7	4	2	1

a) Which code sequence is faster for this application?

b) Find the execution time for each code sequence, if the clock rate is 1 GHz.

c) Find the MIPS rating for each case.

[3] (8+7+10 marks) **Memory Design**

A computer system has an Intel CPU with a 32-bits address bus and a 32-bits data bus. It requires 8 MB of DRAM starting at address $AC800000_H$. The available parts are 512K×4 DRAM chips, and a PAL chip with 20 inputs and 20 outputs. The processor provides $\overline{\text{MRDC}}$, $\overline{\text{MWTC}}$, $\overline{\text{BE0}}$, $\overline{\text{BE1}}$, $\overline{\text{BE2}}$, and $\overline{\text{BE3}}$. The DRAM chips have $\overline{\text{WE}}$, $\overline{\text{OE}}$, and $\overline{\text{CE}}$ control inputs.Do all calculations on this page and draw the circuit on the next page.

a) Find the start and end addresses for each set (level) of DRAM chips that provide a single 32-bit (double-word) data together, that is, for each chip-enable signal.

b) Write the design expressions for the PAL device.

c) Draw a simple circuit diagram including the PAL, indicate all inputs and outputs, and label the wires in your design.