Homework 2
Due 9/15/2005 by 11 am

1. You are storing the string “HELLO UD! BLUE HENS!” in the memory. Assume that the whole string is one object, and that the memory locations are free starting from location 100.
   a. (10 points) Draw a table depicting addresses and values stored in memory locations, if we are using Big Endian notation. Discover ASCII values for characters using an ASCII-chart (e.g., find it on the Internet).
   b. (10 points) Repeat part a) but for Little Endian notation.
   c. (3 points) What is the number of misaligned 1-byte words?
   d. (3 points) What is the number of misaligned 2-byte words?
   e. (3 points) What is the number of misaligned 4-byte words?

2. Assume that we are introducing a new instruction into our architecture so that a sequence of LOAD/ADD instructions can be replaced with one ADD instruction in the following manner:
   LOAD R1, 0(Rb)
   ADD R2, R2, R1
   becomes
   ADD R2, 0(Rb)
   Assume also that adding this new instruction increases clock cycle time by 5%.
   a. (15 points) What is the minimum percentage of loads we must be able to replace to actually benefit from this new instruction (Hint: compare old and new CPUtime). Assume that CPI stays the same.
   b. (15 points) Now assume that I have another optimization in mind – which will result in clock speedup by 30% (new clock cycle will be 70% of the old clock cycle). Calculate the percentage of loads that have to be replaceable so that option a) is better than option b)

3. Assume that registers R2, R3 and R4 store values 100, 200 and 400 respectively. Also assume that Mem[96]=20, Mem[100] = 300, Mem[300] = 500, Mem[400]=100 and Mem[600]=38. What value will be stored in register R1 and in R2 in each of the following cases:
   a. (5 points) ADD R1, R2, R4
   b. (5 points) ADD R1, R2, #4
   c. (5 points) ADD R1, R2, (R4)
   d. (5 points) ADD R1, R2, 300(R2)
   e. (5 points) ADD R1, R2, (R2+ R3)
   f. (5 points) ADD R1, R2, (100)
   g. (5 points) ADD R1, R2, @(100)
   h. (5 points) ADD R1, R3, (R2)+ (assume d=4)
   i. (5 points) ADD R1, R3, -(R2) (assume d=4)
   j. (5 points) ADD R1, R2, 100(R2)[R2] (assume d=4)