جامعة المنصورة
كلية الهندسة
قسم هندسة الحاسبات و النظم

الفرقة الرابعة
امتحان مادة: هندسة معمار الحاسب ٢
الزمن: ٣ ساعات

Please answer the following questions:

Q1: Consider a machine with a byte addressable main memory of 2^{16} bytes and block size of 8 bytes. Assume that a direct mapped cache consisting of 32 lines is used with this machine.

a. How is a 16-bit memory address divided into tag, line number, and byte number?
b. Into what line would bytes with each of the following addresses be stored?
0001000100011011
1100001100110100

Q2: Convert the following arithmetic expressions from RPN to Infix Notation.

a. ABCDEFG +*+*+*
b. ABCDE * / − +
c. ABC * /D − EF/+
d. ABCDEFG + * + * + *

Q3: An instruction is stored at location 300 with its address field at location 301. The address field has the value 400. A processor register Rl contains the number 200. Evaluate the effective address if the addressing mode of the instruction is Direct, Immediate, Relative, Register indirect, and Index with Rl as the index register.

Q4: The program in a computer compares two signed numbers A and B by performing the subtraction A − B and updating the status bits. Let A = 01000001 and B = 10000100.

a. Evaluate the difference and interpret the binary result.
b. Determine the value of status bits S, Z, and V .
c. List the conditional branch instructions that will have a true condition.

Q5: Write a program to evaluate the arithmetic statement:

$$X = \frac{A - B*(C*(D-E))}{F+G*H}$$

a. Using a general register computer with three address instructions.
b. Using a general register computer with two address instructions.
c. Using an accumulator type computer with one address instructions.
d. Using a stack organized computer with zero-address operation instructions.

Q6: An array multiplier multiplies two 4-bits numbers using AND gates and binary adders. The propagation delay in each AND gate is 10ns and 30ns for the adder. (Hint: assume any missing data).

a. Design this array multiplier, showing how many AND gates and adders.
b. If we consider this multiplier as a pipeline, how many segments you need, what is the total time pipeline will take to perform Ai * Bi for i= 1 to 10.
c. What is the total time in a non-pipeline to perform same number of tasks.

Q7: How would you use the floating-point pipeline adder to calculate the inner-product of two vectors A[a1 a2 ..... a100] and B [b1 b2 ..... b100]. Propose a method to add the remaining four partial sums to form the final sum.

Q8: Show the contents of registers E,A,Q, and SC during the process of multiplication of two binary numbers, 00111 (multiplicand) and 00101 (multiplier). The signs are not included.

Good luck. ***Dr. Abdelhameed Fawzy (5/1/2013)***