CSE 220

Midterm #1 Practice Exam

P1: Convert A7 in hex to a number in base 8.

P2: Convert 4.9 in decimal to a number in base 3. The algorithm for converting fractions to base 3, is similar to what we have studied. Apply it carefully with minor changes. Stop after pattern starts repeating.

P3: Normalize this binary number (-0.0001101). You must follow normalization of single precision IEEE format. State the sign bit, exponent, and significand in
binary form for the above normalized number.

P4: How many single precision floating point registers are there in MIPS?
How many double precision registers are there in MIPS?

P5: Perform subtraction (1.01 x 2^1 - 1.11 x 2^0) by aligning exponents. Numbers are already in IEEE normal form. You may do it without 2's complement if you wish. Normalize the result and state the answer using power of 2.
(i) Align exponents and subtract.
(ii) Normalize the result and state it using power of 2.

P6: Consider 6-bit long (including sign) binary numbers.
(a) Consider a binary number (110010) stored in signed magnitude form. What is this number in decimal?
(b) How is -5 stored in 1's complement form?
(c) Perform (001001 + 001101). Answer:
(d) What is the smallest positive number that we need to add to (011010) so that overflow is generated? Decimal answer is expected; remember numbers are 6-bit long. Here negative numbers are stored in 2's complement form. Show all work.

P7: (a) Suppose we want to code letters A through Z (only upper case) using binary numbers, starting with 0. What is the minimum number of bits that we need?
(b) Suppose we want to code letters A through Z (only upper case) using base 3 numbers, starting with 0. What is the minimum number of base 3 digits that we need?
(c) What would be the base-3 code for letter F in the part (b) above.

P8: Consider a machine with 32-bit word (4 bytes in a word). Bytes are numbered 0, 1, 2, 3, ... and words are numbered 0, 1, 2, ... etc. Word-0 contains byte-0, byte-1, byte-2 and byte-3. Word-1 contains byte-4, byte-5, byte-6, and byte-7 etc.
(a) A byte numbered 406 would belong to what word? _______ (word-number)
(b) Assume, this memory is organized using big endian byte order, what would be the least significant byte (one that holds the Least Significant Bit) of Word-20? ______ (byte-number)

P9: Consider the fetch-decode-execute cycle for the John Von Neumann machine that we studied in class. Note that it does not have a cache memory.
(a) Give an example of an instruction that requires accessing memory during execution of an instruction.
(b) Do we always have to access memory in fetch part of the cycle? Why or why not?

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P10: Consider a JVN like processor whose instructions have one memory address and an opcode in each of them. But the size or length of each memory word is 3 times the size of an instruction. (Each memory word holds three instructions.) Each instruction has a 7-bit opcode. The computer has 8192 (or 8K) words of memory. Assume that memory reads or writes one word at a time.

(a) What is the size of MAR? ___________

(b) What is the size of instruction? ___________

(c) What is the size of MBR/MDR? ____________

(d) Assume that memory is connected to the processor using a memory bus. This bus uses five control lines (5 bits) and some lines for address and/or data. It is just wide enough to permit transfer of either data or an address, but not both simultaneously. Including control lines, what is the width (number of line/bits) of this memory bus?

P11: Consider an array A of integers in memory of MIPS. The array is indexed by 0, 1, 2, ... etc. Also assume that address of A is in register $s1. Suppose we want to copy and store the second element of this array (indexed by 2) to variable i. Address of variable i is in register $s2. Write the exact sequence of instructions MIPS that will accomplish this. You may use a temporary register. (In other words, write MIPS code for statement i = A[2];)