國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 電機工程系碩士班丙一組

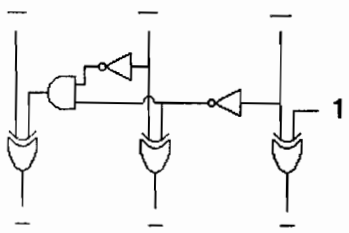
科　　目： 計算機概論

總分100分

1. What is the largest positive integer that can be represented in a two's complement system in which each value is represented by eight bits? (5%)

2. Supposed the floating point notation is (numbered from rightest bit to leftest bit):
   8^{th} bit: 0 indicates nonnegative value, 1 indicates negative value
   7^{th} bit ~ 5^{th} bit: exponent in excess-4 notation
   4^{th} bit ~ 1^{st} bit: mantissa
   Then what answer would be given to each of the following problems:
   a) 1 1/2 + 3/16 = ? (5%)
   b) 2 1/4 + 1 1/8 = ? (5%)

3. If the input and output bit patterns in the circuit below are interpreted as binary representations of numeric values, what operation does the circuit perform? (5%)



4. Explain why adding only a few characters to a text file may increase the file's size by several hundred bytes and at other times may not increase the file's size at all. (5%)

5. Consider a machine using n-stage pipeline on which 30% of the instructions are conditional jumps and another 20% are loop jumps. The conditional jumps can be predicted with 80% accuracy. Despite there is no way to predict loop jumps, the machine still needs to make prediction for these jumps. It takes one cycle for no penalty instructions, and the penalty for guessing wrong is four cycles. There is no penalty for unconditional jumps or correct guesses. On average, what is the efficiency of the pipeline on this machine? (15%)

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6. A dynamic RAM must be given a refresh cycle 60 times per ms. Each refresh operation requires 150 ns, and a memory cycle requires 300 ns. What percentage of the memory's total operating time must be given to memory refreshes? (5%)

7. What is the transfer rate of a 9-track magnetic tape unit whose tape speed is 100 inches per second and whose tape density is 1,500 linear bits per inch? (5%)

8. Design a ***ternary*** Huffman code, using 0, 1, and 2 as letters, for a source with output alphabet probabilities given by {0.05, 0.1, 0.15, 0.17, 0.18, 0.22, 0.13}. What is the resulting average code-word length? Compare the average code-word length with the entropy of the source. (In what base would you compute the logarithms in the expression for the entropy for a meaningful comparison?) (20 %)

9. Give a ***min heap tree*** by inserting the following sequence of numbers: 78, 48, 9, 11, 71, 51, 63, 18, 25, and 33. (10%)

10. Please construct a minimum cost spanning tree for the undirected connected graph ***G*** shown below, where ***V(G)***, ***E(G)***, and ***W(G)*** are the sets of vertices, edges, and weights, respectively.
    (a) ***Prim's*** algorithm without any constrain. (10%)
    (b) ***Prim's*** algorithm with the constrain that a branch contains at most two links. (10%)
    (Note that mark the sequence number beside each link)

    The graph ***G*** is given by:
    V(G) = {0, 1, 2, 3, 4, 5, and 6}; **Assume that source node is node 0.**
    E(G) = {(0,1), (0,3), (0,4), (1,2), (2,3) (2,6), (3,5), (3,6), (4,5), (5,6)} and the corresponding weight
    W(G) = {16, 12, 18, 10, 14, 20, 28, 22, 26, 24}