Institute of Statistical Studies and Research
Department of Computer and Information Sciences
Digital Logic Design-**CS504**
June 2007   Time permitted: Three Hours
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Question #1 (25 pints)

(A) We have the following numbers stored in the computer. What is the decimal value
presented if the number s stored as: *(12 points)*
   a) BCD 2421   b) BCD excess 3
   c) Binary unsigned   d) Binary Signed

   1)   1000 0111   2) 0101 0100   3) 1100 0110

(B) Reduce the expression bellow to a minimum sum of products form using switching
algebra. Show each step. *(5 points)*
$$G = (a+b)(a+c') + ab'$$

(C) Given the function of question 1-(B): *(8 points)*
$$G = (a+b)(a+c') + ab'$$

   1. Show a block diagram for two level implementation of the minimized function
using *AND* and *OR* gates.
   2. Show a block diagram for an implementation of *G* after minimization using only
two input NANDs

Question #2 (24 points)

Given the following functions:

   $F(w,x,y,z) = \sum m(0, 4, 5, 6, 7, 12, 15)$
   $G(w,x,y,z) = \sum m(1, 3, 12, 13, 14, 15)$

   1) Implement them using PLA that has 4-inputs 3-outputs and 2 eight AND Gates.
   2) Implement them using 3-input 8-output decoders with two enables, EN1 and EN2'.
   3) Implement them using a ROM that has four inputs and three outputs.
   Be sure to label the inputs and outputs of each design.

Question #3 (24 points)

Design a network that computes the residue mod 7 of an integer in the range 0 to 15.
Minimize the output to permit sharing then implement the system.

Question #4 (27 points)
(A) Obtain the state description of a sequential system having the following time
behavior: *(12 points)*
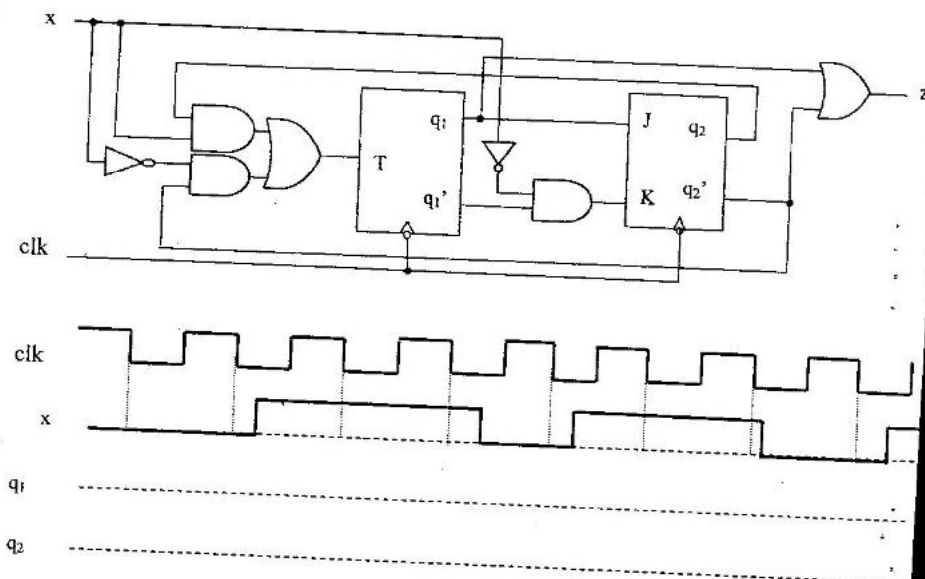Input: $x(t) \in \{0,1\}$
Output: $z(t) \in \{0,1\}$

$$z(t) = \begin{cases} 1 & \text{if } x(t-2,t) = 1010 \\ 0 & \text{otherwise} \end{cases}$$

(B) Given the following sequential network: *(15 points)*
   1. **Obtain** the high level description (i.e., input, output, states, state table and state
diagram)
   2. **Complete** the timing diagram (i.e., draw the timing diagram for q1 and for q2)

Best of Luck ☺