Institute of Statistical Studies and Research
Department of Computer and Information Sciences
Digital Logic_CS504
June 2009 Time permitted: Three Hou

Answer the following questions: ***Clarify your answer, start each problem in a new page. Label your signal lines in each and every Design and Table.***

Question 1: (7 points)

a) Using the version of Hamming code shown, Code the data "*1101*"
a1= a3 ⊕ a5 ⊕ a7
a2= a3 ⊕ a6 ⊕ a7
a4= a5 ⊕ a6 ⊕ a7

b) If the word "*1101101*", was received after being coded with Hamming code, what word was sent (assuming single error).

c) We have a computer that can store 3 decimal digits, How are the following numbers stored, using the specified code/form:
(i) BCD Exsess3(56) (ii) BCD 8421(71) (iii) BCD 5421(65)
(iv) 2's Complement(-47) (v) Signed integer(-124)

Question 2: (7 points)

a) Show the Truth Table for a system that has four inputs, *a, b, c* and *d*, and one output, *f*. The first two inputs (*a, b*) represent one binary number (in the range 0 to 3) and the last two (*c, d*) represent another number in the range 1 to 3. The output, *f*, is to be one, iff, the second number is at least two larger than the first.

b) Reduce the following expression to a minimum Sum of products and a minimur Product of sums, show each step.

$$F= x'y'z + x'yz+ xy'z+ xy'z'$$

Question 3: (7 points)

Given the function, [assume all variables are available, both complemented and uncomplemented]

$$F= abc'+ ad + bd'$$

a) Show a block diagram for a two level implementation of *F* using *And* and *OR* gates
b) Show a block diagram for an implementation of *F* using, Only, NAND gates
c) Expand F to sum of minterms, eliminate any duplications

Question 4: (7 points)

Find the minimum Sum of products, and the minimum Product of sums for the following functions (use K-Map):

a) F= Bc'd'+ cd+ bc'd+ abc+bd

b) G= Σm(0, 2, 3, 6, 8, 11, 14)+ Σd(1, 4, 5, 13, 15)

Question 5: (10 points)

A 1-bit full subtractor that has three inputs, a borrow B_{in}, x and y, and produces Two outputs, the difference D ($D = x-y-B_{in}$) and the new borrow B_{out}.

a) Show the truth table for the full subtractor

b) Use the truth table to find the expressions for D and B_{out}

c) Implement the subtractor using Programmable Logic Array with five *AND* gates, **show** the shared terms.

d) Minimize and implement the subtractor using 3-8 active low decoder with one active low enable; and two *OR* gates.

Question 6: (8 points)

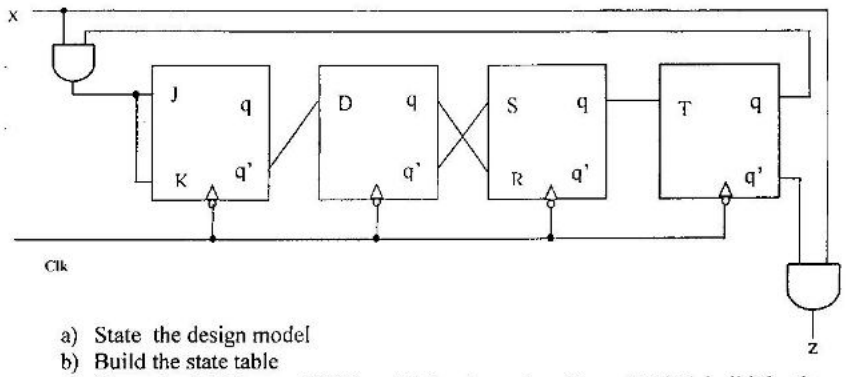
Show the truth table and Design, using AND, OR and NOT, a priority encoder with sever active low inputs, 1',2',...,7' and three active high outputs, CBA that indicate which is the highest priority line active. Input 7' is the highest and 1' is the lowest. If none of the inputs are active, the output is 000.

Question 7: (12 points)

A system that has two inputs ($x, y \in \{a,b\}$) and one output ($z \in \{0, 1\}$) . the output *z* is one when x differs from y for at least three consecutive clock cycles, and is zero, otherwise.

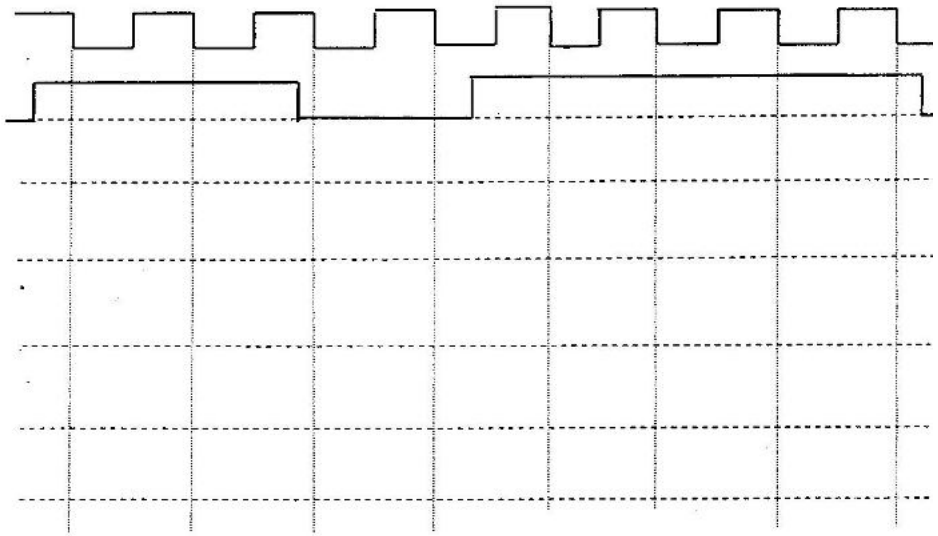
a- Describe the system
b- State the system Model
c- Show the transition and the output functions in a state table
d- Draw the state diagram

Question 8: (12 points)
Given the following circuit:



a) State the design model
b) Build the state table
c) Given the initial state (*0000*) and following values for x: *110011*, build the time Trace (behavior) table for q_1, q_2, q_3, q_4 and the output z.
d) Use the initial state and the given values for x to complete the following time behavior diagram for the circuit.

Clk



☺ *Best Of LUCK* ☺