Roll no:

CS225 Midterm Examination(2019)

Q1: We wish to create a variant on IEEE floating point numbers namely *Half_IEEE*. It has all the properties of IEEE 754 (including denorms, NaNs and ± ∞) just with different ranges, precision and representations. *Half_IEEE* is a single byte split into the following fields (1 Sign, 6 Exponent, 9 Fraction):

(a) What is the largest number smaller than ∞?
(b) What is the smallest positive normalized number ?
(c) What is the negative denormalized number that is closest to 0
(d) Represent -0.625 using the *Half_IEEE*?
(e) Represent 44 using *Half_IEEE*? (10 points)

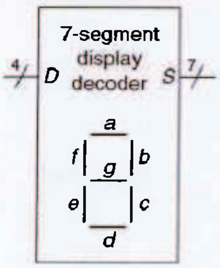
Q2: Design a 10-to-1 multiplexer using three 4-to-1 multiplexers. Show the schematic clearly showing the inputs (I_9 to I_0) and S_3 to S_0 (8 points)

Q3: Design a 5-to-32 decoder using 3-to-8 decoders only . Show the schematic of the design clearly showing how the enable(for each), input (D4 to D0))and outputs(O31 to O0) are connected .

(7 points)

Q4: Design an 8x3 encoder using AND, OR and NOT gates. Assume that only one input will be asserted at any given time. (5points)

Q5: A seven-segment display decodertakes a 4-bit data input, *D*3:0, and produces seven outputs to control light-emitting diodes to display a digit from 0 to 9. The seven outputs are often called segments *a* through *g*, or *Sa*–*Sg*, as defined in Figure . (a) Write a truth table for the outputs, and use K-maps to find Boolean equations for output *Sa and Sb* (Assume that illegal input values (10–15) produce a blank readout). (b) Simplify *Sa and Sb* Assuming that illegal input values (10–15) are don't care.



(10points)

Q6: Design the comparators that would evaluate the following single relations

(a) **X>Y**
(b) **X = Y**
(c) **X<Y**
(d) **X≥Y**
(e) **X≤ Y**

Assuming that $X=a_1a_0$ and $Y=b_1b_0$. (15 points)

Q7:For the function f (A B C D)=∑m(1 4 6 7 8 9 10 11 15), list all of the prime implicants and indicate which of these are essential prime implicants. (4 points)

Q8: Use the QuineMcCluskey method to find all of the prime implicants for f(A,B,C,D)= ∑m(3,7,9,14)+ ∑d(1,4,6,11).

(6points)

Q9: Simplify using K-map f(a,b,c,d,e)=Σm(0,1,2,4,,5,6,10,13,,14,18,21,22,24,26,29,30)
(5 points)

Q10: Assume that the following expression are to be implemented with 2-input NOR gates and perform the gate decomposition that will minimize their delay.

1. f=w'xyz'+w'y'z'+wy'z+yz+w'x'yz'
2. f=w'y+wz+w'z' (10 points)

Q11: You are asked to implement the function:

F(A,B,C,D,E) A+C'D+BD'+B'D+B'CE using a 4:1 multiplexer and as much other logic as you need, but you want to minimize the extra logic. Which two signals would you use to control the multiplexer? Implement the function using a multiplexer controlled by the following combinations of input signals. Which end up requiring the least logic ? Why?

(a) Use A and B as control inputs to the 4:1 multiplexer
(b) Use B and C as control inputs to the 4:1 multiplexer
(c) Use B and D as control inputs to the 4:1 multiplexer
(d) Use C and D as control inputs to the 4:1 multiplexer (20 points)