Indian Institute of Space Science and Technology

Dept of Avionics

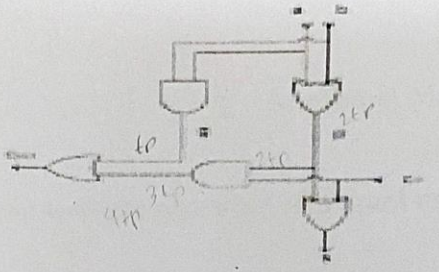
Quiz I February 2023 (17-2-2023)

AV221- Digital Electronics and VLSI Design

Answer all questions.

Max Marks:30 Time:1 hour

1. Find a minimum sum of products solution using Quine Mc-Cluskey method $F(A,B,C,D)= \sum m(2,3,4,7,9,11,12,13,14) + \sum d(1,10,15)$. Implement the reduced logic equation using NAND gate. [6].
2. Calculate the worst case delay of an 8-bit Ripple Carry Adder consisting of the full adder blocks as shown in figure below. The propagation delay of the AND and OR gate is tp and for the XOR gate is 2tp? [4]



3. Design a logic circuit to multiply two 2 bit negative numbers A and B. You are provided with EXOR gates and Full adders/half adders. [5]
4. A. The state of 12 bit register is 010110010111. What is its content if it represents [1]
   (ii) Three decimal digits in the excess-3 code
   B. Write the 8 bit signed magnitude, two's complement and ones complement representation for each of these decimal numbers +18, -49. [2]
5. Determine the number of programmable interconnections in the following programmable logic devices.
   (a) 1K × 4 PROM; [2]
   (b) PLA device with four input variables, 32 AND gates and four OR gates; [2]
   (c) PAL device with eight input variables, 16 AND gates and four OR gates. [2]

6. A flow rate sensing device used on a liquid transport pipeline functions as follows. The device provides a 5 bit output where all five bits are zero if the flow rate is less than 10 gallons per minute. The first bit is 1 if the flow rate is at least 10 gallons per minute; the first and second bits are 1 if the flow rate is at least 20 gallons per minute; the first, second and third bits are 1 if the flow rate is at least 30 gallons per minute and so on. The five bits, represented by the logic variables A,B,C,D and E are used as inputs to a device that provides two outputs Y and Z.

   (i) Write an equation for the output Y if we want Y to be 1 iff the flow rate is less than 30 gallons per minute.[2]
   (ii) Write an equation for the output Z if we want Z to be 1 iff the flow rate is at least 20 gallons per minute but less than 50 gallons per minute. [2]
   (iii) Implement the output Y using Decoder [2]