Name: Id#

COE 202, Term 122

Digital Logic Design

Quiz# 4

Date: Monday, April 8

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# **Q1**. We would like to design an adder to add the 8-bit constant 10101010 to an arbitrary 8-bit number. The adder is to be designed using four identical adder modules, each of which will add 2 bits of the number to the constant (10) and a carry from the next lower pair of bits and produce 2 bits of the sum and the carry to the next bits. A block diagram of part of this design is shown below:



The problem each 2-bit adder solves is:

c

a b

+ 1 0

y s t

* 1. Show a truth table for the 2-bit adder (it has three inputs: a, b, and c, and it has three outputs: y, s, and t), and find minimal SOP expressions for each output.
  2. Compute the delay from the c-input of each module to the y output of that module and the total delay for the 8 bits. Assume that the delay of a gate is related to the number of inputs i.e. the delay of an inverter is 1, the delay of a 2-input gate is 2, etc.

**Q2**.

1. Determine the decimal value of the 7-bit binary number (1011010) when interpreted as:

|  |  |  |  |
| --- | --- | --- | --- |
| An unsigned number | A signed-magnitude number | A signed-1’s complement number | A signed-2’s complement number |
|  |  |  |  |

1. Represent the decimal value (- 21) in binary using a total of 7 bits in the following notations:

|  |  |  |
| --- | --- | --- |
| A signed-magnitude number | A signed-1’s complement number | A signed-2’s complement number |
|  |  |  |

1. Perform the following signed-2’s complement arithmetic operations in binary using 5 bits. All numbers given are represented in the signed-2’s complement notation. Indicate clearly the carry values from the last two stages. For each of the three operations, check and indicate whether overflow occurred or not.

|  |  |  |  |
| --- | --- | --- | --- |
|  | a. 01101  +10110 | b. 01010  - 11001 | c. 11010  - 00100 |
| Overflow Occurred? (Yes/No) |  |  |  |