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CSE 241 Digital Systems

Hourly Exam #2

April 1, 2009

Instructions: Write your name on the top of each sheet. Show all work in the space provided. No calculators or other electronic devices allowed. 50 min closed book.

1. Consider the Boolean function $f(w,x,y,z)$ which is equal to 0 when its last variable z equals the binary sum of its other three variables, else $f(w,x,y,z)$ equals 1.

(a) Draw the Karnaugh Map for $f(w,x,y,z)$ showing the prime implicant subcubes.

(b) List all prime implicants

(c) Find a minimal DNF

2.

$$f(x,y,z) = (x+y)(x'+z')+xyz$$

(a) Use the Quine-McCluskey Algorithm to find all the prime implicants of f . Show your work.

(b) Use the Petrick Method to find the set of all irredundant prime implicant DNF's. Show your work.

2(a)

2(b)

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3. (a) What is the main advantage of a carry look ahead adder over a ripple adder?

(b) What is the main advantage of a n-bit comparator built by cascading n 1-bit comparators over an n-bit comparator which is a minimal DNF realization?

(c) How many more gates does it take to build a 16-bit binary adder/subtractor than a 16-bit binary adder? Assume you can only use AND and OR gates.

3(a)

3(b)

3(c)

4.

$$f(w,x,y,z) = w + w'x(y+z)'$$

(a) Design a circuit which uses the given 16-to-1 MUX shown in Fig. 4(a) below to realize the Boolean function $f(w,x,y,z)$. Label all data and select input lines with their proper constant and literal values.

(b) Repeat using the 2-to-1 MUX shown in Fig. 4(b) below. Label all data and select input lines with their proper constant values, literal or Boolean expressions, and show all additional gates needed to realize f . Choose your select input variable (w, x, y or z) so that the minimum number of additional gates beyond the MUX itself are needed.

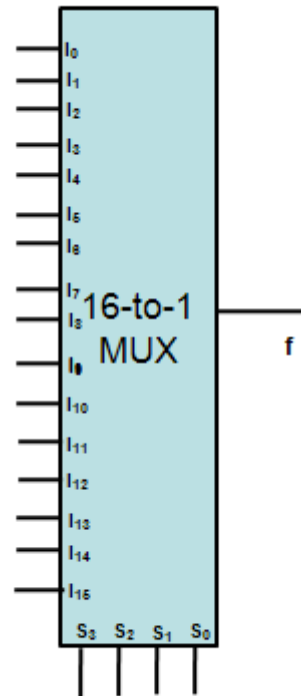


Figure 4a

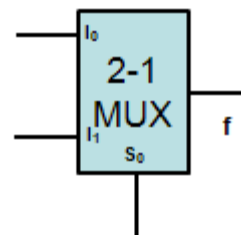


Figure 4b

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Hourly Exam #2 Extra Worksheet

April 2, 2008