CS 201 (David Gerhard): Introduction to Digital Systems





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SOLUTION NOTES FOR ASSIGNMENT 1

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Question 1
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a: 1110 = 8+4+2+0 = 14

b: 11011 = 16+8+0+2+1 = 27

c: 101010 = 32 + 0 + 8 + 0 + 2 + 0 = 42

Question 2

a: $2^12 = 2^10 * 2^2 = about 1000 * 4 = about 4000.$

Actual anser = 4096.

% difference = (4096 - 4000) / 4096 = 2.34%

b: $2^16 = 2^10 * 2^6 = about 1000 * 64 = about 64000$.

Actual anser = 65536.

% difference = (65536 - 64000) / 65536 = 2.34%

c: $2^32 = 2^30 * 2^2 = about 1,000,000,000 * 4 = about 4 billion.$

Actual anser = 4,294,967,296.

% difference = (4,294,967,296 - 4,000,000,000) / 4,294,967,296 = 6.87%

Question 3

a:

NAND gate produces (AB)¹

AND gates produce A(AB)' and B(AB)'

OR gate produces final result A(AB)' + B(AB)'

b: simplify using logic rules

A(AB)' + B(AB)'

A(A'+B') + B(A'+B') demorgan

AA'+AB' + BA'+ BB' distribution

AB' + BA' inverse

This is the minimum 2-level SOP. it is also sum of minterms, as it turns out.

Note that the function can be further simplified to A XOR B

from part B, we can see that the function is $\sum m(1,2)$ therefore, the function is equivalently equal to $\prod M(0,3)$ this is equivalent to (A+B)(A'+B')

to do the same using logic, we can take:

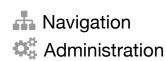
F' = ((AB') + (A'B))'

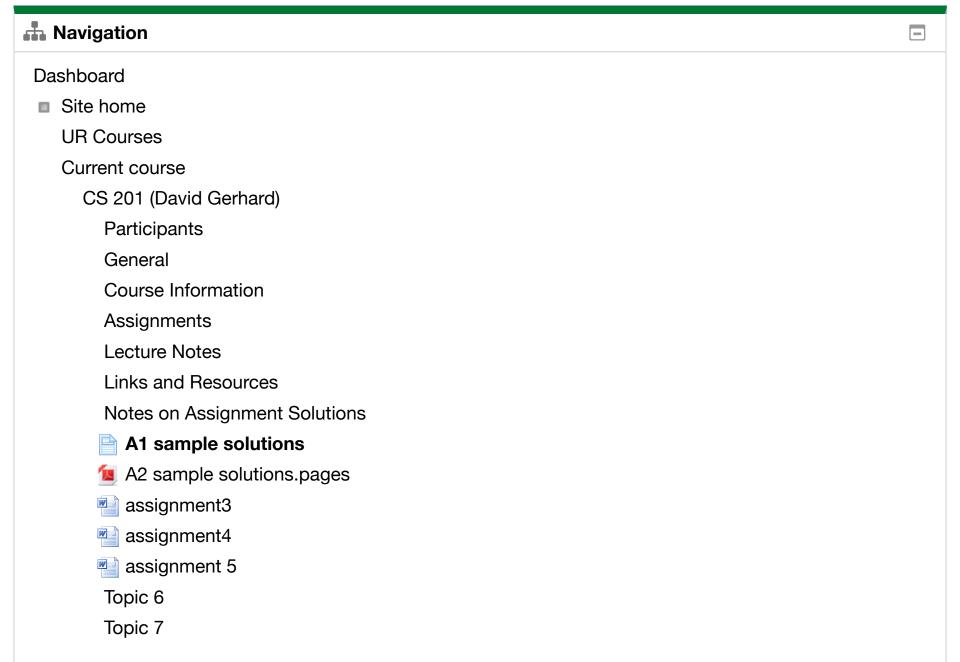
- = (A+B')'(A'+B)' demorgan
- = (A'+B)(A+B') demorgan
- = AA'+AB+A'B'+BB' distribution
- = AB+A'B' inverse

then F = (AB+A'B')'

- = (AB)'(A'B')' demorgan
- = (A'+B')(A+B) demorgan

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