To see the connection to logic, let us correspond the bit value 1 with the logical value T (True) and 0 with F (False). So we can consider , , , to be logical variables.

1. Construct the truth tables for and in terms of , , . For example, when , , and F, the truth values of and .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| F | F | F | F | F |
| F | F | T | F | T |
| F | T | F | F | T |
| F | T | T | T | F |
| T | F | F | F | T |
| T | F | T | T | F |
| T | T | F | T | F |
| T | T | T | T | T |

1. Express as a proposition using the variables , , and the logical connectives ¬,∧,∨. Write a similar expression for .

1. Express and using only the NAND connective discussed in lecture.

alternatively:

alternatively:

1. Next, let’s see how to add two 2-bit numbers , to produce the 3-bit result . Recall how we usually add numbers – we first add the lowest order bits ( and ) to get the value as well as the “carry bit” which when added with and produces and a carry bit (which is for 2-bit numbers). Express each of in terms of , , , using the NAND connective.

\*\*Carry bit

\*\* Similar to from part a/b/c (with instead of a, b, c)

\*\* Similar to from part a/b/c (with instead of a, b, c)