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CIS 240: HW 2 answers

1.15 One advantage of higher-level languages is that they're easier to understand, debug, and maintain.
One disadvantage is that they're slower and less memory-efficient than low-level programs and can't communicate directly with the hardware.

1.16 The ISA specifies the number of operations, data types, and addressing modes.

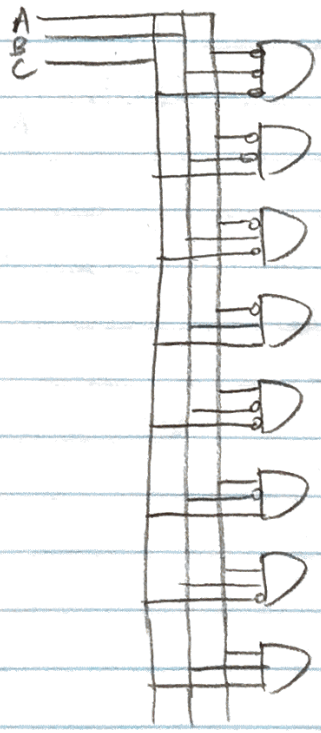
1.17 The micro architecture is the implementation of the ISA, which makes tradeoffs between the cost of the microprocessor and the performance it will provide.

3.5

A	B	C	OUT
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

3.9

A	B	NOT(NOT(A) OR NOT(B))
0	0	0
0	1	0
1	0	0
1	1	1



3.12

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

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$\bar{A}B + A\bar{B}$

$(\bar{A}B)\,\overline{(A\bar{B})}$

$(A\bar{B})(\bar{A}B)$

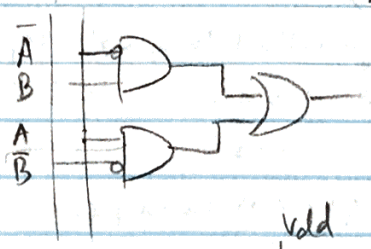
3.13

A 5-input decoder will have $2^5 = 32$ output lines.

8

A	B	out
0	0	0
0	1	1
1	0	1
1	1	0

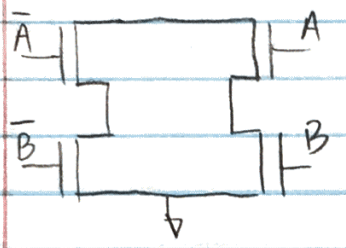
→



$\bar{A}B + A\bar{B}$

$A \oplus B = A\bar{B} + B\bar{A}$

$= (A+B)(\overline{AB})$



nMOS

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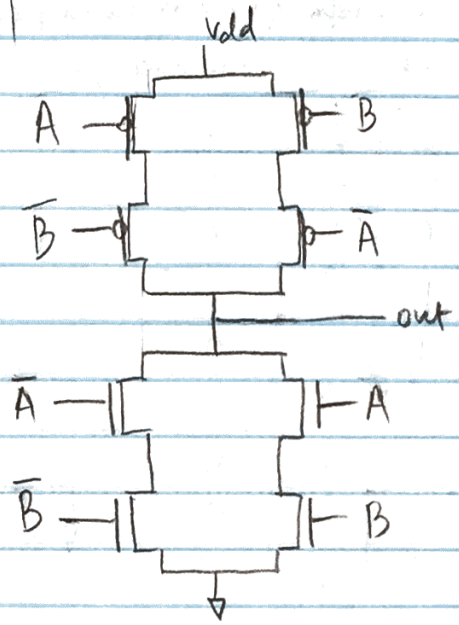


9.

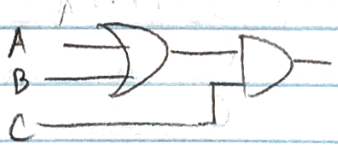
$Y = (A \text{ OR } B) \text{ AND } C$

$= (A+B)C$

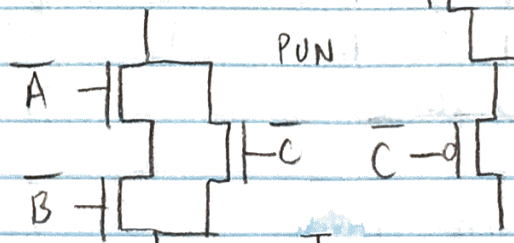
$\bar{Y} = \overline{(A+B)C}$

$= \overline{A+B} + \bar{C}$

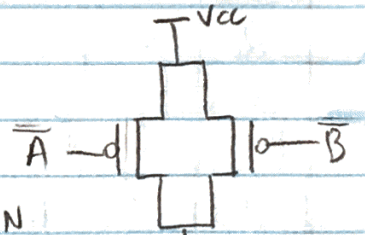
$= \bar{A}\bar{B} + \bar{C}$



PDN:

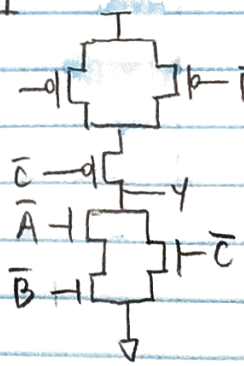


PUN



A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

gate:



10 computational sprinting is a way of powering the processor in a computer for a shorter but far more powerful rate (say, 16x its sustainable rate for half a second) and then allowing it to dial back so it can cool down. One advantage for this is that it could activate areas of otherwise powered down "dark silicon" processor cores for subsecond bursts of intense parallel computation in response to user activity.

11. Some entrepreneurial Bitcoin mining ventures are moving to North Country for cheap hydroelectric power from the nearby St. Lawrence to power the servers that mine cryptocurrencies nonstop like Bitcoin. The residents there are not happy because the miners drive up the cost of their electricity bill.

12.

$AB + A\bar{B} = A(B+\bar{B})$ distributive law

$= A(1)$ additive identity

$= A$ since $A(1) = A$

$(A+B)(A+\bar{B}) = (B\bar{B}) + A$ distributive law

$= 0 + A$ multiplicative identity

$= A$ since $0 + A = A$

$A(A+B) = (A+B)(0+A)$ by identity $(0+A) = A$

$= (B0) + A$ by distributive law

$= 0 + A$ since $(B0) = 0$

$= A$ since $0 + A = A$

$A + \bar{A}B = (A+\bar{A})(A+B)$ distributive law

$= (1)(A+B)$ additive identity b/c $(A+\bar{A}) = 1$

$= A+B$ since $(1)(A+B) = A+B$

$(A+\bar{B}+\bar{C})(A+\bar{B}C) = A+\bar{B}C$

$= A + (\bar{B}+\bar{C})(\bar{B}C)$ associate property

$= A + (\bar{B}\bar{B}C + \bar{C}\bar{B}C)$ distributive

$= A + (\bar{B}C + \bar{B}0)$ b/c $\bar{B}\bar{B} = \bar{B}$ and $\bar{C}C = 0$

$= A + \bar{B}C$