Introduction to Information Technology

CSC109

2019

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Optane memory

Intel launched Optane as a memory module designed to provide an additional data cache between its CPUs and storage devices

Thinkpad introduce Optane memory to their products

Dramatically improve boot times and accelerate system performance, as it is Non-Volatile in Nature

Intel is positioning it as a way to get expensive, SSD-style speed and responsiveness in systems equipped with slower (but cheaper) spinning HDDs.

Make use of advanced memory management software such as Intel Rapid Storage Technology (RST), Express cache(without which it cannot be used)

- Cost savings: With Optane capable of making less expensive HDD systems run nearly as fast as ones with SSDs, Optane puts SSD-like performance
- Faster... everything

Re: Lenovo E540 with SanDisk SSD U110 16GB

08-07-2014 06:35 AM - edited 08-07-2014 06:37 AM

If I am not mistaken, the 16GB SSD is for caching only to speed things up, which is out of user control.

Caching SSD is different from SSD disk. Caching SSD is usually smaller in size compared to SSD disk. Not sure, but I think 32GB and lower are usually for chaching while 64GB and above is for actuall SSD disk.

✔ [SOLVED] Formatted my SSD on x240. How do enable caching again?

11-10-2015 11:16 AM - edited 11-11-2015 12:57 PM

So I accidentally wiped my 16GB SanDisk SSD (which used to be invisible in the Computer) on my ThinkPad x240 after upgrading to Windows 10 from 7. Now it shows up as a separate 15 GB SSD drive. How do I go back so that the drive is used as a caching drive (or whatever is the default to boost performance)?

FYI, there seems to be no SATA option in the Config tab of my BIOS (I was going to setup RAID then install the Intel Rapid Storage thingy).

9’s Complement

When smaller number is to be subtracted from larger one

Regular subtraction

```
 678
-234
----
 444
```

Subtraction using 9’s complement

```
  678
 +765 ←(9’s complement of 234)
 ----
 1443
   +1
 ----
  444
```

When larger number is to be subtracted from smaller one

Regular subtraction

```
 228
-485
----
-257
```

Subtraction using 9’s complement

```
 228
+514 ←(9’s complement of 485)
----
 742  (No carry indicates –ve value)
  ↓
-257 (9’s complement of result)
```

Exercise use of 9's Complement

1. $(215)_{10}-(155)_{10}$
2. $(1234)_{10}-(4567)_{10}$

10's Complement

When smaller number is to be subtracted from larger one

Regular subtraction

```
 678
-234
----
 444
```

Subtraction using 10's complement

```
 678
+766 ←(10's complement of 234)
----
1444 ←(Ignore the carry)
  ↓
----
 444
```

When larger number is to be subtracted from smaller one

Regular subtraction

```
  228
- 485
-----
- 257
```

Subtraction using 10's complement

```
 228
+515 ←(10's complement of 485)
----
 743  (No carry indicates –ve value)
  ↓
- 257 (10's complement of result)
```

Exercise using 10's Complement

1. $(215)_{10}-(155)_{10}$
2. $(1234)_{10}-(4567)_{10}$

Subtract using 10's complement

$(9871)_{10}$ from $(1234)_{10}$

Logic Gates

In Binary Signal can represented in two state “OFF” or “ON” equivalent to 0 or 1.

In digital circuits manipulation of binary data is done using Logic Gates

These are hardware electronic circuit component which gives 1, 0 and its combination output based on its input.

Each logic gate has a unique symbol and its operation is described using algebraic expression

AND, **OR** and **NOT** are the basic logic gates.

Other Gates made out of above 3 basic gates are

NAND, NOR, XOR and XNOR.

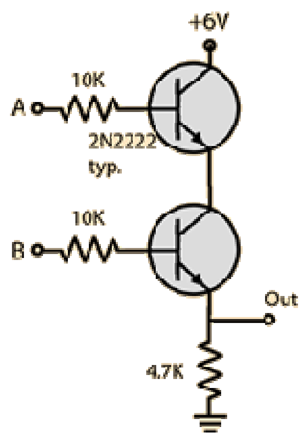
AND Gate

The output is high only when both input A and B are high

AND operation represented by A.B or AB

Also called intersection of A & B

Eg: IC 7408



A	B	Out
0	0	0
0	1	0
1	0	0
1	1	1

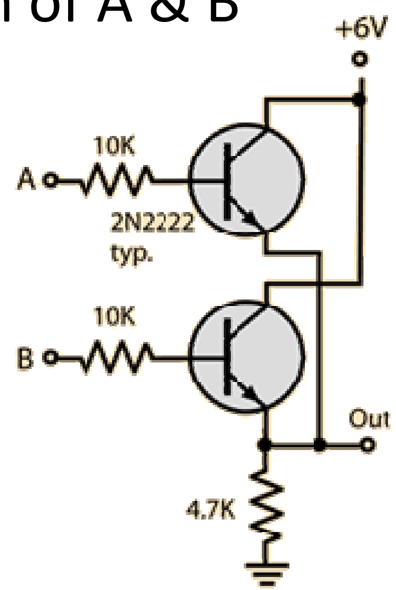
OR Gate

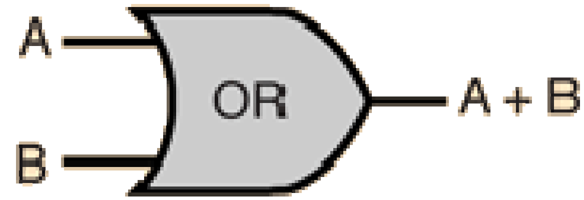
The output is high when either or both of inputs A or B is high

OR operation represented by A+B

Also called Union of A & B

Eg: IC 7432

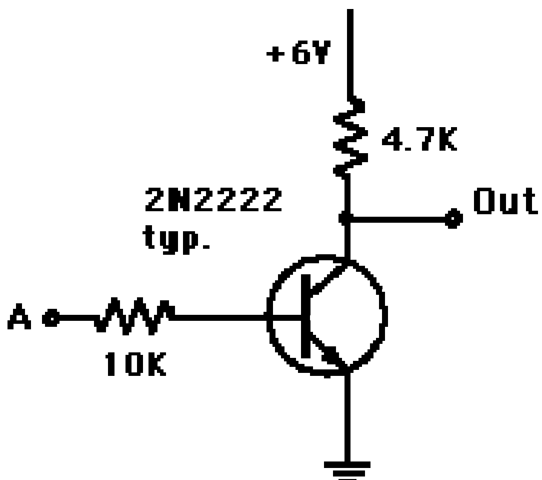


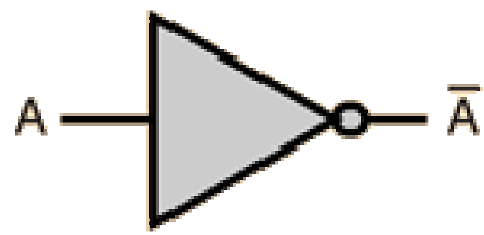


A	B	Out
0	0	0
0	1	1
1	0	1
1	1	1

NOT Gate

This gate is also called as *inverter*
Produces the state opposite the input.
NOT operation represented by A’ (A complement) for input A.
Eg: IC 7404





Inverting Buffer

In	Out
0	1
1	0

NAND Gate

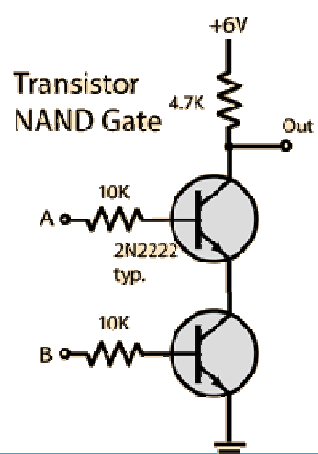
The output is high when either of inputs A or B is high, or if neither is high

Universal Gate

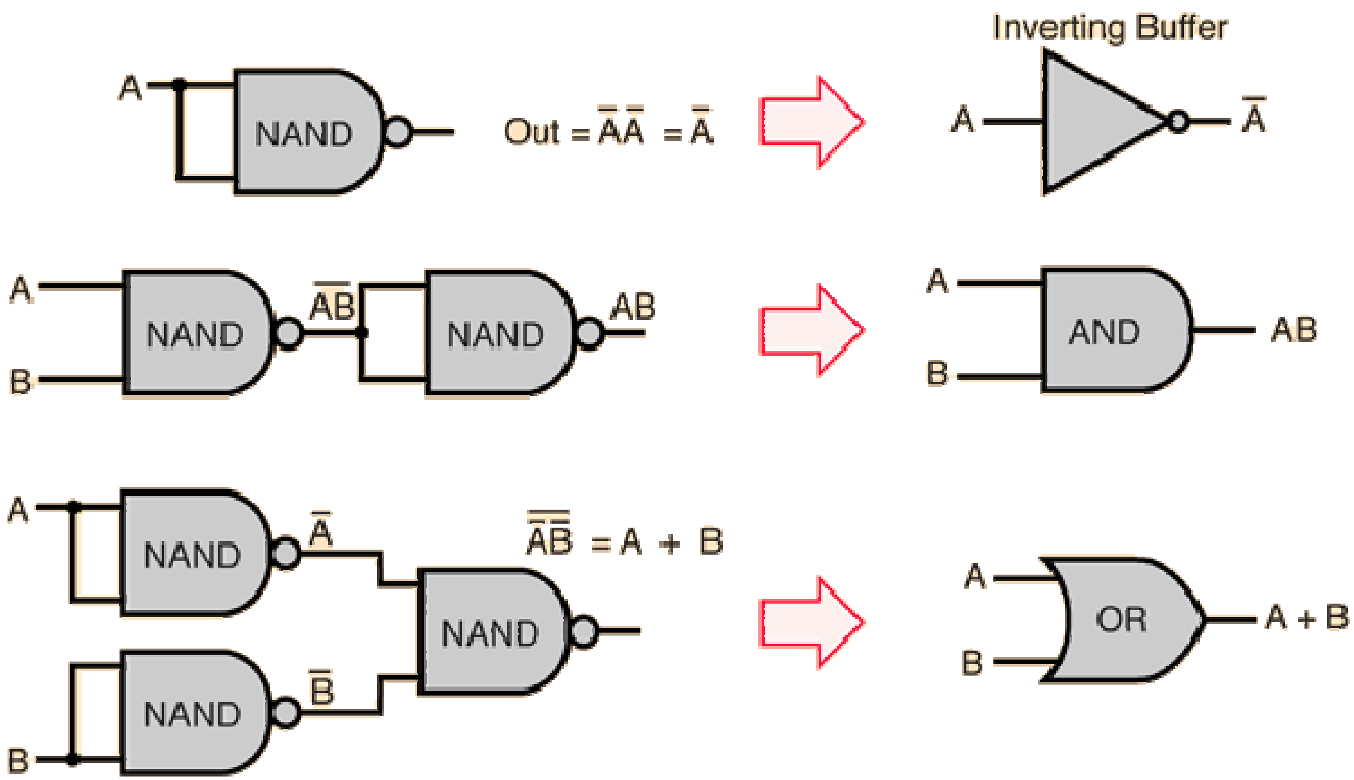
NOT operation represented by AB’ (AB complement)

Eg: IC 7400

A	B	Out
0	0	1
0	1	1
1	0	1
1	1	0



The NAND gate also called a universal gate because combinations of it can be used to accomplish all the basic functions



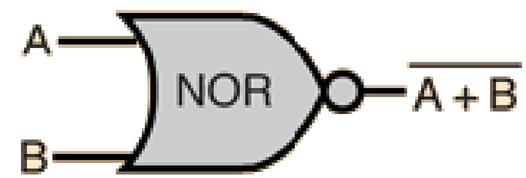
NOR Gate

The output is high only when neither is high

Universal Gate

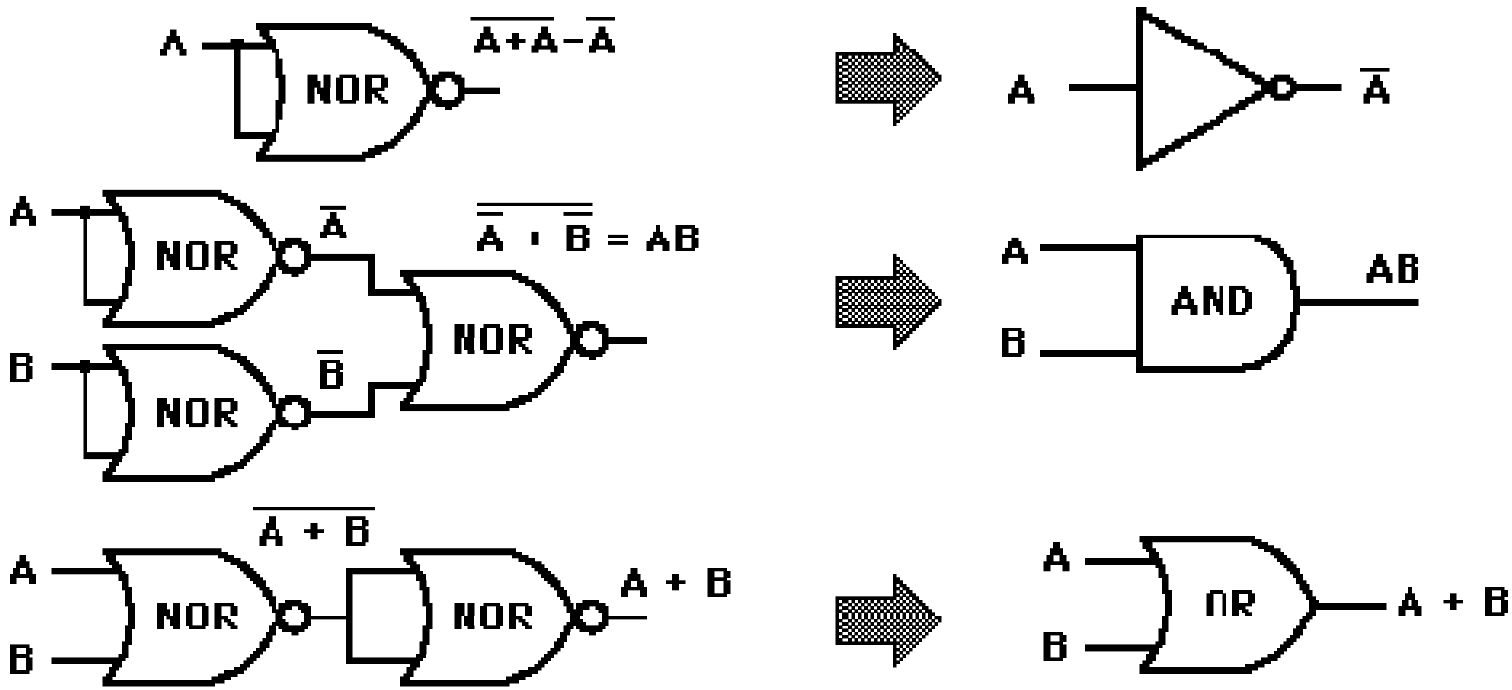
NOT operation represented by (A+B)’ (A+B complement)

Eg: IC 7402



A	B	Out
0	0	1
0	1	0
1	0	0
1	1	0

The NOR gate also called a universal gate because combinations of it can be used to accomplish all the basic functions



XOR Gate

The output is high when either of inputs A or B is high, but not if both A and B are high.

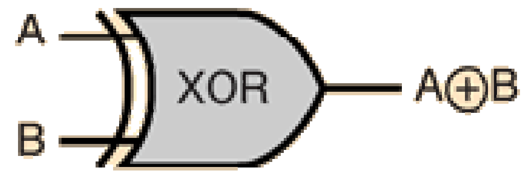
XOR operation represented by

$(A \oplus B) =$

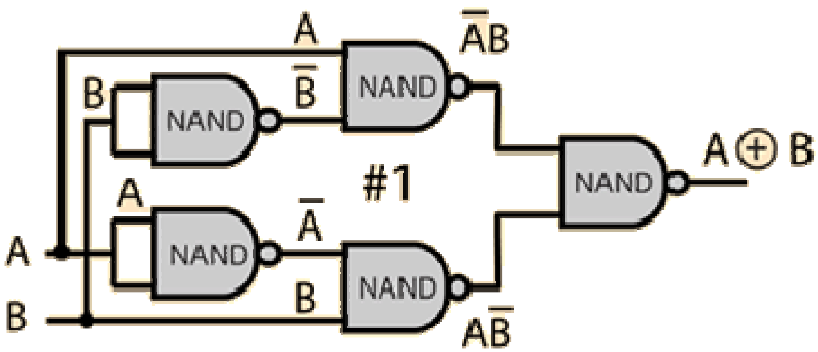
$$1.\; A \oplus B = A\overline{B} + B\overline{A}$$

$$2.\; A \oplus B = (A + B)(\overline{AB})$$

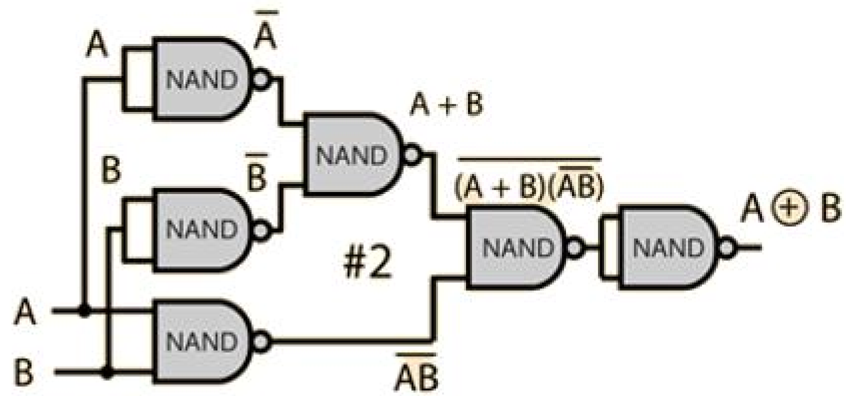
Eg: IC 7486



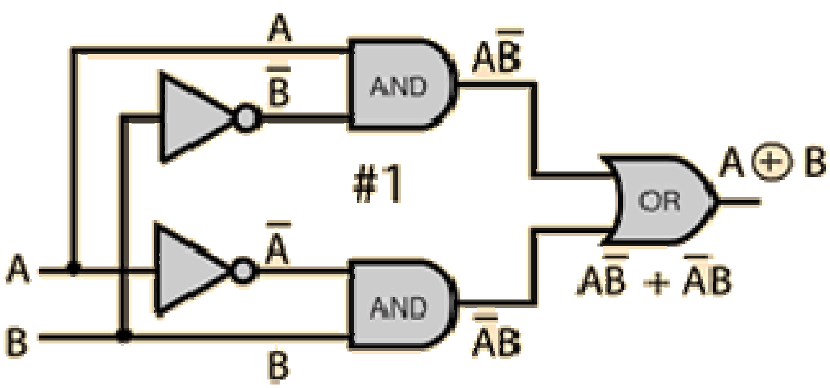
A	B	Out
0	0	0
0	1	1
1	0	1
1	1	0



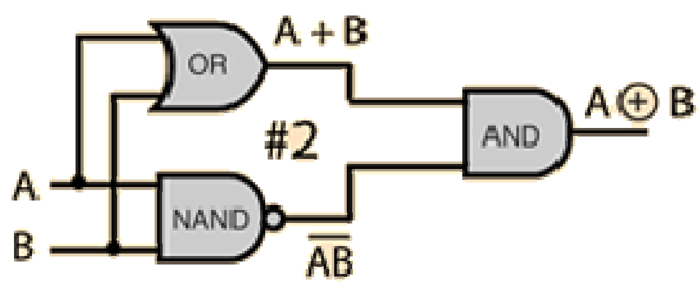
A
$\overline{A}B$
B
NAND
$\overline{B}$
NAND
NAND
A ⊕ B
#1
A
NAND
$\overline{A}$
NAND
A
B
B
$A\overline{B}$



A
NAND
$\overline{A}$
A + B
NAND
B
$\overline{B}$
$\overline{(A + B)(\overline{AB})}$
NAND
NAND
NAND
A ⊕ B
#2
A
NAND
B
$\overline{AB}$



A
AND
$A\overline{B}$
$\overline{B}$
#1
OR
A ⊕ B
$\overline{A}$
A
AND
$A\overline{B} + \overline{A}B$
B
$\overline{A}B$
B



OR
A + B
AND
A ⊕ B
#2
A
NAND
B
$\overline{AB}$

XNOR Gate

The output is high when both inputs A and B are high and when neither A nor B is high.

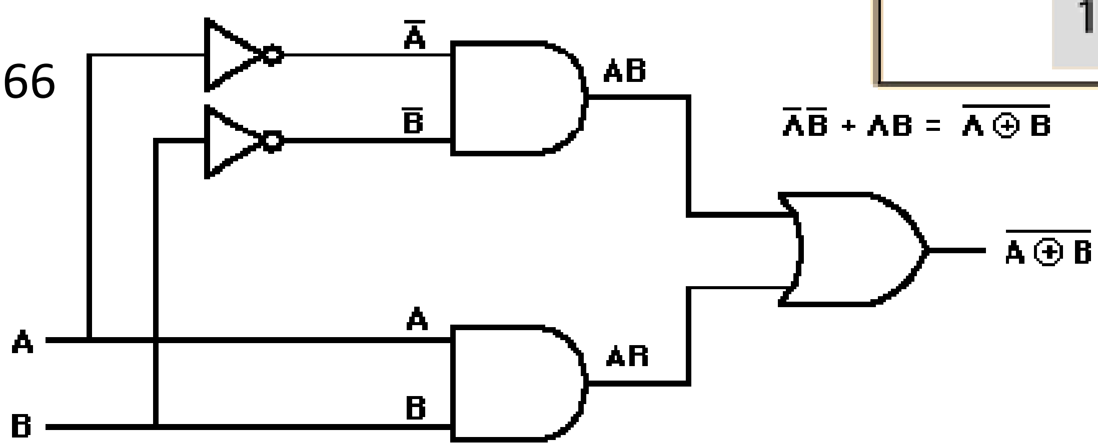
XNOR operation represented by

$(A \oplus B)'$ = Complement of XOR Gate

$(A+\overline{B})\cdot(\overline{A}+B)$ or $A\cdot B+\overline{A}\cdot\overline{B}$

A	B	Out
0	0	1
0	1	0
1	0	0
1	1	1

Eg: IC 74266



Remaining to Cover

1. Fixed Point and Floating Point Number Representation
2. Binary Coding Schemes
   - Extended Binary Coded Decimal Interchange Code (EBCDIC),
   - American Standard Code for Information Interchange (ASCII), and
   - Unicode

Binary Data Representation

- Computers use Binary number system to represent all types of information inside the computers.
- Alphanumeric characters are represented using binary bits (i.e., 0 and 1).
- Digital representations are easier to design, storage is easy, accuracy and precision are greater.
- binary number in addition to sign bit also has binary point
- Binary point is used for representing fractions, integers and integer-fraction numbers.
- There are **two ways of representing the position of the binary point in the register**—
  - **fixed point number representation** & **floating point number representation**