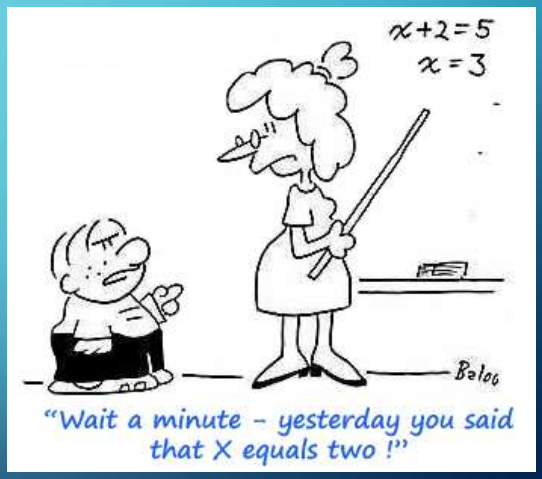
What are all those boring problems and exercises good for ???

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July 2018



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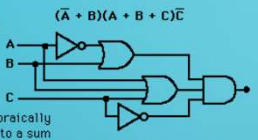
- Logic
- Algebra
- Math
- Calculus
- Physics

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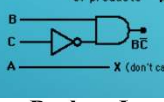
Logic is the foundation of Digital Electronics and Computer Science

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

and implements it in the form: $(\bar{A} + B)(A + B + C)\bar{C}$



This works, but it can be simplified algebraically by expanding it to a sum of products $\bar{A}A\bar{C} + \bar{A}B\bar{C} + \bar{A}C\bar{C} + BA\bar{C} + BB\bar{C} + BC\bar{C}$



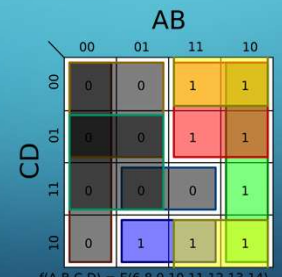
$\bar{A}B\bar{C} + AB\bar{C} + B\bar{C}$ using $\bar{A}A=0$ and $AA=A$

$B\bar{C}(\bar{A} + A + 1)$ factoring

$B\bar{C}$ $\bar{A} + A = 1$ and $A + A = A$

Boolean Laws

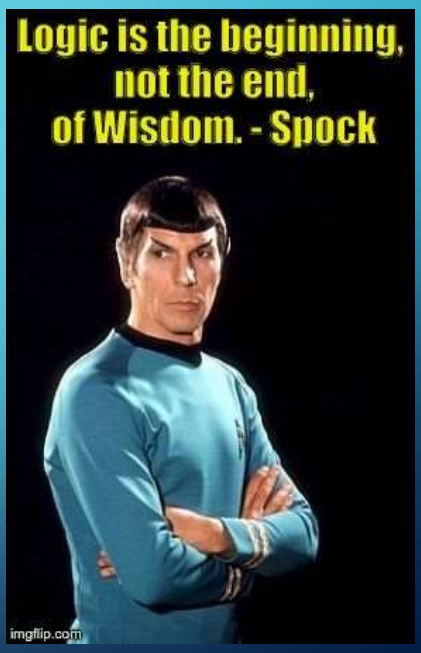
Law	Dual Pair	Remark
A + B = B + A	A.B = B.A	Commutative Law
A + (B + C) = (A + B) + C	A (BC) = (AB) C	Associative Law
A (B + C) = AB + AC	A + (BC) = (A + B)(A + C)	Distributive Law
A + 1 = 1	A.1 = A	Identity Law/ Redundancy Law
A + 0 = A	A.0 = 0	
A + A = A	A.A = A	
$A + \bar{A} = 1$	$A.\bar{A} = 0$	
A + AB = A	A (A + B) = A	Absorption Law
$\bar{\bar{A}} = A$	-	Involution Law
$A + \bar{A}B = A + B$	$A (\bar{A} + B) = A$	-
$\bar{B} + \bar{B} = \bar{B}$	-	-



f(A,B,C,D) = E(6,8,9,10,11,12,13,14)

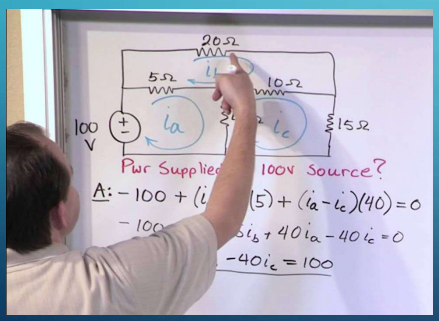
F=AC'+BCD'+AD'

F=(A+B)(A+C)(B'+C'+D')(A+D')



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- Calculus



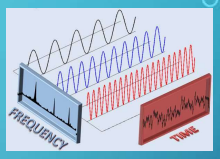
Signal Energy & Power Comments

Usually, the limits are taken over an infinite time interval

$$E_\infty = \int_{-\infty}^{\infty} |x(t)|^2\,dt \qquad E_\infty = \sum_{n=-\infty}^{\infty} |x[n]|^2$$

$$P_\infty = \lim_{T\to\infty} \frac{1}{2T}\int_{-T}^{T} |x(t)|^2\,dt \qquad P_\infty = \lim_{N\to\infty} \frac{1}{2N+1}\sum_{n=-N}^{N} |x[n]|^2$$

- We will encounter many types of signals
- Some have infinite average power, energy, or both
- A signal is called an **energy signal** if $E_\infty < \infty$
- A signal is called a **power signal** if $0 < P_\infty < \infty$
- A signal can be an energy signal, a power signal, or neither type
- A signal can not be both an energy signal and a power signal



General Fourier series of a periodic function $f(x)$ in the interval $(-L, L)$ is defined as

$$f(x) = \frac{1}{2L}\int_{-L}^{L} f(t)\,dt + \sum_{n=1}^{\infty}\frac{1}{L}\int_{-L}^{L} f(t)\cos\frac{n\pi t}{L}\,dt.\cos\frac{n\pi x}{L} + \sum_{n=1}^{\infty}\frac{1}{L}\int_{-L}^{L} f(t)\sin\frac{n\pi t}{L}\,dt.\sin\frac{n\pi x}{L}$$

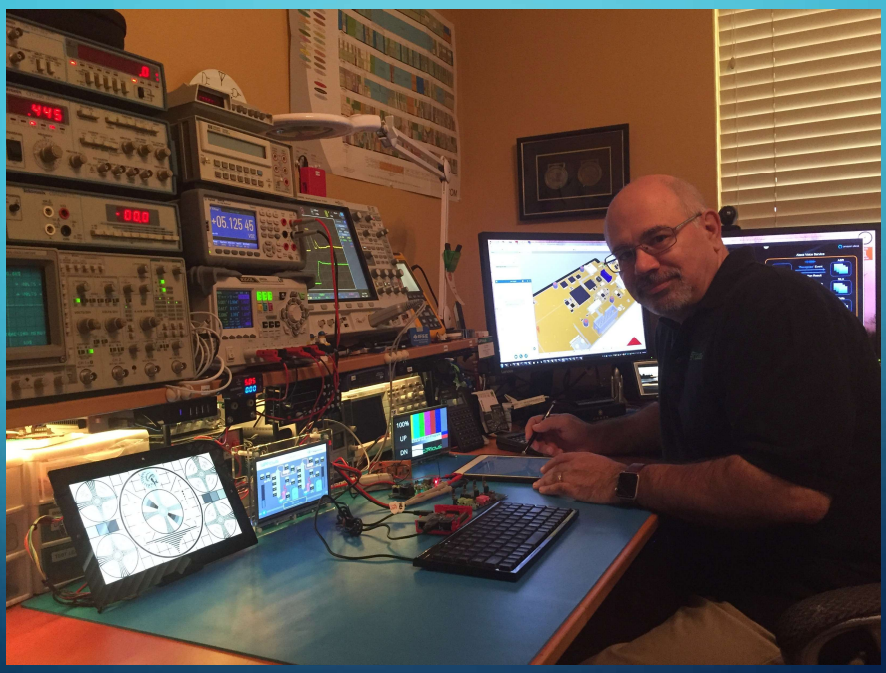
$$= \frac{1}{2L}\int_{-L}^{L} f(t)\,dt + \frac{1}{L}\int_{-L}^{L} f(t)\left[\sum_{n=1}^{\infty}\left\{\cos\frac{n\pi x}{L}\cos\frac{n\pi t}{L} + \sin\frac{n\pi x}{L}\sin\frac{n\pi t}{L}\right\}\right]dt$$

$$= \frac{1}{2L}\int_{-L}^{L} f(t)\,dt + \frac{1}{2L}\int_{-L}^{L} f(t)\left[2\sum_{n=1}^{\infty}\cos\left\{\frac{n\pi(x-t)}{L}\right\}\right]dt$$

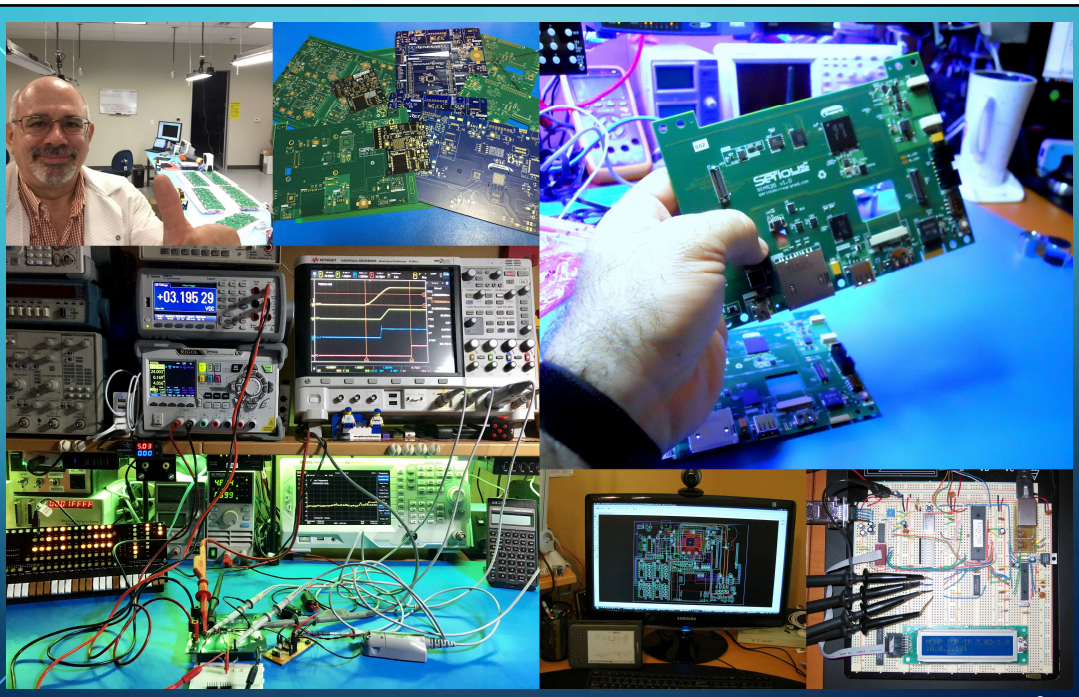
$$= \frac{1}{2L}\int_{-L}^{L} f(t)\left[1 + 2\sum_{n=1}^{\infty}\cos\left\{\frac{n\pi(x-t)}{L}\right\}\right]dt$$

$$= \frac{1}{2\pi}\int_{-L}^{L} f(t)\left[\frac{\pi}{L} + \sum_{n=1}^{\infty}\frac{2\pi}{L}\cos\left\{\frac{n\pi(x-t)}{L}\right\}\right]dt$$

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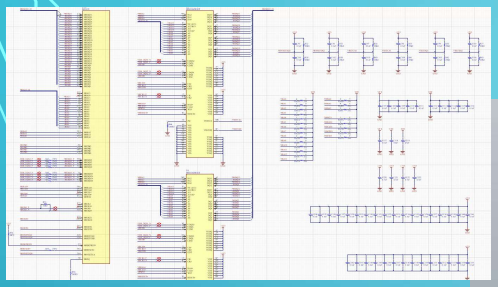
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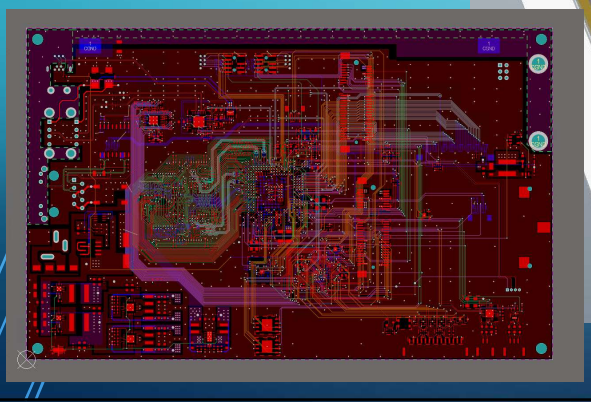
Cheat Tools

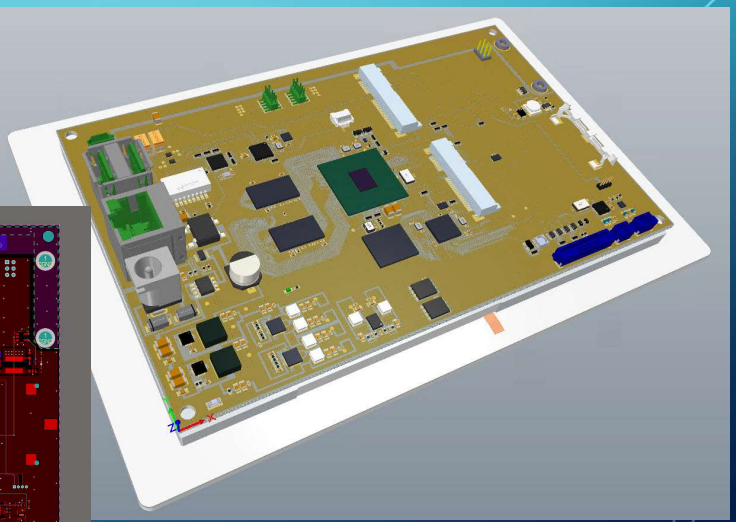


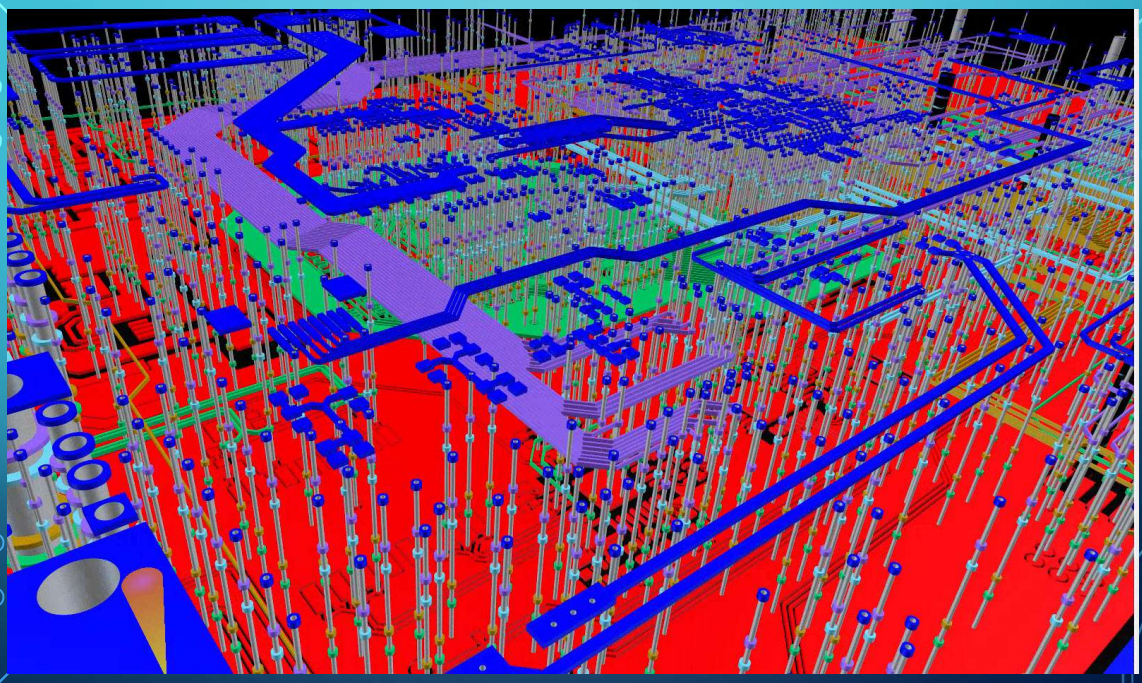


CAD Tools (Computer Assisted Design)

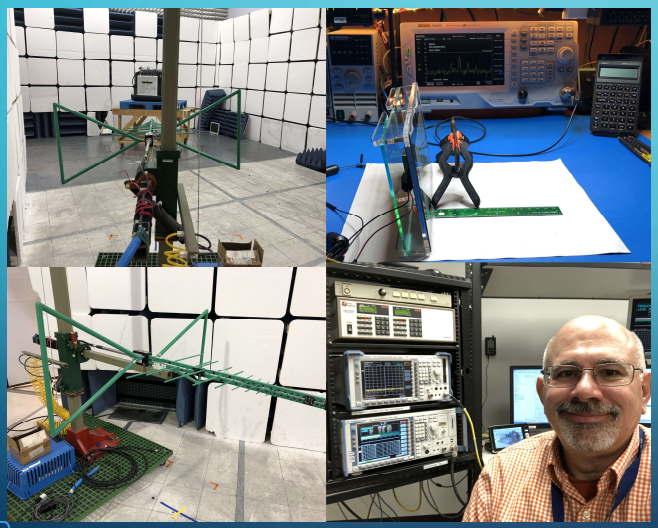








Electro-Magnetic Compatibility (The Art of Black Magic)



Actually, it is just Physics 101

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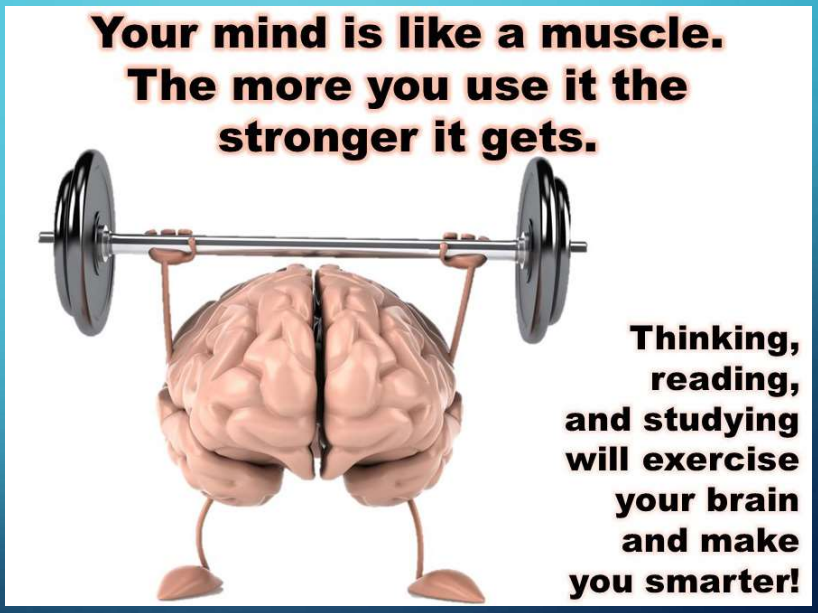
What athletes do ?



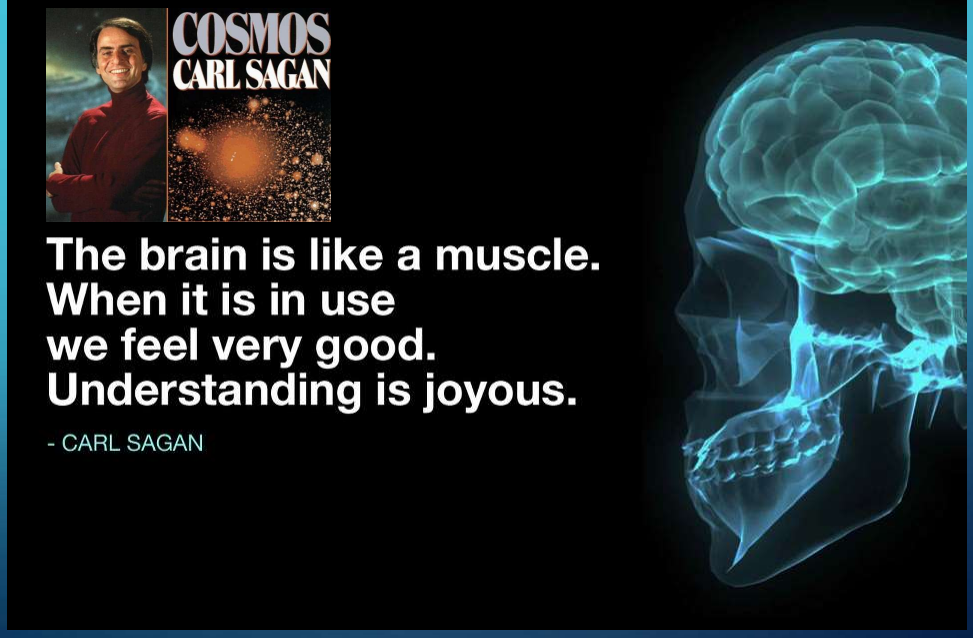


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The Answer is …



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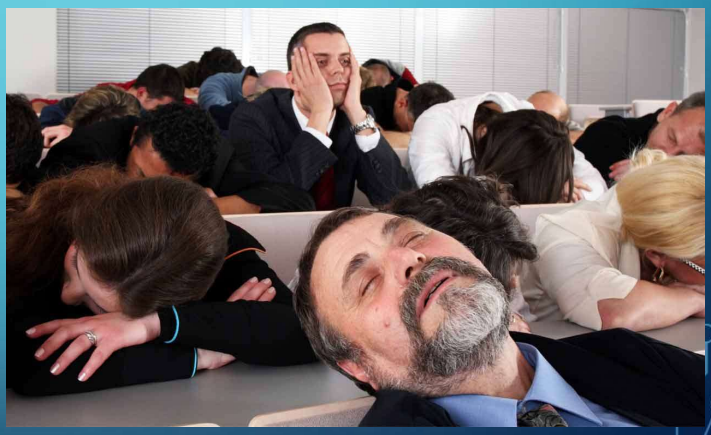
Thank you for your attention !

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