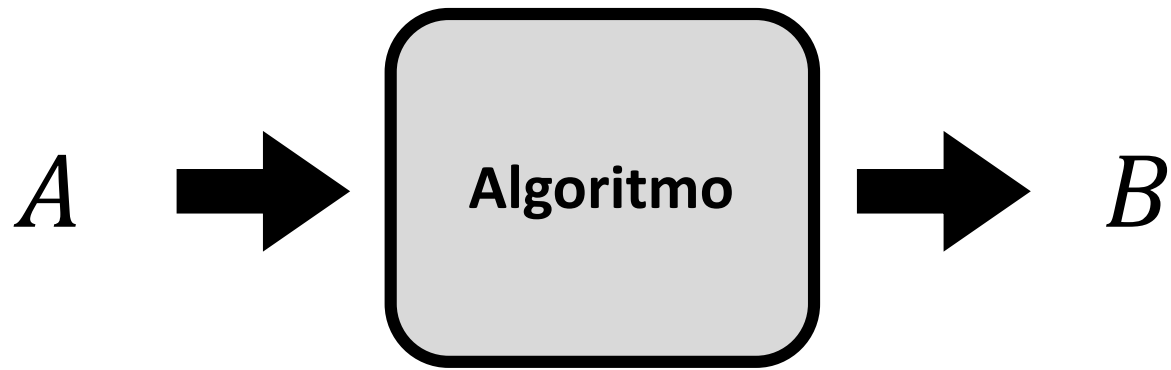
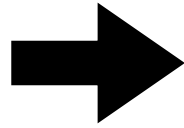


1.- PRELIMINARES: ALGORITMOS Y FUNCIONES

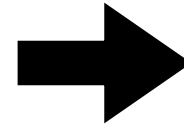
1.- ПОПЕРЕДНІЙ: АЛГОРИТМИ ТА ФУНКЦІЇ



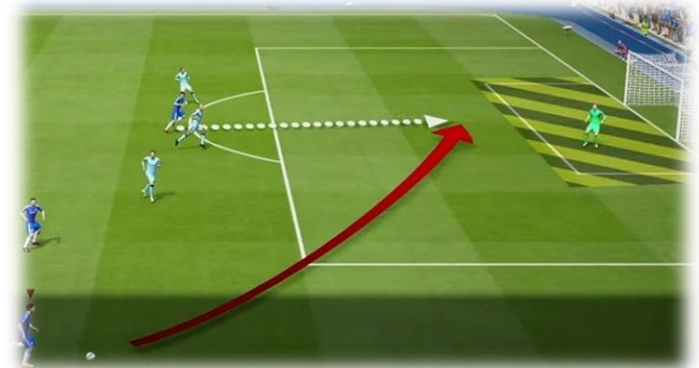
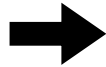
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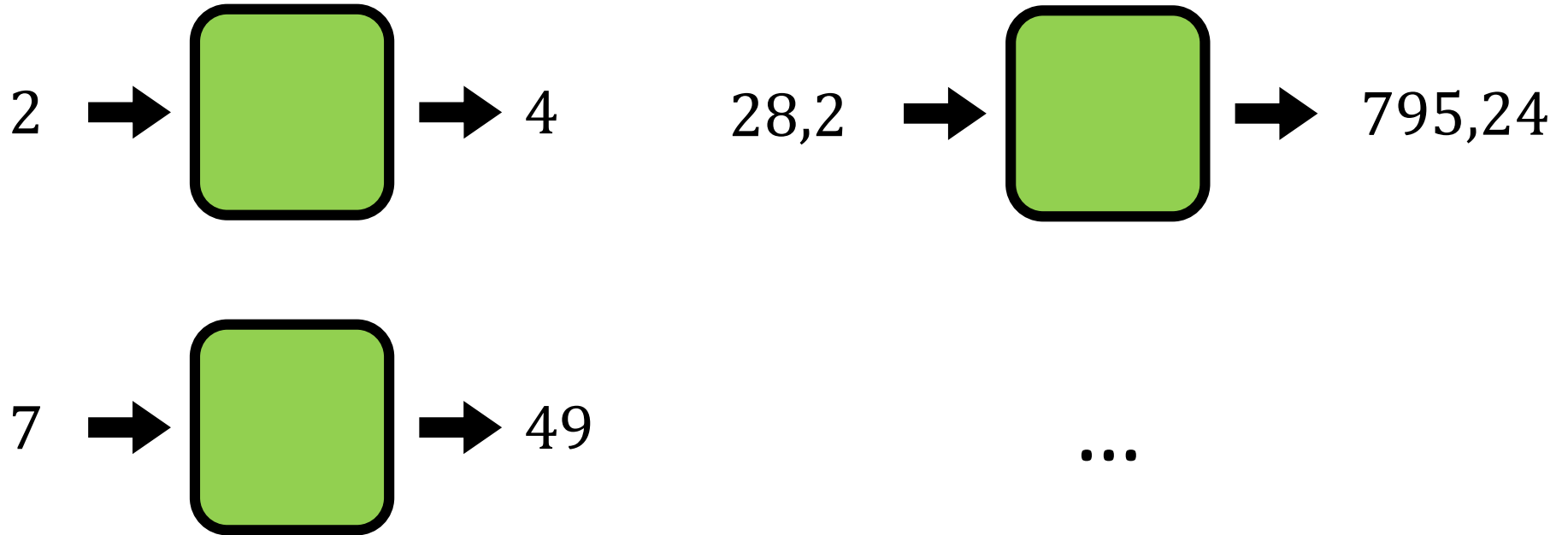
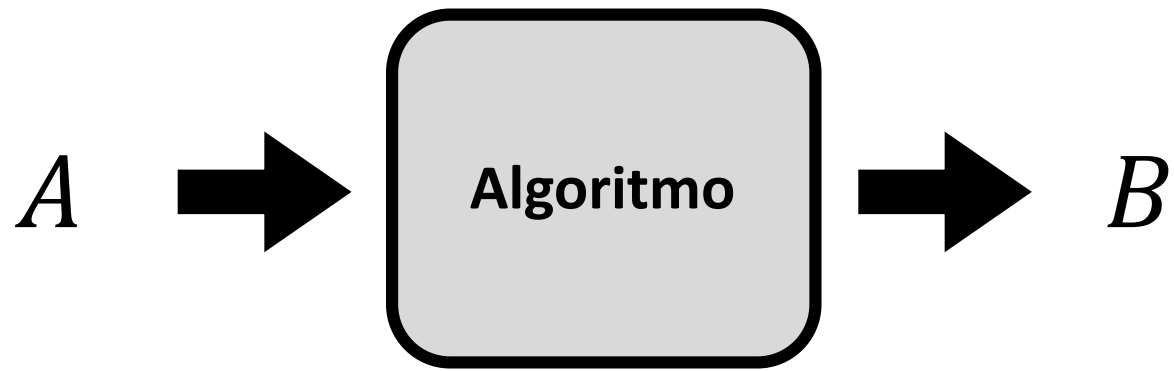


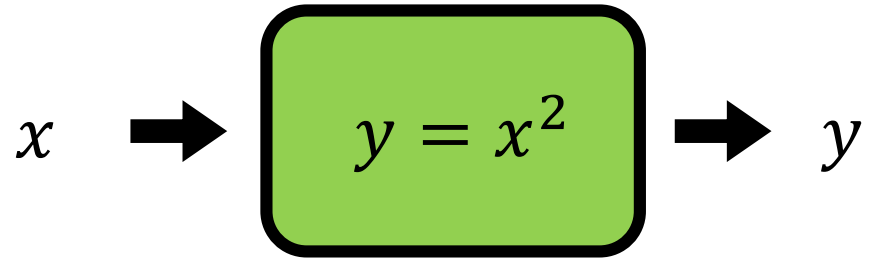
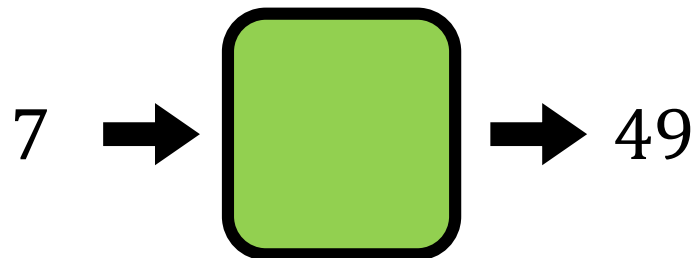
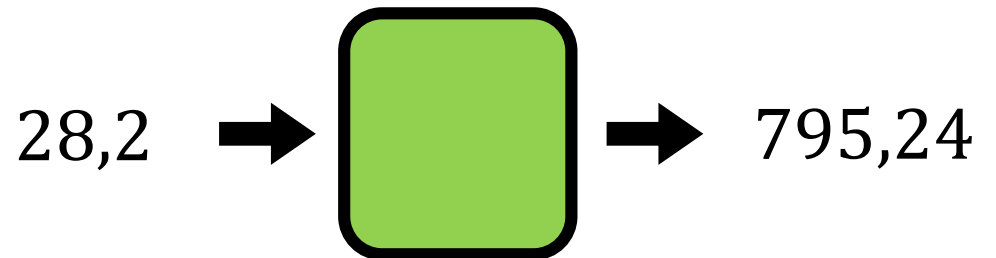
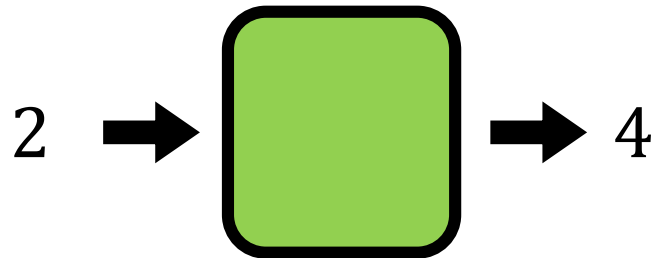
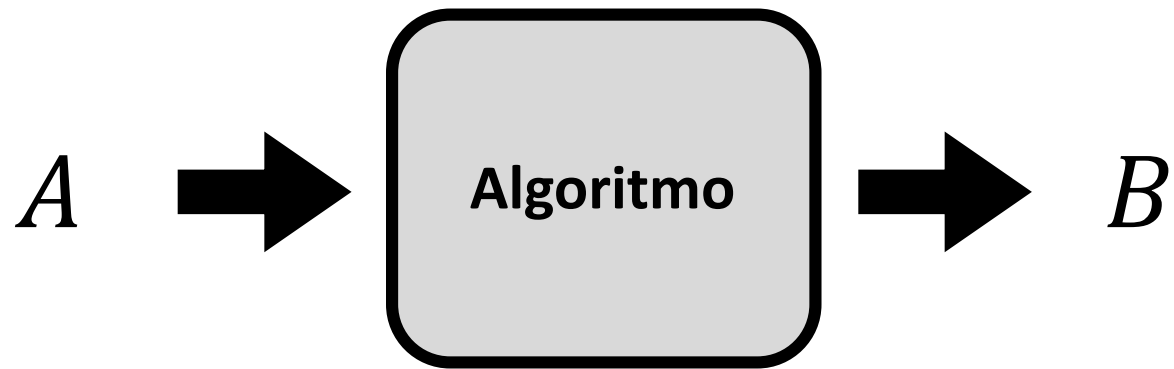
Algoritmo



B



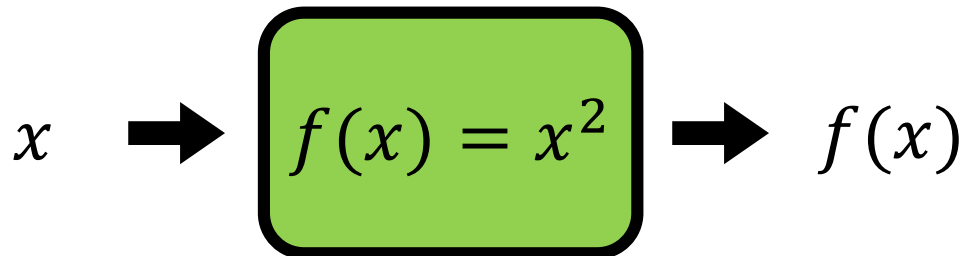
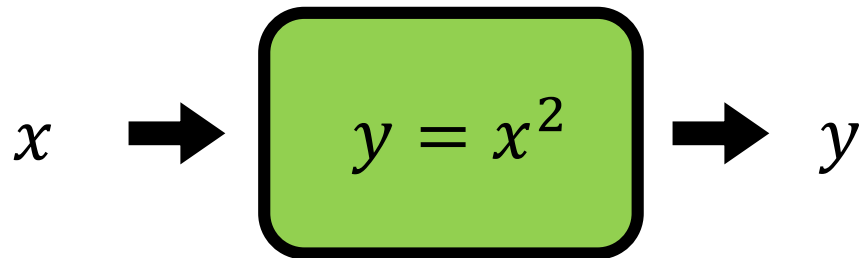




NOTACIÓN

$$y = y(x)$$

$$y = f(x)$$



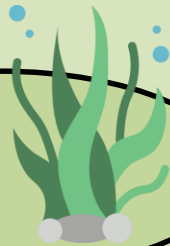
2.- EL MAPA DE LAS MATEMÁTICAS

2.- МАТЕМАТИЧНА КАРТА

BIOLOGÍA

Botánica

Algas



Zoología

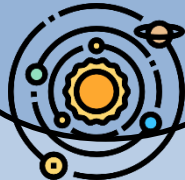
Reptiles



FÍSICA

Astrofísica

Estrellas



Óptica

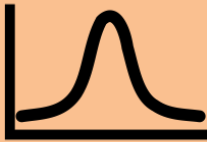
Lentes



MATEMÁTICAS

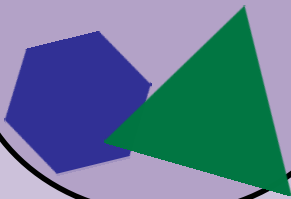
Análisis

Funciones



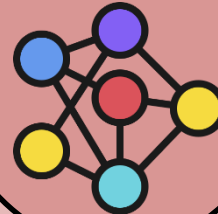
Geometría

Áreas



Aprendizaje automático

Redes neuronales



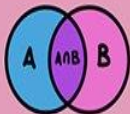
FOUNDATIONS

FUNDAMENTAL RULES

MATHEMATICAL LOGIC

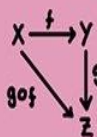
$$p \Rightarrow q$$

SET THEORY



CONSISTENT SET OF AXIOMS?

GÖDEL INCOMPLETENESS THEOREMS



CATEGORY THEORY

MEASURE THEORY



TOPOLOGY



DIFFERENTIAL GEOMETRY



COMPLEX ANALYSIS



FRactal GEOMETRY



BUTTERFLY EFFECT



CHAOS THEORY



DYNAMICAL SYSTEMS



VECTOR CALCULUS



DIFFERENTIAL EQUATIONS

PURE MATHEMATICS

$P \neq NP?$

COMPLEXITY THEORY

NUMBER THEORY

COMBINATORICS



GRAPH THEORY



GROUP THEORY



PERMUTATION GROUP

MATRICES

$$\begin{pmatrix} 6 & 7 \\ -3 & 2 \end{pmatrix}$$

VECTORS



ALGEBRA

$$x^2 - 4x - 8 = 5x + 18$$
$$x^2 - 4x - 36 = 0$$
$$(x+3)(x-12) = 0$$

EQUATION

$$y = mx + c$$

STRUCTURES

SPACES

GEOMETRY

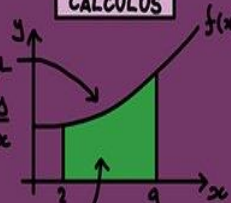


TRIGONOMETRY



DIFFERENTIAL

$$\text{GRADIENT} = \frac{dy}{dx}$$

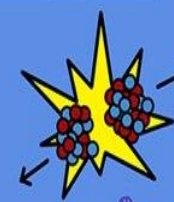


$$\text{AREA} = \int_2^9 f(x) dx$$

CALCULUS

CHANGES

MATHEMATICAL PHYSICS



THEORETICAL PHYSICS



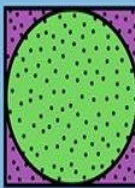
MATHEMATICAL CHEMISTRY



BIOMATHEMATICS



NUMERICAL ANALYSIS



GAME THEORY



STATISTICS



BAYES' RULE

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$



PROBABILITY

while awake:
do_science()
if self.tired():
awake=False
self.repair_brain()

while awake:
do_science()
if self.tired():
awake=False
self.repair_brain()

COMPUTER SCIENCE

TURING MACHINE

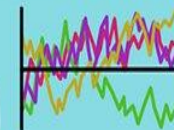


MACHINE LEARNING



OPTIMIZATION

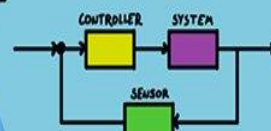
MATHEMATICAL FINANCE



ECONOMICS

APPLIED MATHEMATICS

ENGINEERING



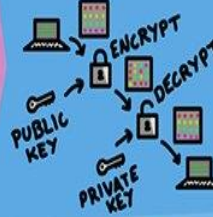
CONTROL THEORY

CARDINAL NUMBERS
 \aleph_0 ALPH NULL

OCTONION
 $\{e_0, e_1, e_2, e_3, e_4, e_5, e_6, e_7\}$

QUATERNION
 $a+bi+cj+dk$

CRYPTOGRAPHY



COMPLEX NUMBERS
 $5i, 4+3i, -4i$

RATIONAL NUMBERS
 $-7, \frac{1}{2}, 2.32$

REAL NUMBERS
 $-4\pi, \sqrt{2}, e$

INTEGERS
 $\dots, -1, 0, 1, 2, \dots$

NATURAL NUMBERS
 $1, 2, 3, 4, 5, \dots$

PRIME NUMBERS
 $3, 11, 47, 907$

EXPONENTIAL
 π, e

PI
 π

THEORY OF COMPUTATION

00011100

$P \neq NP?$

COMPLEXITY THEORY

NUMBER THEORY

COMBINATORICS



GRAPH THEORY



GROUP THEORY



PERMUTATION GROUP

LINEAR ALGEBRA

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \cdot \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 17 & 20 \\ 25 & 32 \end{pmatrix}$$

MATRICES

$$\begin{pmatrix} 6 & 7 \\ -3 & 2 \end{pmatrix}$$

VECTORS



ALGEBRA

$$x^2 - 4x - 8 = 5x + 18$$
$$x^2 - 4x - 36 = 0$$
$$(x+3)(x-12) = 0$$

EQUATION

$$y = mx + c$$

STRUCTURES

SPACES

GEOMETRY

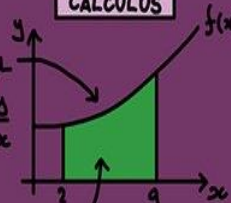


TRIGONOMETRY



DIFFERENTIAL

$$\text{GRADIENT} = \frac{dy}{dx}$$

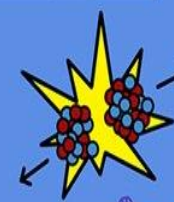


$$\text{AREA} = \int_2^9 f(x) dx$$

CALCULUS

CHANGES

MATHEMATICAL PHYSICS



THEORETICAL PHYSICS

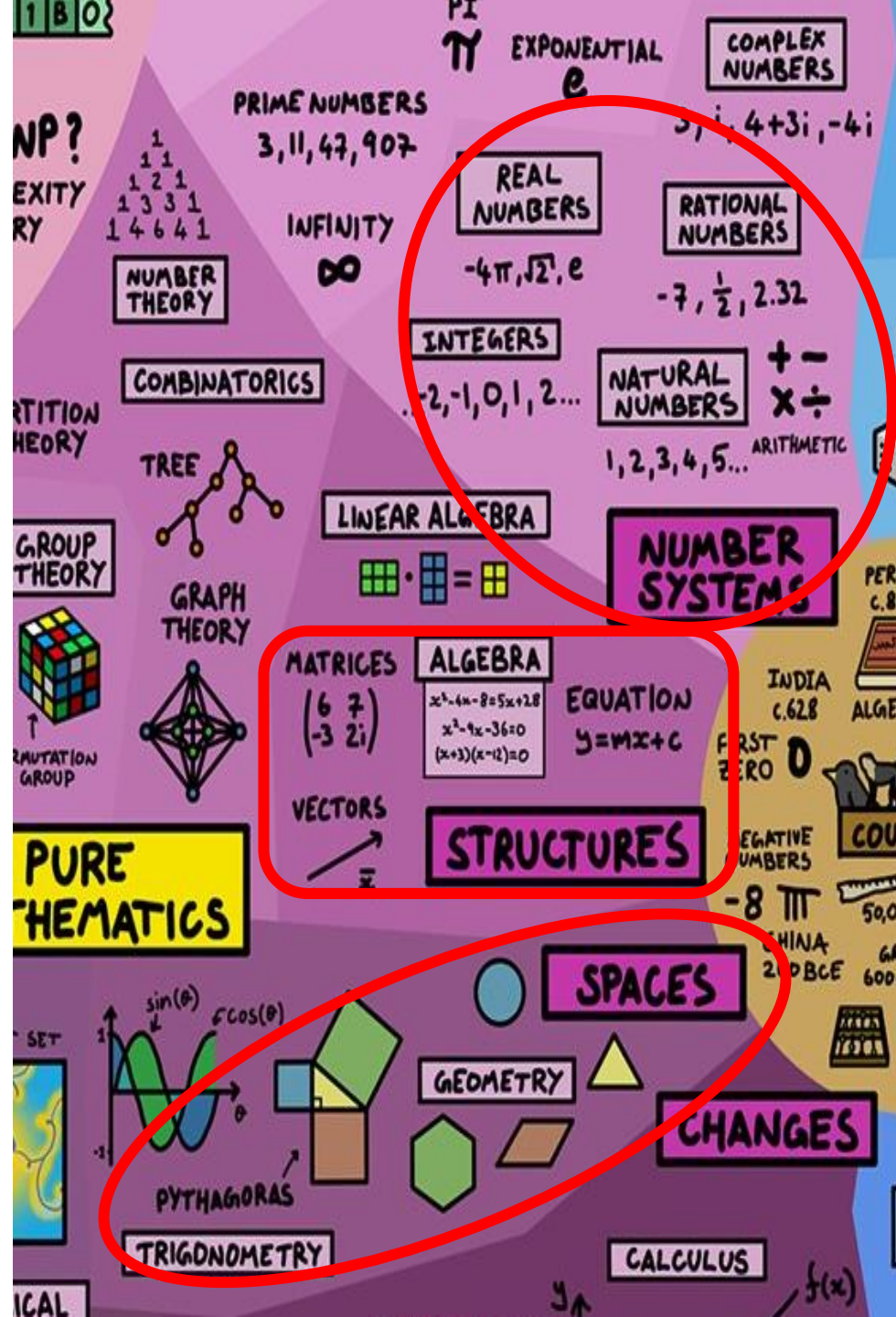


MATHEMATICAL CHEMISTRY



BIOMATHEMATICS





FOUNDATIONS

FUNDAMENTAL RULES

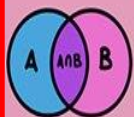
MATHEMATICAL LOGIC

$$p \Rightarrow q$$

CONSISTENT SET OF AXIOMS?

GÖDEL INCOMPLETENESS THEOREMS

SET THEORY



CATEGORY THEORY

MEASURE THEORY



TOPOLOGY

DIFFERENTIAL GEOMETRY



1 HOLE (GENUS 1)

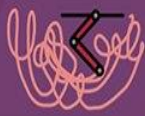
COMPLEX ANALYSIS

FRactal Geometry



BUTTERFLY EFFECT

CHAOS THEORY



THEORY OF COMPUTATION

00011180

$P \neq NP?$

COMPLEXITY THEORY

PRIME NUMBERS
3, 11, 47, 907

NUMBER THEORY

PARTITION THEORY

COMBINATORICS



GROUP THEORY



PERMUTATION GROUP

GRAPH THEORY



LINEAR ALGEBRA

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 5 \\ 6 \end{bmatrix} = \begin{bmatrix} 13 \\ 26 \end{bmatrix}$$

MATRICES

$$\begin{pmatrix} 6 & 7 \\ -3 & 2i \end{pmatrix}$$

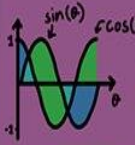
VECTORS



PURE MATHEMATICS



MANDELBROT SET



$\sin(\theta)$

TRIGONOMETRY

DYNAMICAL SYSTEMS

FLUID FLOW



VECTOR CALCULUS

DIFFERENTIAL EQUATIONS

AREA = $\int_1^9 f(x) dx$

INTEGRAL

GRADIENT = $\frac{dy}{dx}$

DIFFERENTIAL

AREA = $\int_1^9 f(x) dx$

INTEGRAL

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FOUNDATIONS

FUNDAMENTAL RULES

MATHEMATICAL LOGIC

$$p \Rightarrow q$$

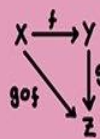
CONSISTENT SET OF AXIOMS?

GÖDEL INCOMPLETENESS THEOREMS

SET THEORY



CATEGORY THEORY



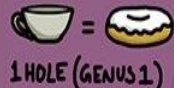
MEASURE THEORY



TOPOLOGY



DIFFERENTIAL GEOMETRY



1 HOLE (GENUS 1)

COMPLEX ANALYSIS



FRactal Geometry

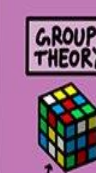
THEORY OF COMPUTATION

00011100

$P \neq NP?$

COMPLEXITY THEORY

PARTITION THEORY



GROUP THEORY

COMBINATORICS



GRAPH THEORY



PURE MATHEMATICS



DYNAMICAL SYSTEMS

FLUID FLOW



ECOSYSTEMS



CARDINAL NUMBERS

\aleph_0 ALPH NULL

OCTONION

$\{e, e^2, e^3, e^4, e^5, e^6, e^7, e^8\}$

QUATERNION

$a+bi+cj+dk$

π

EXPONENTIAL

e

COMPLEX NUMBERS

$3, i, 4+3i, -4i$

REAL NUMBERS

$-4\pi, \sqrt{2}, e$

RATIONAL NUMBERS

$-7, \frac{1}{2}, 2.32$

INTEGERS

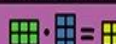
$\dots -2, -1, 0, 1, 2 \dots$

NATURAL NUMBERS

$1, 2, 3, 4, 5 \dots$

NUMBER SYSTEMS

LINEAR ALGEBRA



MATRICES

$\begin{pmatrix} 6 & 7 \\ -3 & 2 \end{pmatrix}$

ALGEBRA

$x^2 - 4x - 8 = 5x + 28$
 $x^2 - 4x - 36 = 0$
 $(x+3)(x-12) = 0$

EQUATION

$y = mx + c$

STRUCTURES

SPACES

GEOMETRY



CHANGES

CALCULUS

DIFFERENTIAL

GRADIENT = $\frac{dy}{dx}$

INTEGRAL

AREA = $\int_2^9 f(x) dx$

DIFFERENTIAL EQUATIONS

VECTOR CALCULUS



ORIGINS

INDIA c. 628

FIRST ZERO

NEGATIVE NUMBERS

-8

CHINA 200 BCE

GREECE 600-300 BCE

50,000 BCE

EGYPT FIRST EQUATION 3000 BCE

PERFECT SQUARE

ALGEBRA

c. 1730 MATHEMATICAL NOTATION

$e^{i\pi} = -1$

COUNTING

INDIA c. 628

FIRST ZERO

NEGATIVE NUMBERS

-8

CHINA 200 BCE

GREECE 600-300 BCE

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EGYPT FIRST EQUATION 3000 BCE

PERFECT SQUARE

ALGEBRA

c. 1730 MATHEMATICAL NOTATION

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TURING MACHINE

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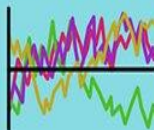
STATISTICS



GAME THEORY



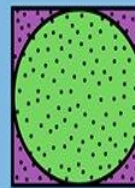
MATHEMATICAL FINANCE



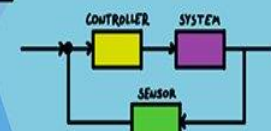
ECONOMICS

APPLIED MATHEMATICS

NUMERICAL ANALYSIS

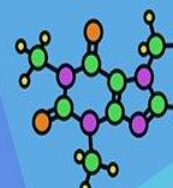


ENGINEERING



CONTROL THEORY

MATHEMATICAL CHEMISTRY



BIOMATHEMATICS

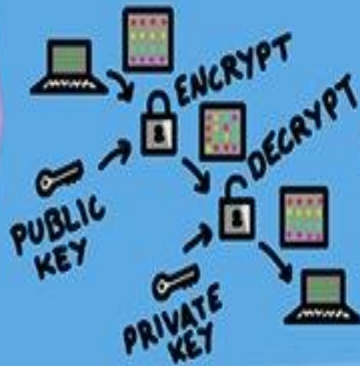


MACHINE LEARNING



OPTIMIZATION

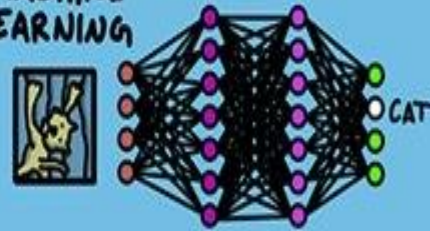
CRYPTOGRAPHY



COMPUTER SCIENCE



MACHINE LEARNING



PROBABILITY

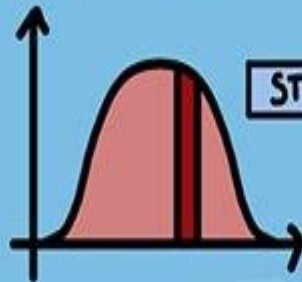


BAYES' RULE

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

```
while awake:  
  do_science()  
  if self.tired():  
    awake = False  
    self.repair_brain()
```

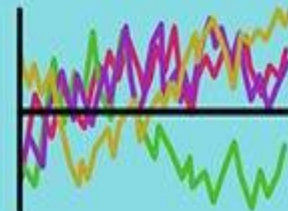
STATISTICS



OPTIMIZATION



MATHEMATICAL FINANCE



ECONOMICS

GAME THEORY



APPLIED MATHEMATICS

PERIA
.820
عالم الجبر
GEBRA
c.1730
MATHEMATICAL
NOTATION
 $e^{i\pi} = -1$
COUNTING
0,000 BCE
GREECE
00-300 BCE
EGYPT
FIRST
EQUATION
3000 BCE

3.- INTELIGENCIA ARTIFICIAL, APRENDIZAJE AUTOMÁTICO Y REDES NEURONALES

**3.- ШТУЧНИЙ ІНТЕЛЕКТ, МАШИННЕ НАВЧАННЯ ТА
НЕЙРНІ МЕРЕЖІ**

Kasparov has Deep Blues after losing Chess champ: I was rooked

By MICHELE McPHEE,
K.C. BAKER
and CORKY SIEMASZKO
Daily News Staff Writers

The world's greatest human chess player threw a tantrum and cried foul yesterday after being thrashed by a supercomputer.

It took IBM's Deep Blue just 19 moves to defeat world chess champion Garry Kasparov — a stunning finale to an epic week-long battle of man versus machine.

Not mollified by his \$400,000 loser's share, Kasparov stormed off like a sore loser after resigning. He later accused IBM of unfairly programming the high-speed computer to beat him specifically.

He suggested that Deep Blue, which was supposed to play on its own, was coached during the match. He stopped short of saying the computer team cheated.

"I suspect there were things in the match that were well beyond my understanding," Kasparov said. "And when a big corporation with unlimited resources would like to do so, there are many ways to achieve the result, and the result was achieved."

IBM team leader C.J. Tan denied the computer was coached. "Once the clock started, it relied on Deep Blue's system itself," he said.

Kasparov's pal, Michael Khodarkovski, blamed Kasparov's graceless exit on a lack of practice — he said Kasparov had never lost a match.

Kasparov came close to losing to Anatoly Karpov in a 1984-85 championship match that was suspended without a victory on either side.

Kasparov, 34, considered by some chess experts as the greatest player in the history of the game, last year defeated Deep Blue 4-2.

After losing the opening game of the rematch at the Equitable Center in Manhattan, the computer won the second game and fought Kasparov to draws in the next three.

Then yesterday — with a swiftness that stunned the chess world — Deep Blue took advantage of Kasparov's clumsy opening moves and placed him in a no-win situation after less than an hour of play.

Unable to find a way out, Kasparov — playing the black pieces — tipped his king and resigned. He buried his head in his hands and didn't look at IBM's Tan when they shook hands.

The final score was 3½ points for the computer and 2½ points for Kasparov. Kasparov said he "cracked under the pressure."

"I am ashamed," said Kasparov, who would have won \$700,000 if he had beaten the computer.

Patrick Wolff, author of "The Complete Idiot's Guide to Chess," said the world champ "basically cracked."

Kasparov, playing black, used a standard defense known as the "Caro-Kann," forcing white to sacrifice a piece. But for some reason he botched his seventh move and "he became lost," Wolff said.

"This is not a position he wanted to get into," said Ilya Gurevich, a grand master from Manhattan. "It's a pure calculating position where the computer has a big advantage. The computer's strength is tactics."

The computer Kasparov battled was capable of analyzing 200 million positions per second — twice as many positions per second as the IBM model he defeated in Philadelphia last year.

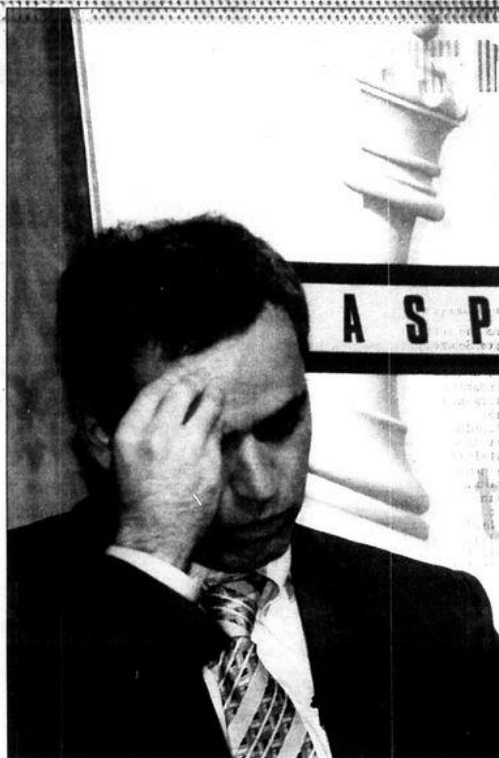
One expert said he was surprised when Kasparov resigned. "It didn't seem lost," said grand master John Fedorovitch of the Bronx, who helped the IBM team prepare its game plan.

At Chess Forum on Thompson St. in Greenwich Village, die-hard chess fans expressed shock at Kasparov's loss.

"This is a historic event," said Mark Wieder, 46, also a computer programmer. "The greatest human player of all time lost to a machine."

Chess Forum owner Imad Khan, 31, said Kasparov was following in the footsteps of other sore losers by suggesting his foe didn't play fair.

"This is not uncommon in chess," he said. "When Viktor Korchnoi was playing Karpov in the '70s, Korchnoi made the accusation that the KGB was sending him telepathic messages to destroy his concentration."



LARRY ZURNWALT

RESIGNED: Chess champion Garry Kasparov is disappointed yesterday after losing to IBM's Deep Blue supercomputer. IBM's team leader C.J. Tan (left) denied the computer had been coached, as Kasparov charged after the historic loss in Manhattan. Kasparov will get \$400,000 for his efforts.



Artificial intelligence not black and white

FORGET ABOUT THE Garden or the Meadowlands. The real action was outside the Equitable Center on Seventh Ave., where Garry Kasparov, with a name like a hockey player, did battle with Deep Blue, an IBM supercomputer whose name suggests some starlet who did her best work on 42d St. in those hazy days before Disney.

The scalpers were asking as much as \$500 for a \$25 seat. "Actually, I'd settle for a couple of hundred," said Ze Ayala. "I have extras."

In the history of New York, there's never been a scalper so hopelessly well-mannered as Ze Ayala, Ph.D. Instead of the usual hawk's cry —

"Who got tickets?" — Ayala was content to let the business come to him as he burnished his new henna tattoo with a cotton ball doused in lemon juice.

"The lemon juice helps the absorption of the dye," he said. The tattoo bore the name of his band, "Flashpot," for whom the tall, long-haired Ayala plays guitar. It should be noted that in lieu of a day job, he works at the Institute of Molecular Evolutionary Genetics at Penn State. His mission wasn't even merce-

nary; it was professional. He said he wouldn't have sold his own seat for a million bucks.

"My field is artificial intelligence,"

he said. "And this is the coolest thing to happen in my lifetime."

In such a spirit, the 28-year-old scientist had come to witness the inevitable coolness: Man mangled by Machine.

He couldn't help but root for Kasparov. The sentimental part of him was taken with the charms of obsoles-

cence. But he knew better than to bet against technology.

Kasparov is the best chess player in the world; but unlike Deep Blue, he can also be vain, angry, neurotic, panicked, fearful, in all, human. "Chess is fundamentally psychological," Ayala said. "And that's precisely what Kasparov has working against him."

I asked him how long before Deep Blue is playing lead guitar in his band.

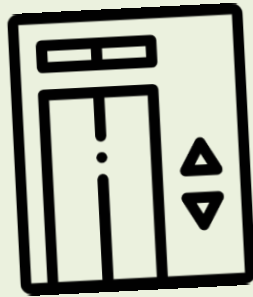
That day will come, he said, and it won't be too long. "You know the band Nine Inch Nails?" he said. "That's all computers. But what you're really asking is: Will a computer be able to write



MARK KRIEGL



INTELIGENCIA ARTIFICIAL

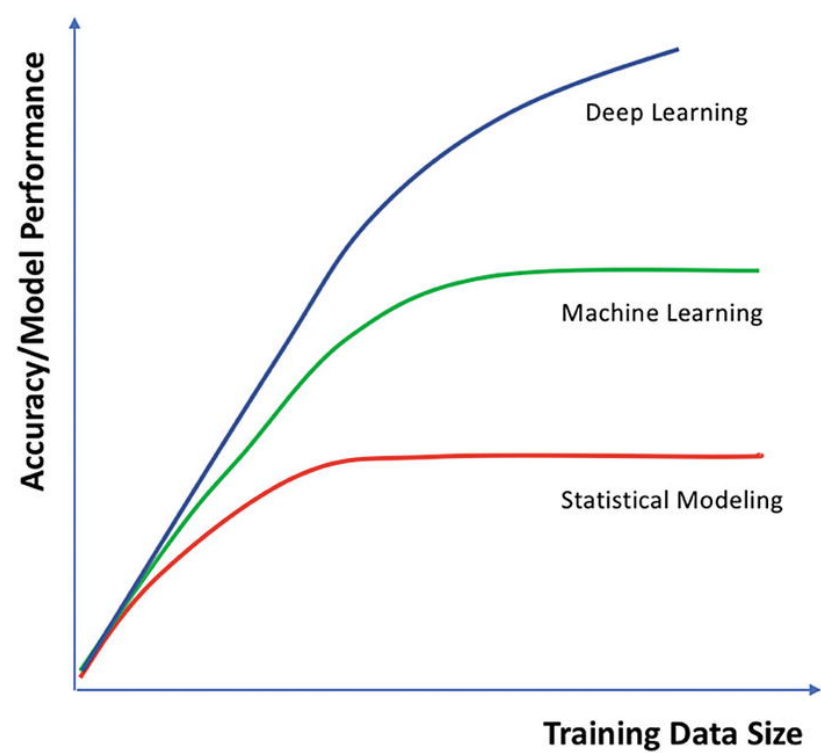
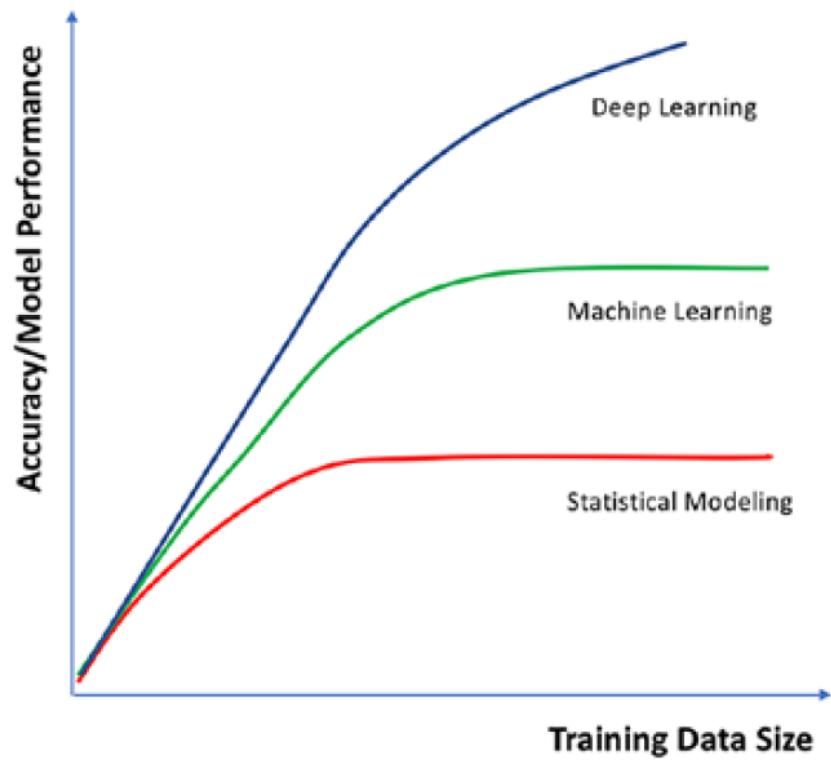


Aprendizaje automático



Redes neuronales

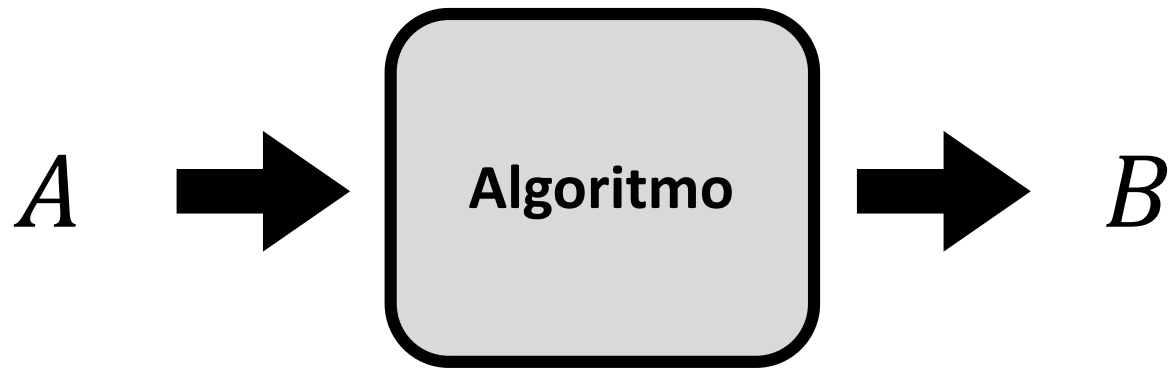


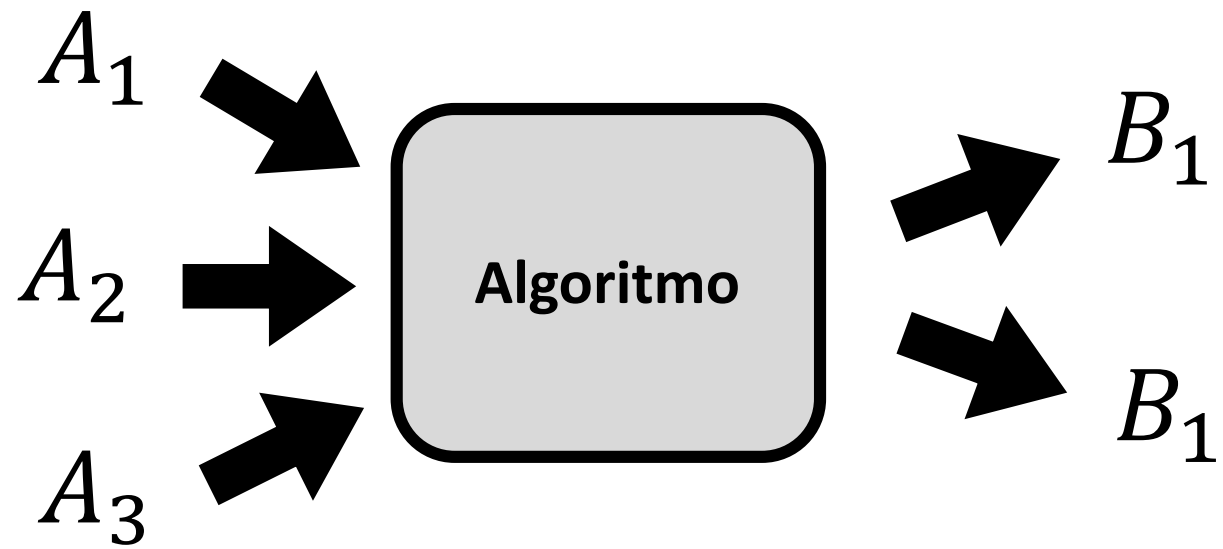


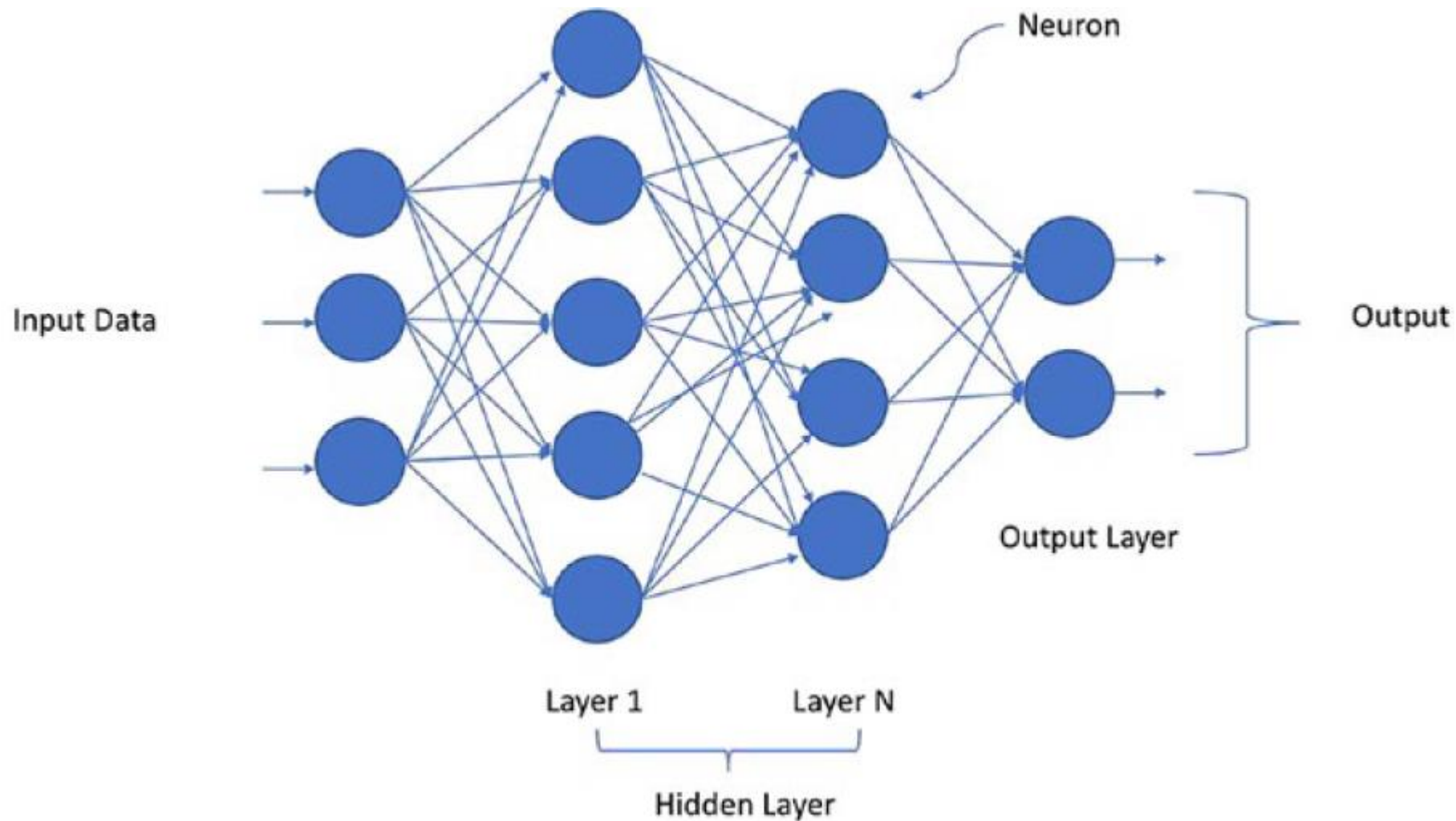


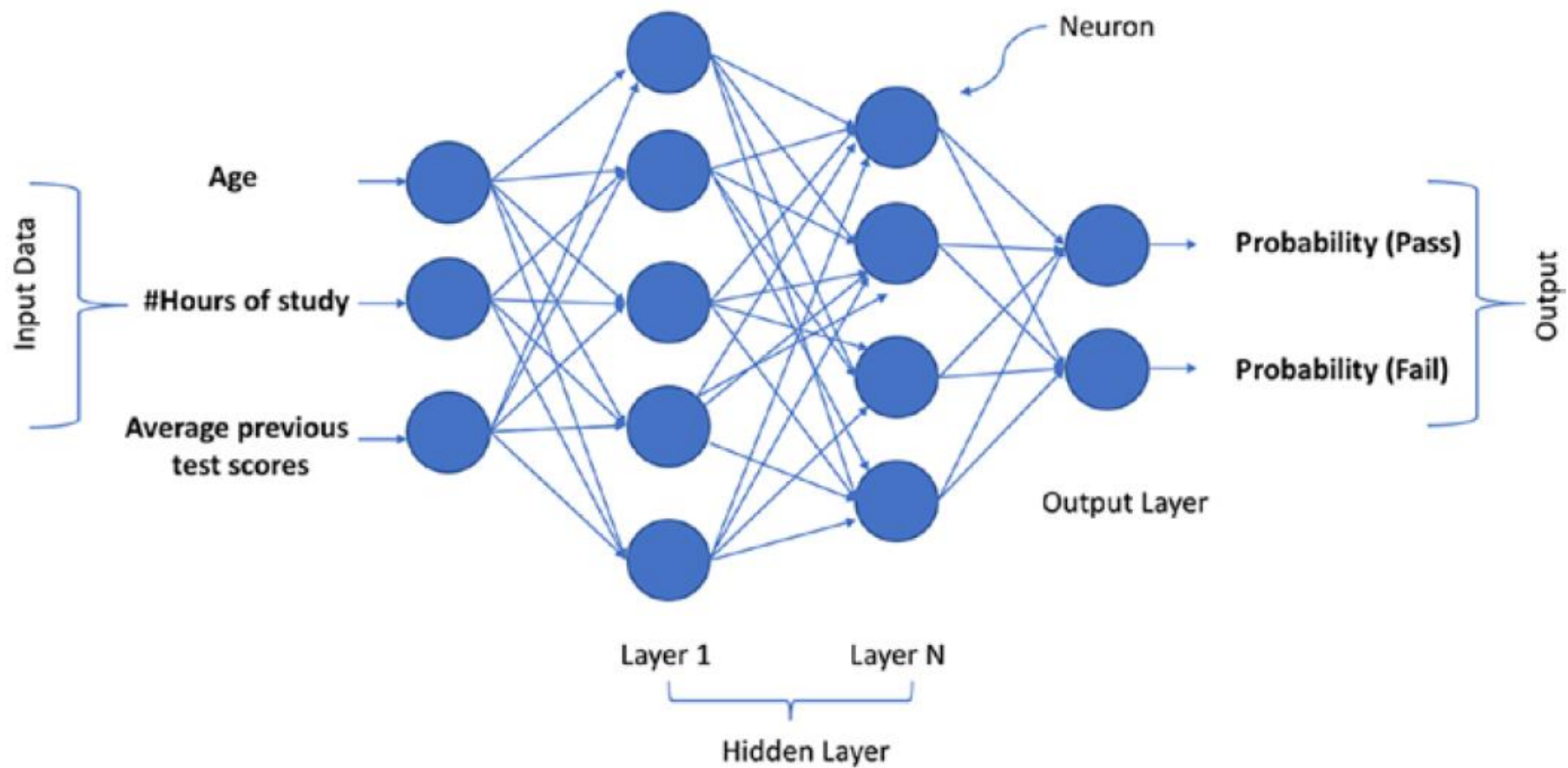
4.- INTRODUCCIÓN A LAS REDES NEURONALES

4.- ВСТУП В НЕЙРНІ МЕРЕЖІ

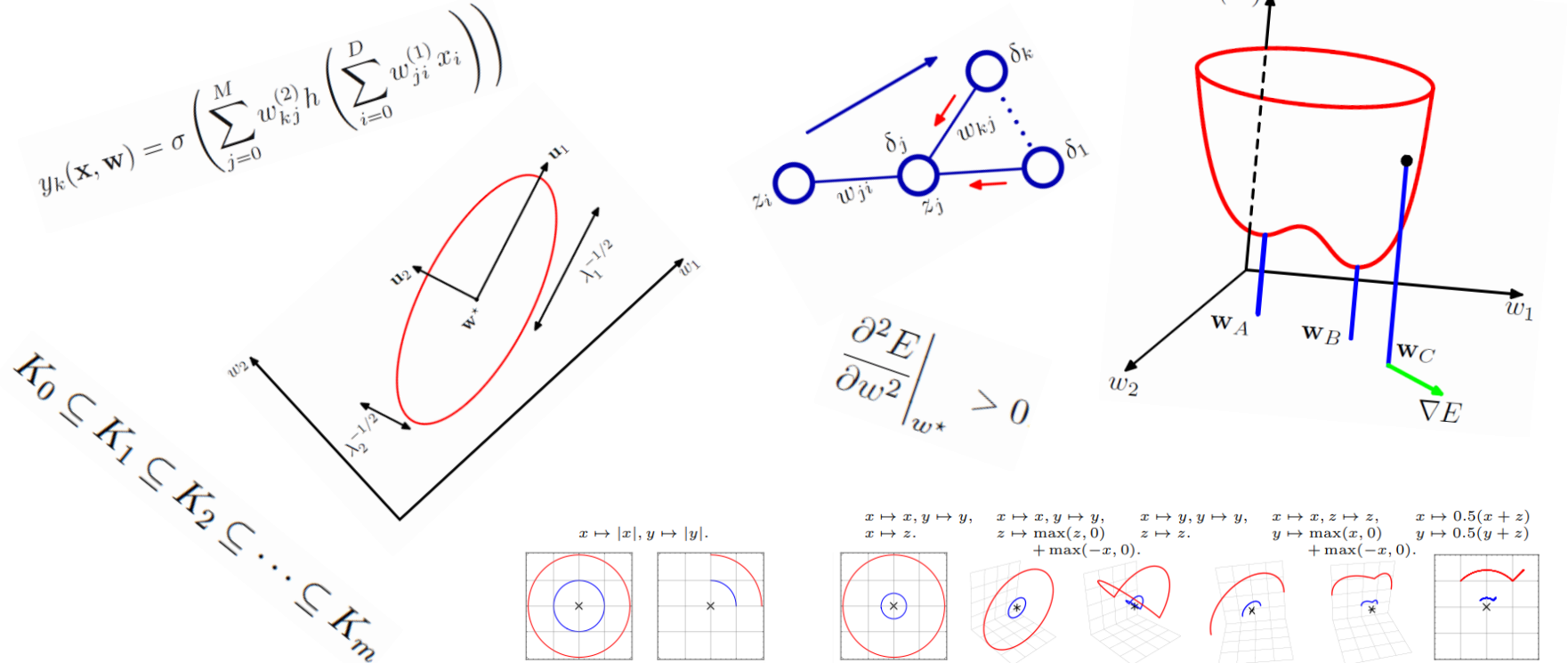








REALIDAD



REALIDAD \neq Ecuaciones y gráficas aleatorias y sin sentido que no entiende nadie.

REALIDAD = Herramientas y conceptos matemáticos, que con estudio e investigación, cualquiera puede dominar y usar.

FOUNDATIONS

FUNDAMENTAL RULES

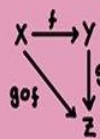
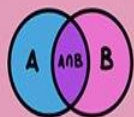
MATHEMATICAL LOGIC

$$p \Rightarrow q$$

CONSISTENT SET OF AXIOMS?

GÖDEL INCOMPLETENESS THEOREMS

SET THEORY



CATEGORY THEORY

MEASURE THEORY

THEORY OF COMPUTATION

00011100

$P \neq NP?$

COMPLEXITY THEORY

NUMBER THEORY

COMBINATORICS

PARTITION THEORY

GROUP THEORY

PERMUTATION GROUP

ORDER THEORY

PURE MATHEMATICS

TOPOLOGY

1 HOLE (GENUS 1)

DIFFERENTIAL GEOMETRY

COMPLEX ANALYSIS

FRactal Geometry



DYNAMICAL SYSTEMS

FLUID FLOW

ECOSYSTEMS

CARDINAL NUMBERS

\aleph_0 ALPH NULL

OCTONION

$\{e, e^2, e^3, e^4, e^5, e^6, e^7, e^8\}$

QUATERNION

$a+bi+cj+dk$

π

EXPONENTIAL

COMPLEX NUMBERS

RATIONAL NUMBERS

NATURAL NUMBERS

INTEGERS

LINEAR ALGEBRA

MATRICES

$\begin{pmatrix} 6 & 7 \\ -3 & 2 \end{pmatrix}$

VECTORS

ALGEBRA

$x^2 - 4x - 8 = 5x + 28$
 $x^2 - 4x - 36 = 0$
 $(x+3)(x-12) = 0$

EQUATION

$y = mx + c$

STRUCTURES

SPACES

GEOMETRY

TRIGONOMETRY

CALCULUS

DIFFERENTIAL
GRADIENT = $\frac{dy}{dx}$

INTEGRAL

AREA = $\int_2^9 f(x) dx$

DIFFERENTIAL EQUATIONS

VECTOR CALCULUS

CRYPTOGRAPHY



PROBABILITY

BAYES' RULE
 $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$

COMPUTER SCIENCE

TURING MACHINE

```
while awake:
do_science()
if self.tired():
awake=False
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```

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MATHEMATICAL PHYSICS

THEORETICAL PHYSICS

MACHINE LEARNING



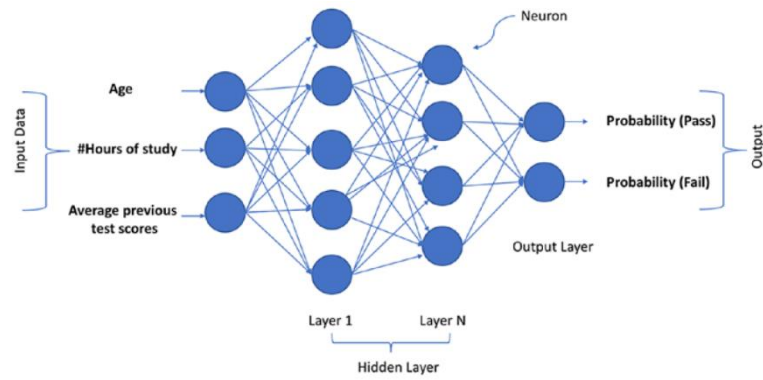
OPTIMIZATION

MATHEMATICAL FINANCE

ECONOMICS

5.- MI PRIMERA RED NEURONAL

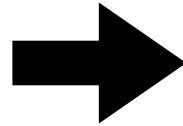
5.- МОЯ ПЕРША НЕЙРНА МЕРЕЖА



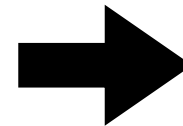
INGREDIENTES

Datos

Estructura



Entrenamiento
y testeo



RN lista para
predecir



RN entrenada y testeada



RN entrenada



RN sin entrenar



