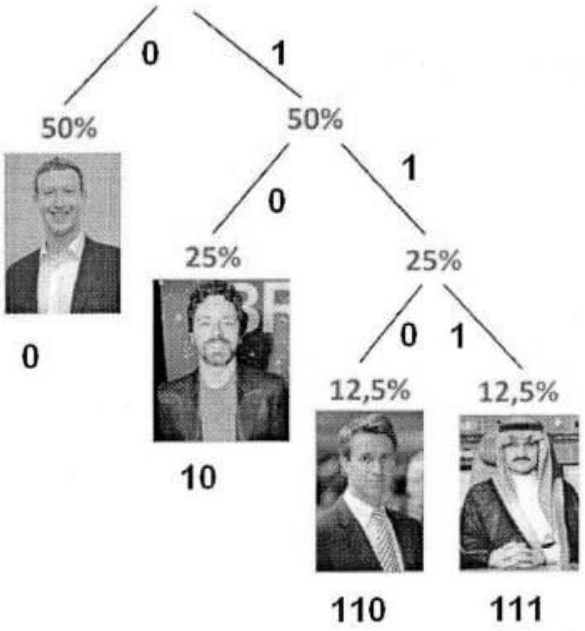


First-order approximation (symbols independent but with frequencies of Belarusian txt).

Мама мыла ра

М - 3	30%	1-3 М
а - 4	40%	4-7 а
ы -1	10%	8 -ы
л - 1	10%	9 -л
р - 1	10%	10 -р

10

лламаммар

Мама мыла ра

Ма - 2	22%	1-2 ма
ам - 2	22%	3-4 ам
мы - 1	11%	5 мы
ыл - 1	11%	6 ыл
ла - 1	11%	7 ла
ар - 1	11%	8 ар
ра - 1	11%	9 ра

9

0.467319167 35

ам ыл ла ам ма ра ма ыл ла ам мы

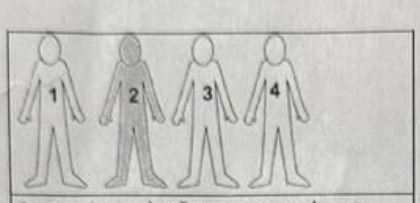
мылла рама

Second-order approximation (digram (2-symbols) structure as in Belarusian)

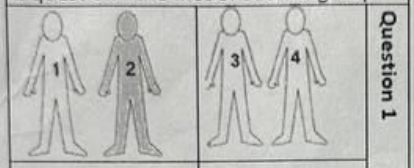
Say **NO** to the **first**

Say **YES** to the **second** if it is better than the first

Say **NO** to the **third** only if it is worse than all the others



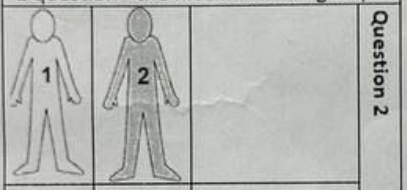
1 question - the first or second group



Question 1

X

2 question - the first or second group



Question 2

X

Average number of questions =

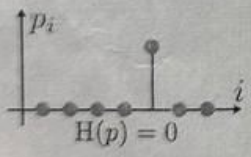
2*0.25+ 2*0.25+ 2*0,25+ 2*0,25 =2

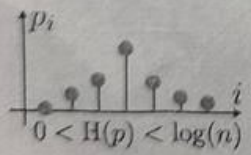
Average number of questions =

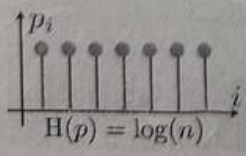
1*0.5+	2*0.25+	3*0,125+	3*0,125
			

Question 1. Is this Zuckerberg?	 50%	1*0.5
Question 2. Is this Sergey Brin?	 25%	2*0.25
Question 3. Is this Stefan from BMW?	 12,5%	3*0,125
So Prince Saud	 12,5%	3*0,125
Average number of questions =		1,75

$$H(X) = \sum_{i=1}^{n} p(x_i) \log_b \frac{1}{p(x_i)}$$







$$\sum_{i=1}^{n} p(i) \log_2 \frac{1}{p(i)}$$

Quantifying information

$$I(x_i) = \log_2\left(\frac{1}{p_i}\right)$$

number of bits required to encode choice

$$\sum_{i=1}^{n} p(x_i)\, I(x_i)$$

50 billion | 25 billion | 12.5 billion | 12.5 billion

Mark Zukerberg P(1)= **50%**

Sergey Brin P(2)= **25%**

Stefan Quandt P(3)= **12,5%**

Prince Al Saud P(4)= **12,5%**

0000 80%

0

Step 5.

Now we need to compile the file using the compiler csc.exe which is in the folder

C:\Windows\Microsoft.NET\Framework\v3.5

C:\WINDOWS\Microsoft.NET\Framework\v3.5\csc.exe ABBA.cs

the result is a file ABBA.exe that can already be run (which is located in the same folder). If you have taken the 1st step, then this means that the education-process has begun. This is victory. csc /target:library ABBA.cs - will make ABBA.dll.

```
>ABBA
ABBA
```

Step 6. Modify the file as follows

```
using System;

class ABBA
{
  static int Factorial(int n)
  {
    if (n == 1) return 1;
    return n * Factorial(n - 1);
  }

  static void Main(string[] args)
   // Here's a method called main.
   {
        System.Console.WriteLine("ABBA -"+
                                  Factorial(4));

   }
  }
```

```
>C:\WINDOWS\Microsoft.NET\Framework\v3.5\csc.exe ABBA.cs

>ABBA
ABBA – 24
```

Step 7. Modify the file as follows

```
using System;

class ABBA
{
  static int Factorial(int n)
  {
   if (n == 1) return 1;
    return n * Factorial(n - 1);
   }

public static void Main()
 {
  System.Console.WriteLine("ABBA");
  System.Console.Write("Enter number of Vovels:");
  string s = Console.ReadLine();
  int vovels=int.Parse(s);
  System.Console.Write("Enter number of Consonants:");
  s=System.Console.ReadLine();
  int consonants=int.Parse(s);
  Console.WriteLine(Factorial(vovels)*Factorial(consonants) );
  }
}
```

```
>ABBA
ABBA
Enter number of Vovels:2
Enter number of Consonants:2
4
```

```
>ABBA
ABBA
Enter number of Vovels:3
Enter number of Consonants:3
36
```

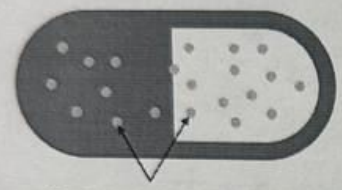
1 2 3 4

This is the program we need to write today

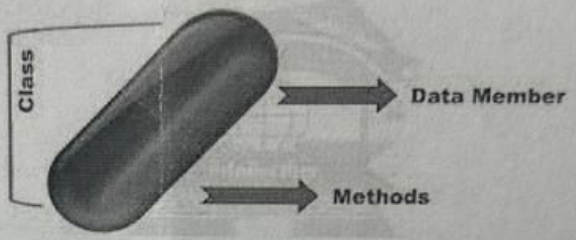
```
class ABBA      -
  {
  static void Main(string[] args)
                    // Here's a method called Main.
  {
     System.Console.WriteLine("ABBA!");
   }
  }
```

So there's the keyword class. Unlike C++, in C# all code must be placed in a class.

Encapsulated in a class.



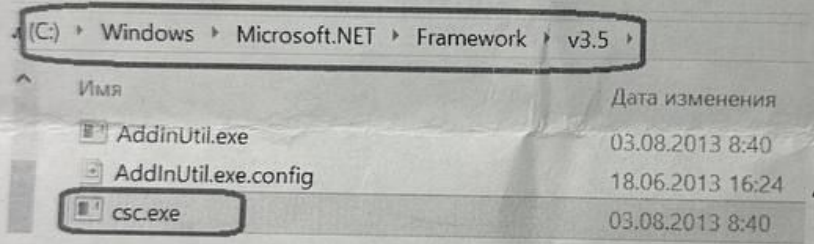
Medicines Inside Capsule



$A \neq a$

C# is case sensitive

C:\WINDOWS\Microsoft.NET\Framework\v3.5\ csc.exe



ABBA.cs => csc.exe = ABBA.exe

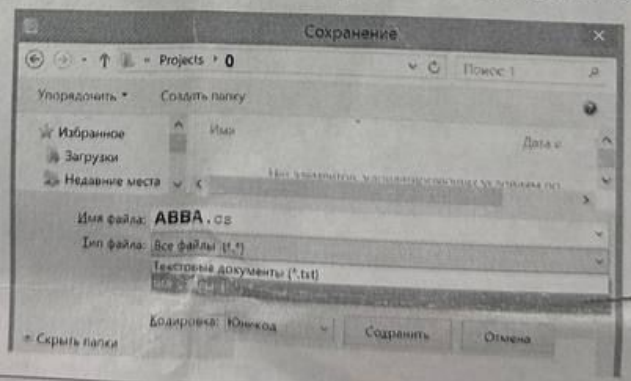
C# Compiler

Step 1. And on my HDD, I also make a folder with the same name D:\ IT

Step 2. In the folder **E:** IT\ we make the folder of the **Projects** - **E:\ IT\Projects**

And in the **Project** folder make folder **0** - **E:\ IT\Projects\0** where our today's practical work will be stored

Step 3. As I mentioned above, C# is a built-in language of Windows. Notepad is enough to write a program



You need to switch from *.txt (Text documents) to *.* (all files)

Otherwise, notepad with *.txt extension

Step 4.Entering command mode

Start=>Run=>cmd

cd E: - After that go to the folder IT/Projects/0/

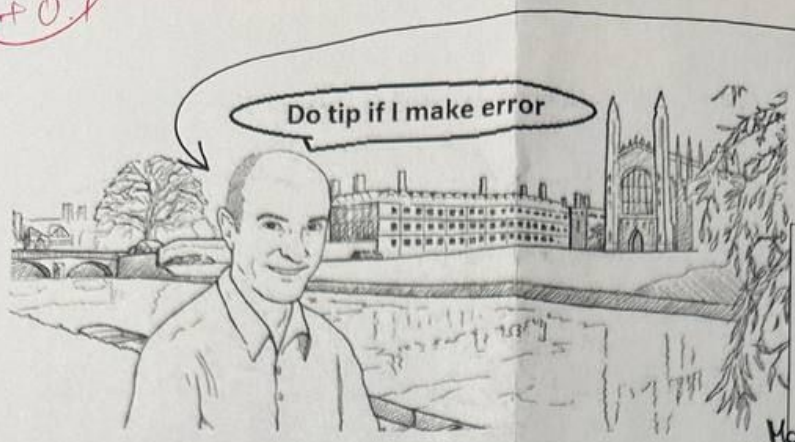
cd IT -Then go to the folder Projects

cd projects - Then go to the folder 0

cd 0 –

```
E:\>cd IT
E:\IT>cd Projects
E:\IT\Projects>cd 0
E:\IT\Projects\0>
```

+0.1



Sir **Dr. D. MacKay,**
University of Cambridge
(22 April 1967 – 14 April 2016)

John Nash Alan Turing

Machine Translation and coding
Artif. Intel.

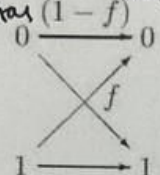
"I believe in clean energy,
but I also believe in mathematics"

Send message

Parity bit

1	0	0	1	0	0	1	1

Transmitted data unit



majority voting 111 → 1 (1)

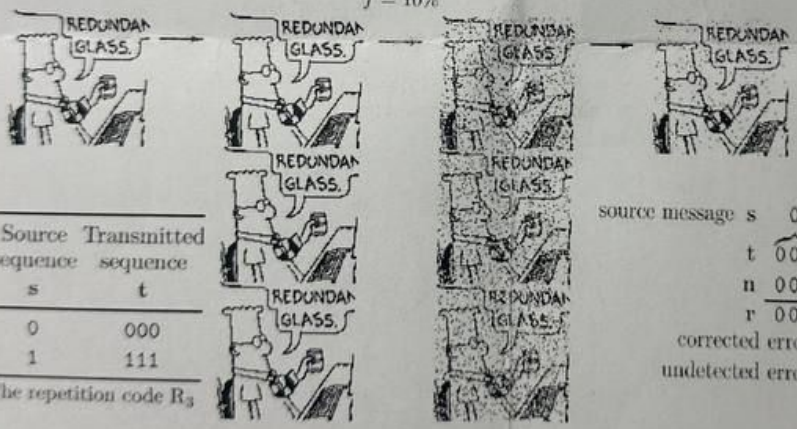
Parity bit

1	0	0	1	1	0	1	0

Transmitted data unit

one bit changed

s ENCODER t CHANNEL $f = 10\%$ r DECODER ŝ

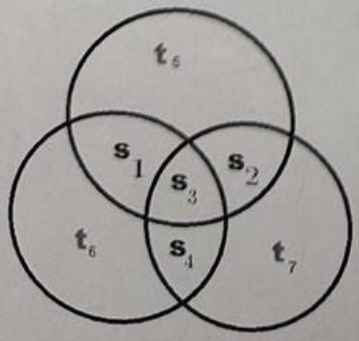


Source sequence s	Transmitted sequence t
0	000
1	111

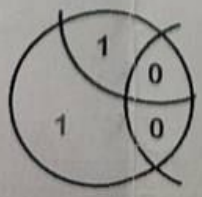
The repetition code R_3

source message	s	0	0	1	0	1	1	0
	t	000	000	111	000	111	111	000
	n	000	001	000	000	101	000	000
	r	000	001	111	000	010	111	000
corrected errors			*					
undetected errors						*		

7.4. Hamming code. $\frac{4}{\Sigma} \rightarrow \frac{7}{t}$

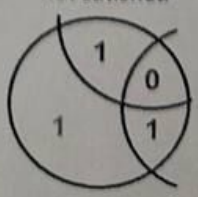


satisfied

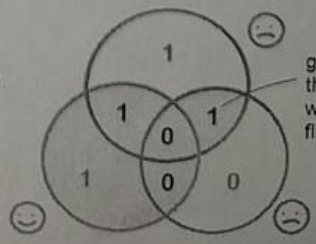


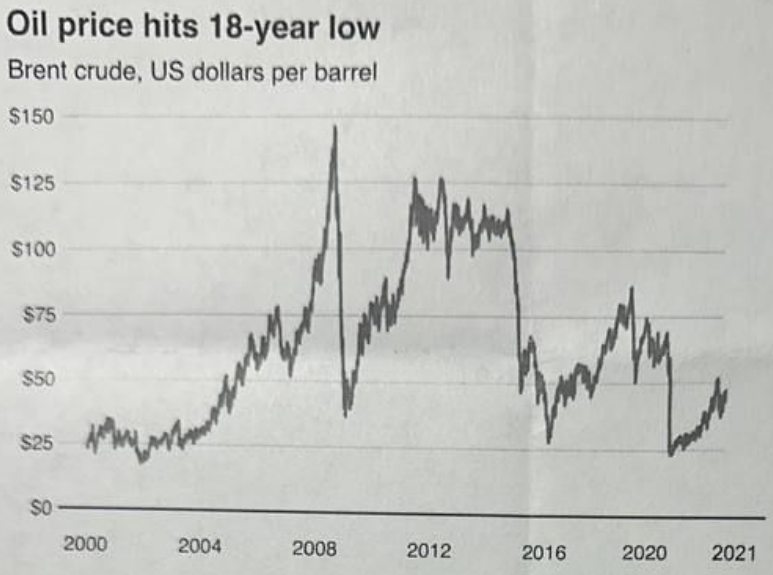
1+1+0+0=**0**

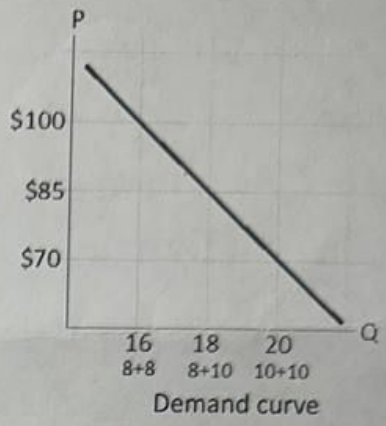
not satisfied

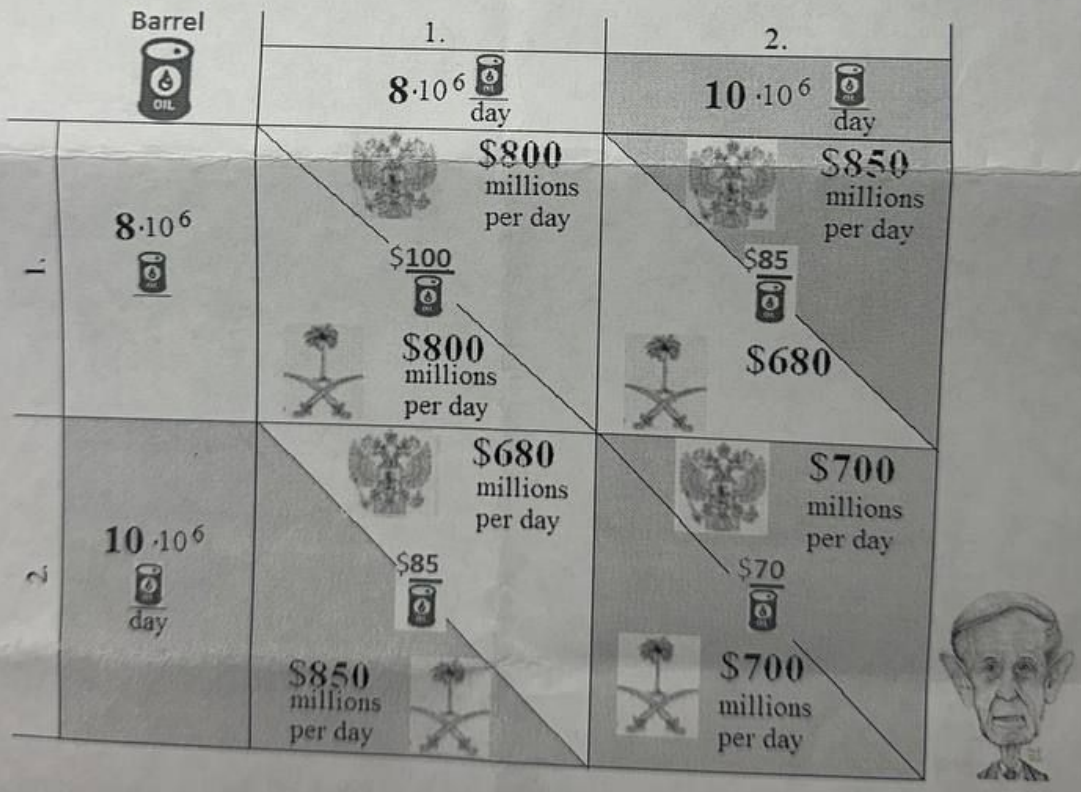


1+1+0+1=1




Oil price hits 18-year low
Brent crude, US dollars per barrel
$150
$125
$100
$75
$50
$25
$0
2000
2004
2008
2012
2016
2020
2021


P
$100
$85
$70
16
8+8
18
8+10
20
10+10
Q
Demand curve


Barrel
1.
2.
$8 \cdot 10^6$ day
$10 \cdot 10^6$ day
$8 \cdot 10^6$
$10 \cdot 10^6$ day
$800 millions per day
$850 millions per day
$100
$85
$800 millions per day
$680
$680 millions per day
$700 millions per day
$85
$70
$850 millions per day
$700 millions per day

How to calculate the amount of possible variants of events?

French math.

Pascal's triangle

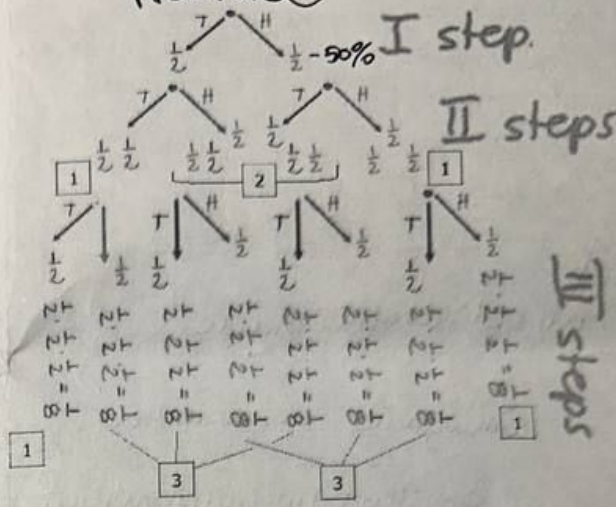
1+1=2

1+2; 2+1;
1+3; 3+3; 3+1;

1								← 1	
1	1							← 2	Бросок (2⁵)
1	2	1						← 4	
1	3	3	1					← 8	
1	4	6	4	1				← 16	Варианты
1	5	10	10	5	1			← 32	
1	6	15	20	15	6	1		← 64	
1	7	21	35	35	21	7	1	← 128	

1 8 28 56 70 56 28 8 1

Prob. tree



Newton's Binomial

$$(a+b)^0 = 1$$
$$(a+b)^1 = a+b$$
$$(a+b)^2 = a^2+2ab+b^2 \quad 121$$
$$(a+b)^3 = a^3+3a^2b+3ab^2+b^3 \quad 1331$$
$$(a+b)^4 = a^4+4a^3b+6a^2b^2+4ab^3+b^4$$
$$(a+b)^5 = a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$$
$$(a+b)^7 = a^7+7a^6b+21a^5b^2+35a^4b^3+35a^3b^4+21a^2b^5+7ab^6+b^7$$

Pascal's triangle shows in how many ways can the even happened.

1 бросок
Орел или Решка
1 2 1

2 броска, варианты OO, PP, OP, PO
Сколько раз выпадает один орёл → OP, PO - 2 раза

121 - два способа получить 1 орёл

+0.1 11.2.26

+0.1 17.6.26

вероятность 80%

how much inf. we can get from this picture?

bad way

good way

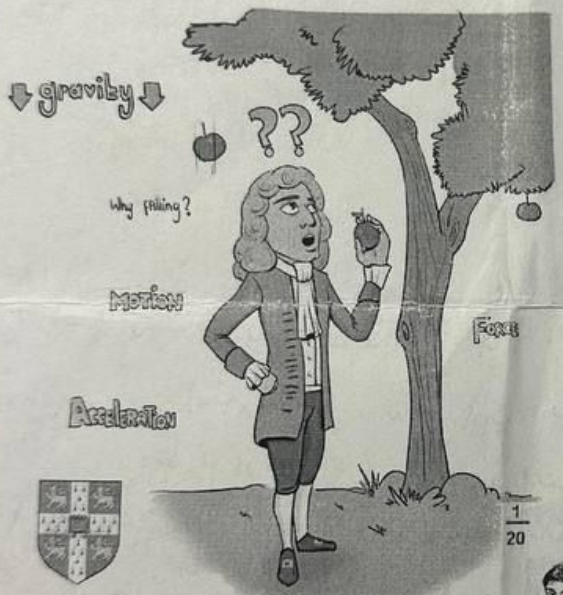
1. listening
2. first way of processing
3. Writing, incl. sth., you're not quite sure about

наблюдение – понимание – изучение – запись формул – универ

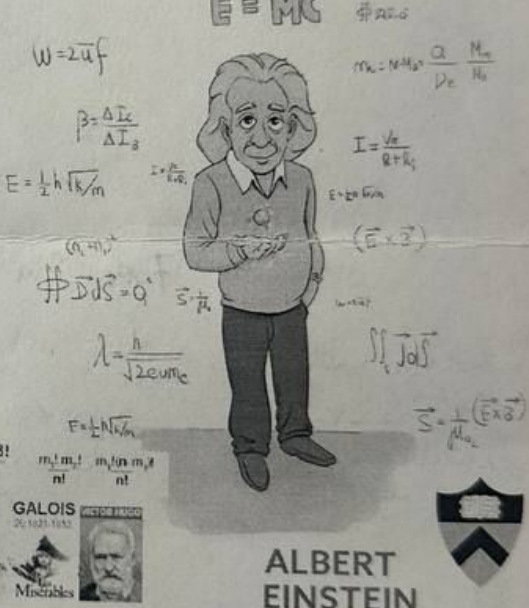
School gravity MOTION just listen ==formalism==> University $E=MC^2$ $\oint \vec{J} d\vec{S}$

Переход от обычных представлений к математическому описанию глубокое изучение

CONCRETE AND ABSTRACT THINKING



ISAAC NEWTON

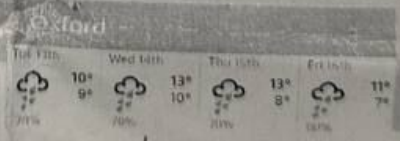


ALBERT EINSTEIN

Motivation: 80% chance of rain

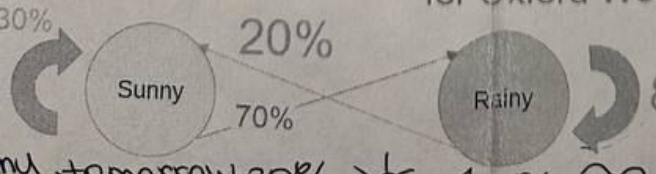
Let A_i be the event of rain on day i of this term, i.e. Ω

Suppose the events A_i each have probability p, independently



russian mathematist

Markoff Chain Probability Model for Oxford Weather



Today sunny, tomorrow 30% – ☀, 70% 🌧

Today rainy, tomorrow 80% 🌧, 20% ☀

Single day prod – 0,8

Every day is independent, today's rain not affect tomorrow's rain. Then prob. for rain two days in a row will be

$0,8 \cdot 0,8 = \frac{4}{5} \cdot \frac{4}{5} = \frac{16}{25} \approx 0,64 = 64\%$

3 days: $0,8 \cdot 0,8 \cdot 0,8 \approx 0,512 = 51,2\%$

$P = 0,8^n$

Resume of Lecture by Pr. Bob Gallagher from MIT

Massachusetts Institute of Technology (MIT)

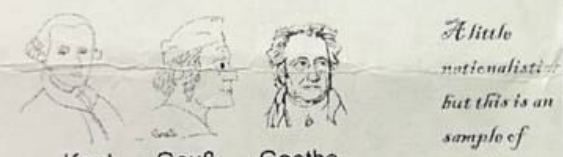
George Boole (1815-1864) developed Boolean logic

The principles of logical thinking have been understood (and occasionally used) since the Hellenic era.

Boole's contribution was to show how to systemize these principles and express them in equations (called Boolean logic or Boolean algebra).

Claude Shannon (1916-2001) showed how to use Boolean algebra as the basis for switching technology. This conribution systemized logical thinking for computer and communication systems, both for the design and programming of the systems and their applications.

Logic continues to be abused in politics, religion, and most non-scientific areas.



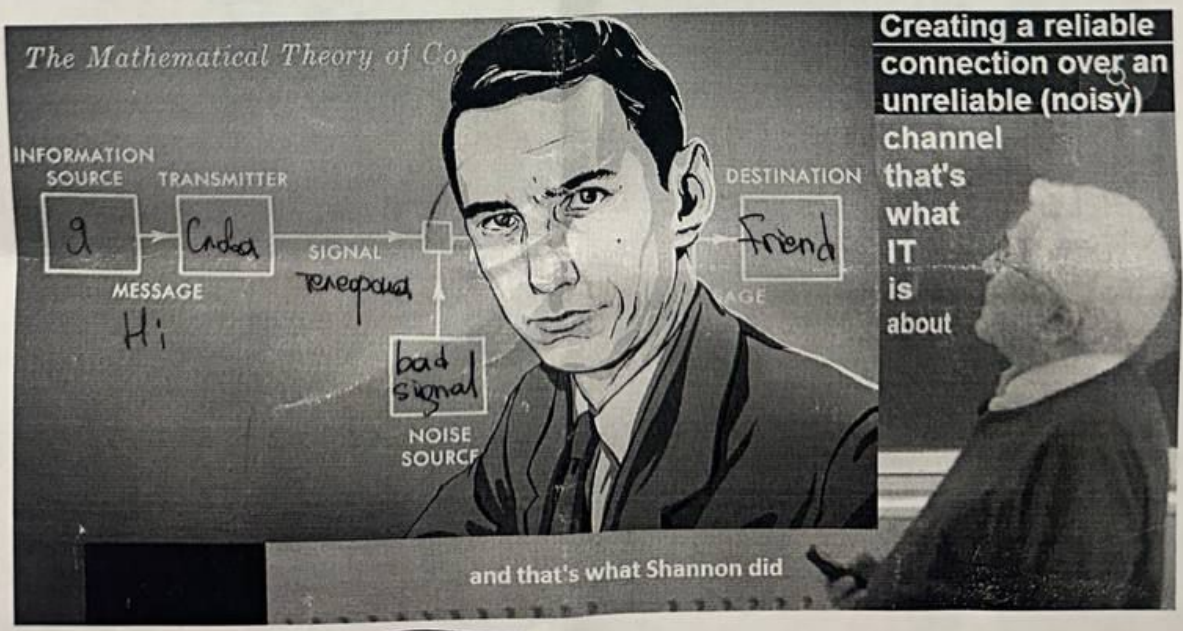
A little nationalistic but this is an sample of right logic

Kant, Gauss, Goethe are great

Kant, Gauss, Goethe - Germans

Germany Great

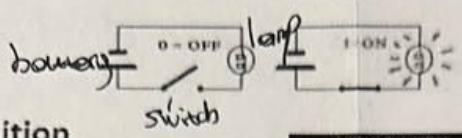
Bad logic (abuse of logic)



receiver (phone)

Massachusetts Institute of Technology (MIT)

Lecture by Pr. Bob Gallagher
Boole (1815-1864) & **Shannon** (1916-2001)

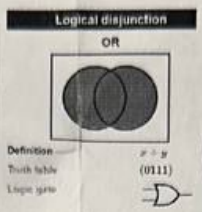


V-or
Λ-and
¬-not

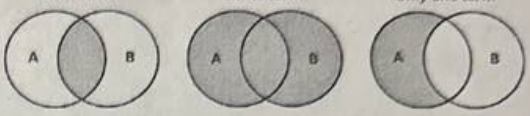
Logical addition (disjunction)

A	B	F=A∨B
0	0	0
0	1	1
1	0	1
1	1	1

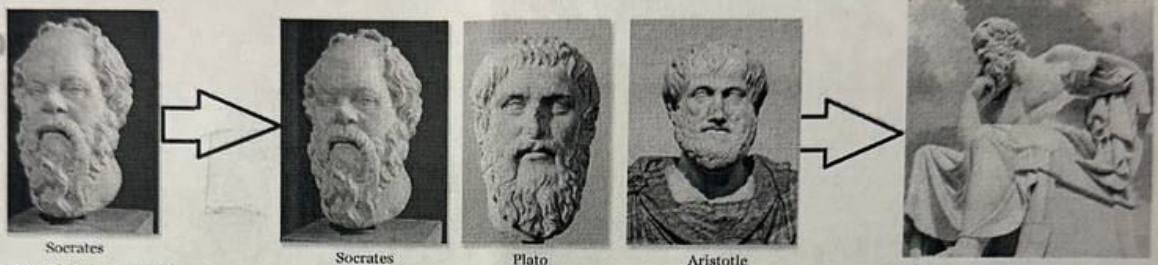
A	B	$A \vee B$
True	True	True
True	False	True
False	True	True
False	False	False



BOOLEAN LOGIC



Good logic



Socrates was a philosopher

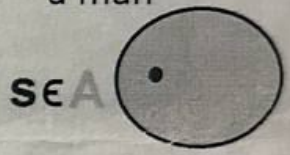
$S \in \Phi$

philosophers are men

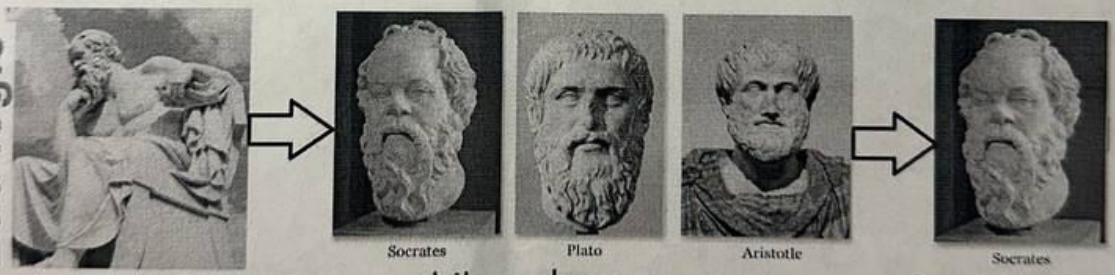
$\Phi \in A$

Socrates was a man

$S \in A$



Bad logic



Socrates was a man

$S \in A$

philosophers are men

$\Phi \in A$

Socrates was a philosopher

$S \in \Phi$