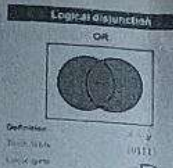


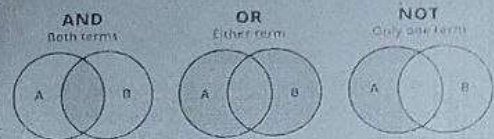
Logical addition (disjunction)

A	B	F=A∨B
0	0	0
0	1	1
1	0	1
1	1	1

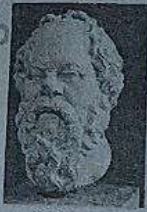
A	B	A∨B
True	True	True
True	False	True
False	True	True
False	False	False



BOOLEAN LOGIC

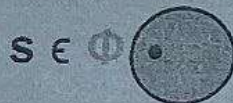


Good logic



Socrates

Socrates was a philosopher



Socrates

philosophers are men



Plato



Aristotle



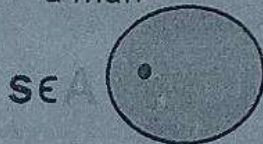
Socrates was a man



Bad logic



Socrates was a man



Socrates

philosophers are men



Plato

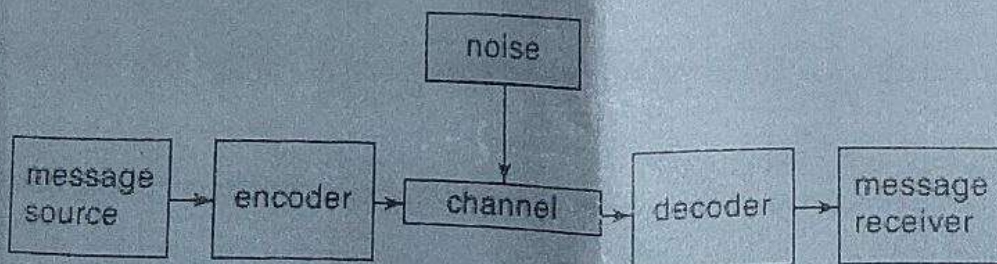


Aristotle



Socrates

Socrates was a philosopher



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 Vowels:");
    string s = Console.ReadLine();
    int vowels=int.Parse(s);
    System.Console.Write("Enter number of Consonants:");
    s=System.Console.ReadLine();
    int consonants=int.Parse(s);
    Console.WriteLine(Factorial(vowels)*Factorial(consonants) );
}
```

>ABBA
ABBA
Enter number of Vowels:2
Enter number of Consonants:2
4

>ABBA
ABBA
Enter number of Vowels:3
Enter number of Consonants:3
36



1

2

3

4



+0.1 to fin 16.2.26

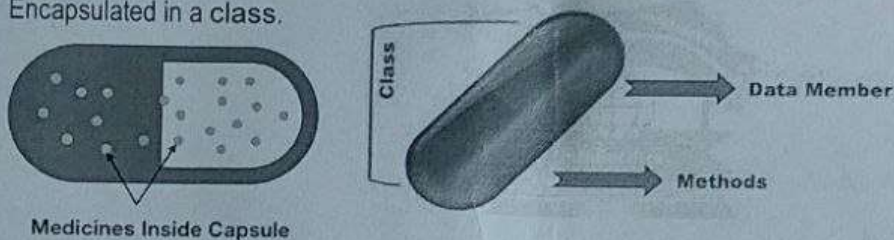
This is the program we need to write today

```
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.



A ≠ a

C# is case sensitive

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

(C:) > Windows > Microsoft.NET > Framework > v3.5 >

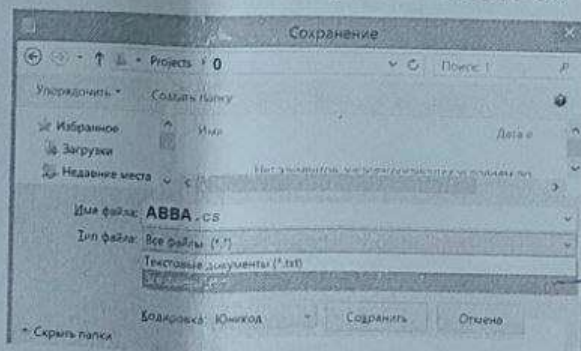
Имя	Дата изменения	
AddInUtil.exe	03.08.2013 8:40	
AddInUtil.exe.config	18.06.2013 16:24	
csc.exe	03.08.2013 8:40	ABBA.cs => csc.exe = ABBA.exe C# Compiler

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



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>

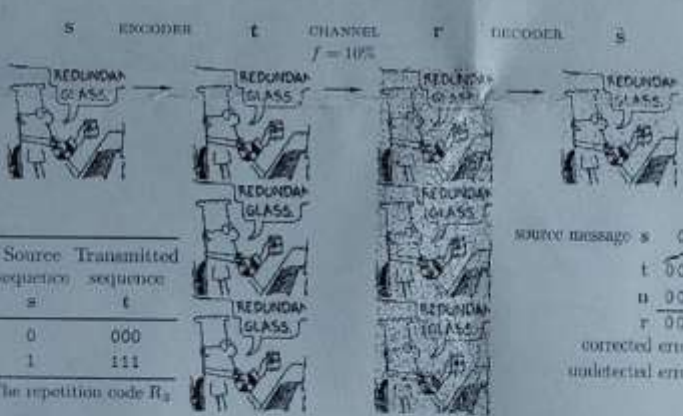
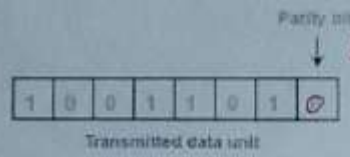
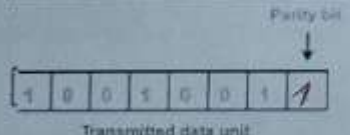
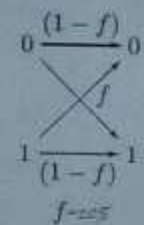
+0.1 +0.2 +0.1 +0.1 Thorn



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



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



Source Transmitted sequence sequence

s	t
0	000
1	111

The repetition code R_3

Source message s

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

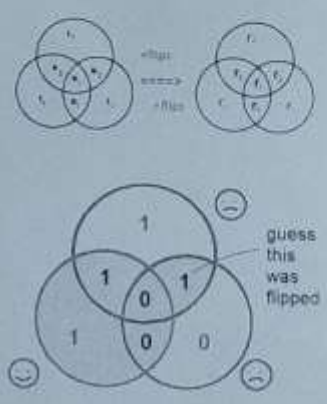
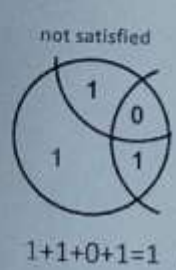
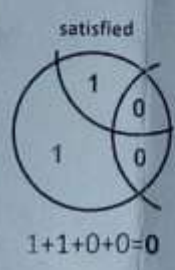
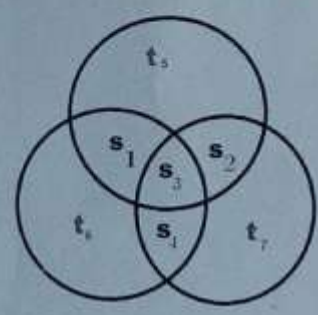
corrected errors *
undetected errors *

+0.1

+0.1 Perelman

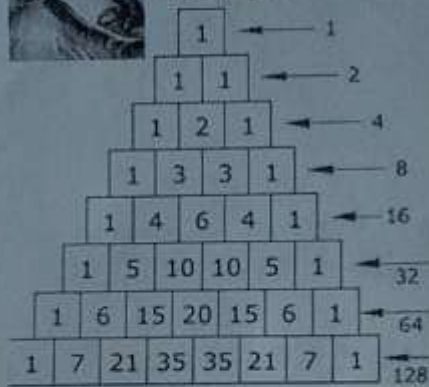
7.4. Hamming code.

$$\frac{4}{\Sigma} \rightarrow \frac{7}{t}$$





Pascal's triangle



$$(a + b)^0 =$$

$$(a + b)^1 =$$

$$(a + b)^2 =$$

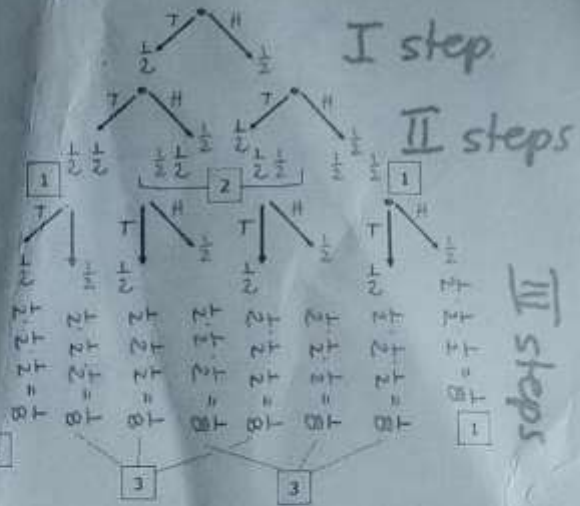
$$(a + b)^3 =$$

$$(a + b)^4 =$$

$$(a + b)^5 =$$

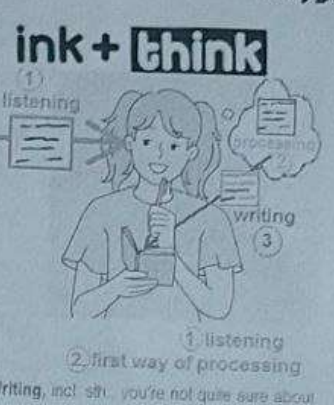
$$\begin{aligned}
 &1 \\
 &a + b \\
 &a^2 + 2ab + b^2 \\
 &a^3 + 3a^2b + 3ab^2 + b^3 \\
 &a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4 \\
 &a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5
 \end{aligned}$$

Newton's Binomial



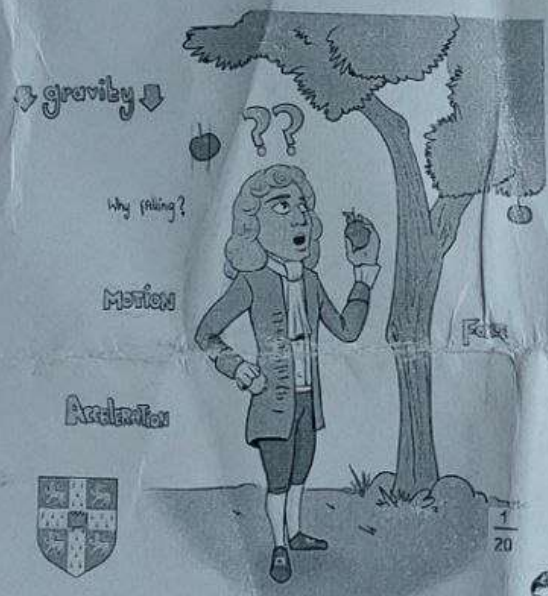
+0.1 11.2.26

+0.1 16.2.26
ABBA

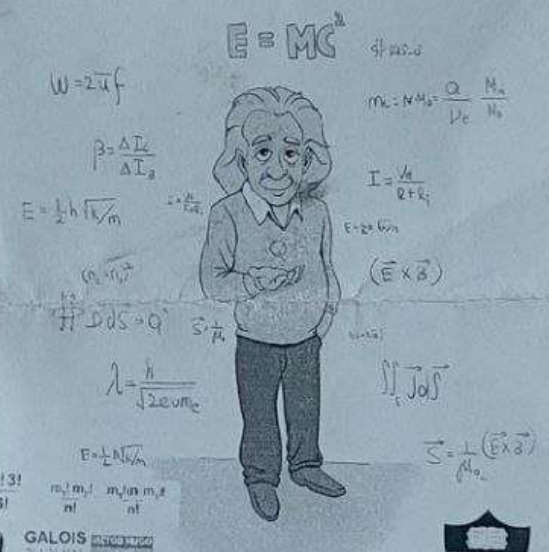


School $\downarrow$ gravity $\downarrow$ MOTION ==formalism==> University $E=MC^2$ $\oint \vec{A} \cdot d\vec{s} = \oint \vec{A} \cdot d\vec{s}$

CONCRETE AND ABSTRACT THINKING



ISAAC NEWTON



ALBERT EINSTEIN

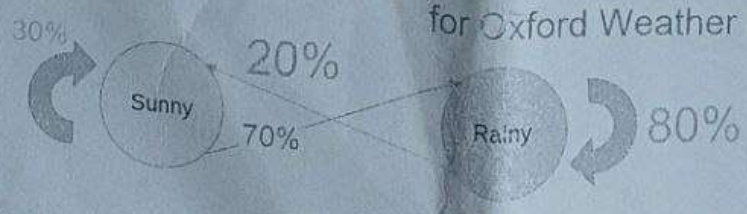
Motivation: 80% chance of rain
Let A_i be the event of rain on day i of this term. Is A_i independent of A_j ?

Oxford

Tue 13th	Wed 14th	Thu 15th	Fri 16th
10° 9° 10%	13° 10° 20%	13° 8° 20%	11° 7° 10%

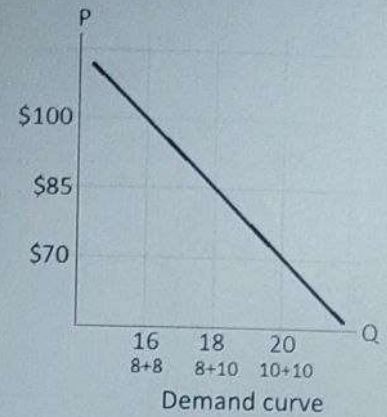


Markoff Chain Probability Model
for Oxford Weather



Oil price hits 18-year low

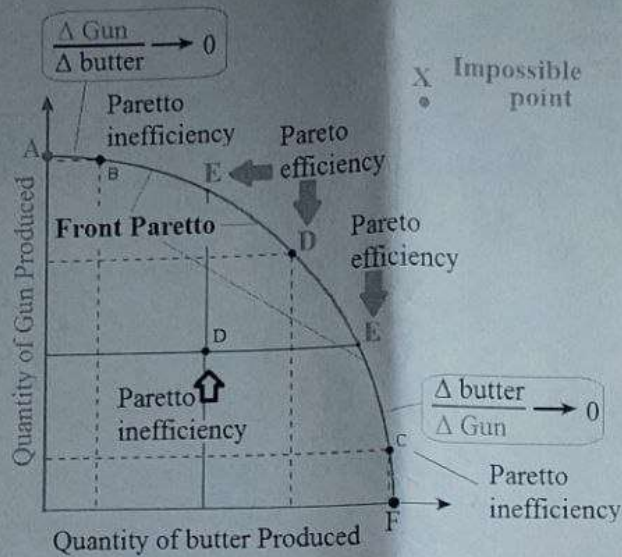
Brent crude, US dollars per barrel



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



Concise



by Vilfredo Pareto
1848-1923

The orange sector E-D-E is the most Pareto efficient - since an increase in one indicator leads to a decrease in another.

Prisoners' dilemma

		prisoner B	
		confess	remain silent
prisoner A	confess	5 years 5 years	0 year 20 years
	remain silent	20 years 0 year	1 year 1 year

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Game Theory

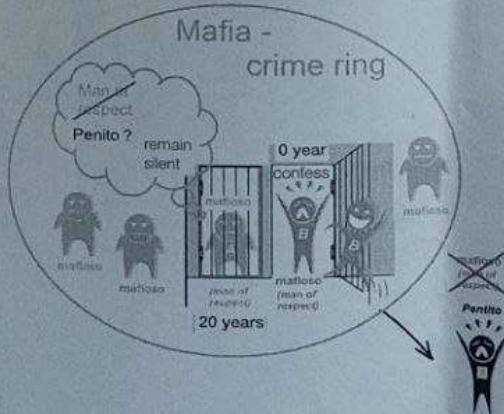
Nash Equilibrium



** => Nash equilibrium

		Player 2	
		Recognition;	Non-recognition;
Player 1	H ₁ (x)		
	H ₂ (x)		
Recognition;	1	1 -5*	2 0
Non-recognition;	2	2 -20	1 -1

-1-1
Pareto Optimality



0.1



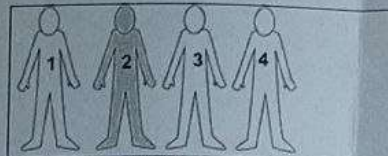
Say
NO to
the
first



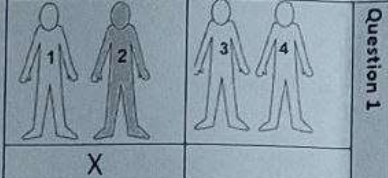
Say YES to
the second
if it is better
than the
first



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

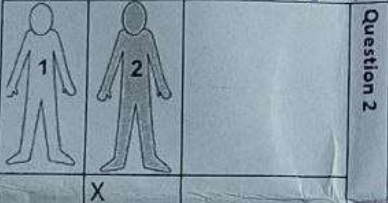


1 question - the first or second group



X

2 question - the first or second group



X

Average number of questions =

$$2 \cdot 0.25 + 2 \cdot 0.25 + 2 \cdot 0.25 + 2 \cdot 0.25 = 2$$

Average number of questions =

$$1 \cdot 0.5 + 2 \cdot 0.25 + 3 \cdot 0.125 + 3 \cdot 0.125$$



Question 1.
Is this
Zuckerberg?



50%

$$1 \cdot 0.5$$

Question 2.
Is this Sergey
Brin?



25%

$$2 \cdot 0.25$$

Question 3.
Is this Stefan
from BMW?



12,5%

$$3 \cdot 0.125$$

So Prince
Saud

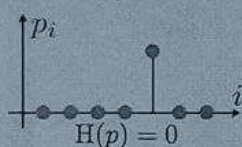


12,5%

$$3 \cdot 0.125$$

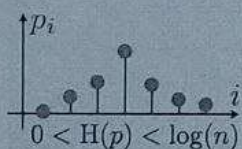
Average number of questions = 1,75

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



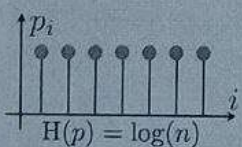
$$\sum_{i=1}^n p(i) \log_2 \frac{1}{p(i)}$$

Quantifying
information

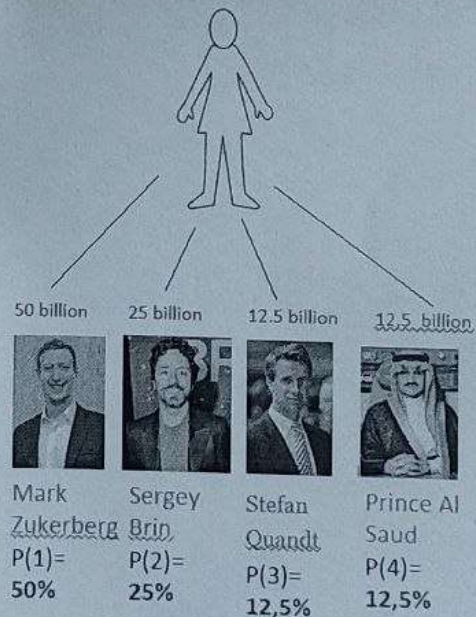


$$I(x_i) = \log_2 \left(\frac{1}{p_i} \right)$$

number of bits
required to encode
choice

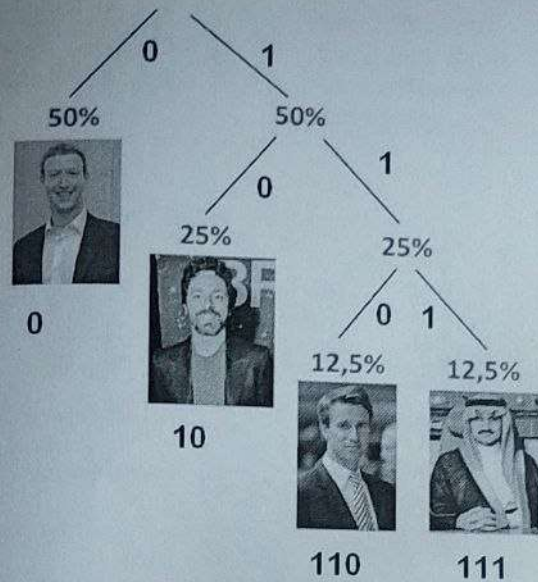


$$\sum_{i=1}^n p(x_i) I(x_i)$$



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
лла **мам** ма р



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
а р - 1 11% 8 ар
ра - 1 11% 9 ра

9

0. 4 6 7 3 1 9 1 6 7 3 5
ам ыл ла ам ма ра ма ыл ла ам мы
мылла рама



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

Resume of Lecture by Pr. Bob Gallager from MIT ^{MIT 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 contribution 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.

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



Kant Gauß Goethe

Kant, Gauss, Goethe are great

Kant, Gauss, Goethe - Germans

It's truly nationalistic, but this is an example of right logic.

Germany Great



Bad logic (abuse of logic)

The Mathematical Theory of Communication



Creating a reliable connection over an unreliable (noisy) channel that's what IT is about

and that's what Shannon did