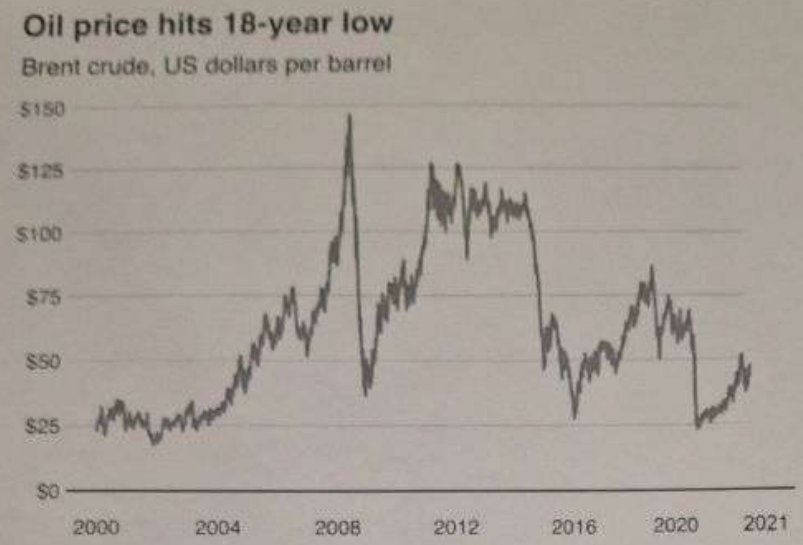
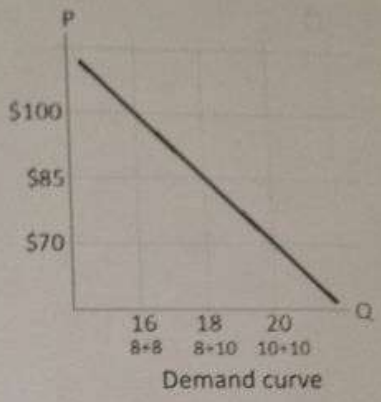


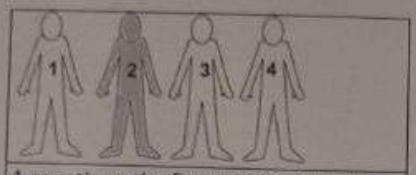


	Barrel	1.	2.
		$8 \cdot 10^6$ barrel / day	$10 \cdot 10^6$ barrel / day
1.	$8 \cdot 10^6$ barrel	$800 millions per day $100 barrel $800 millions per day	$850 millions per day $85 barrel $680
2.	$10 \cdot 10^6$ barrel / day	$680 millions per day $85 barrel $850 millions per day	$700 millions per day $70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

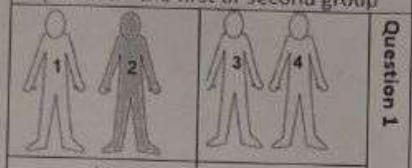
Say **NO** to the **first**

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

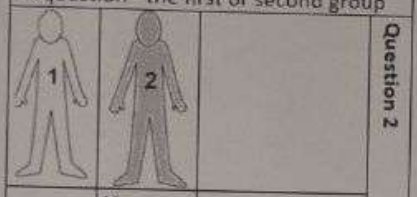
Say NO to the **third** only if it is worse than all the others



1 question - the first or second group



2 question - the first or second group



Average number of questions =

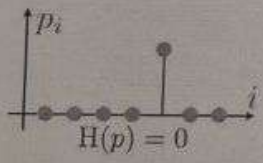
2*0.25+ 2*0.25+ 2*0,25+ 2*0,25 =2

Average number of questions =

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

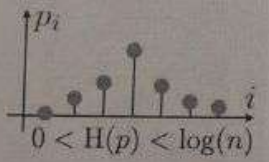
Question 1. Is this Zuckerberg?	 50%	1*0.5
Question 2. Is this Sergey Brin?	 25%	2*0.25
Question 3. Is this Stefan from BMW?	 12,5%	3*0,125
So Prince Saud	 12,5%	3*0,125
Average number of questions =		1,75

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



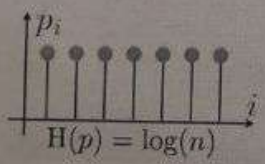
$$\sum_{i=1}^{n} p(i) \log_2 \frac{1}{p(i)}$$

Quantifying information

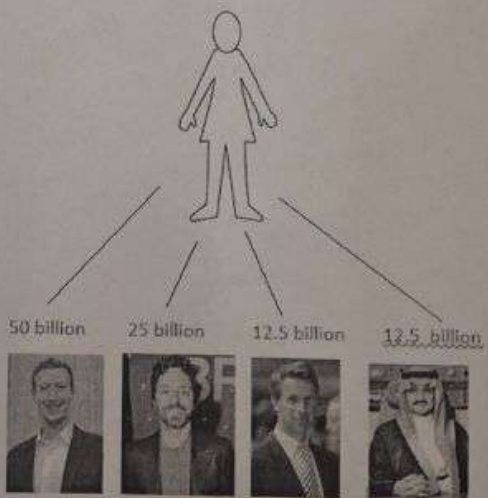


$$I(x_i) = \log_2\left(\frac{1}{p_i}\right)$$

number of bits required to encode choice



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



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

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

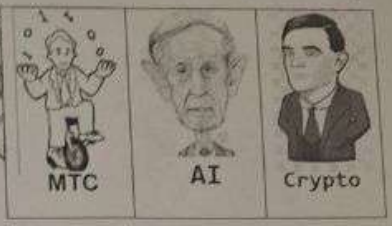
Stefan Quandt P(3)= **12,5%**

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

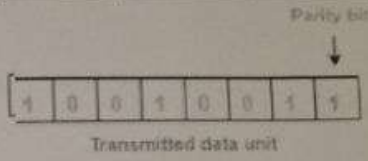
+0.1 0000

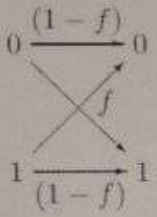
+0.1 +0.1

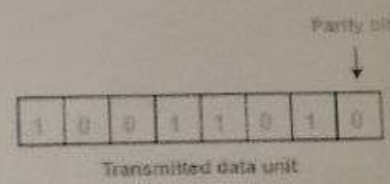
Sir **Dr. D. MacKay,**
University of Cambridge
(22 April 1967 – 14 April 2016)



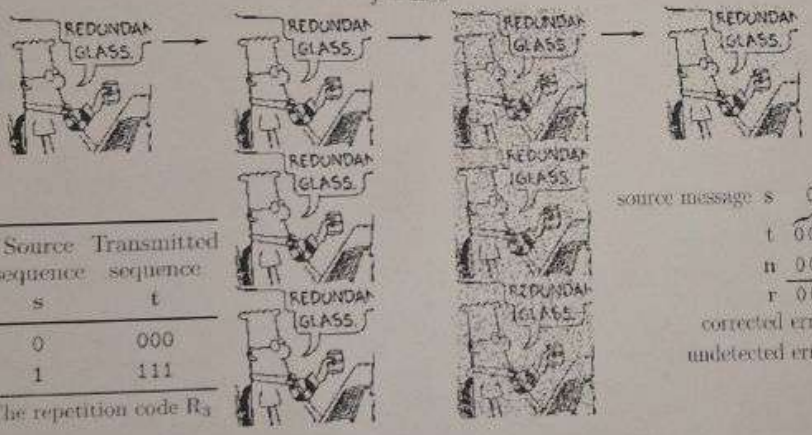
"I believe in clean energy,
but I also believe in mathematics"







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

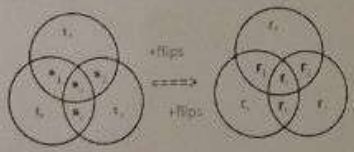


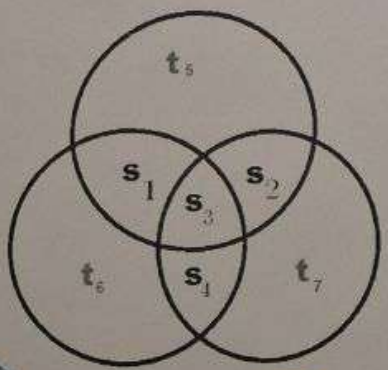
Source sequence s	Transmitted sequence t
0	000
1	111

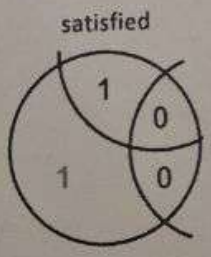
The repetition code R_3

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					*		

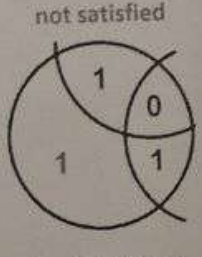
7.4. Hamming code. $\frac{4}{\Sigma} \rightarrow \frac{7}{t}$



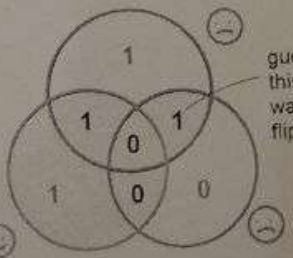




1+1+0+0=0

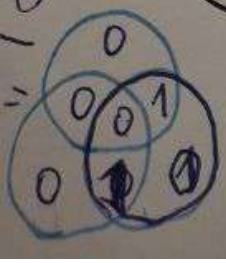


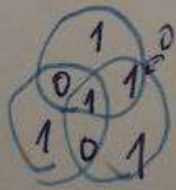
1+1+0+1=1

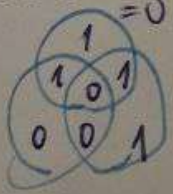


0.1

2 ~~flips~~ 1 flips







— Find flips

0.1

Resume of Lecture by Pr. Bob Gallagher from MIT

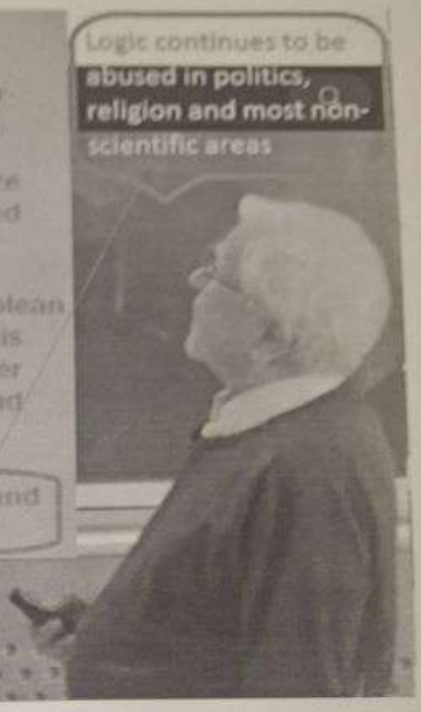
George Boole (1815-1864) developed Boolean logic.

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.

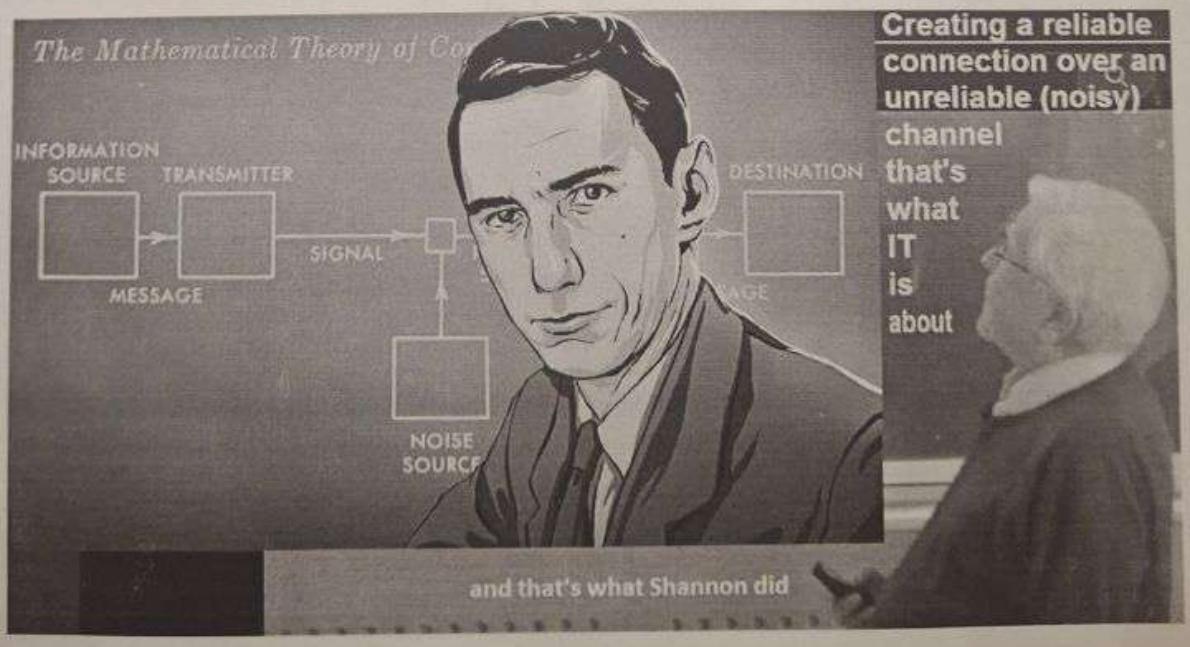
Logic continues to be abused in politics, religion, and most non-scientific areas.



A little nationalistic, but this is an example of right logic

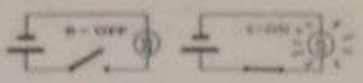
Kant, Gauss, Goethe are great → Kant, Gauss, Goethe - Germans → Germany Great

Bad logic (abuse of logic)



Lecture by Pr. Bob Gallagher

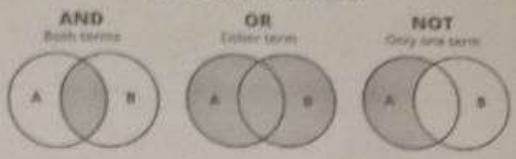
Boole (1815-1864) & **Shannon** (1916-2001)



Logical addition (disjunction)

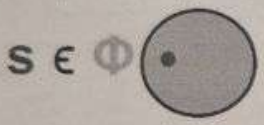
A	B	A ∨ B
True	True	True
True	False	True
False	True	True
False	False	False

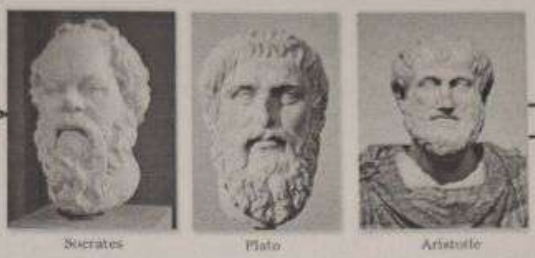
BOOLEAN LOGIC



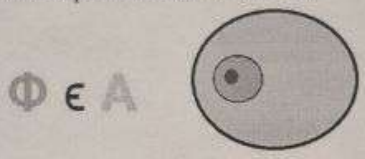
Good logic

Socrates was a philosopher

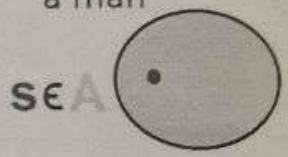




philosophers are men

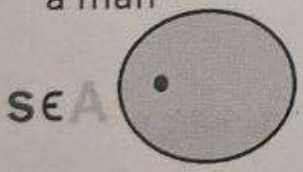


Socrates was a man

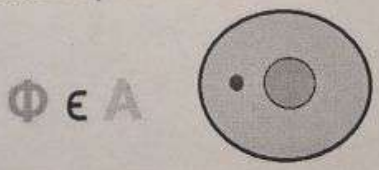


Bad logic

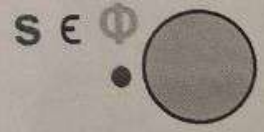
Socrates was a man

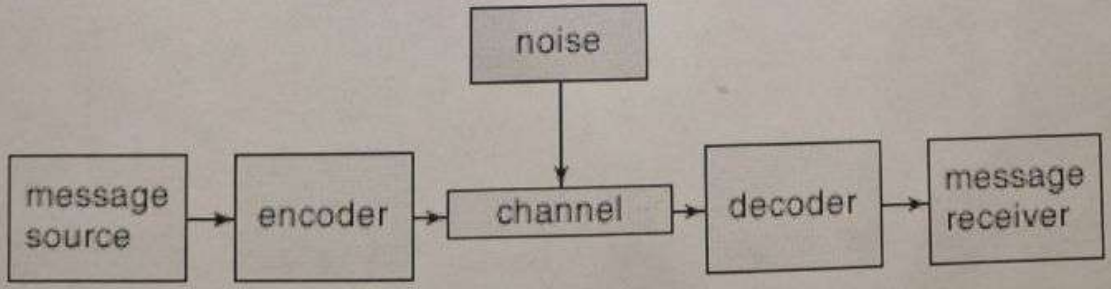


philosophers are men



Socrates was a philosopher

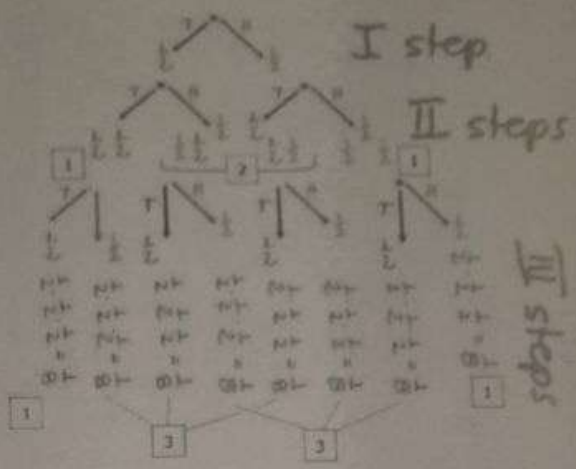




? Your correction

Pascal's triangle

1								1
1	1							2
1	2	1						4
1	3	3	1					8
1	4	6	4	1				16
1	5	10	10	5	1			32
1	6	15	20	15	6	1		64
1	7	21	35	35	21	7	1	128



Newton's Binomial

$$(a+b)^0 = 1$$

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

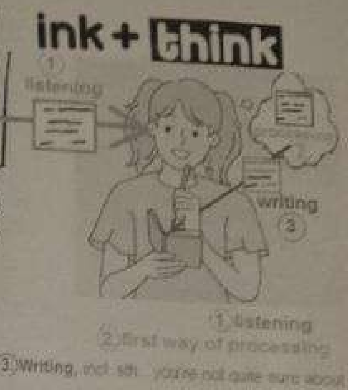
$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(a+b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$$

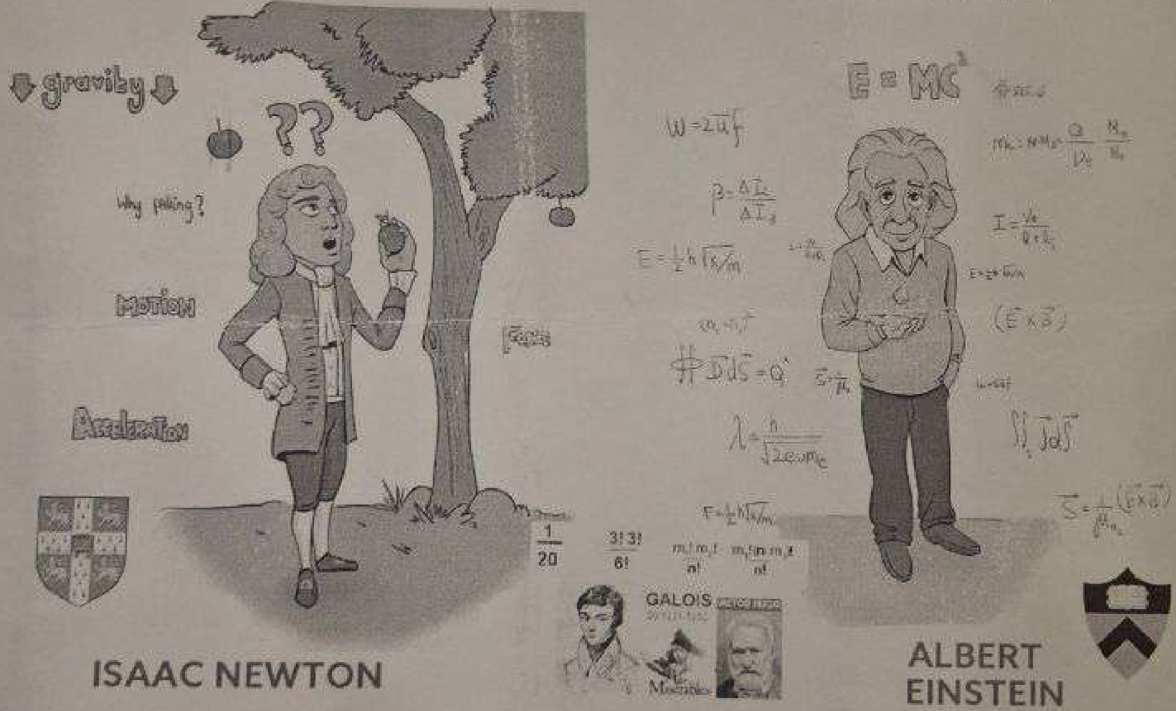
$$(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$$

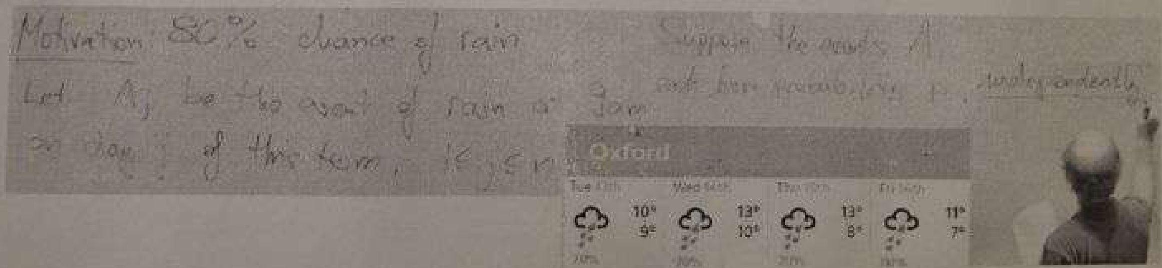
+0.1 12.6 +0.1 11.2.26 +0.1 +0.1 16.2.2026



School gravity Motion ==formalism==> University $E = MC^2$

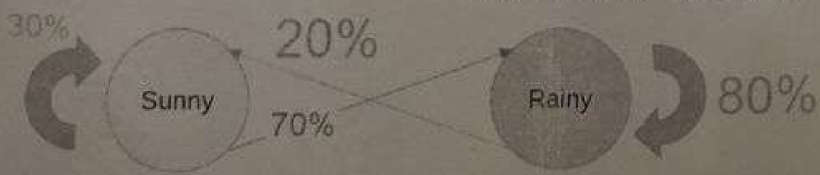
CONCRETE AND ABSTRACT THINKING





Markoff Chain Probability Model

for Oxford Weather



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
```

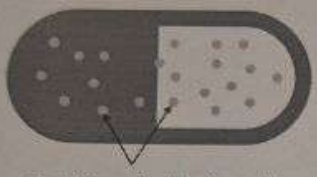
1 2 3 4

This is the program we need to write today

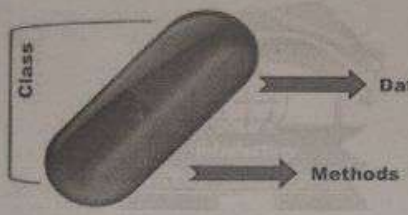
```
class ABBA
 {
 static void Main(string[] args)
                    // Here's a method called Main
 {
    System.Console.WriteLine("ABBA!");
 }
}
```

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

Encapsulated in a class.



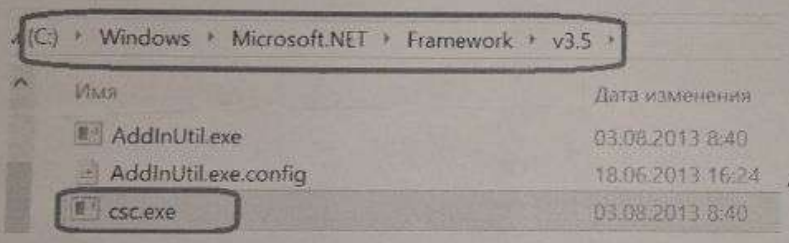
Medicines Inside Capsule



$A \neq a$

C# is case sensitive

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



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

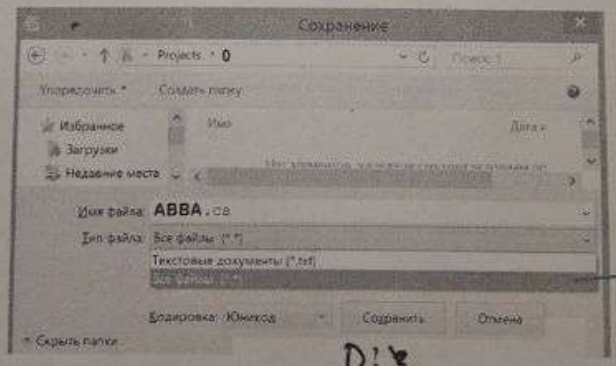
C# Compiler

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

D:\

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

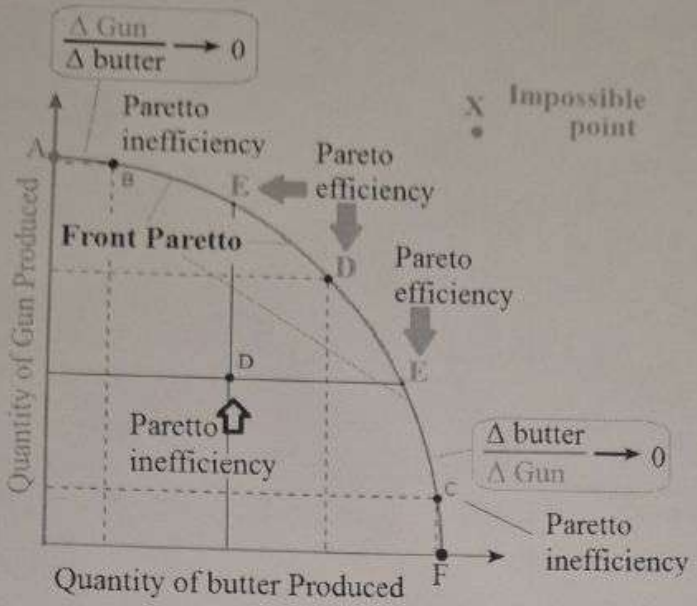
cd 0 –

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

I-T

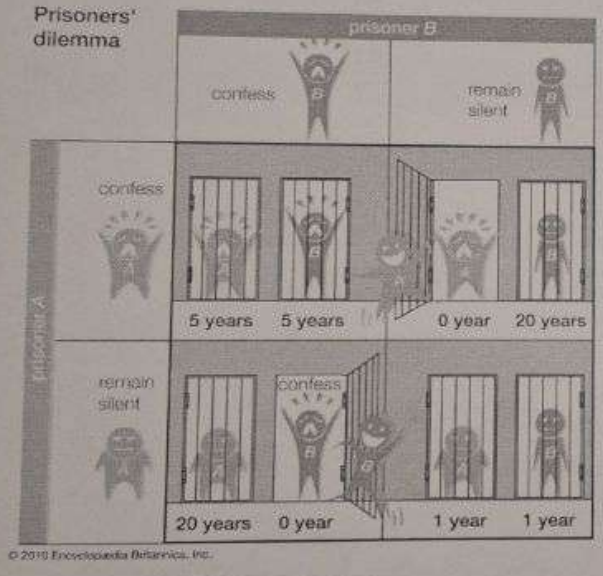
ABBA.cs

DIR



by Vilfredo Pareto

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



Game Theory

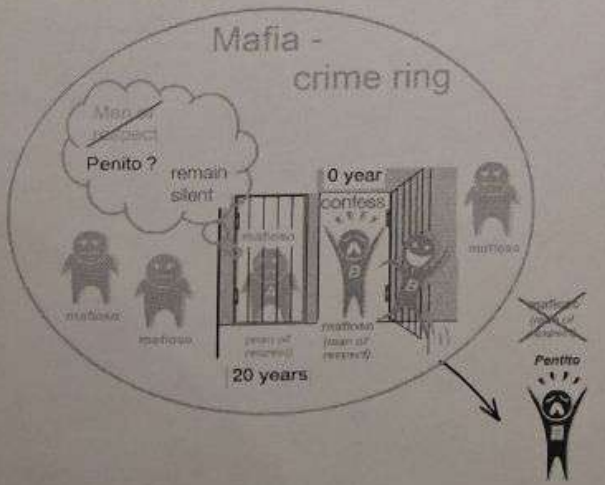
Nash Equilibrium

** => Nash equilibrium

$H_1(x)$ / $H_2(x)$	*Player 2*	Recognition;	Non-recognition;
Player 1		1	2
Recognition;	1	* -5	-20
		-5 *	0
Non-recognition;	2	0	-1
		-20	-1

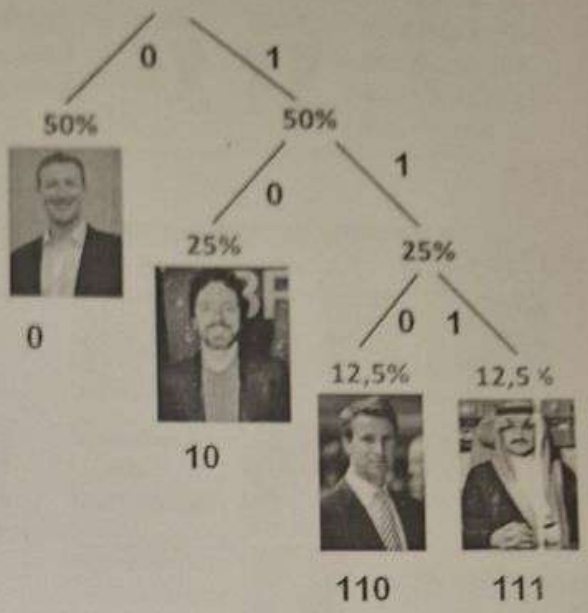
-1-1

Pareto Optimality



+0.1

+0.1



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 мамма 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
ар - 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

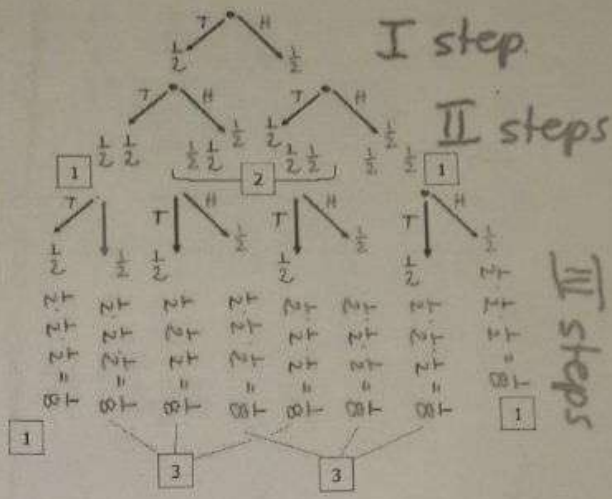
мылла рама

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

Pascal's triangle

1								← 1
1	1							← 2
1	2	1						← 4
1	3	3	1					← 8
1	4	6	4	1				← 16
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



Newton's Binomial

$(a+b)^0 = 1$

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

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

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

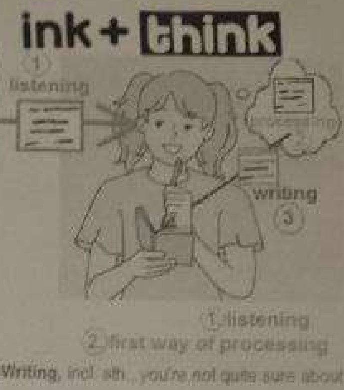
$(a+b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$

$(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

$(a+b)^6 = a^6 + 6a^5b + 15a^4b^2 + 20a^3b^3 + 15a^2b^4 + 6ab^5 + b^6$

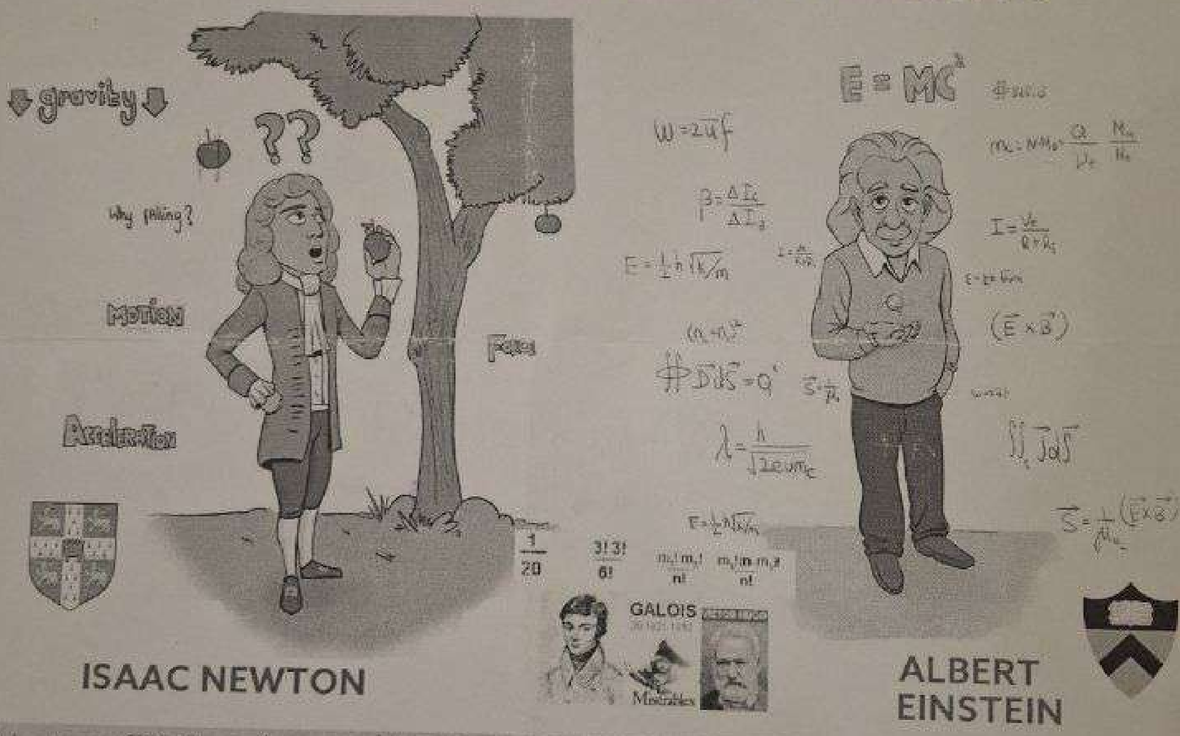
$(a+b)^8 = a^8 + 8a^7b + 28a^6b^2 + 56a^5b^3 + 70a^4b^4 + 56a^3b^5 + 28a^2b^6 + 8ab^7 + b^8$

+0.1 5.3.26



School ⇩gravity⇩ MOTION ==formalism==> University $E = MC^2$ $\oint$ $\iint$

CONCRETE AND ABSTRACT THINKING



Motivation: 80% chance of rain. Suppose the events A_j each have probability p, independently.
Let A_j be the event of rain at 9am on day j of this term, $1 \le j \le n$.

Markoff Chain Probability Model for Oxford Weather