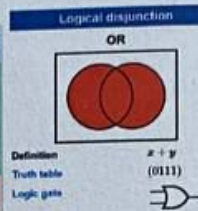


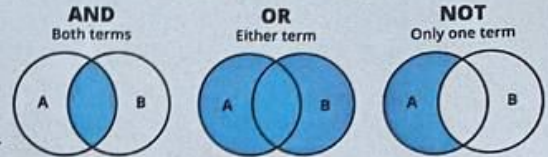
### Logical addition (disjunction)

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

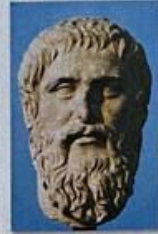


Socrates

Socrates was  
a philosopher



Socrates



Plato



Aristotle

philosophers are men



Socrates was  
a man



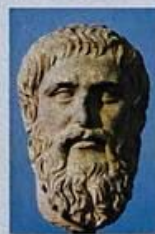
Bad logic



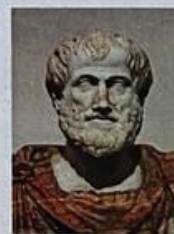
Socrates was  
a man



Socrates



Plato



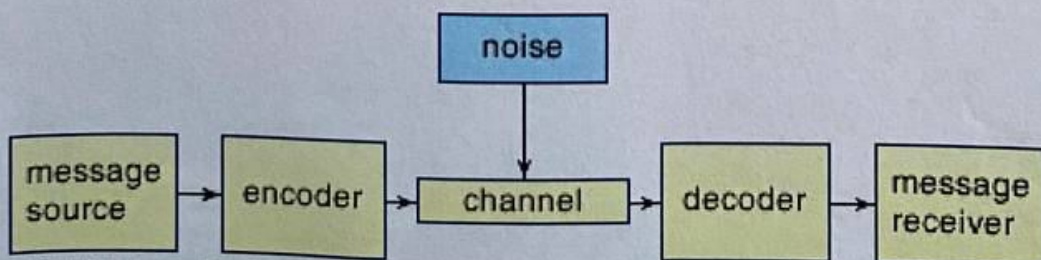
Aristotle

philosophers are men



Socrates

Socrates was  
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# Resume of Lecture by Pr. Bob Gallagher from MIT Massachusetts Institute of Technology (MIT)

George Boole (1815-1864) developed Boolean logic

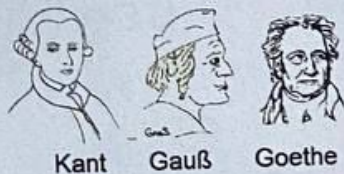
The principles of logical thinking have been understood (and occasionally used) since the Hellenic era.

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 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

*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)

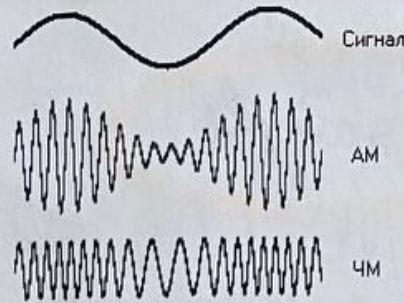
*The Mathematical Theory of Communication*



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

and that's what Shannon did





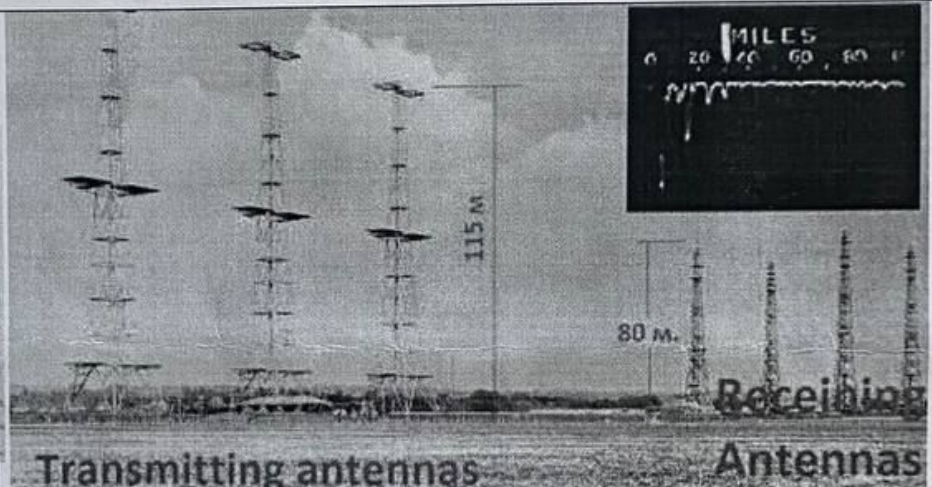
## Reginald A. Fessenden

(October 6, 1866 – July 22, 1932)

first transmission of speech by radio (1900), and the first two-way radiotelegraphic communication across the Atlantic Ocean (1906)

"No organization engaged in any specific field of work, ever invents any important development in that field, or adopts any important development in that field, until forced to do so by outside competition." Oxford University Press. The Quarterly Journal of Economics, Feb., 1926, p. 262.

## Battle of Britain (3 month 3 weeks) 10.07-31.10.1940



Radar played a major role in the Battle of England

## H. Nyquist



$$W = K \log m$$

Where  $W$  is the speed of transmission of intelligence,  
 $m$  is the number of current values,  
and,  $K$  is a constant.



$$H = n \log s$$

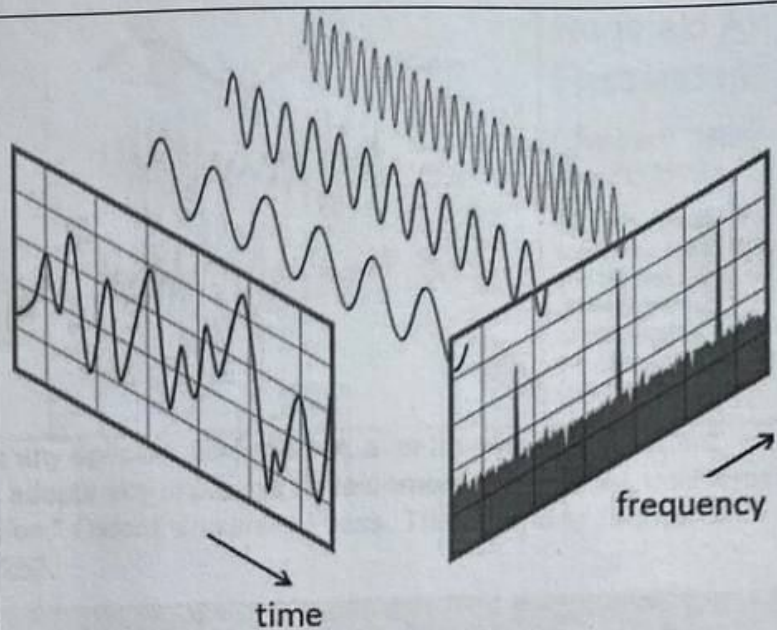
$$= \log s^n.$$

$$(13) s = 2 \cos(2\omega \cdot 9 \cdot t - \frac{\pi}{2}) + 7 \cos(2\omega \cdot 2 \cdot t + \frac{\pi}{2})$$

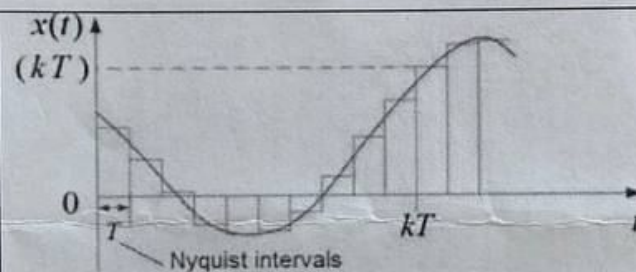
$F_{\text{sample}}$



# Fourier transform



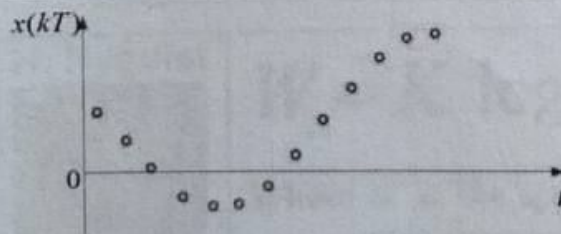
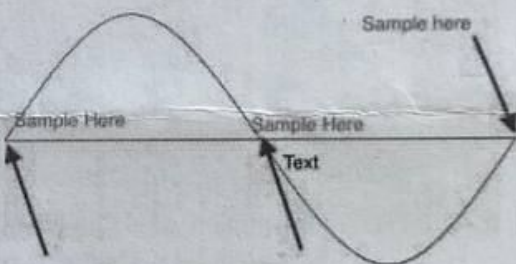
## Sampling. Kotelnikov-Nyquist Theorem



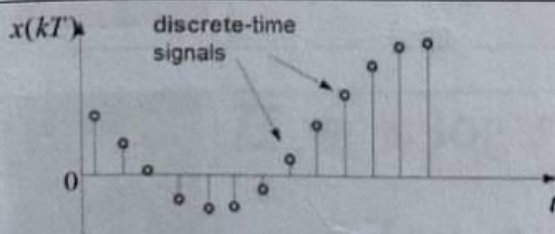
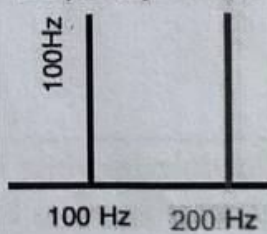
Time intervals  $T$ , through which readings  $s(kT)$  are taken, are called Nyquist intervals.

Sine with period  $T$

Sampling at  $T/2$



frequency Sample

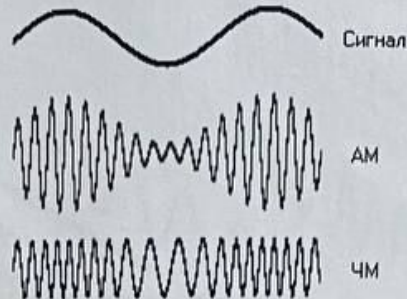


$$F_{\text{sample}} \geq 2 * F_{\text{max}}$$

$$(T_{\text{sample}} \leq T_{\text{min}}/2)$$



# Information of continuous signals



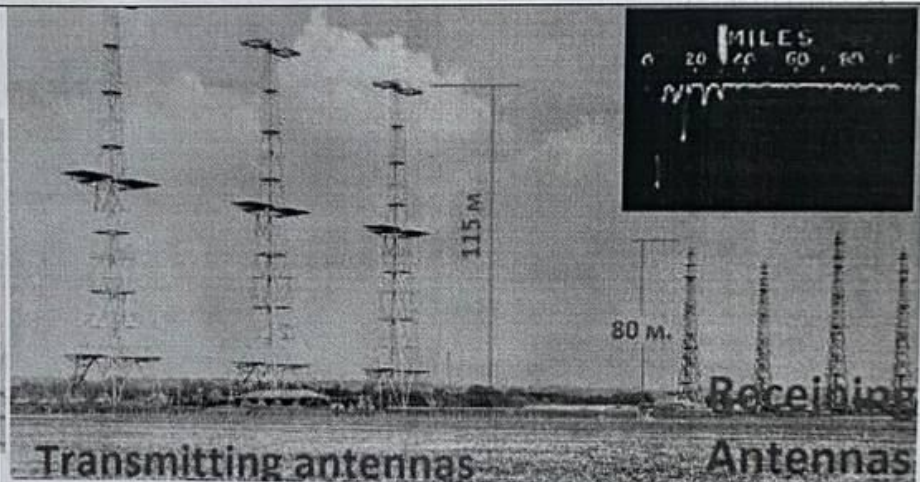
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(3 month 3 weeks)  
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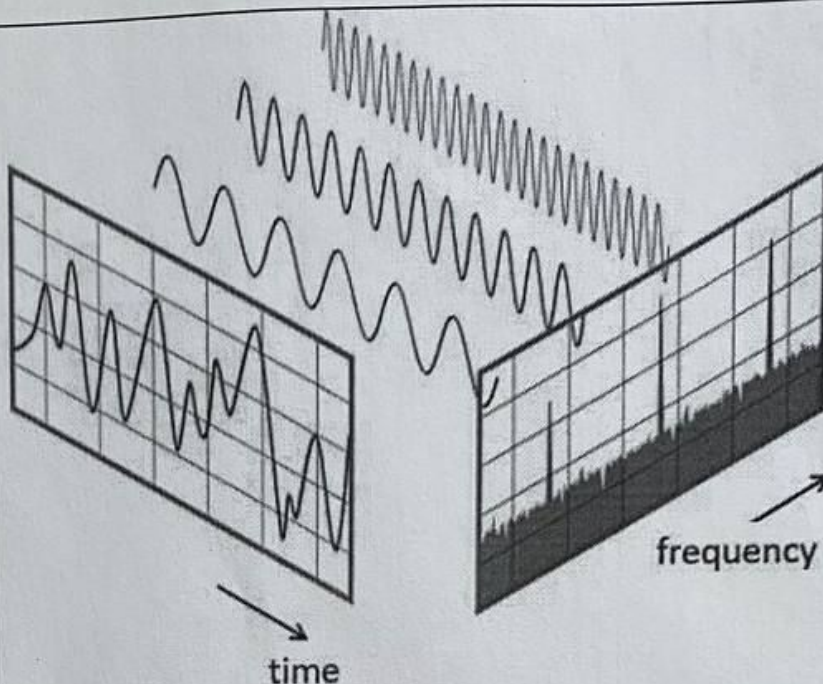
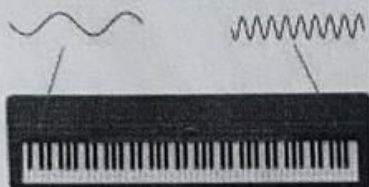


$$H = n \log s$$

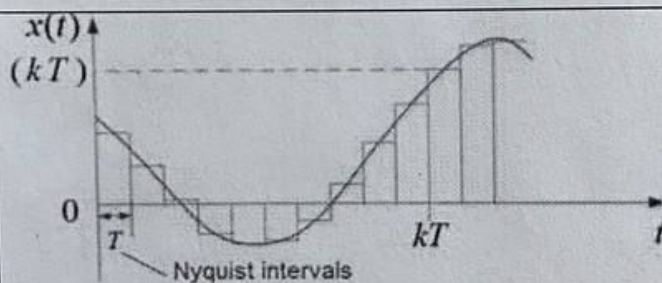
$$= \log s^n.$$



# Fourier transform



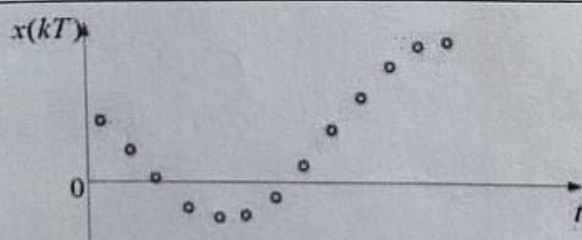
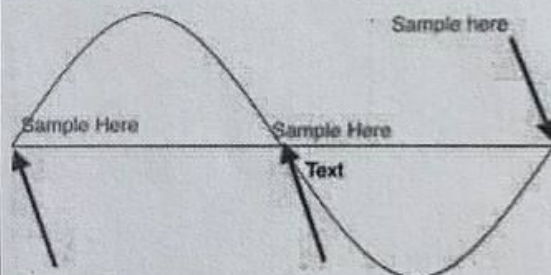
## Sampling. Kotelnikov-Nyquist Theorem



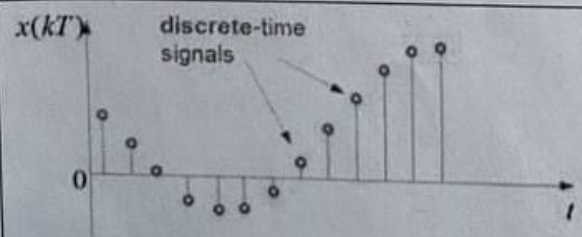
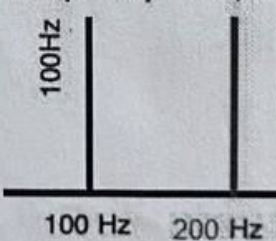
Time intervals  $T$ , through which readings  $s(kT)$  are taken, are called Nyquist intervals.

Sine with period  $T$

Sampling at  $T/2$



frequency Sample



$$F_{\text{sample}} \geq 2 * F_{\text{max}}$$

$$(T_{\text{sample}} \leq T_{\text{min}} / 2)$$



G A L O I S  
1 2 3 4 5 6

0 0

2

$$n(n-1)(n-2)(n-3)$$

$$= n! \text{ factorial}$$

+0.3

18.3.28



+0.1 + 0.1 (20.3.2024 Practice 3:1)

É. Galois (1811-1832) Les Misérables | Do You Hear the People Sing?



Example

There are  $6!$  ways to order the letters of GALOIS  
If randomly reorder the letters what is probability that the Vowels (A, O, I) are all before consonants (G, L, S)?

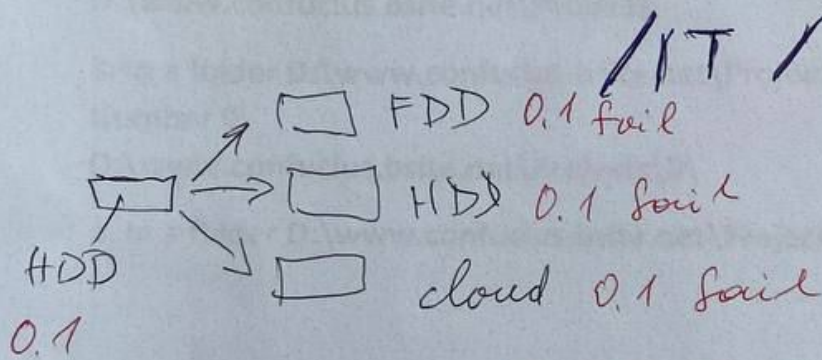


GALOIS

$3! \cdot 3! - \text{Vowels 1st}$

$$P = \frac{6!}{3! \cdot 3!}$$

esperanto. bsite. net / IT /  
Projects / 0 /



$$0.1 \cdot 0.1 \cdot 0.1 = 0.001\%$$

C#  $\rightarrow$  Windows

c:\windows\Microsoft.NET\Framework\v3.5

csc.exe

Price = Step  $\textcircled{N}$

Compiler of C#



## What should you do in class:

0. Come up with a good name for your site.

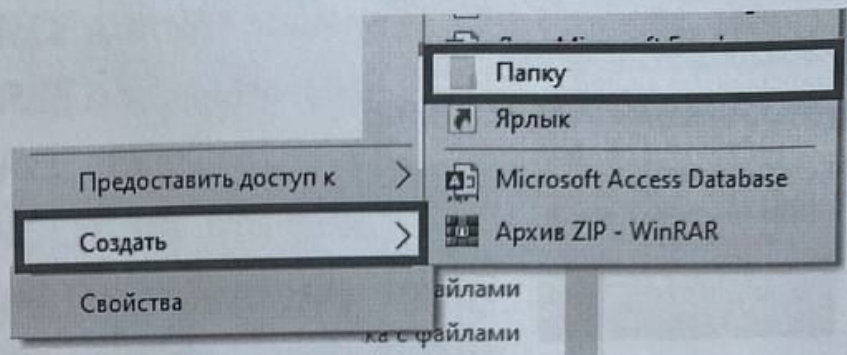
I came up with a name for my site - Confucius (in my opinion, this is a good name)

[www.confucius.bsite.net](http://www.confucius.bsite.net)

1. On a disk or on a flash drive, make a folder that matches the name of the site

[www.confucius.bsite.net](http://www.confucius.bsite.net)

Новый том (D:) >  
www.confucius.bsite.net



2. In a folder **D:\www.confucius.bsite.net\** create a folder for Projects  
**D:\www.confucius.bsite.net\Projects**

3. In a folder **D:\www.confucius.bsite.net\Projects** create a folder for Projects Number 0

**D:\www.confucius.bsite.net\Projects\0\**

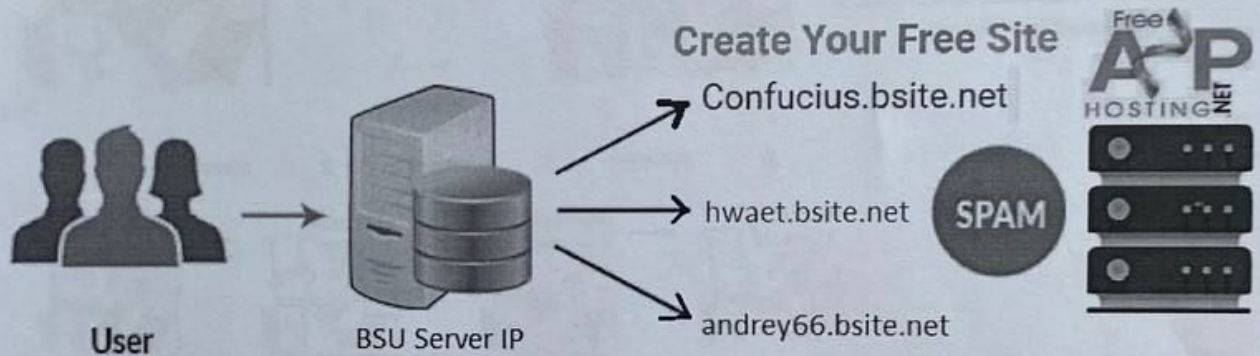
4. In a folder **D:\www.confucius.bsite.net\Projects\0\** create file ***index.htm***



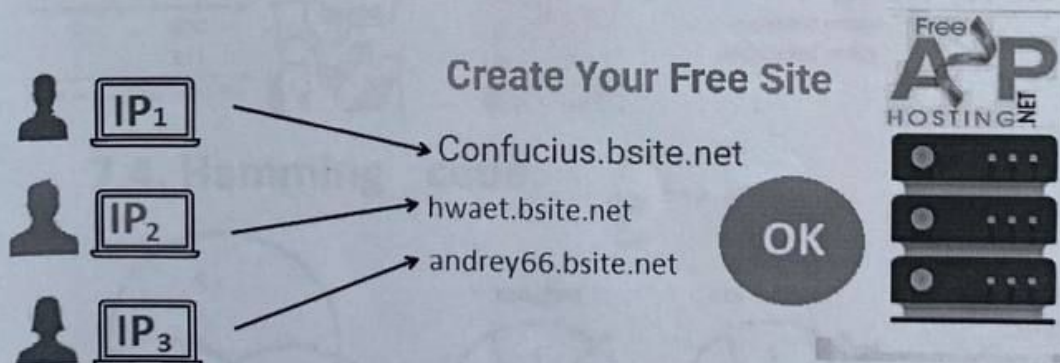
What should you do at home:  
Register free hosting on **freeasphosting.net**  
At home because many hosting services do not register from one IP address.

The screenshot shows the homepage of freeasphosting.net. The main heading is "ASP.NET Hosting .NET 7". Below it, the text reads: "FREE ASP.NET Hosting", "FREE Domain Hosting", "FREE MS SQL Database", and "INCLUDES .NET Core Full Trust Permissions". On the right side, there is a "SIGN UP FOR FREE" button. Below this, the text says "Create Your Free Site". There are three input fields: an email field with "Confucius@studentweb.cc", a domain field with "https://Confucius.bsite.net", and a password field with ".....". Below the password field, it says "By signing up with our service you agree to our [Terms & Conditions](#)." At the bottom of the sign-up form is a "Create Site" button.

If several dozen hosting attempts to register from one IP address, the **freeasphosting.net** server may decide that this is a SPAMer and block it.

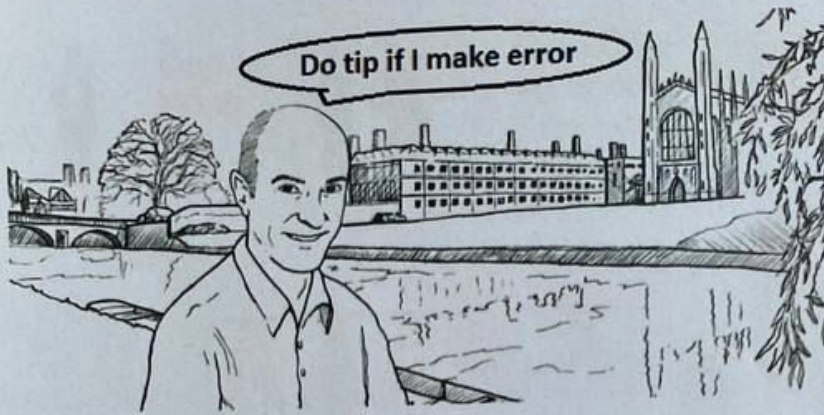


And if registration is carried out from different computers (with different IP addresses), then the freeasphosting.net server does not raise any suspicions.

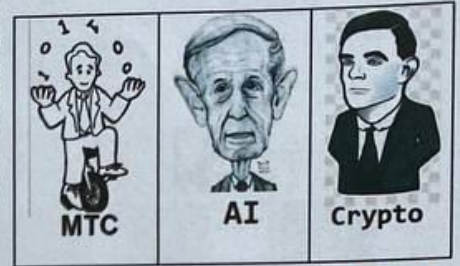


After you have registered on the server, send me your address (which you received during registration) by email.

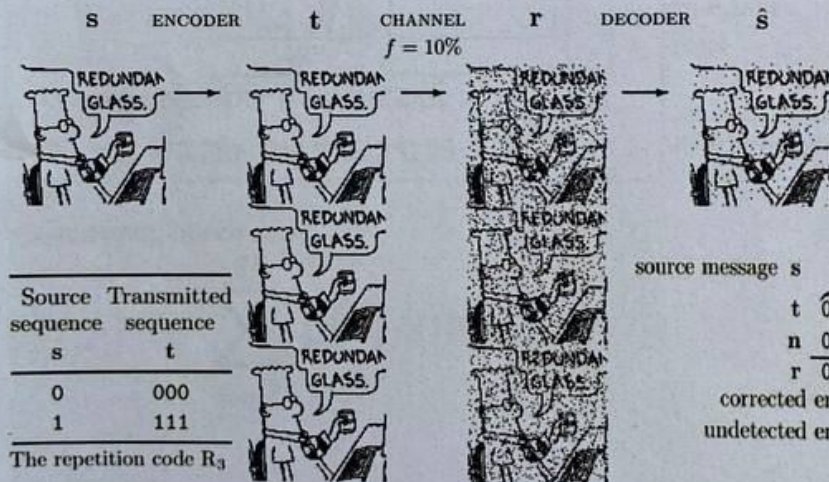
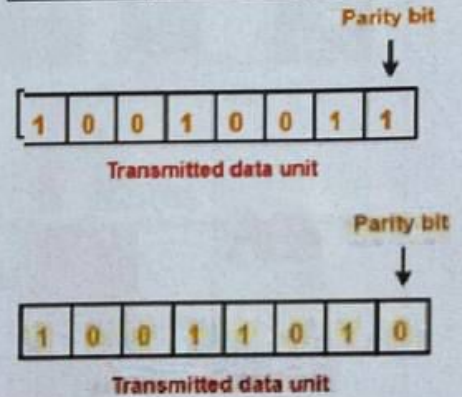
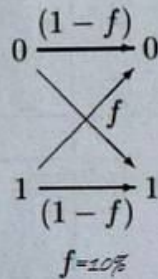
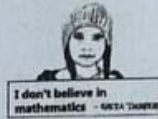




Sir Dr. D. MacKay,  
University of Cambridge  
(22 April 1967 – 14 April 2016)

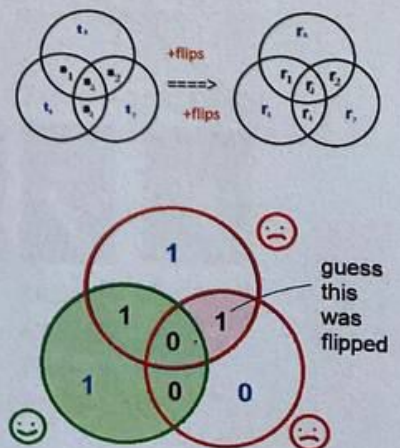
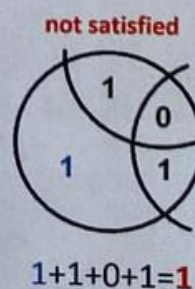
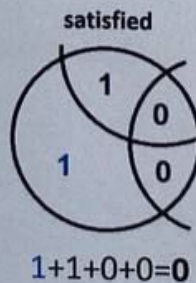
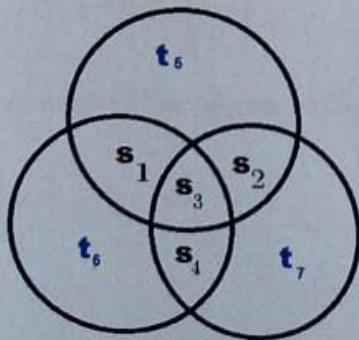


"I believe in clean energy,  
but I also believe in mathematics"



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







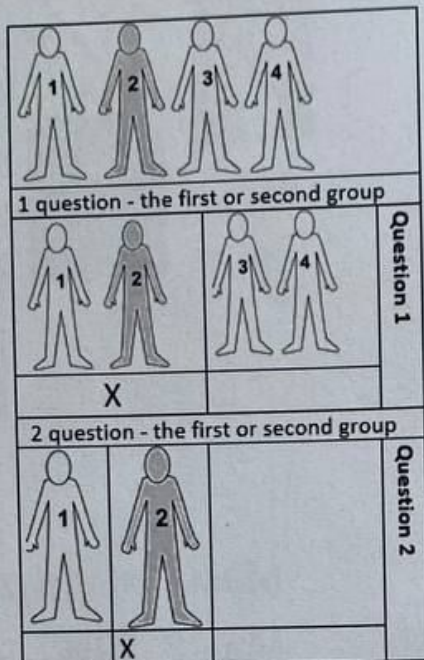
Say **NO** to the first



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







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 = <b>1,75</b>		

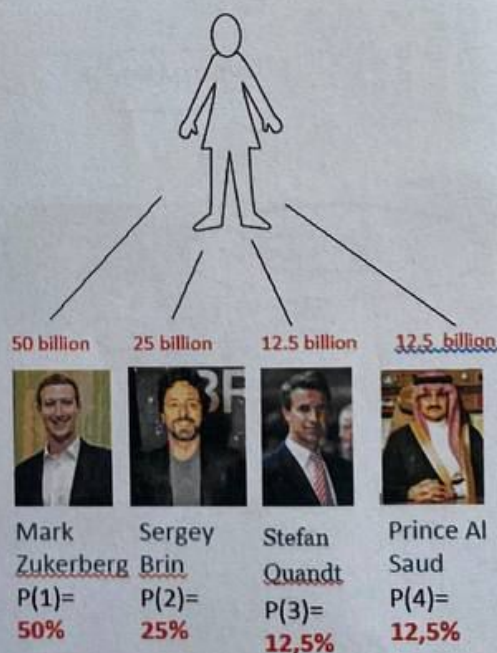
Quantifying information

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

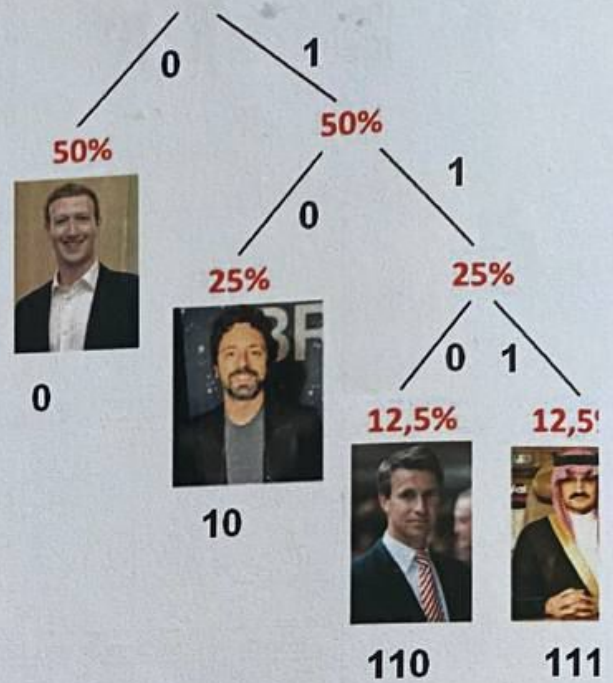
Quantifying information

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

number of bits required to encode choice







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)