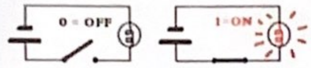
Bobilskaya M. 254

Lecture by Pr. Bob Gallagher

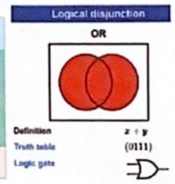
Boole (1815-1864) & **Shannon** (1916-2001)



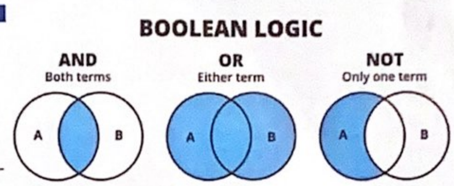
Logical addition (disjunction)

A	B	F=A∨B
0	0	0
0	1	1
1	0	1
1	1	1

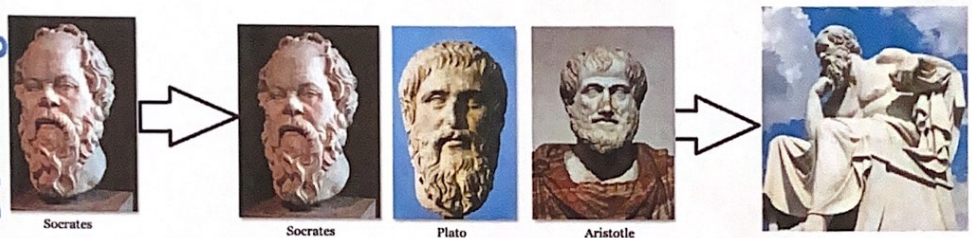
A	B	$A \vee B$
True	True	True
True	False	True
False	True	True
False	False	False



BOOLEAN LOGIC



Good logic

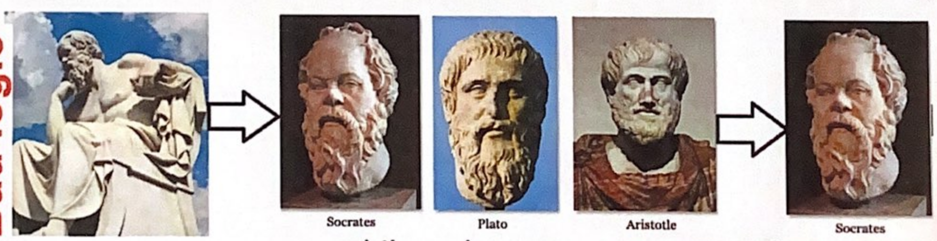


Socrates was a philosopher

philosophers are men

Socrates was a man

Bad logic



Socrates was a man

philosophers are men

Socrates was a philosopher

10 (десять)

бубубу.

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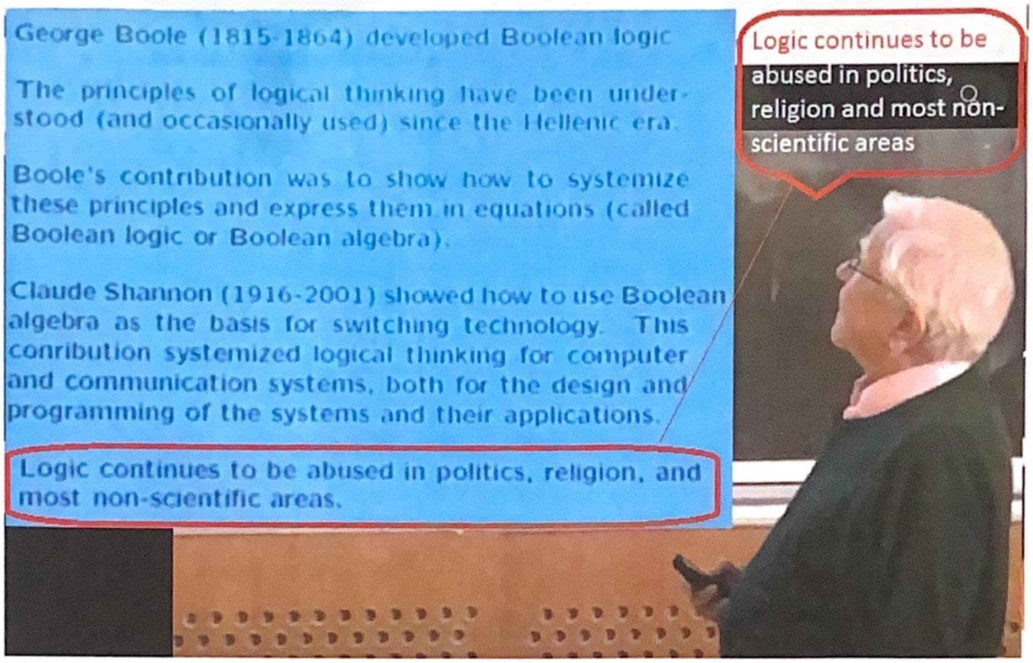
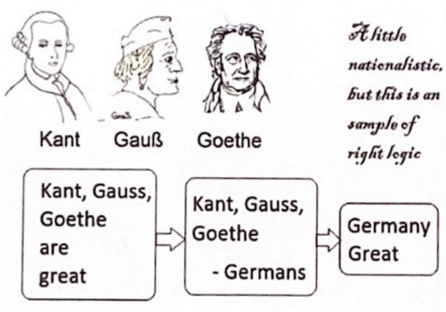
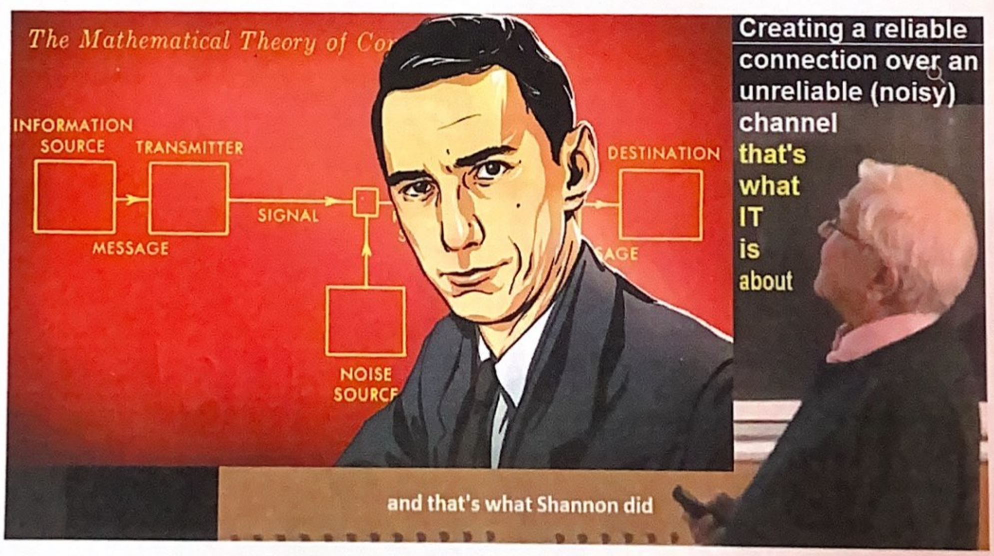
Resume of Lecture by Pr. Bob Gallagher from MIT

Massachusetts Institute of Technology (MIT)





Bad logic (abuse of logic)



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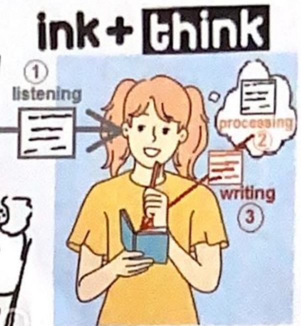
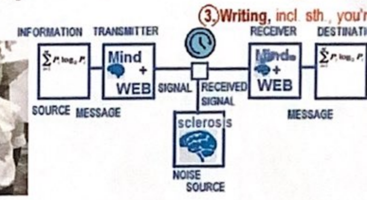
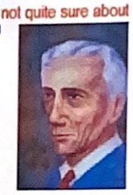


Good way ① listening
② first way of processing
③ Writing, incl. sth., you're not quite sure about

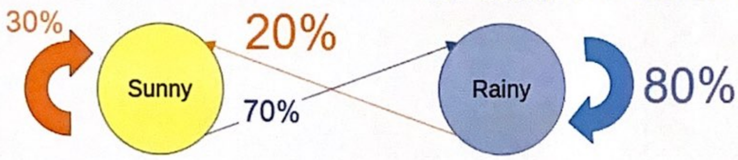
80% chance of rain

says the Met Office in its weather forecast for Oxford.

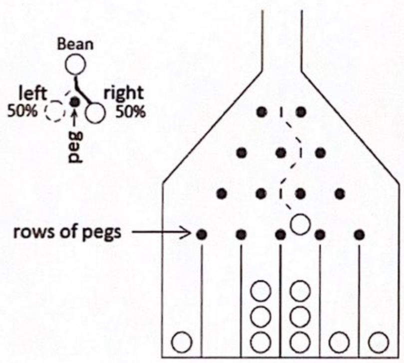


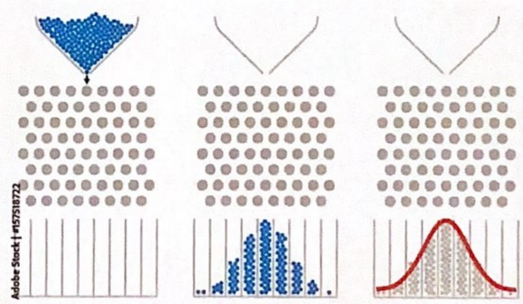


Markoff Chain Probability Model for Oxford Weather

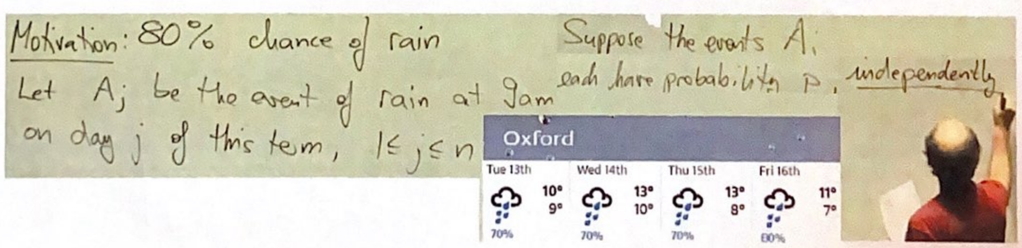


If it is Rainy today => there is an 80% chance that it will be rainy tomorrow.





School gravity MOTION == formalism ==> University E = MC²



then take notes on the lecture yourself

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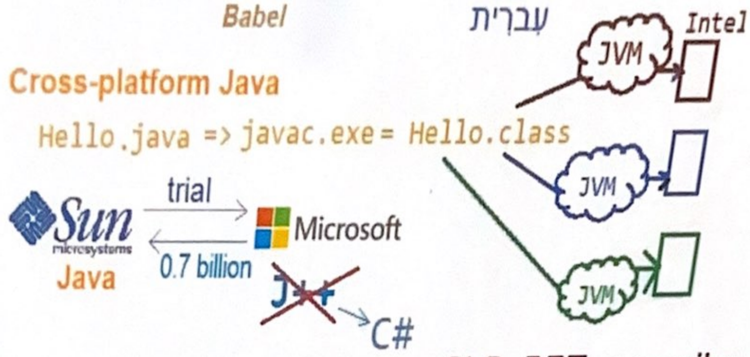

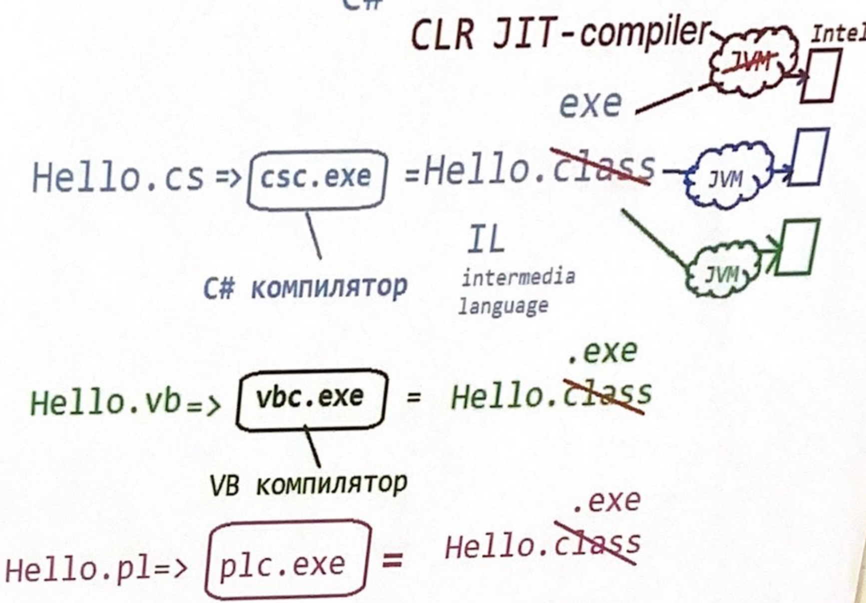

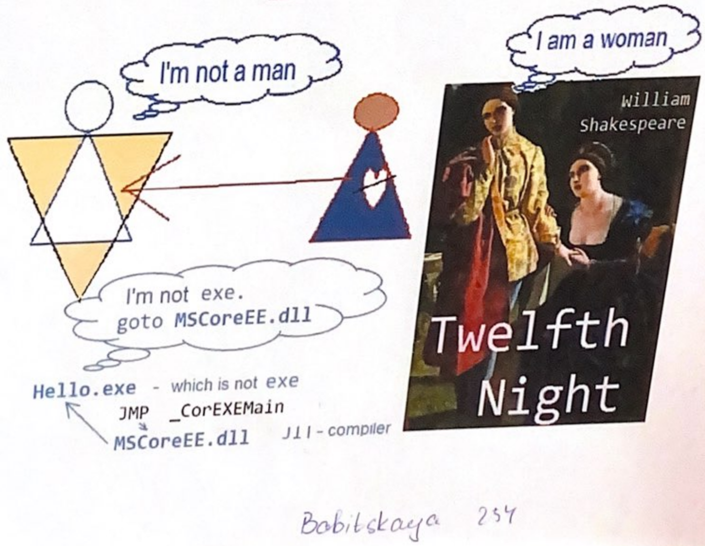

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Yaroshevich. Oxford Lecture

80% chance of rain at 9 a.m on the day "j"

(+1.1) to exam +0.2 +0.5

$0 \le j \le n$ → 30, 40 days

Suppose the event A have probability independently (P) → 0,1 ... 0,9

1. Event and probabilities:

Consider an "experiment" which has a set of Ω of outcomes $w\in\Omega$ - sample space

a) tossing a coin $\Omega = \{H|T\}$ (mat, tail)

b) throwind a dice:

$\Omega = \{(i,j), i,j \in [1,2,3,4,5,6]\}$

A subset of Ω is called an event

For example

a) a coin comes up tail $A = \{T\}$

b) We observe of total 9

$A = \{(3,6), (4,5), (5,4), (6,3)\}$

If $w\in\Omega$ is the outcome, we say that event A occur if $w \in A$

Compliment of A:

A^c occurs if A doesn't occur

Union $A \cup B$ occur if A or B occurs (or both)

Intersection: $A \cap B$

occurs if both A and B occurs

Set difference: $A \setminus B = A \cap B^c$ occur if A occurs and B doesn't occurs

A and B

disjoint $A \cap B = \emptyset$ i.e A and B cannot occur together

We assign a probability $P(A)$ of each A

Simplest case:

Ω is finite and all outcomes are equally likely, then $P(A) = \frac{|A|}{|\Omega|}$

a) $\left.\begin{matrix}|\Omega| = 2\\ |A| = 1\end{matrix}\right\} = P(A) = \frac{1}{2}$.

b) $\left.\begin{matrix}|\Omega| = 36\\ |A| = 4\end{matrix}\right\} \Rightarrow P(A) = \frac{4}{36} = \frac{1}{9}$ ← queen

Elementary Combinatorics:

Arrangement of distingwishable object. Suppose we have a distingwishable objects $n=3$. How many ways are there to order them?

$\Omega = 3! = 3\cdot2\cdot1 = 6$

Example: 1) There are 6! ways to order the letters of GALOIS. If we randomly reoder the letters what is the probability that vowels are all before consonants?

$$\frac{3!\,3!}{6!}$$

2) Arrangements when not all object are indistingweshable.
How many different arrangements of AAA BCD

A is repeated — 3 are distinguishable

$$\frac{6!}{3!} = \frac{1\cdot 2\cdot 3\cdot 4\cdot 5\cdot 6}{3\cdot 2\cdot 1} = 120$$

хоп мусорок
не шей мне срок

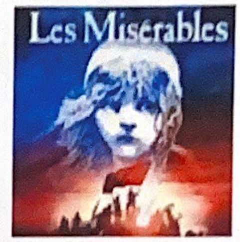
Рита

Бабишкая Маргарита Станиславовна

от Ули ♡

+0,1+0,1+0.1

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)?

3! 3!

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

PUTA ♡

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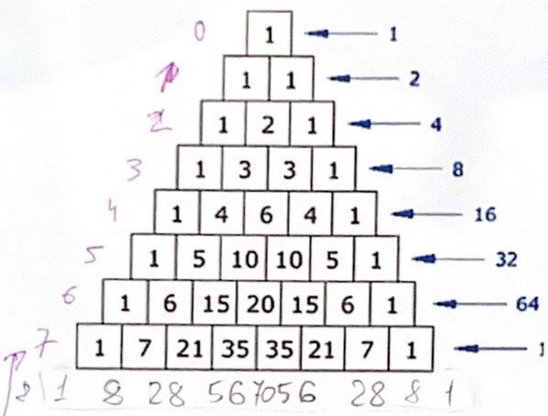
6



Shannon Hartley Theorem

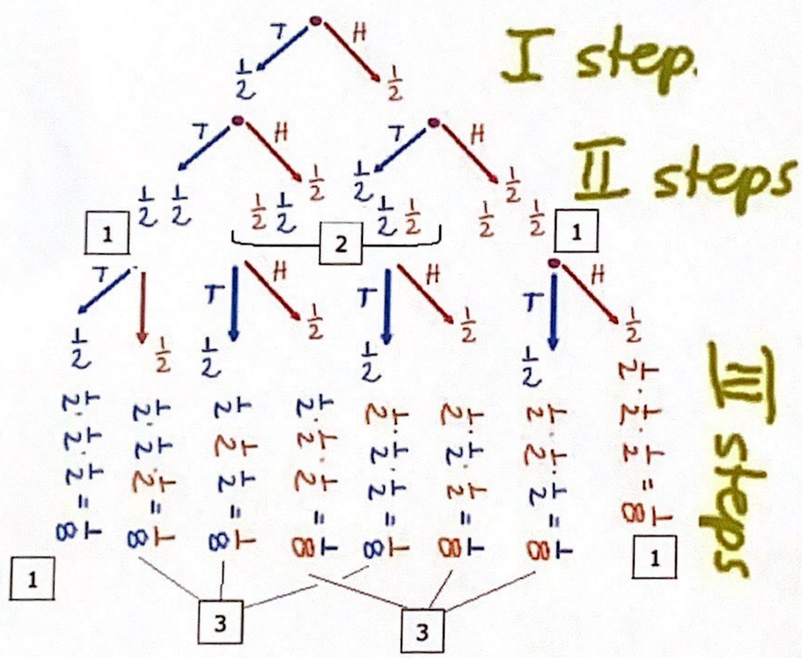
This is a measure of the *capacity* on a channel; it is impossible to transmit information at a faster rate without error.

$$C = B\log_2(1+S/N)$$

- C = capacity (in bit/s)
- B = bandwidth of channel
- S = signal power (in W)
- N = noise power (in W)

It is more usual to use SNR (in dB) instead of power ratio (as with terrestrial and commercial communications syste[ms]) S/N >> 1, then rewriting in terms of log10.

$$C = B\frac{\log_{10}(S/N)}{\log_{10}2} = B\frac{10\log_{10}(S/N)}{10.\log_{10}2} = B\frac{SNR}{3.01}$$



$$(a+b)^0 = 1$$
$$(a+b)^1 = a+b$$
$$(a+b)^2 = a^2+2ab+b^2$$
$$(a+b)^3 = a^3+3a^2b+3ab^2+b^3$$
$$(a+b)^4 = a^4+4a^3b+6a^2b^2+4ab^3+b^4$$
$$(a+b)^5 = a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$$

$$(1+x)^7 = 1+7x+21x^2+35x^3+35x^4+21x^5+7x^6+x^7$$

$$\binom{7}{0}\binom{7}{1}\binom{7}{2}\binom{7}{3}\binom{7}{4}\binom{7}{5}\binom{7}{6}\binom{7}{7}$$

$$(y+x)^7 = y^7+7y^6x+21y^5x^2+35y^4x^3+35y^3x^4+21y^2x^5+7yx^6+x^7$$

+0,2 Exam

$ABBA = \frac{4!}{2!2!} = \frac{24}{4} = 6$. The number of arrangements of the N obj

♡ $\underbrace{x_1 \ldots x_1}_{m_1}, \underbrace{x_2 \ldots x_2}_{m_2}, \ldots, \underbrace{x_k \ldots x_k}_{m_k}$

where $n = m_1 + m_2 + \ldots + m_k$

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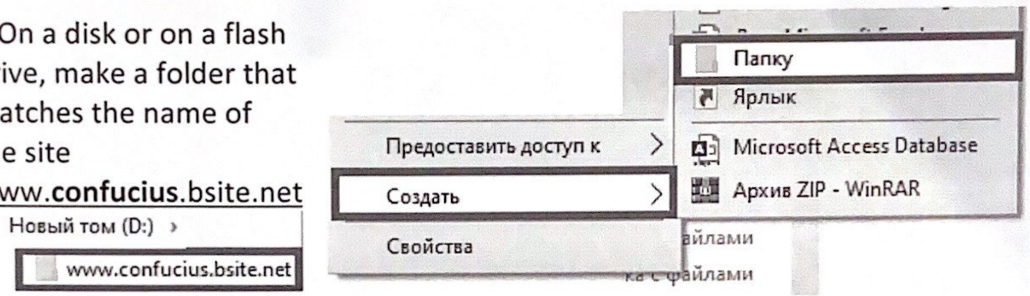
What should you do in class:

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

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

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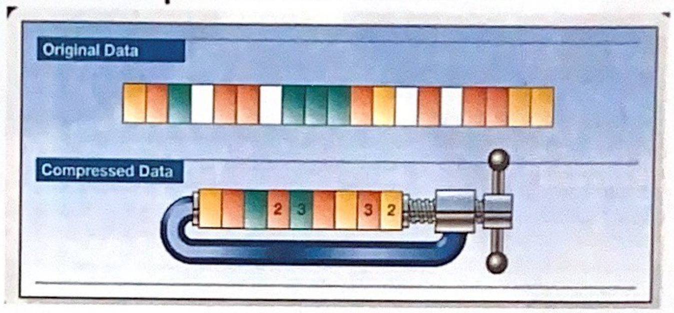
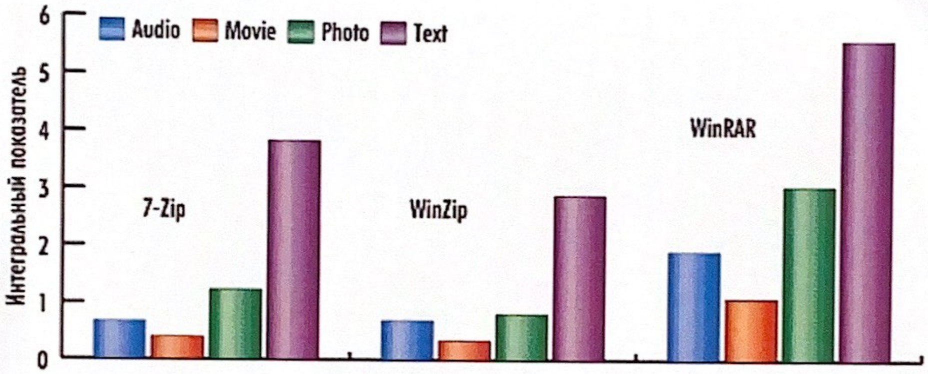
Comparison of the compression ratio of popular archivers





Before Compression

Data ↓

AAAAAAABCCCCCCDDEEEEE →

Symbol	Frequency
A	7
B	1
C	6
D	2
E	5

After Compression

Symbol	Bit Code
A	00
B	111
C	01
D	110
E	10

Entropy compression ratio

Before Compression - 21 x 8 bits -198 bits
After Compression - 7 x 2 bits + 1 x 3 bits + 6 x 2 bits + 2 x 3 bits + 5 x 2 bits = 45 bits

$\log_2(64) = 2$ — +0.3 to Exam !!!

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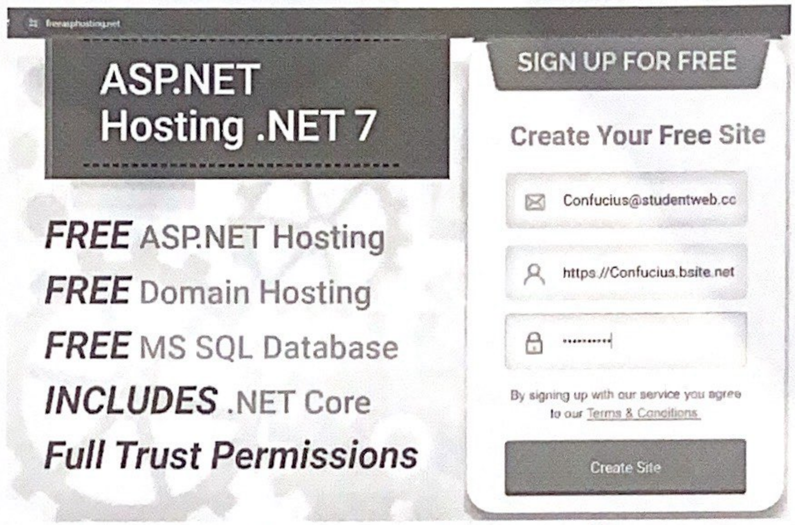
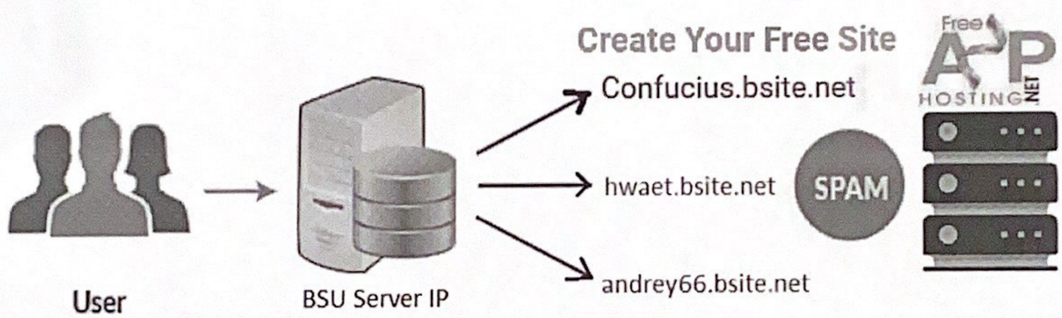
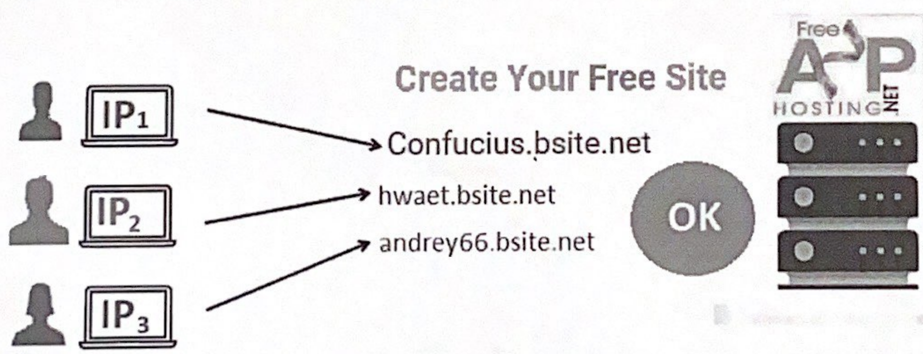
What should you do at home: Register free hosting on **freeasphosting.net** At home because many hosting services do not register from one IP address.



If several dozen hosting attempts to register from one IP address, the **freeaspohosting.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.

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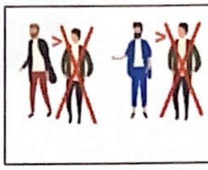
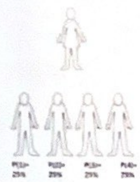
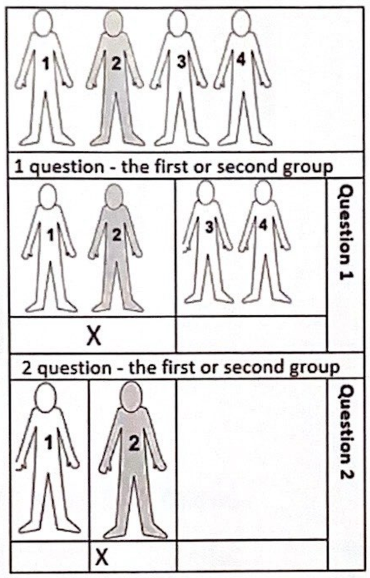
Say **NO** to the **first**

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*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**		

Quantifying information

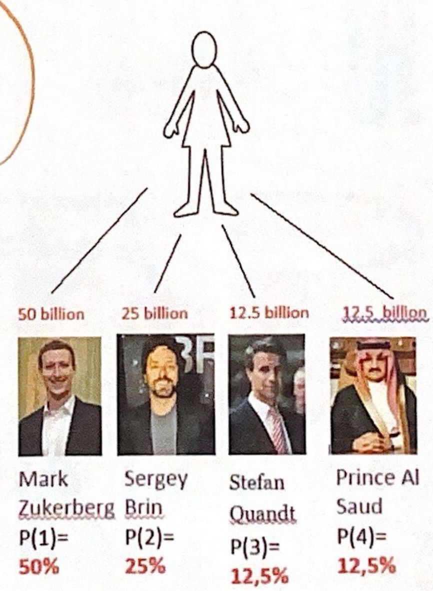
$$S(x) = \sum_{i=1}^{n} p(i) \log_2 \frac{1}{p(i)}$$

Quantifying information

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

+0.5 to Exam

number of bits required to encode choice



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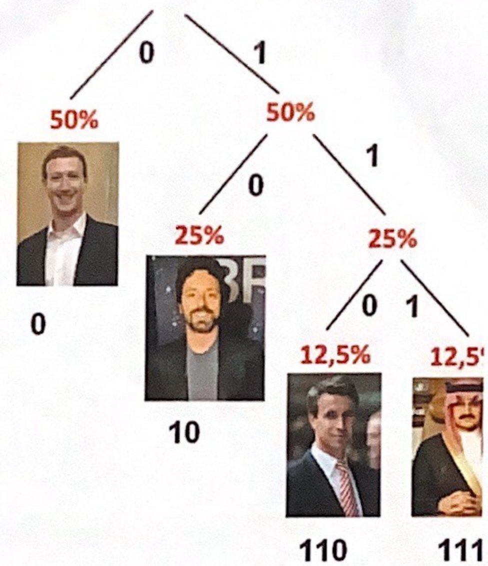

First-order approximation
(symbols independent but with frequencies of Belarusian txt).

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

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

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

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