



Sapere aude!



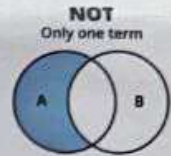
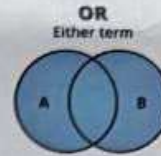
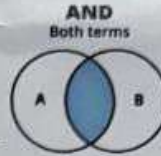
Logical addition
(disjunction)

| A | B | F=A∨B |
|---|---|-------|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

| Conjunction: | | |
|--------------|---|-------|
| p | q | p ∧ q |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |



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



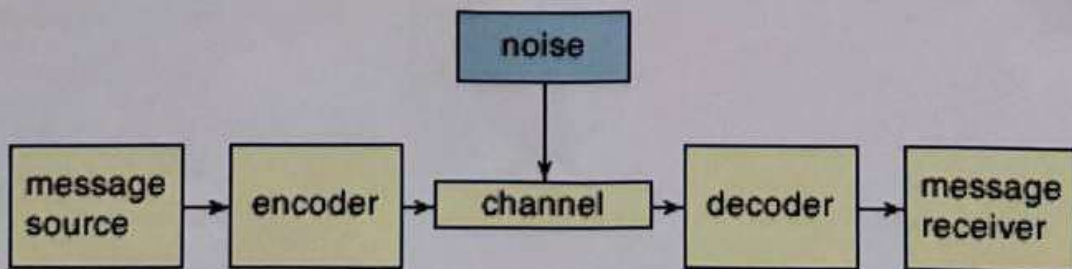
Aristotle

philosophers are men



Socrates

Socrates was
a philosopher



dot, not, by



+ 0.4

+ 0.4

+ 0.2 for F_{14}

Gen $\frac{n!}{m_1! m_2!} m_k$

$$1) n! = (1 \cdot (n-1) \cdot (n-2) \dots)$$

$$2) P(A) = \frac{m_1! \cdot m_2!}{n!}$$

$$3) m_1 + m_2 = n$$

$$4) \frac{n!}{m_1! m_2! \dots m_k!}$$

$$5) \frac{n!}{m_1! \cdot (n-m)!}$$

MTBank Bank свежих решений

Identifying inf.

$$1. \frac{6}{10} = 0.6$$

$$2. \frac{3}{10} = 0.3 \cdot 2 = 0.6$$

$$3. \frac{1}{10} = 0.1 \cdot 3 = 0.3$$

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$$-129.3 - 0.3 = -129.6$$

$$-129.6 - 0.3 = -129.9$$

$$-129.9 - 0.3 = -130.2$$

$$-130.2 - 0.3 = -130.5$$

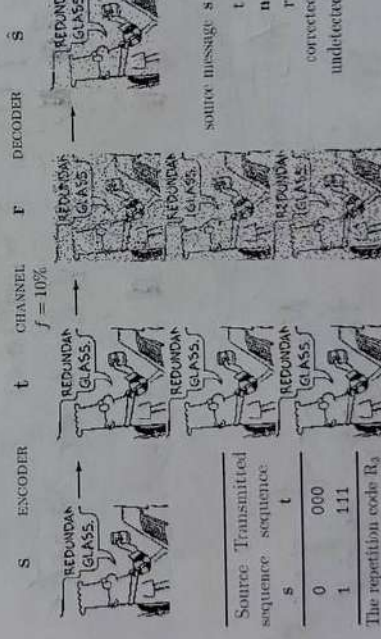
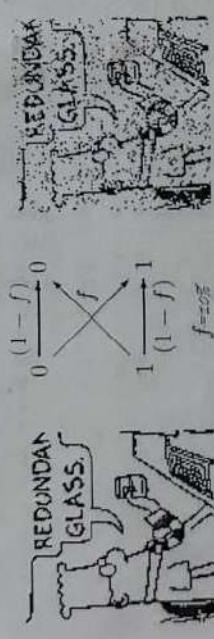
$$-130.5 - 0.3 = -130.8$$

$$-130.8 - 0.3 = -131.1$$

$$-131.1 - 0.3 = -131.4$$

$$-131.4 - 0.3 = -131.7$$

$$-131.7 - 0.3 = -1$$



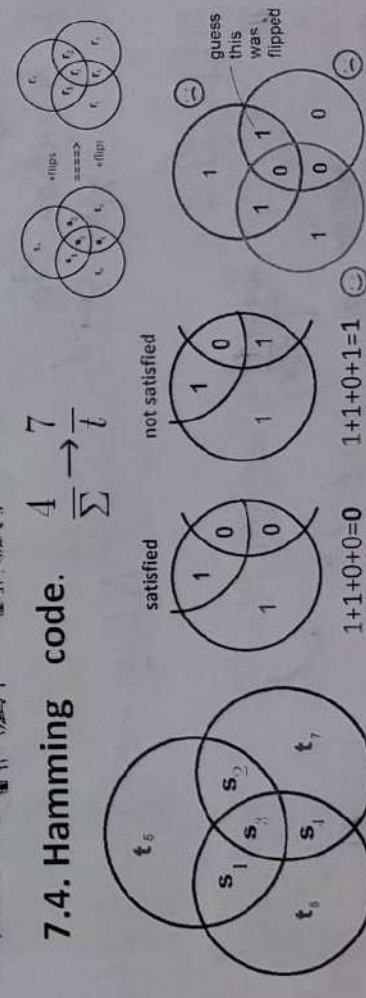
| Source sequence | Transmitted sequence |
|-----------------|----------------------|
| 0 | 000 |
| 1 | 111 |

The repetition code R_3

| | | | | | | | |
|-------------------|-----|-----|-----|-----|-----|-----|-----|
| source message: s | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| t | 000 | 000 | 111 | 000 | 111 | 111 | 000 |
| u | 000 | 001 | 000 | 000 | 101 | 000 | 000 |
| r | 000 | 001 | 111 | 000 | 010 | 011 | 000 |


corrected errors *

undetected errors *

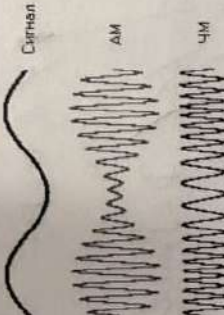


7.4. Hamming code.

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



Reginald A. Fessenden
(October 6, 1866 – July 22, 1932)




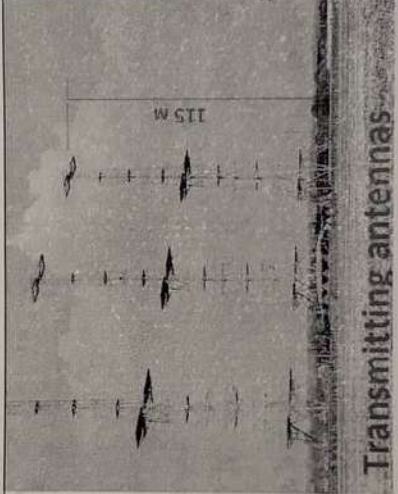
Circuit
AM
FM

(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)

"Ни одна организация, занимающаяся какой-либо конкретной областью деятельности, никогда не изобретает какие-либо важные разработки в этой области или не внедряет какие-либо важные разработки в этой области до тех пор, пока она не будет вынуждена сделать это из-за внешней конкуренции.." Oxford University Press. The Quarterly Journal of Economics, Feb., 1926, p. 262.

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






115 M
80 M.

Transmitting antennas

Receiving Antennas

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.

Ralph Hartley
(81:1888-1970)



$$H = n \log s$$

$$= \log s^n.$$

~~4. asp~~

Projects/1/1.aspx

index.html
↳ 1.aspx

<meta
http

Projects/1/ Default.aspx

Projects/1/

Go-

HTML Redirection

index.html

<html>

<head>

→ HTML Redirection

</head>

</html>

url = '1.aspx' - V

$$H = \sum_{x=1}^n p(x) \log_2 \left(\frac{1}{p(x)} \right)$$

$$H(x) = \log_2 \left(\frac{1}{p(x)} \right)$$

$$1st \quad 0.6 \cdot \log_2 \left(\frac{1}{0.6} \right) = 0.6 \cdot \log_2 \left(\frac{10}{6} \right) =$$

$$0.2 \cdot \log_2 \left(\frac{1}{0.2} \right) = 0.2 \cdot \log_2 \left(\frac{10}{2} \right) =$$

$$0.1 \cdot \log_2$$

$$0.1 \cdot \log_2$$

Σ

Shannon Ent. \rightarrow

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

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

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

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

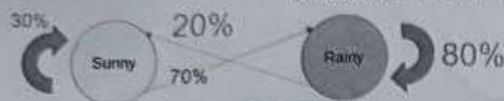
Say NO to the third only if it is worse than all the others

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

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

Markoff Chain Probability Model
for Oxford Weather**ink + think**

① listening
② first way of processing

School   **MOTION** ==formalism==> University     

Motivation: 80% chance of rain

Let A_j be the event of rain at Jam
on day j of this term, $1 \leq j \leq n$.

Suppose the events A_i each have probability p , independently

| Oxford | | | |
|---|--|---|---|
| Tue 13th | Wed 14th | Thu 15th | Fri 16th |
|  10° 9° |  13° 10° |  13° 8° |  11° 7° |

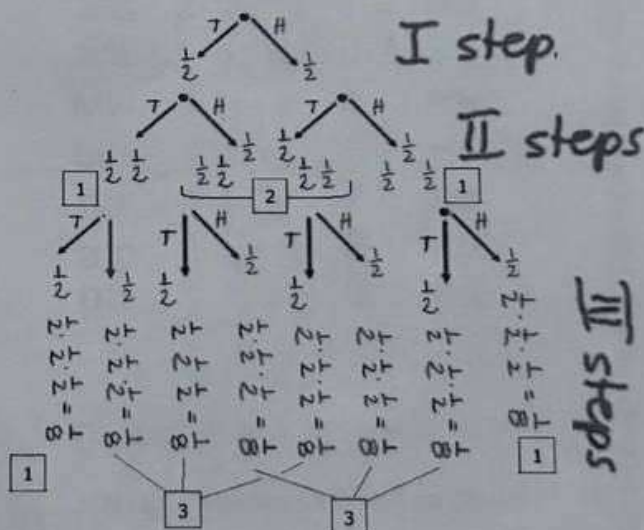


Pascal's triangle

Diagram illustrating the binomial coefficients for $(a+b)^n$ using Pascal's Triangle. The triangle shows the coefficients for $(a+b)^0$ through $(a+b)^7$. The coefficients are arranged in rows, with the number of terms in each row corresponding to the power of $(a+b)$. The coefficients are symmetric and follow the rule that each number is the sum of the two numbers directly above it.

| | | | | | | | |
|---|---|----|----|----|----|---|---|
| 1 | | | | | | | |
| 1 | 1 | | | | | | |
| 1 | 2 | 1 | | | | | |
| 1 | 3 | 3 | 1 | | | | |
| 1 | 4 | 6 | 4 | 1 | | | |
| 1 | 5 | 10 | 10 | 5 | 1 | | |
| 1 | 6 | 15 | 20 | 15 | 6 | 1 | |
| 1 | 7 | 21 | 35 | 35 | 21 | 7 | 1 |

Labels on the right side of the triangle (corresponding to the powers of $(a+b)$): 1, 2, 4, 8, 16, 32, 64, 128.



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

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

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

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

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

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

1

Newton's Binomial

$a + b$

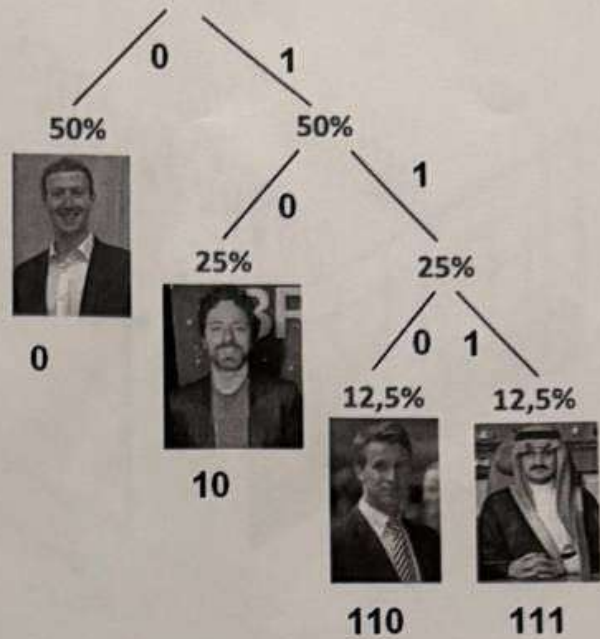
$$a^2 + 2ab + b^2$$

$$a^3 + 3a^2b + 3ab^2 + b^3$$

$$a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$$

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





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 |

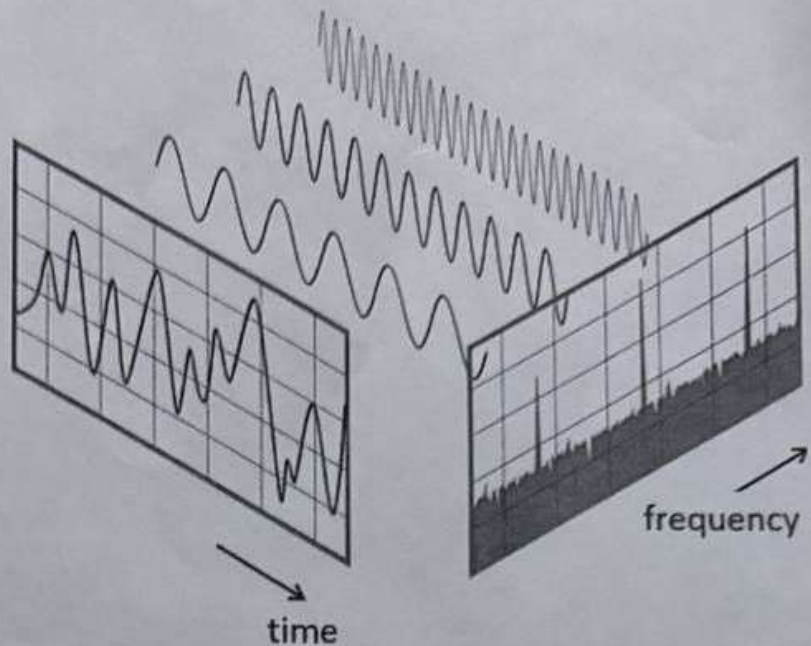
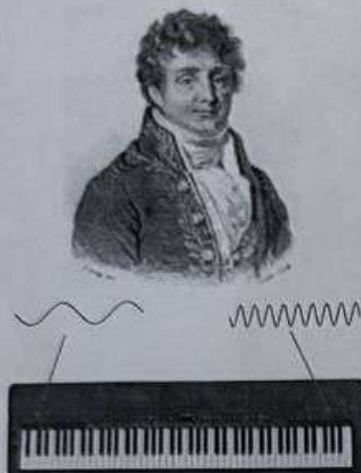
9

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

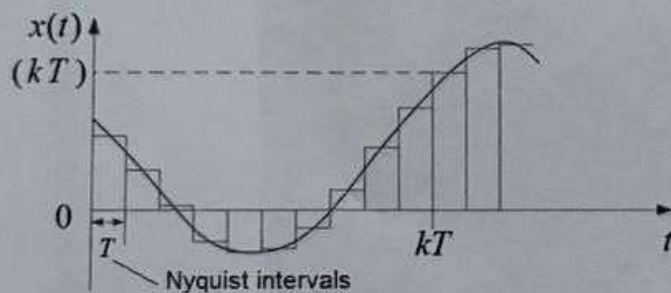


Second-order approximation (diagram (2-symbols) structure as in Belarusian)

Fourier transform



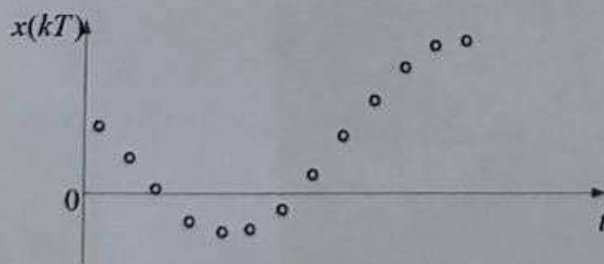
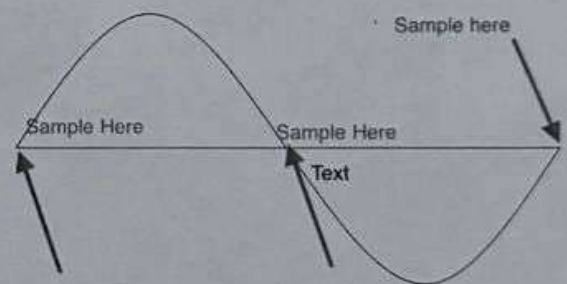
Sampling. Kotelnikov-Nyquist Theorem



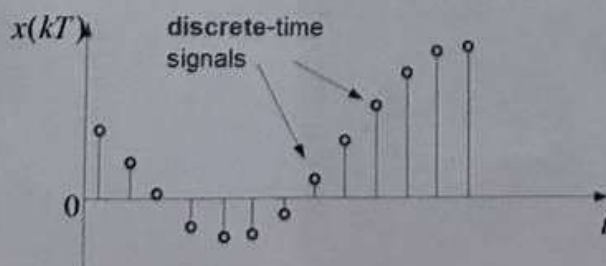
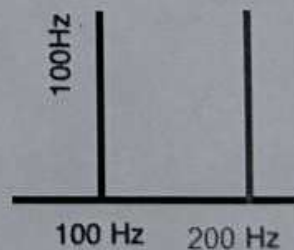
Time intervals T , through which readings $s(kT)$ are taken, are called Nyquist intervals.

Sine with period T

Sampling at $T/2$



frequency Sample



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

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

+0.1 June +0.1 to fin Grade

Resume of Lecture by Pr. Bob Gallagher from MIT



Massachusetts Institute of Technology (MIT)

George Boole (1815-1864) developed Boolean logic

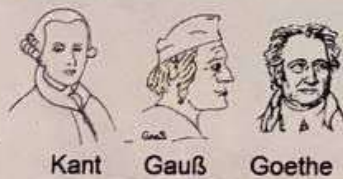
The principles of logical thinking have been understood (and occasionally used) since the Hellenic era.

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

INFORMATION SOURCE
MESSAGE
TRANSMITTER

SIGNAL

NOISE SOURCE

DESTINATION

MESSAGE

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

and that's what Shannon did