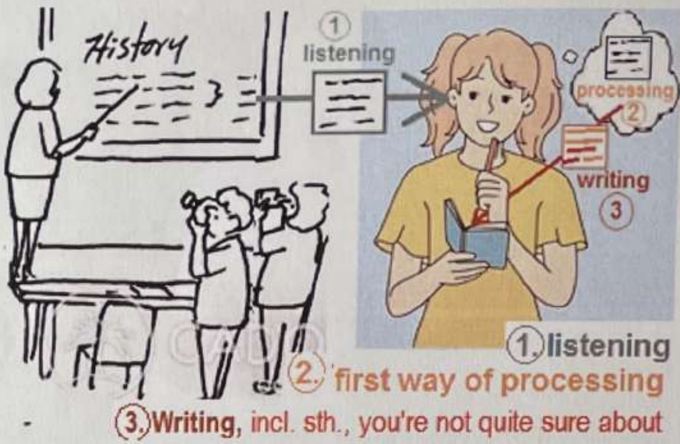
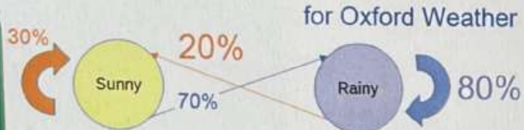
+0.1 to final Grade
+0.1

+0.1 for Handout 25.Feb 04

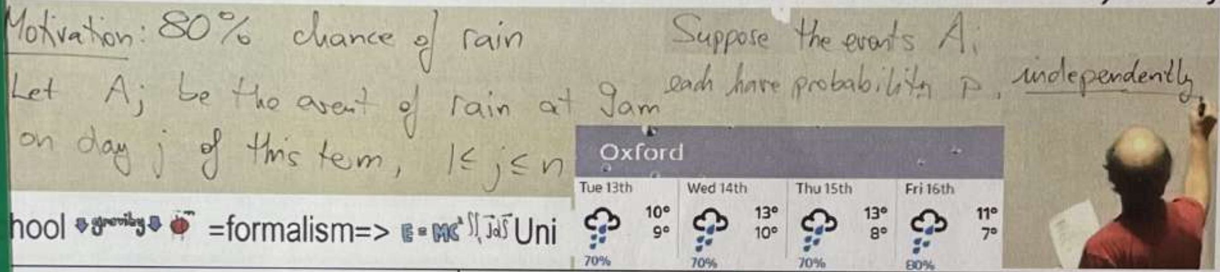
+0.1 for



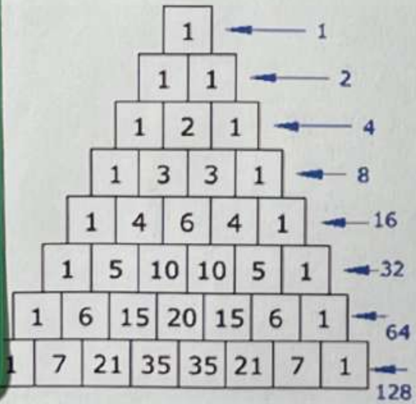


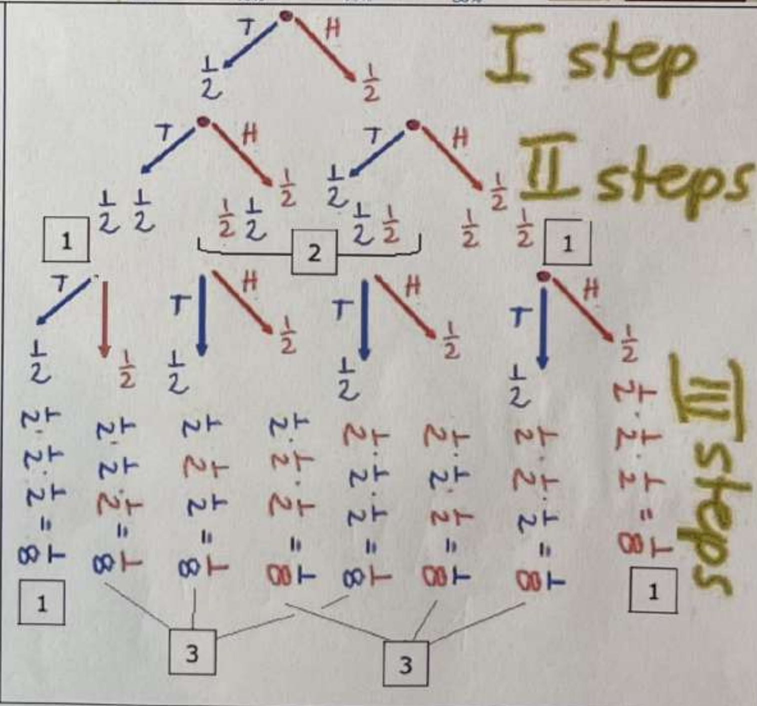
CHALK+TALK ink+think

take notes on the lecture yourself



Pascal's triangle





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

+0.1 GALOIS 6!

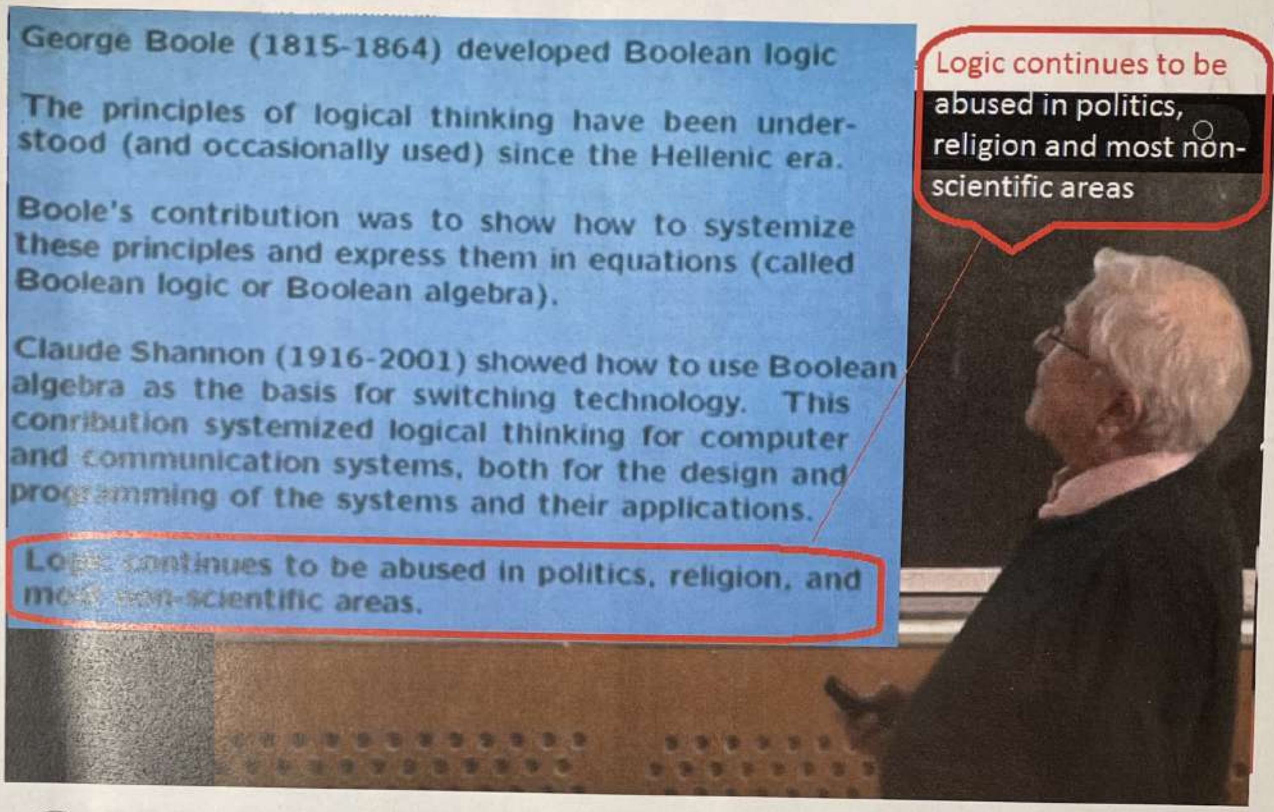
+0.1 $\frac{m_1!\, m_2!}{n!}$

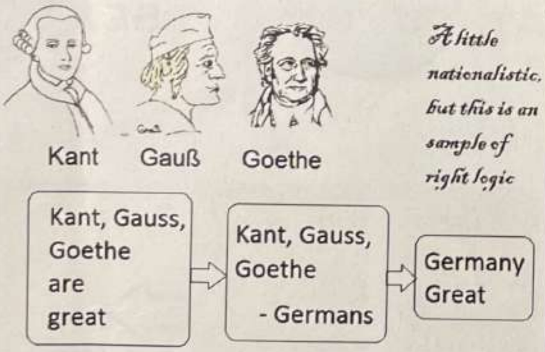
+0.1 Pr ABBA

+0,5 to final Grad

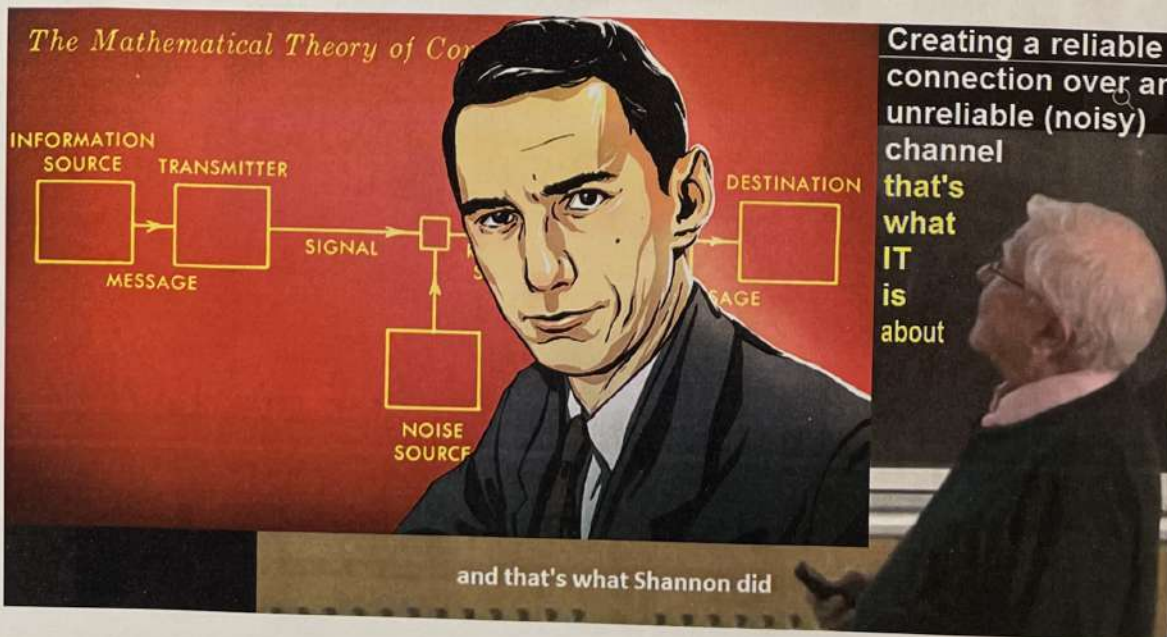
Resume of Lecture by Pr. Bob Gallagher from MIT

Massachusetts Institute of Technology (MIT)





Bad logic (abuse of logic)



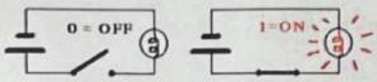
important

(+0.2) to final grade

Massachusetts Institute of Technology (MIT)

Lecture by Pr. Bob Gallagher
Boole (1815-1864) & **Shannon** (1916-2001)

Sapere aude!



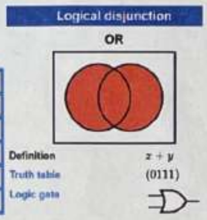
9 10
4.5
10

Logical addition (disjunction)

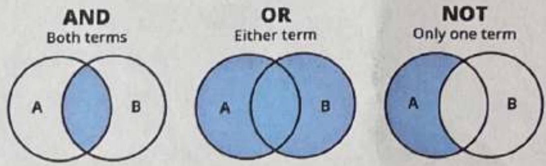
A	B	F=A∨B
0	0	0
0	1	1
1	0	1
1	1	1

Project 6

Conjunction:		
p	q	p ∧ q
T	T	T
T	F	F
F	T	F
F	F	F



BOOLEAN LOGIC

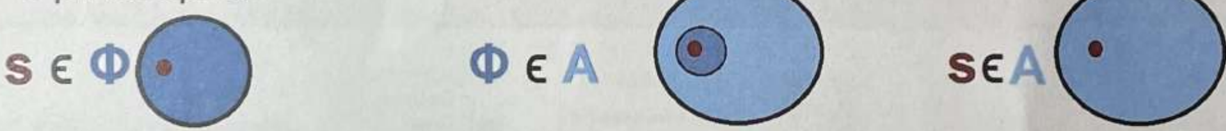


Good logic

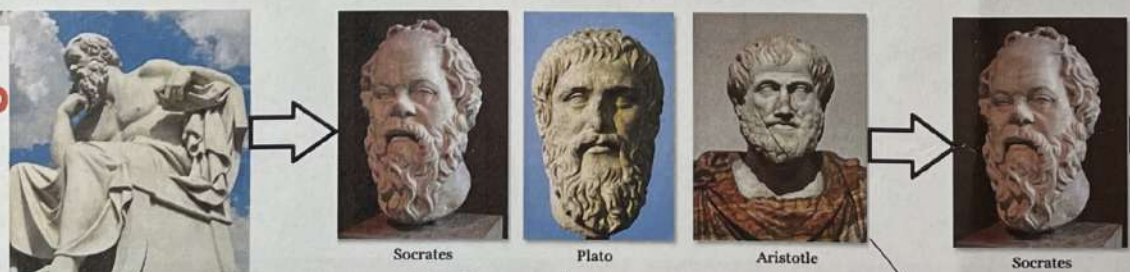
Socrates was a philosopher

philosophers are men

Socrates was a man



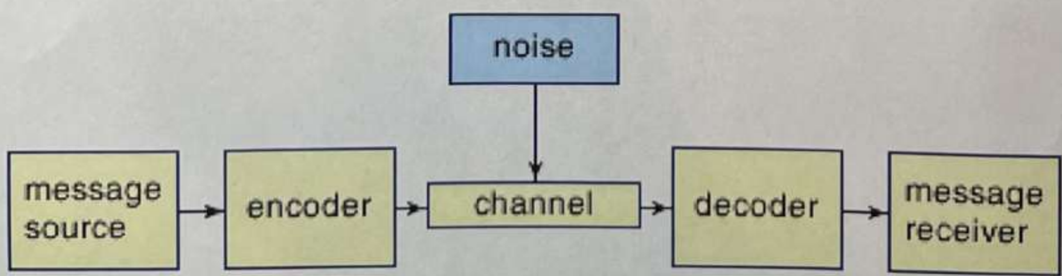
Bad logic



Socrates was a man

philosophers are men

Socrates was a philosopher



XOR ×

0	0	0
0	1	1
1	0	1
1	1	0

$0101_2 \rightarrow 5_{10}$

$01111_2 \rightarrow 15$

d: cd IT\Projects\0\ ↙

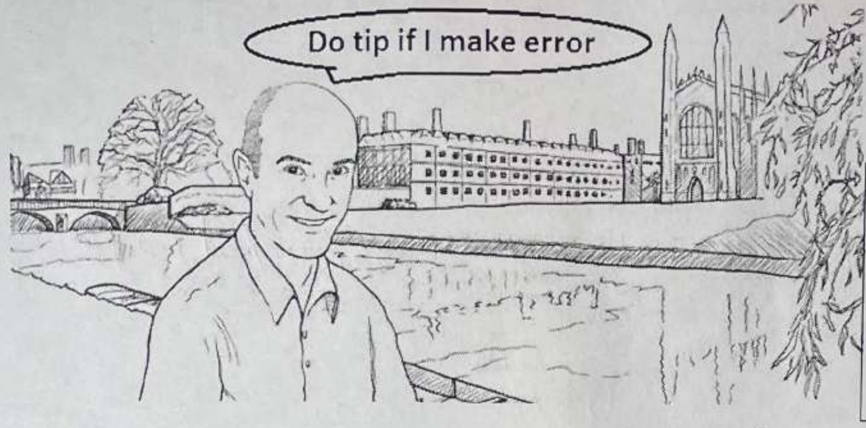
↑ Any tex

```
class MBoole
{
    public static void Main()
    {
        System.Console.WriteLine("Hi");
    }
}
```

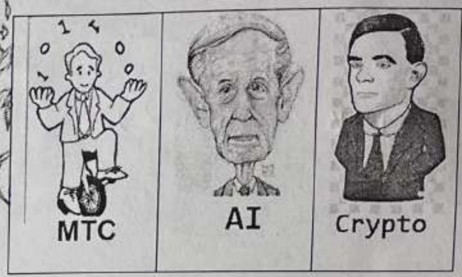
Save As MBoole.cs

Prompt cmd d:

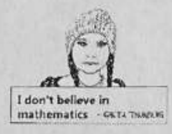
cd IT\Projects\0

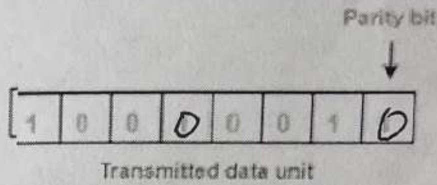


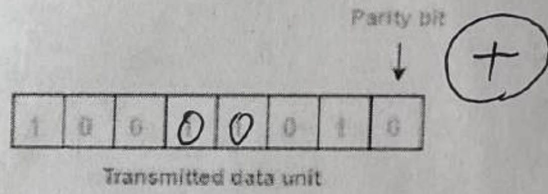
Sir **Dr. D. MacKay**,
University of Cambridge
(22 April 1967 – 14 April 2016)

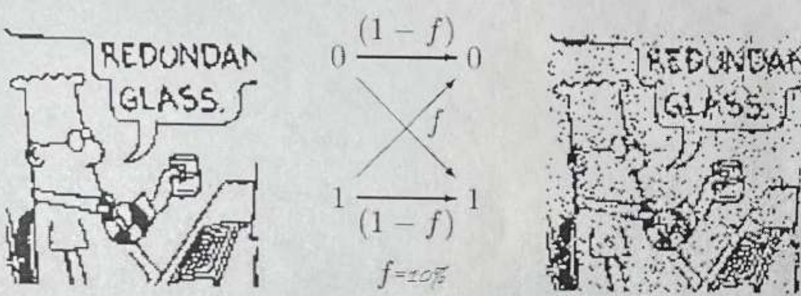


"I believe in clean energy,
but I also believe in mathematics"



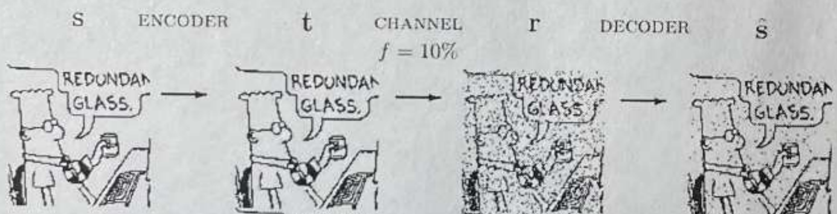


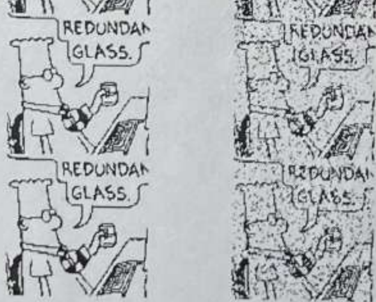




50%

ABC
DEF





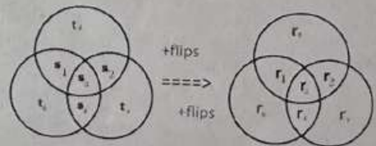
Source sequence s	Transmitted sequence t
0	000
1	111

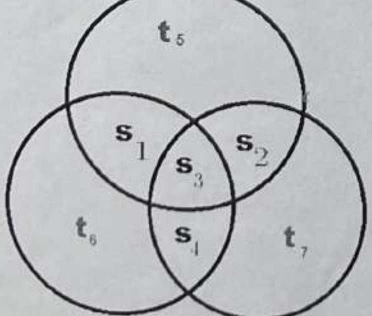
The repetition code R_3

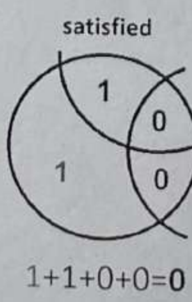
source message s	0	0	1	0	1	1	0
t	000	000	111	000	111	111	000
n	000	001	000	000	101	000	000
r	000	001	111	000	010	111	000
corrected errors		*					
undetected errors					*		

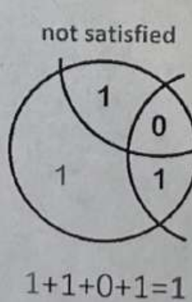
7.4. Hamming code.

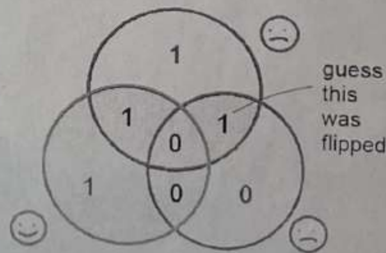
$$\frac{4}{\Sigma} \rightarrow \frac{7}{t}$$





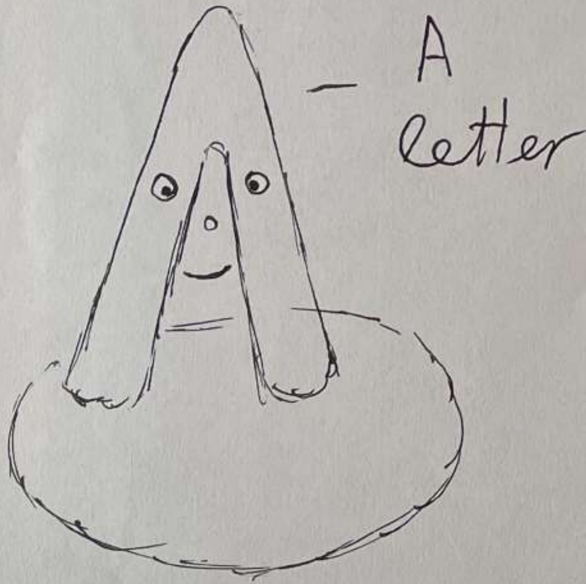






D!

+0Λ to Fin Ex



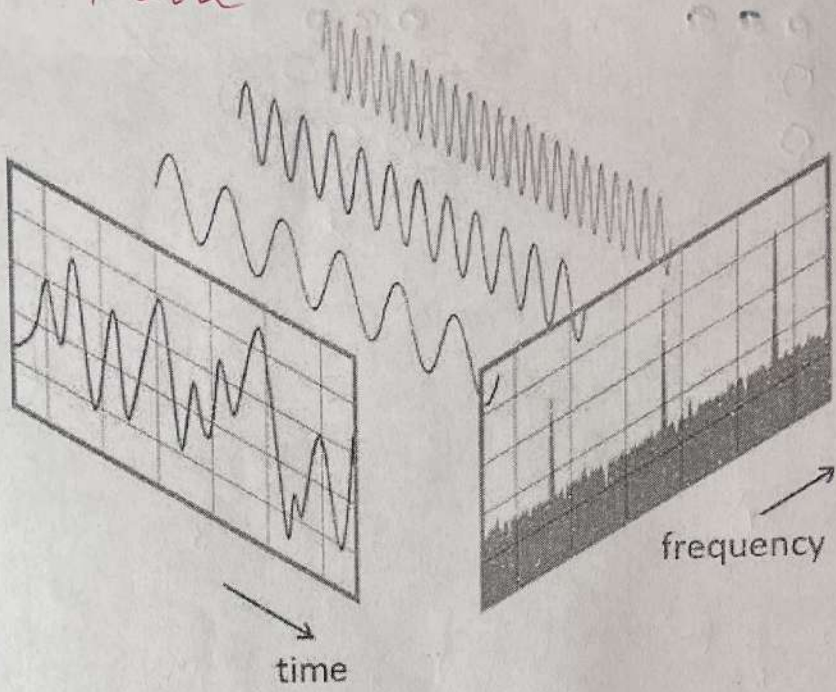
Girls
invisible

+0,7 to fin Grade

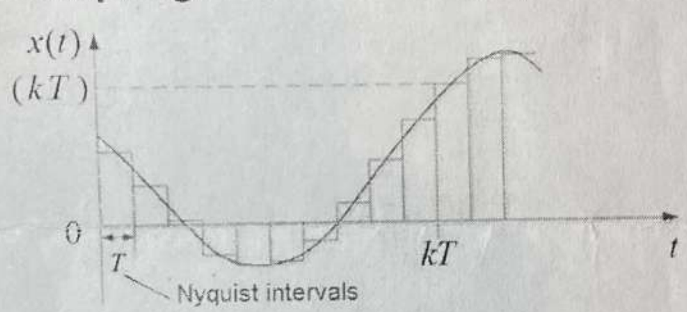
+0,1 to fin Grade 6.5.25
+0,3 to fin Grade 6.5.25

+0,1 for A
+0,1

Fourier transform

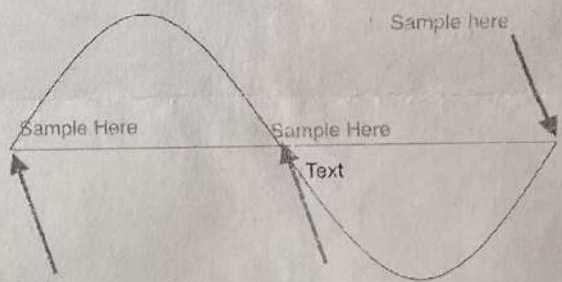


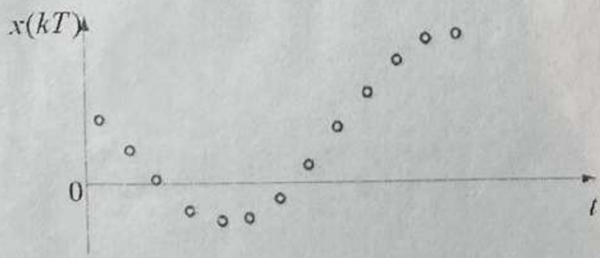
Sampling. Kotelnikov-Nyquist Theorem

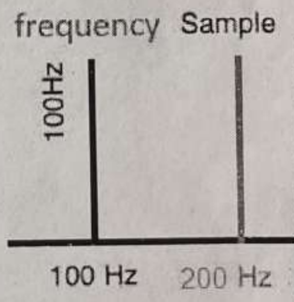


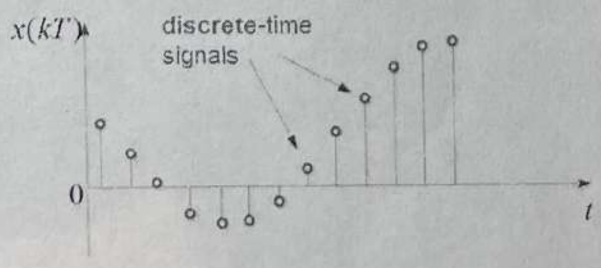
Time intervals T, through which readings s (kT) are taken, are called Nyquist intervals.

Sine with period T **Sampling at T/2**









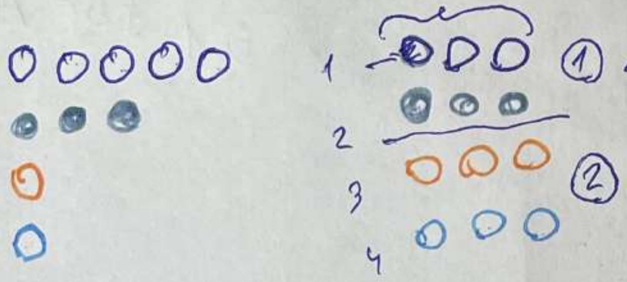
$$F_{sample}>=2*F_{max}$$
$$(T_{sample}<=T_{min}/2)$$

quantity of inf = $\log_2 x$

$f=1 \quad T=1$
$f=2 \quad T=\frac{1}{2}$
$f=3 \quad T=\frac{1}{3}$
$\Rightarrow T=\frac{1}{f}=f^{-1}$

T – period, f – frequency (Hz)

Как передавать все комбинации в покере, чтобы это не заметили



1\. Q

2\. Quest

It is O

yes

2 question

Entrophy

$\log_2 4 = 2$

1st: $H(x) = 0{,}5 \cdot 1 + 0{,}3 \cdot 2 + 0{,}1 \cdot 3 + 0{,}1 \cdot 3 = 0{,}5 + 0{,}6 + 0{,}3 + 0{,}3 = 1{,}7$

2nd: $H(x) = \frac{3}{12} \cdot 1 + \frac{3}{12} \cdot 2 + \frac{3}{12} \cdot 3 + \frac{3}{12} \cdot 3 = 0{,}25 \cdot (1+2+3+3) = 0{,}25 \cdot 9 = 2{,}25$

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

$I(x) = \log_2\left(\frac{1}{p(x)}\right)$ - Quantifying Information

2nd variant

$H(x) = 0{,}5 \cdot \log_2\left(\frac{1}{0{,}5}\right) + 0{,}3 \cdot \log_2\left(\frac{1}{0{,}3}\right) + 0{,}1 \cdot \log_2\left(\frac{1}{0{,}1}\right) + 0{,}1 \cdot \log_2\left(\frac{1}{0{,}1}\right) =$

$= 0{,}5 \cdot \log_2 2 + 0{,}3 \cdot \log_2 3{,}33 + 0{,}1 \cdot \log_2 10 + 0{,}1 \cdot \log_2 10 =$

$= 0{,}5 \cdot 1 + 0{,}3 \cdot 1{,}74 + 0{,}1 \cdot 3{,}32 + 0{,}1 \cdot 3{,}32 = 1{,}686$

Events and probabilities

- consider our "experiment", which was a set of Ω of outcomes $\omega \in \Omega$.

Ex. a) tossing a coin $\Omega = \{H, T\}$

b) throwing a dice 

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

A - subset of Ω - event

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

b) $A = \{(3, 6)\}$ - event

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

Complement of A : $\overline{A}$ - occur when A doesn't occur
A^c

Set difference : $A \setminus B = A \cap B^c$

Intersection : $A \cap B$ occur if both A and B occur

Union : $A \cup B$ occur if any A or B occur

Boolean

&		
	0 0	0
	0 1	0
	1 0	0
	1 1	1

Union		
	0 0	0
	0 1	1
	1 0	1
	1 1	1

· A and B are disjoint if $A \cap B = \emptyset$

$\Downarrow$

A and B can't occur together

· $p(A)$ – probability of each event A : $A = \{T\}$, $A = \{(i, j) ...\}$

Case 1

Ω is finite and all outcomes are equally likely

$$p(A) = \frac{|A|}{|\Omega|}$$

Example 1 a) coin $|\Omega| = 2$ b) dice $|\Omega| = 6$

$|A| = 1$ $|A| = 1$

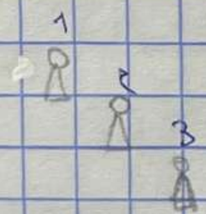
$p(A) = \frac{1}{2}$ $p(A) = \frac{1}{6}$

Elementary combinatorics

· Arrangement of distinguishable objects

· Suppose we have n distinguishable objects

How many ways to order them



$n = 3! = 6$

For n there are n options for 1st

then n-1 for 2nd object

inductively $n-(n-1)$ – nth

in all there're $n(n-1)(n-2)\dots 2\cdot 1 = n!$ permutations

$$p(A) = \frac{m_1! \cdot m_2!}{n!}, \quad m_1 + m_2 = n$$

$2 \cdot 3 \cdot 4$
$6 \cdot 4 = 24$

$$p(A) = \frac{(n-m)! \cdot m!}{n!}$$

Arrangements when not all objects are indistinguishable

AAA BCD } 6!

indistinguishable   distinguishable

(AAA) $(A_1 A_2 A_3)$

$\frac{6!}{3!}$ (number of combinations when the order doesn't matter)

$\frac{4!}{2!}$ $\frac{24}{2} = 12$ $\frac{4!}{4}$

$\frac{4!}{2!} = \frac{24}{2}$ 12

$$ABBAT = \frac{5!}{2! \cdot 2! \cdot 1!}$$

$\frac{4!}{2!} \rightarrow \frac{4!}{2! \cdot 2!}$

$$TALLINN = \frac{7!}{1! \cdot 1! \cdot 1! \cdot 2! \cdot 2!}$$

$\frac{4!}{2! \cdot 2!}$

$$\frac{n!}{m_1! \cdot m_2! \dots m_k!} \qquad \frac{n!}{m!(n-m)!}$$

$k = 2$

$$\frac{n!}{m!(n-m)!}$$ – final formula