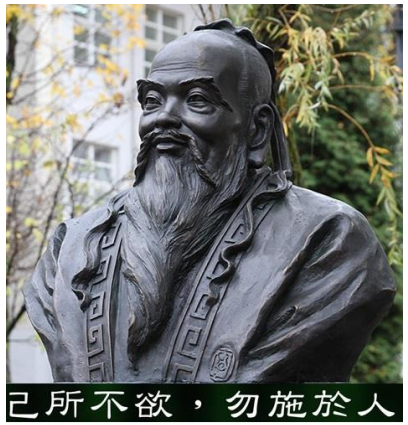
Information Theory Introduction

Sapere Aude

No mind is visible
to one,
who has no mind



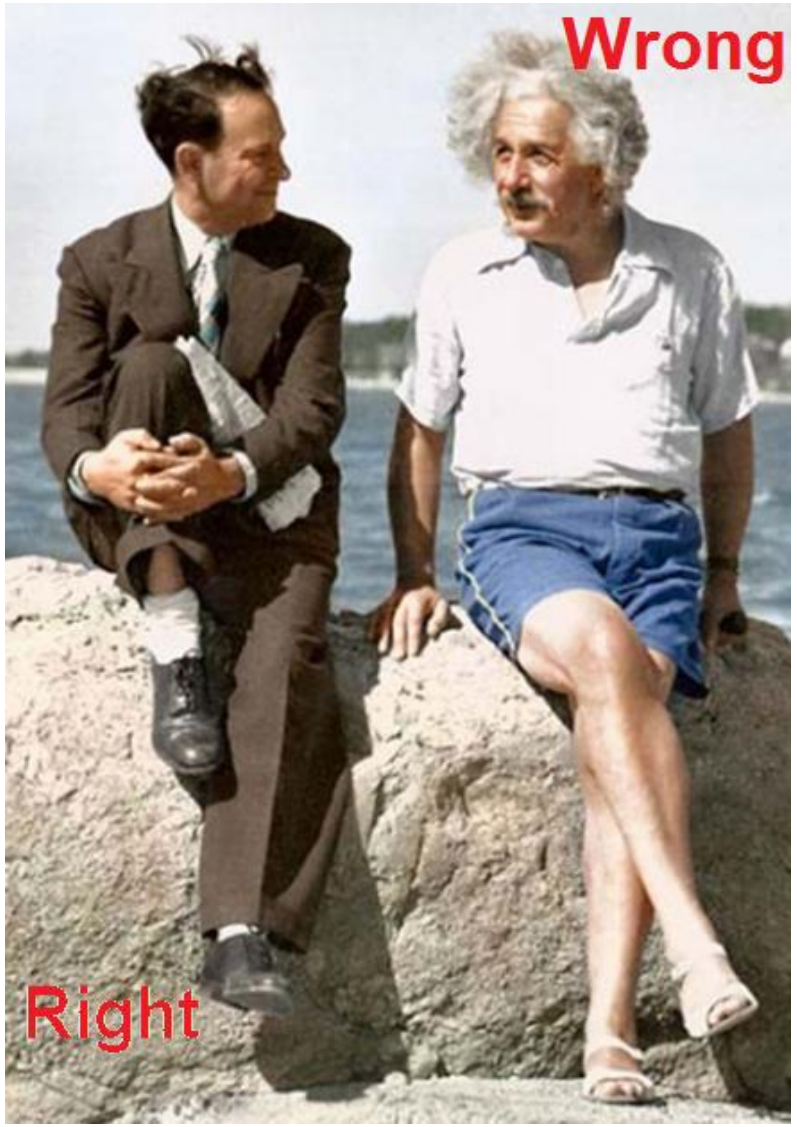
己所不欲，勿施於人

yourself what you don't want
don't do to others

YAROSHEVICH
Andrey Olegovich

www.YAROSHEVICH.com
ao@dot.net.by
+375 29 254-07-92

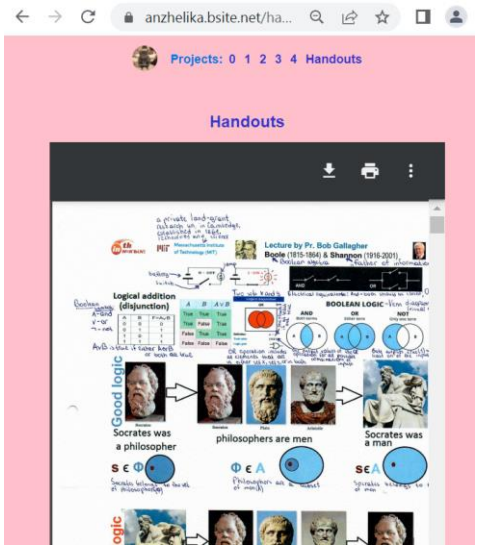
Business School Dress Code



anzhelika.bsite.net/handouts/

How to prepare for the exam:

1. **Paper Abstract**
   (handout+your notes).
   50%



2. PDF-handout
(handout+your notes).
+ premium
12%

3. **1st copy of site**
   50%

4. **2nd copy of site**
   + premium 12%

itcoursee.bsite.net/

Percentage of work completed

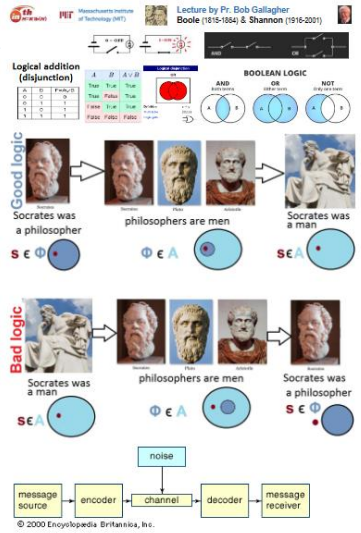
Exam grade

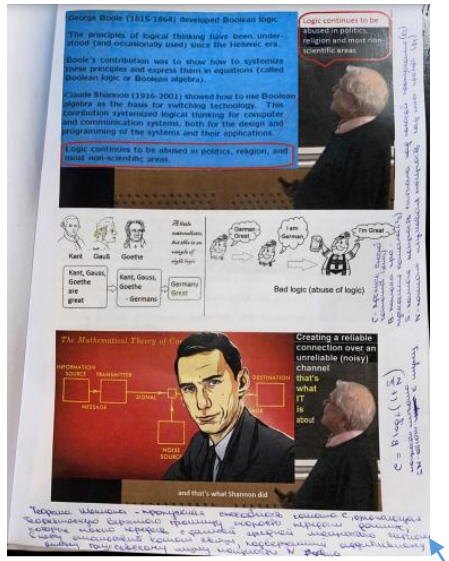
1.12*8=8.96 Final grade

1.24*8=9.92

lecture

Handout is a summary of the lecture





The **grade criterion** is understanding of the material.

If you understand the material:
by 50% - you get 5,
by 90% - 9

If you don't understand something about handout, ask the teacher
or download the lecture and figure it out

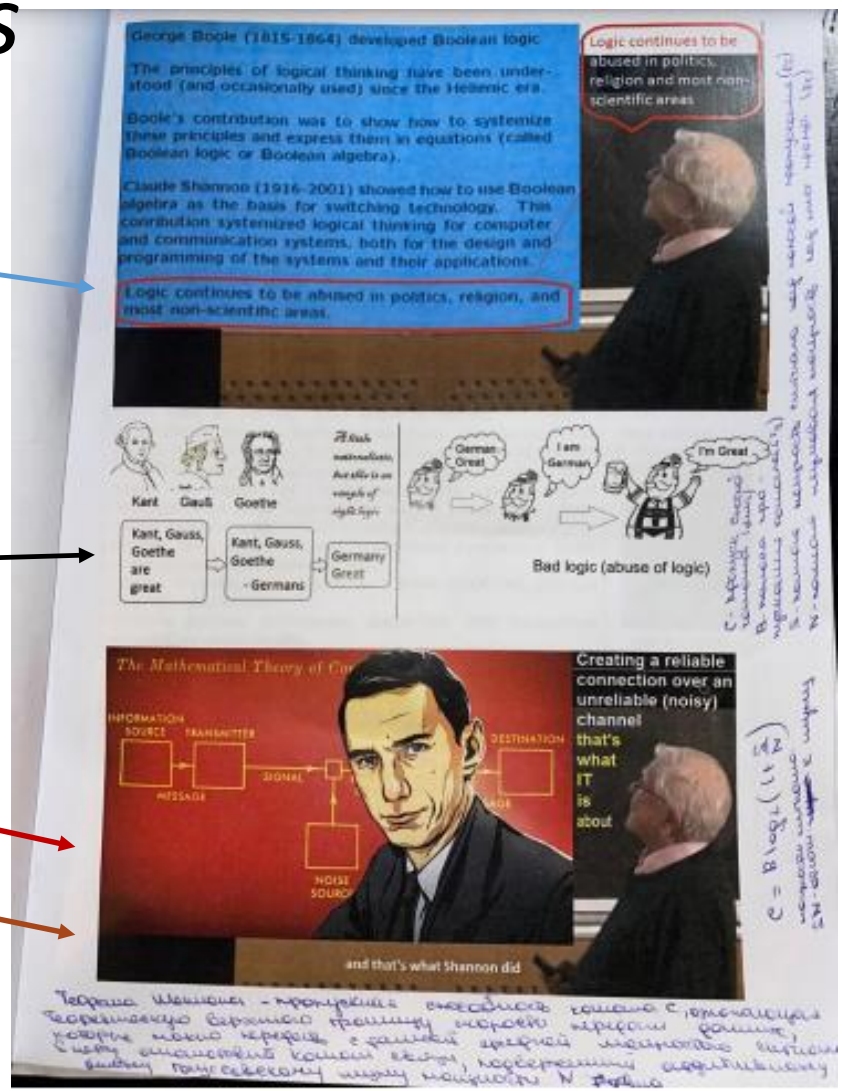
Abstract = *handout + your notes*

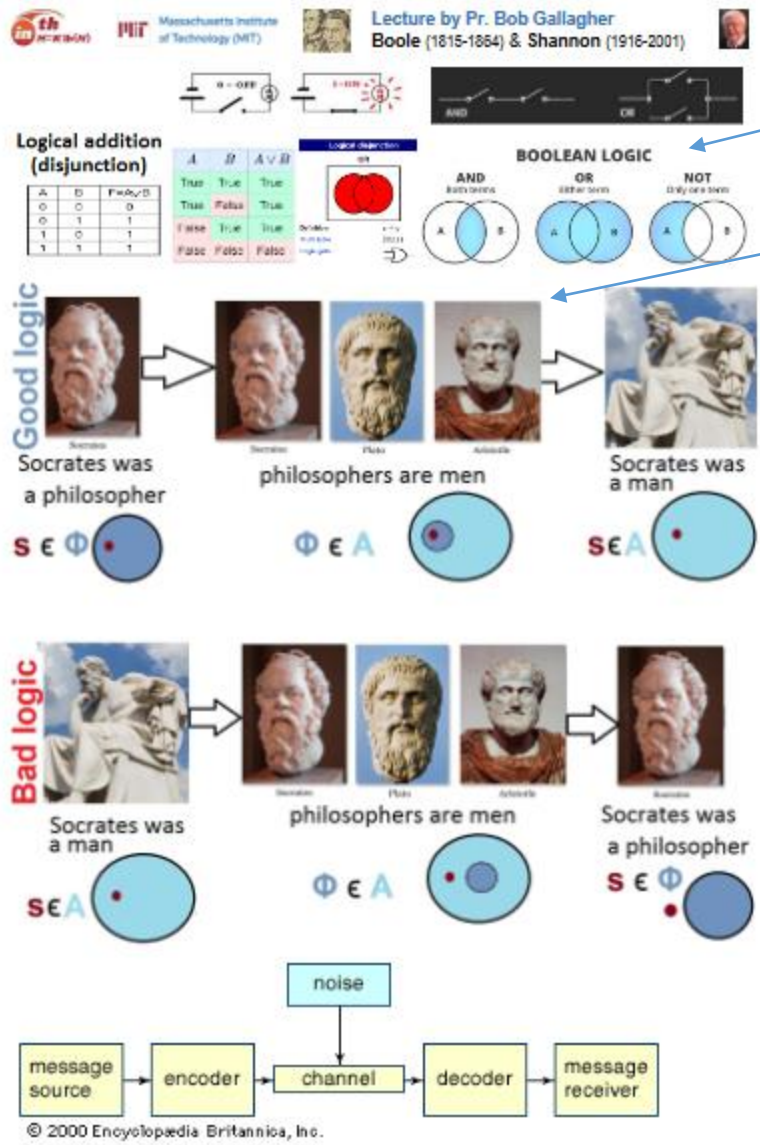
what is written there?

What does this picture mean?

What did Shannon do while developing Information Theory?

What Information Theory is about?

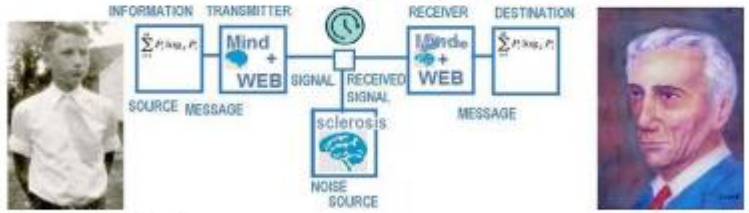




What is the difference between Boolean logic and Aristotelian logic?

What is this?

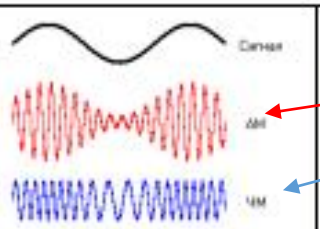
Is this girl good or bad?



School ==formalism==> University

then take notes on the lecture yourself

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



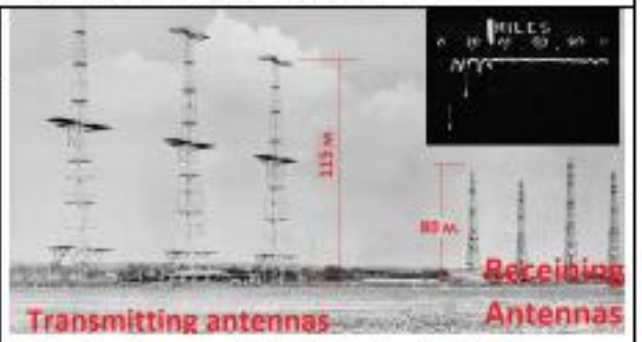
(October 6, 1866 – July 22, 1932)

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

What is this?

"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



Radar played a major role in the Battle of England

H. Nyquist

$$W = K \log m$$

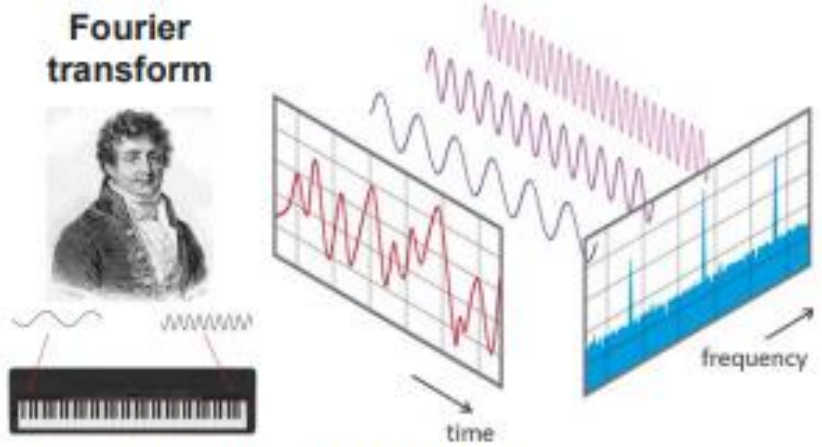
Where W is the speed of transmission of intelligence,
m is the number of current values,
and, K is a constant.

Ralph Hartley
(81:1888-1970)

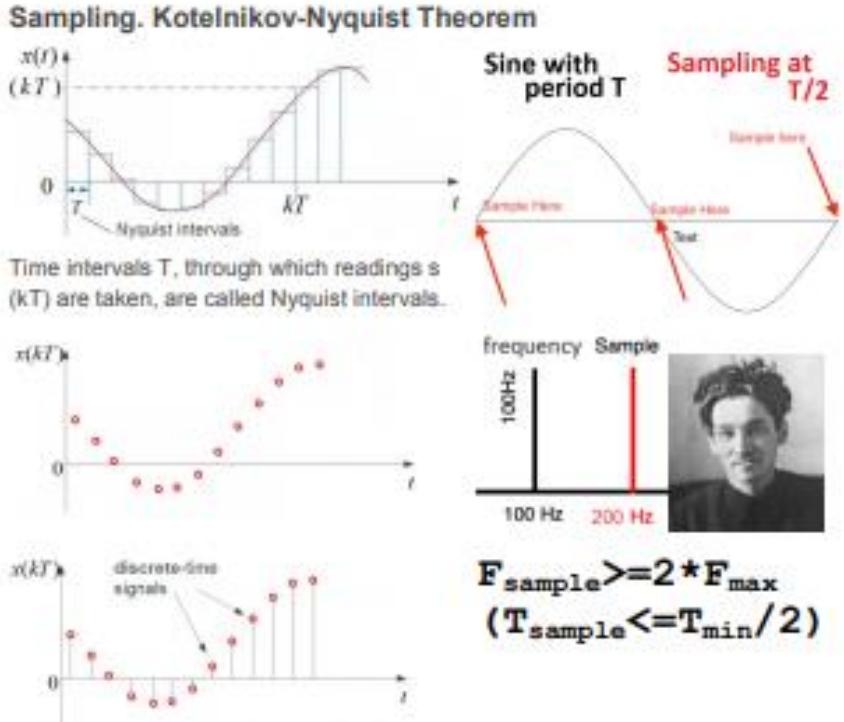
$$H = n \log s$$
$$= \log s^n.$$

what is the entropy of a deck of cards for Bridge, preference (or Durak)?

What is Fourier transform?



What is sampling?



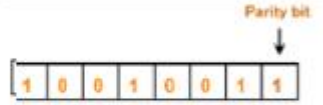
Who is this gentleman?

$F_{sample} >= 2 * F_{max}$

$(T_{sample} <= T_{min}/2)$

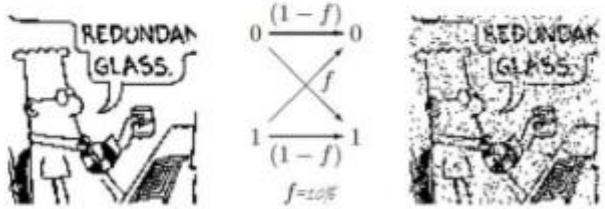
what good did he do for all of us

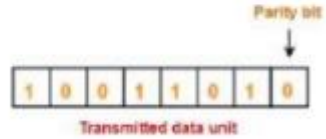
"I believe in clean energy,
but I also believe in mathematics"



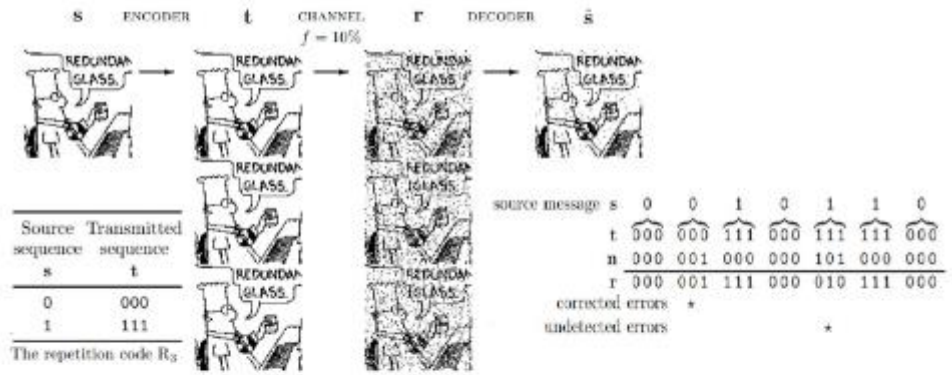
What is a parity bit?

What it is?





What it is?

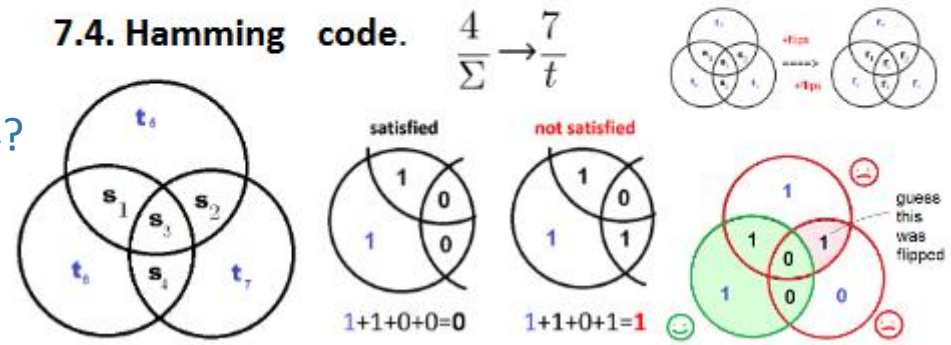


Source sequence s	Transmitted sequence t
0	000
1	111

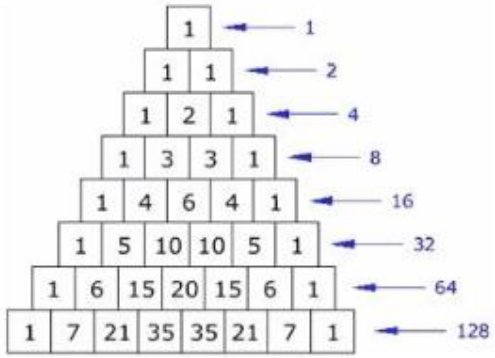
The repetition code R_3

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					*		

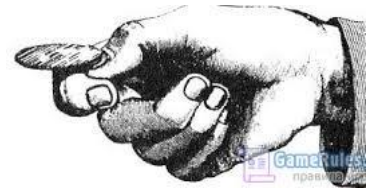
Why is the Hamming code number 7.4?



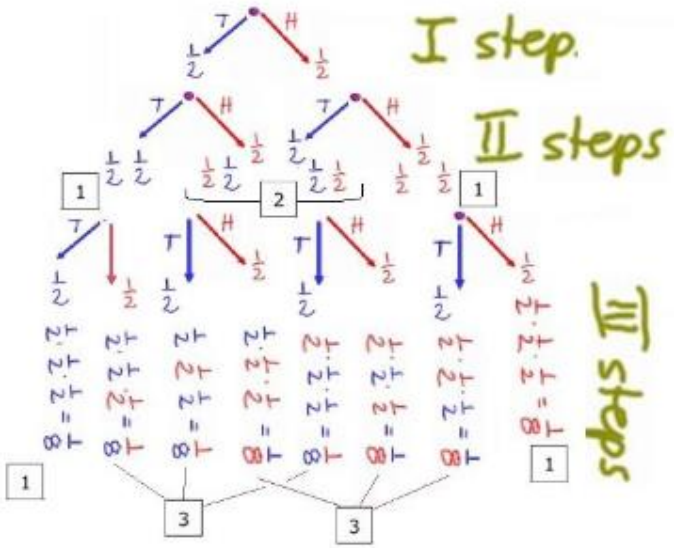
Encode the number 7 with Hamming code



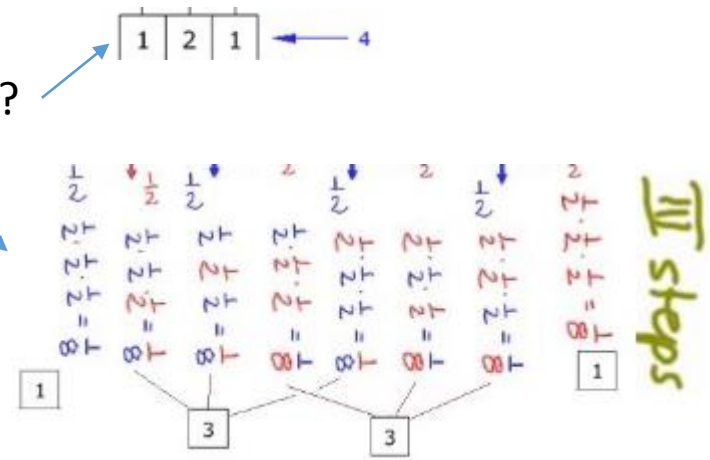
Pascal's triangle



Why did Pascal create his triangle?

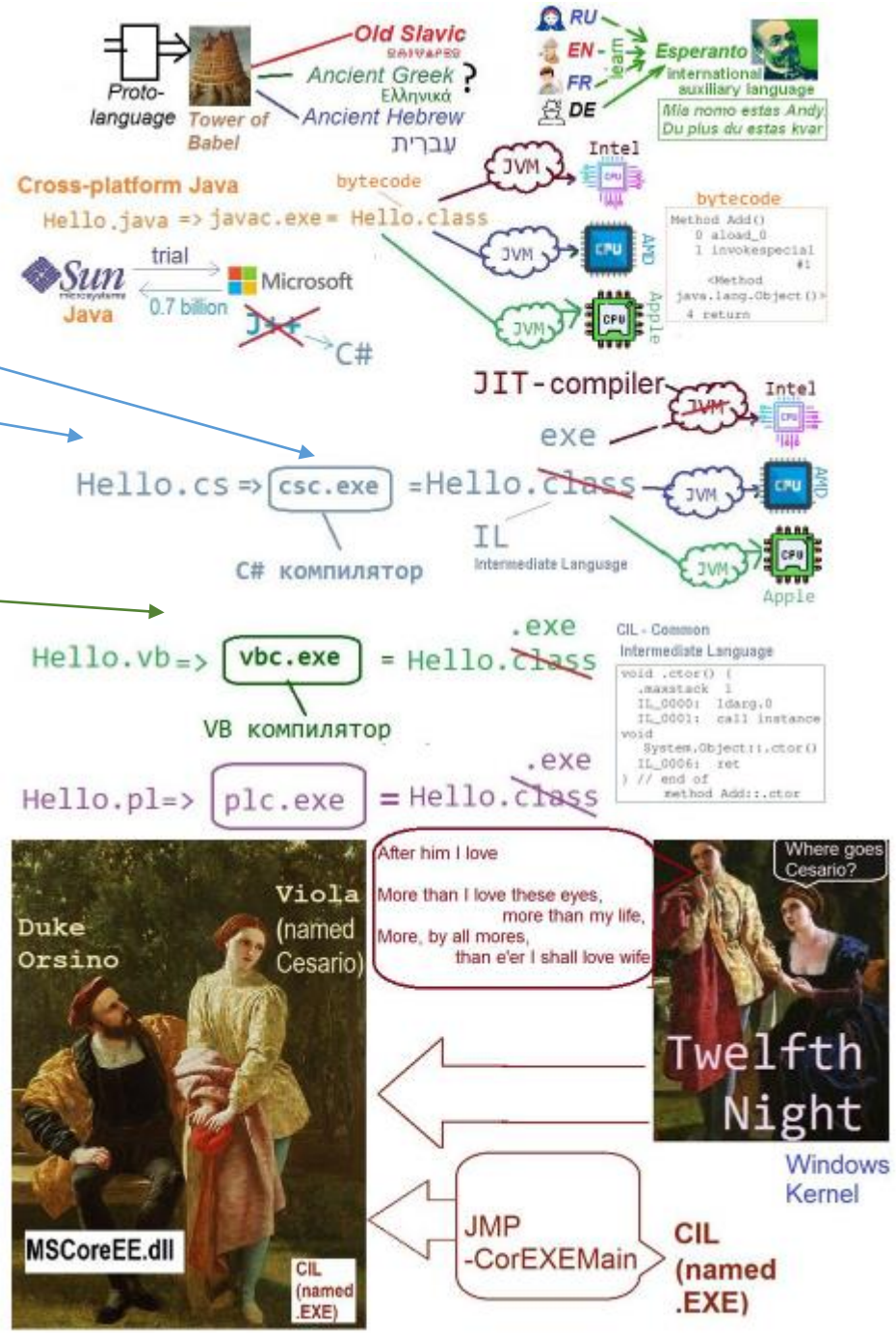


What is it?



What is this thing called?

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



Who wrote 12th. night

What is this?

```
class Dog
{
  public string name;
  public string bread;
  public int age;
```


```
  public void Bark()
  {
    Console.WriteLine("Woof woof!");
  }
```

What is this?

```
static void Main(string[] args)
{
    Dog dori = new Dog();  //Constructor works
    dori.age = 3;

    dori.name = "Dori";
    dori.breed = "Mongrel";
    dori.Bark();
}
```

What is this?

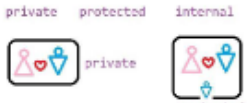
1 - **constructor** no returns value

2. The name of the **constructor** is the same name is the class.

3. more than one **constructor**

```
public Dog()
{
}
public Dog(string name)
{
    this.name = name;
}
public Dog(string name, string breed)
{
    this.name = name;
    this.breed = breed;
}
```

What is this?




```
class AFather
{
   protected string name;
   int age;
}
class ASon:AFather
{
    public ASon(string name)
    {
       base.age = 33;
       base.name = name;
    }
}
```

unavailable available

What is this?


```
class Program
{
    static void Main(string[] args)
    {
        AFather af = new AFather();
        ASon andy = new ASon("Olaf");
    }
}
```

What is this?

Program.exe

```
class AFather
{
   protected string name;
   internal int age;
}

class Program
{
    static void Main(string[] args)
    {
        AFather af = new AFather();
        af.age = 33;
        ASon andy = new ASon("Olaf");
    }
}
```

available
unavailable

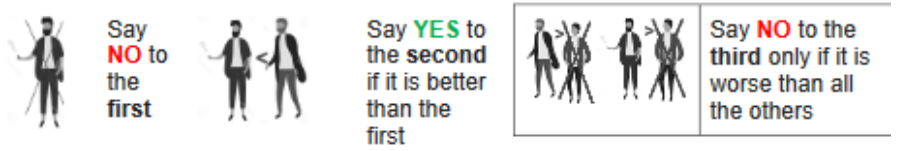
ASon.dll

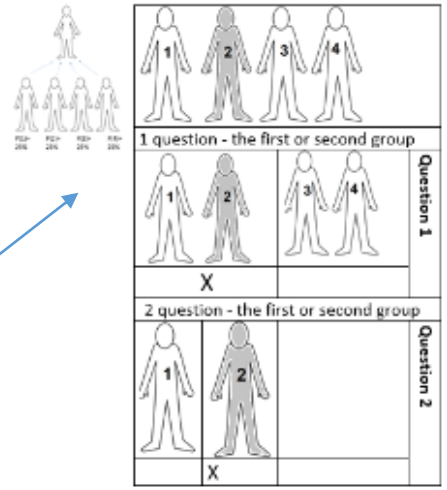
```
class ASon:AFather
{
    public ASon(string name)
    {
        base.name = name;
        base.age = 33;
    }
}
```

What is this?

What is this?

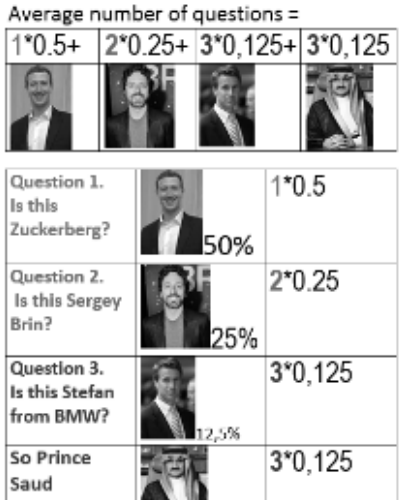
What is this?

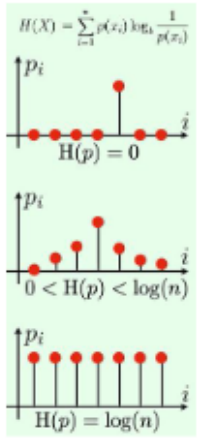




Average number of questions =

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





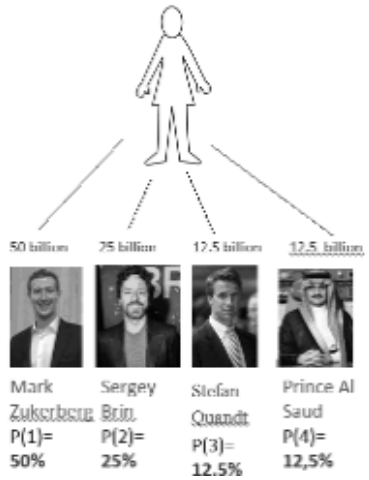
$$\sum_{i=1}^{n} p(i) \log_2 \frac{1}{p(i)}$$

Quantifying information

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

number of bits required to encode choice

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



Calculate your bonuses for the exam – before the exam starts

Amount

DKK kr.5

Converted to

USD $0.77

data.bls.gov/cgi-bin/c...

CPI Inflation Calculator

$ 0.77

in January 1998

has the same buying power as

$1.53

in May 2025

Calculate

+0.5 to Exam 22.3.23

KATYA = 5!/2!

To: vanojefferson@g

Date: Thu, 1 May 2025

Subject: +0.5: QUEST 1 35

0.5

\+ 1.53

\+ 0.5

ANSWER: 1929

= 2.53

Не очко обычно губит,

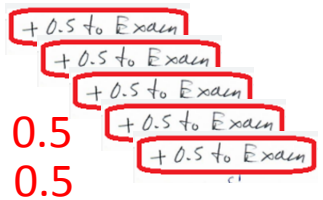
а к 11 туз

[песня «Владимирский централ»]

For it is when you overplay your hand

That you will probably lose.

[It is not the lack that ruins, but the excess]



0.5
0.5
0.5
0.5
0.5

\+ 1.53
0.5

To: vanojefferson@g
Date: Thu, 1 May 2025
Subject: +0.5: QUEST 1 3
ANSWER: 1929

= 4.53

3.03