

# INTELIGÊNCIA COMPUTACIONAL

TEORIA DE GRAFOS E REDES

FELIPE TORRES

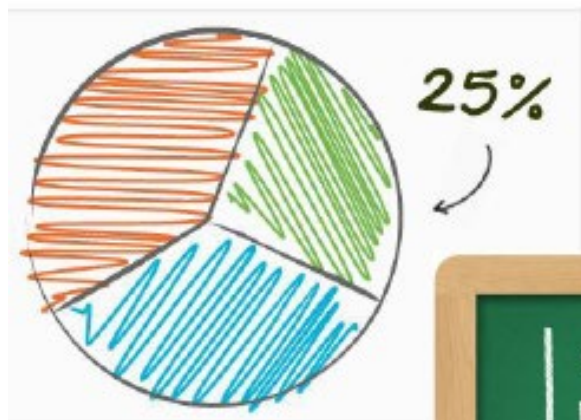
# O QUE É A TEORIA DE GRAFO ?

A **teoria dos grafos** é um ramo da matemática que estuda as relações entre os objetos de um determinado conjunto.

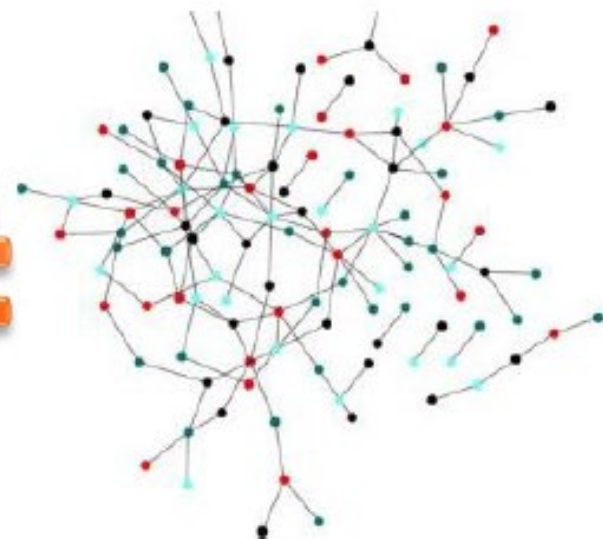
**Biggs et al., 1986**



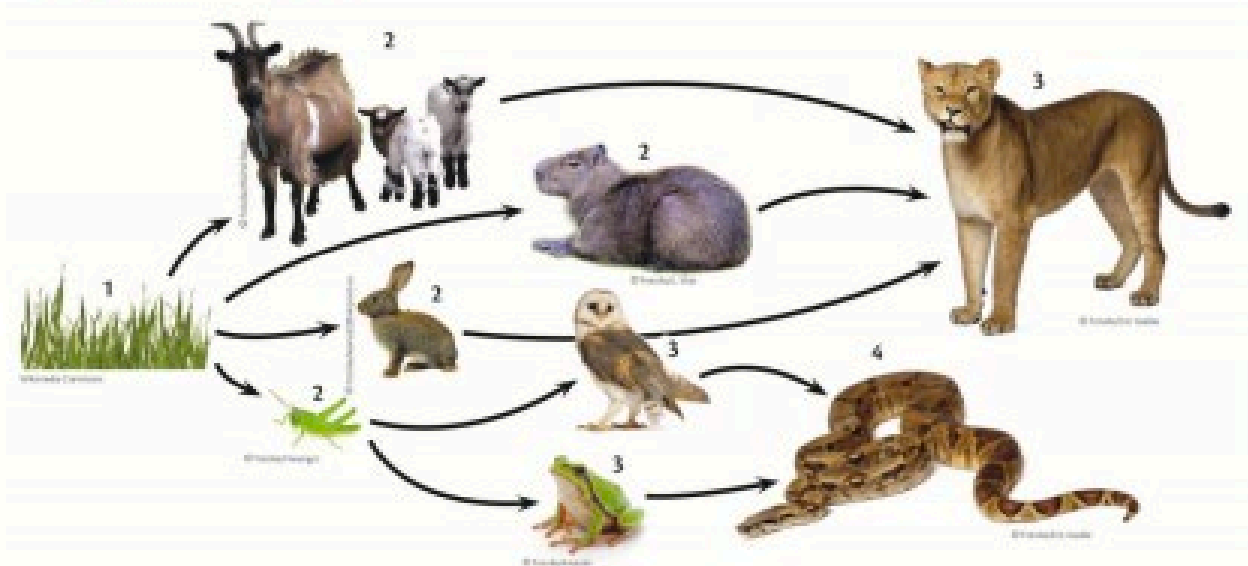
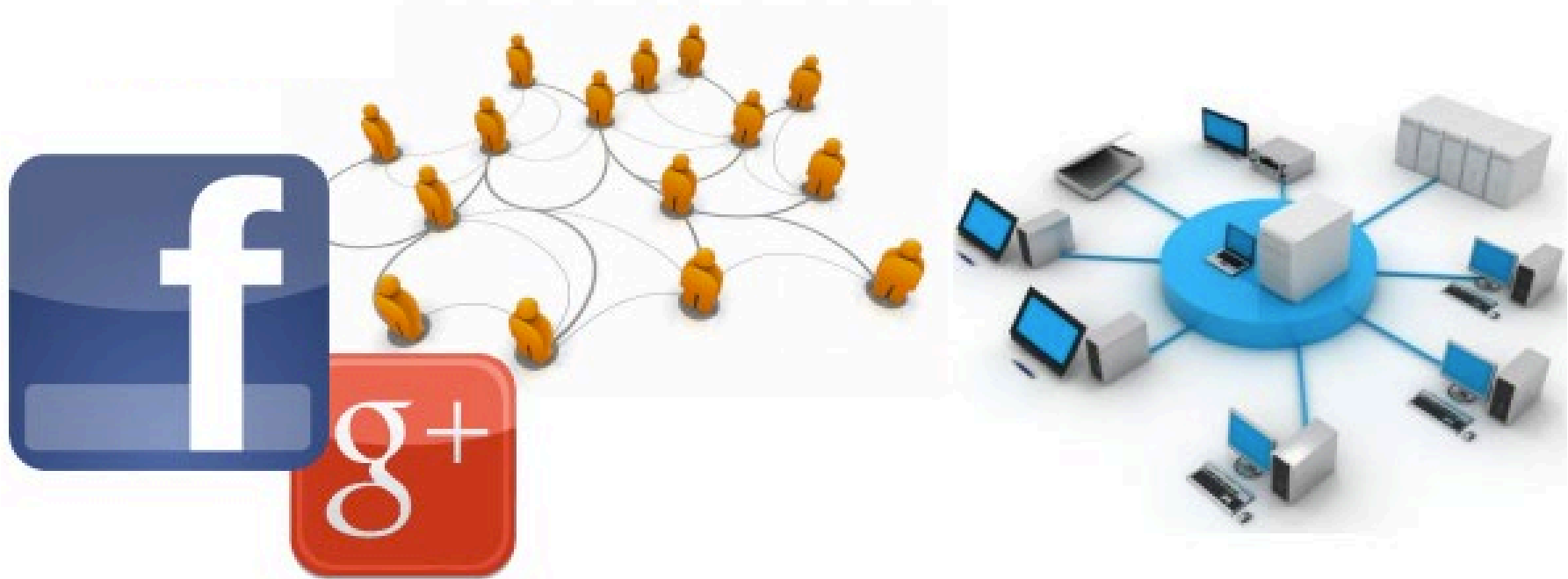
# GRÁFICO <> GRAFOS



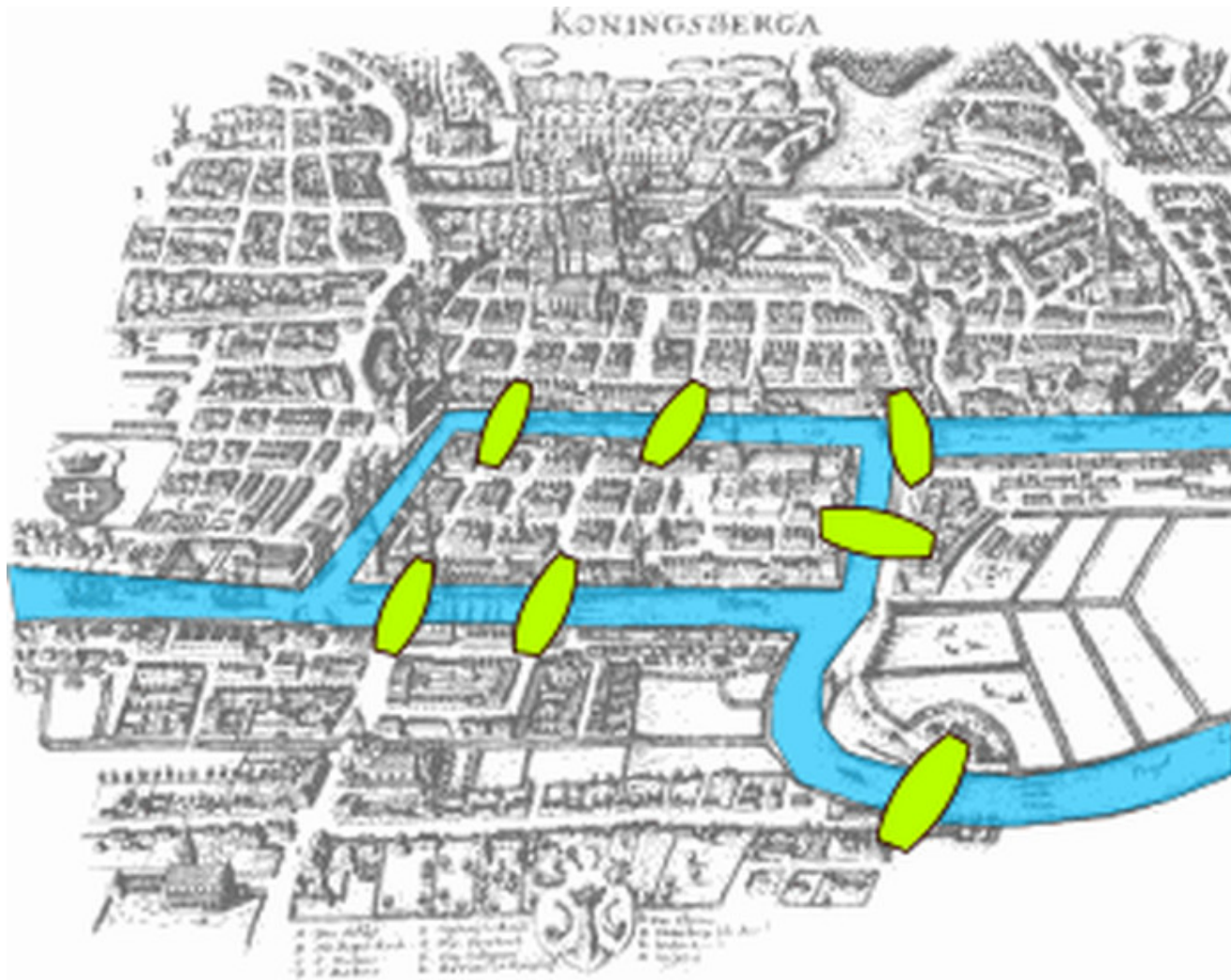
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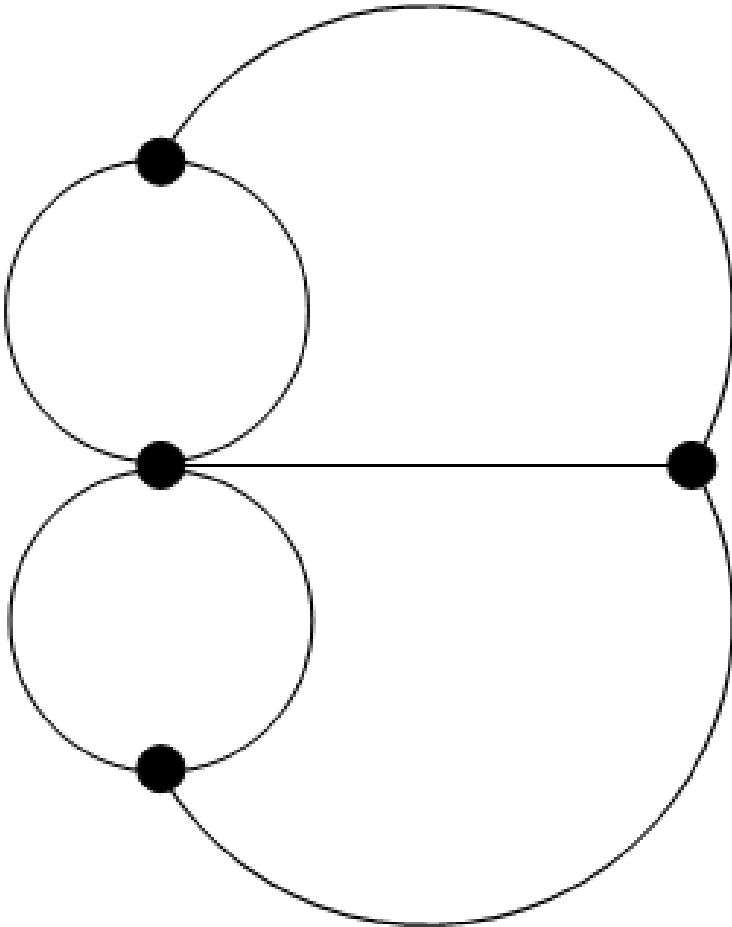
# VOCÊ JÁ VIU ALGO PARECIDO COM ISSO ?



# O PROBLEMA INICIAL



# O GRAFO QUE REPRESENTA O PROBLEMA



**LEONHARD EULER**





# SOLUÇÃO DO PROBLEMA

128

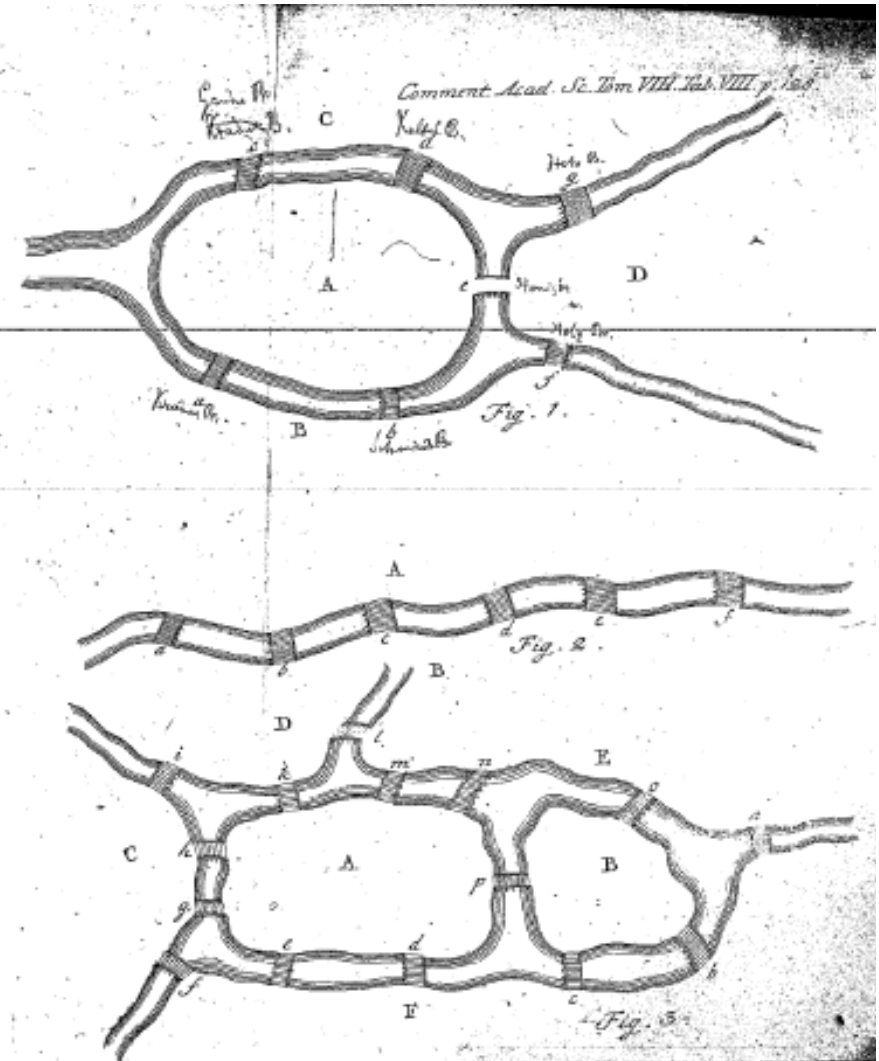
SOLVTIO PROBLEMATIS  
SOLVTIO PROBLEMATIS  
AD  
GEOMETRIAM SITVS  
PERTINENTIS.  
AVCTORE  
Leonb. Eulero.

§. I.

Tabula VIII.

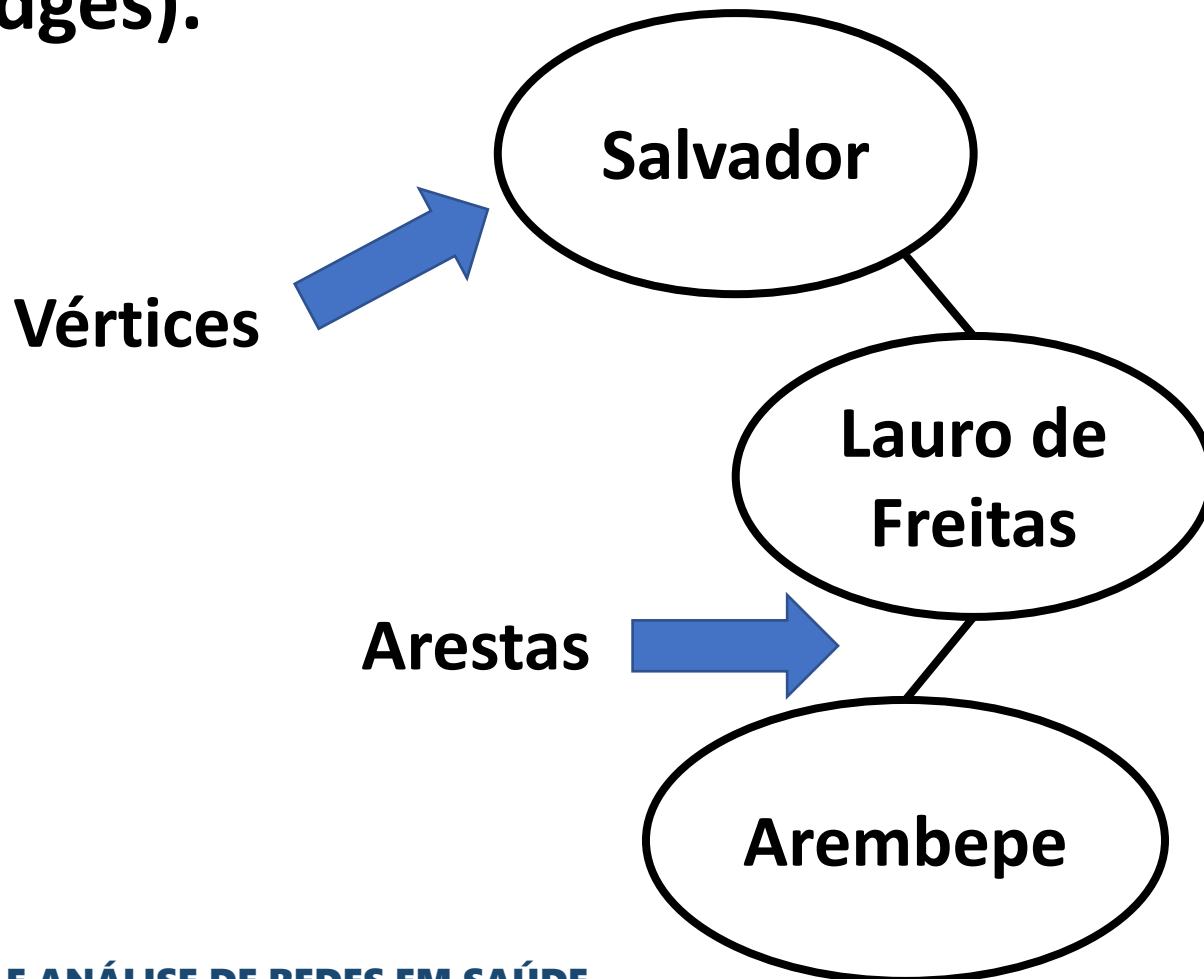
**P**raeter illam Geometriae partem, quae circa quantitates versatur, et omni tempore summo studio est excolta, alterius partis etiamnum admodum ignotae primus mentionem fecit *Leibnitzius*, quam Geometriam situs vocauit. Ista pars ab ipso in solo sui determinando, situsque proprietatibus eruendis occupata esse statuitur; in quo negotio neque ad quantitates respiciendum, neque calculo quantitatum vrendum sit. Cuiusmodi autem problemata ad hanc situs Geometriam pertineant, et quasi methodo in his resoluendis vti oporteat, non satis est definitum. Quamobrem, cum super problematis cuiusdam mentio esset facta, quod quidem ad geometriam pertinere videbatur, at ita erat comparatum, vt neque determinationem quantitatum requireret, neque solutionem calculi quantitatum ope admitteret, id ad geometriam situs referre haud dubitauit: praesertim quod in eius solutione solus situs in considerationem veniat, calculus vero nullius prorsus sit vñs. Methodum ergo meam quam ad huius generis problemata

mata



# ESTRUTURA BÁSICA DE UM GRAFO

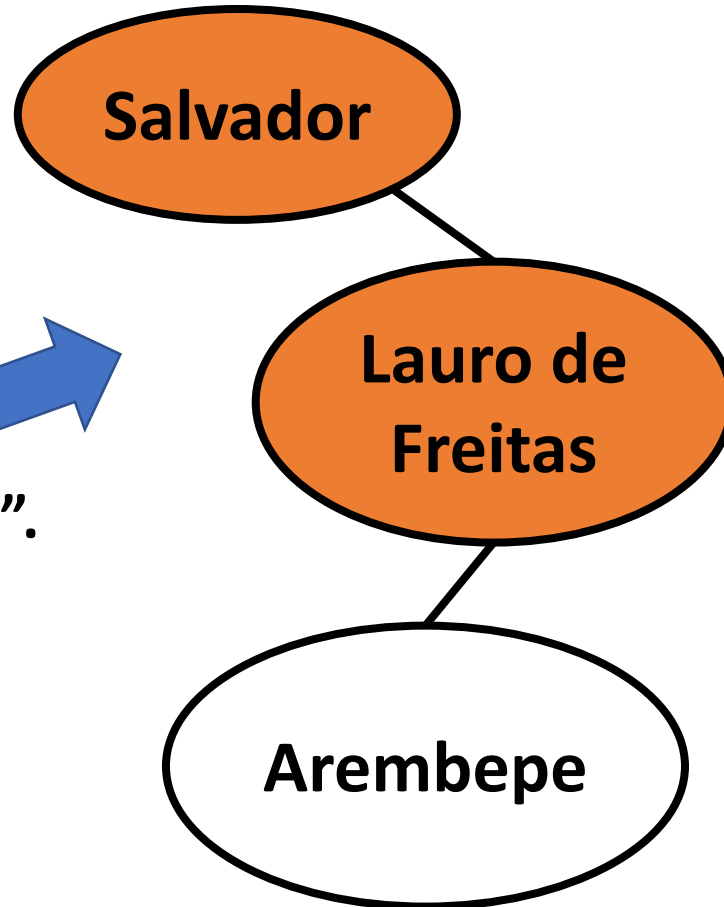
Um grafo é formado por **vértices (vortex)** e **arestas (edges)**.



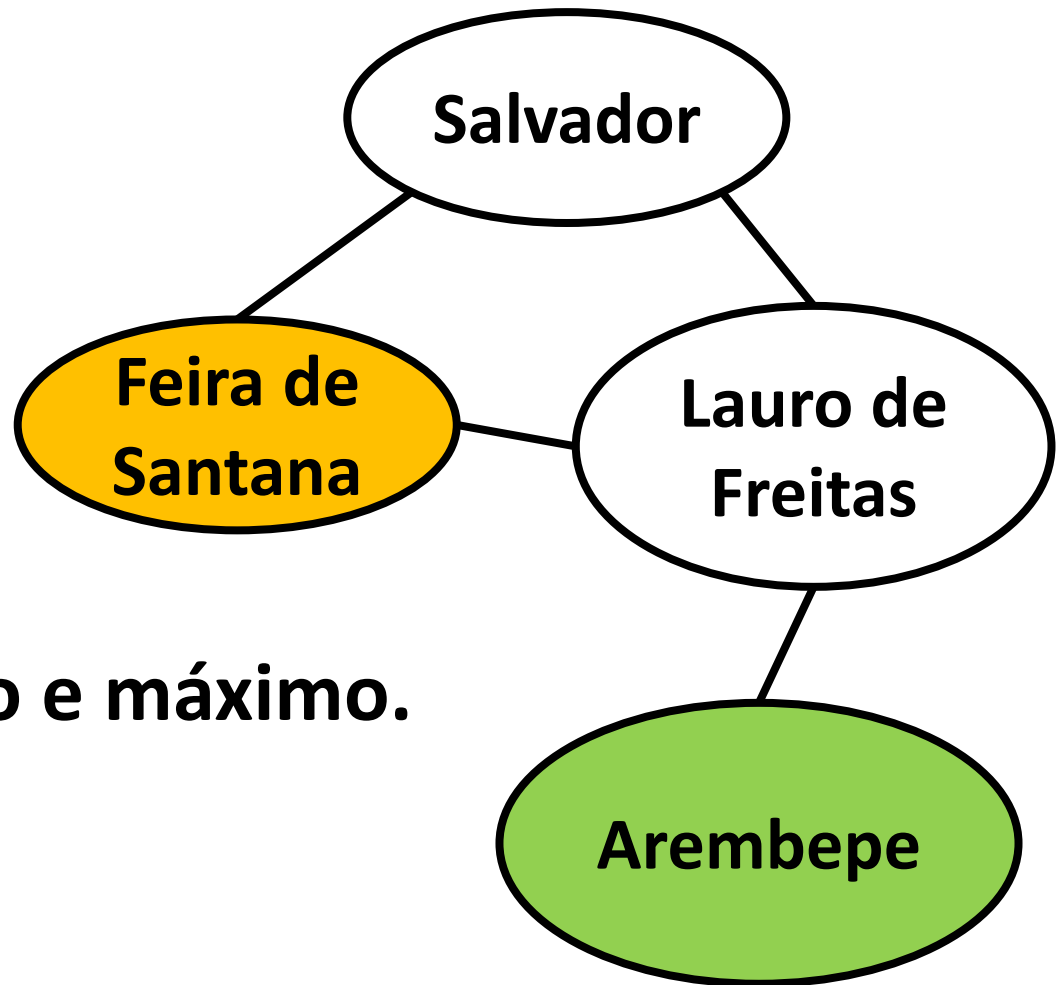


# ESTRUTURA BÁSICA DE UM GRAFO

Somos vértices adjacentes.  
Temos conexão, somos “vizinhos”.



# ESTRUTURA BÁSICA DE UM GRAFO



**Caminho mínimo e máximo.**

# EXEMPLO DE USO DO MENOR CAMINHO

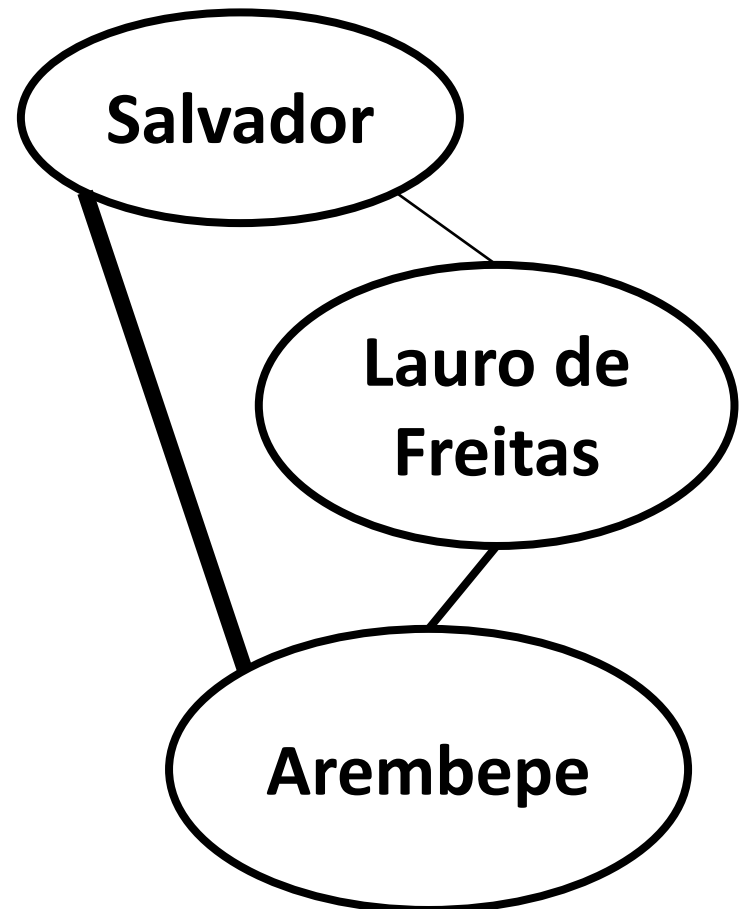


# ESTRUTURA BÁSICA DE UM GRAFO

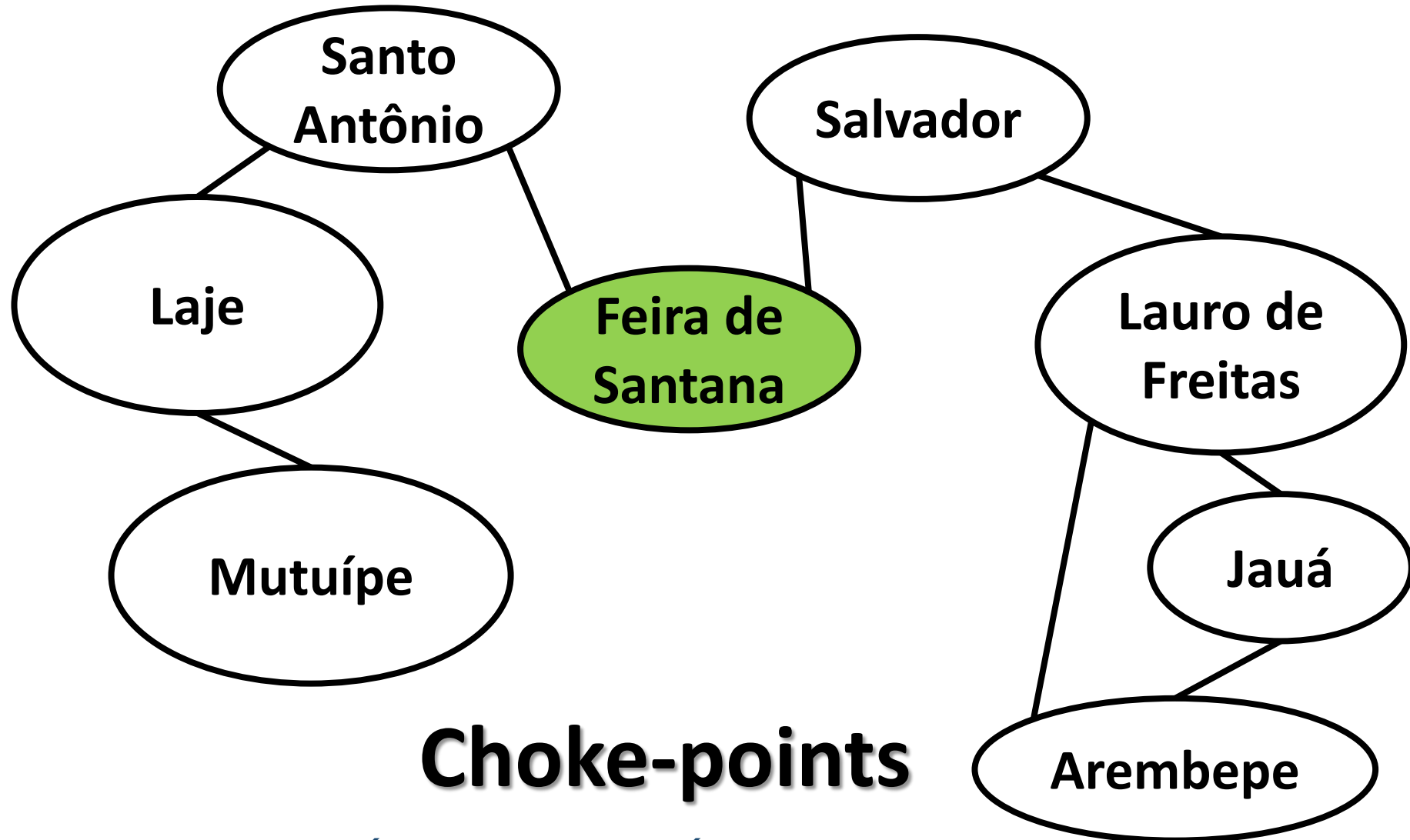
**Grafo não-ponderado**



**Grafos ponderado**



# ESTRUTURA BÁSICA DE UM GRAFO



# EXEMPLO DO WAZE



# TEORIA DOS SEIS GRAUS DE SEPARAÇÃO



**Stanley Milgram**

Relizou um estudo, **em 1967**, onde participantes tinham que levar uma carta a um indivíduo específico passando-a para pessoas que conhecessem alguém próximo a ele.

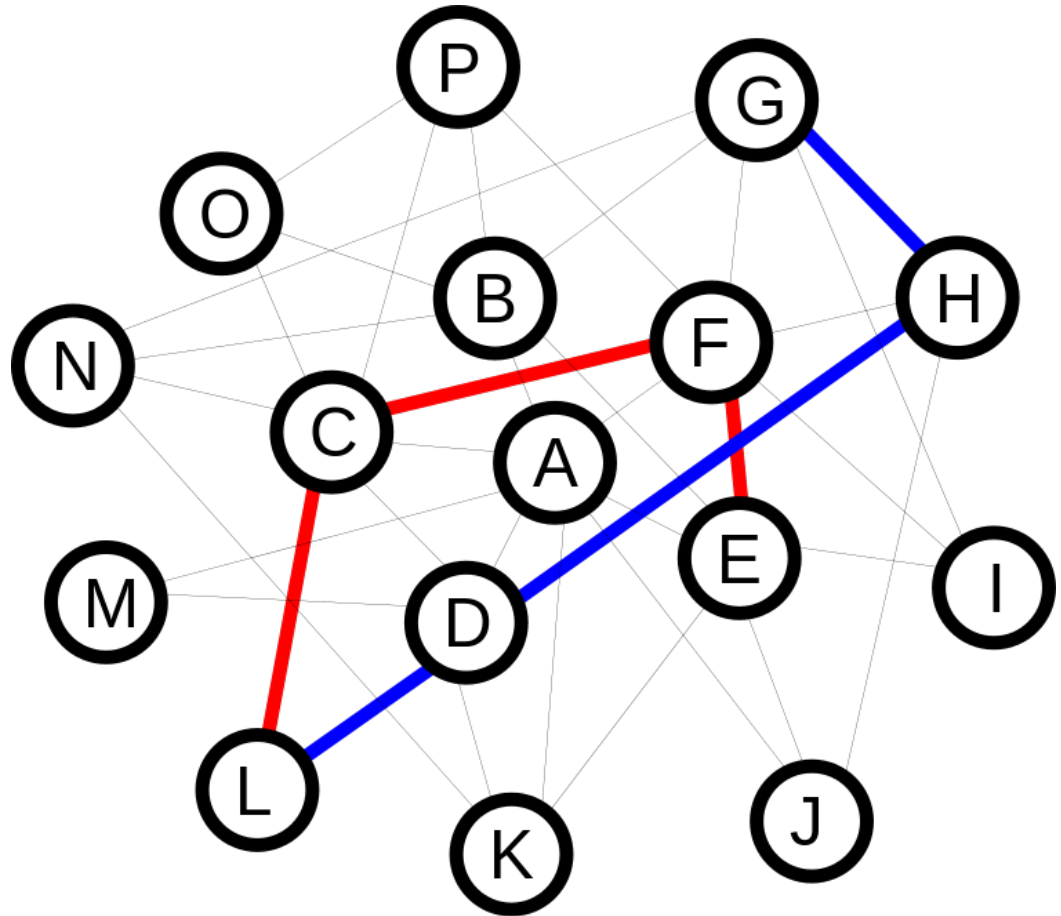
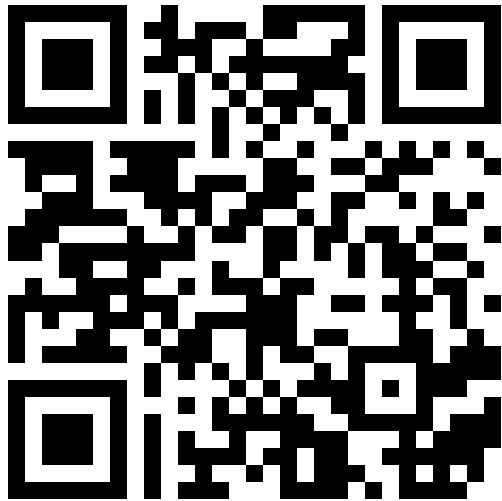
A carta passava, em média, por **cinco pessoas** antes de chegar ao destino, em um total de seis graus de separação.



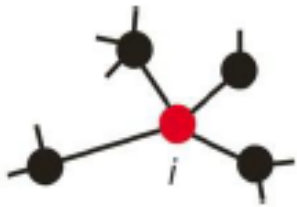
# TEORIA DOS SEIS GRAUS DE SEPARAÇÃO



# TEORIA DOS SEIS GRAUS DE SEPARAÇÃO

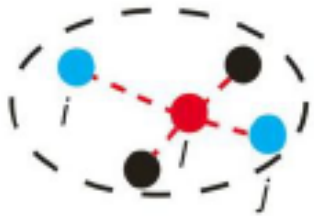


# MEDIDAS DE GRAU E CENTRALIDADE



Grau

$k_i =$  Número de arestas conectadas ao nó  $i$



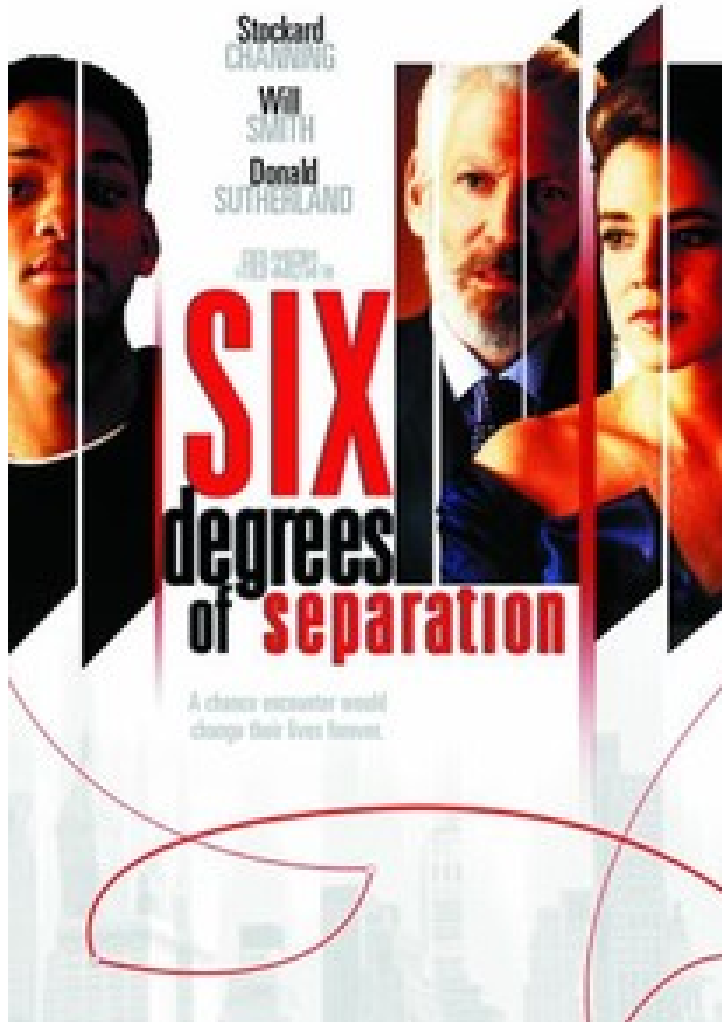
Centralidade

$b_l = \sum_{ij} p_{ij}(l) / p_{ij}$

$p_{ij}$  Número de menores caminhos entre  $i$  e  $j$

$p_{ij}(l)$  Número de menores caminhos entre  $i$  e  $j$  passando por  $l$

# SEIS GRAUS DE SEPARAÇÃO



# TEORIA DOS SEIS GRAUS DE SEPARAÇÃO

by FACEBOOK

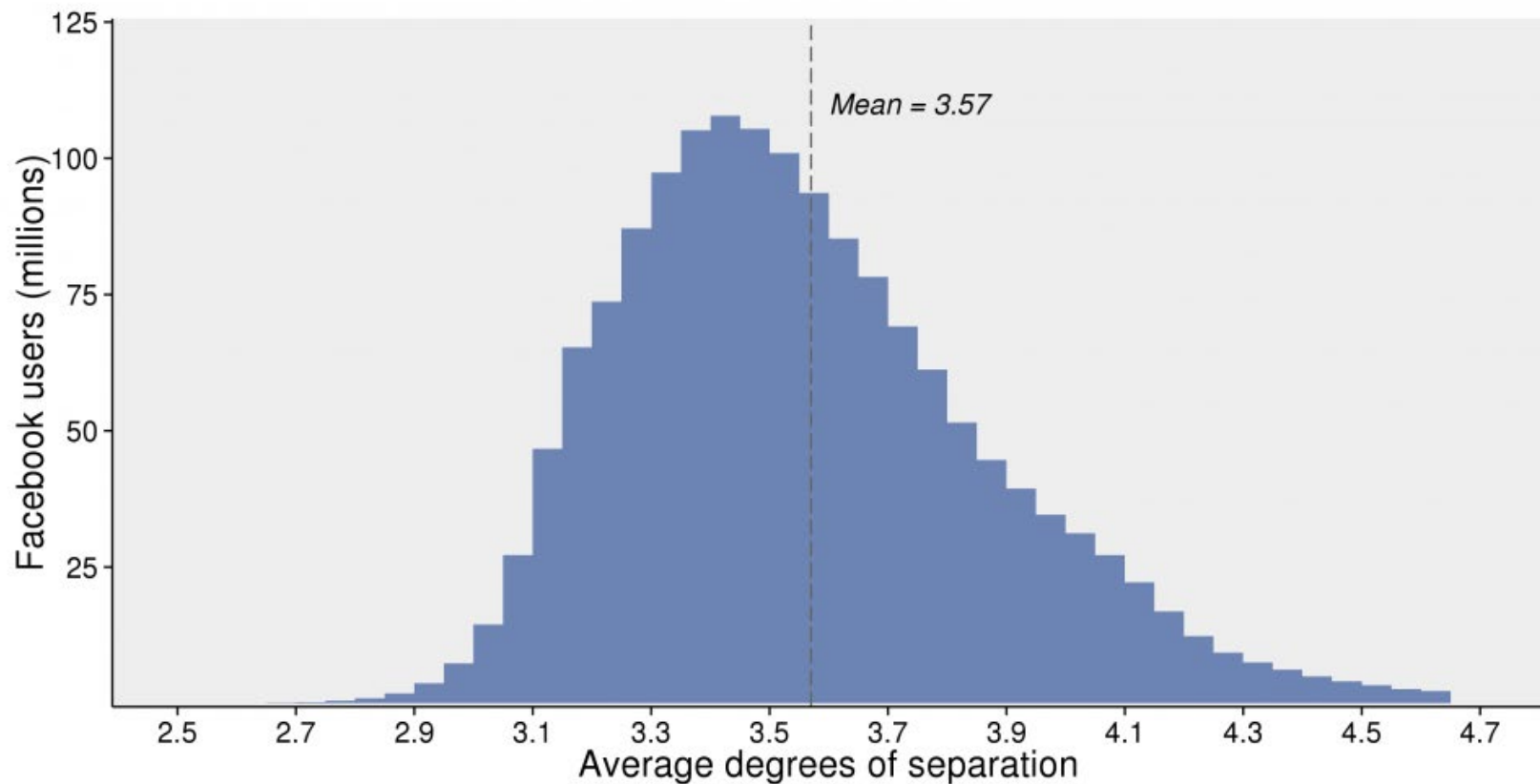
2008

2011



# TEORIA DOS SEIS GRAUS DE SEPARAÇÃO

by FACEBOOK



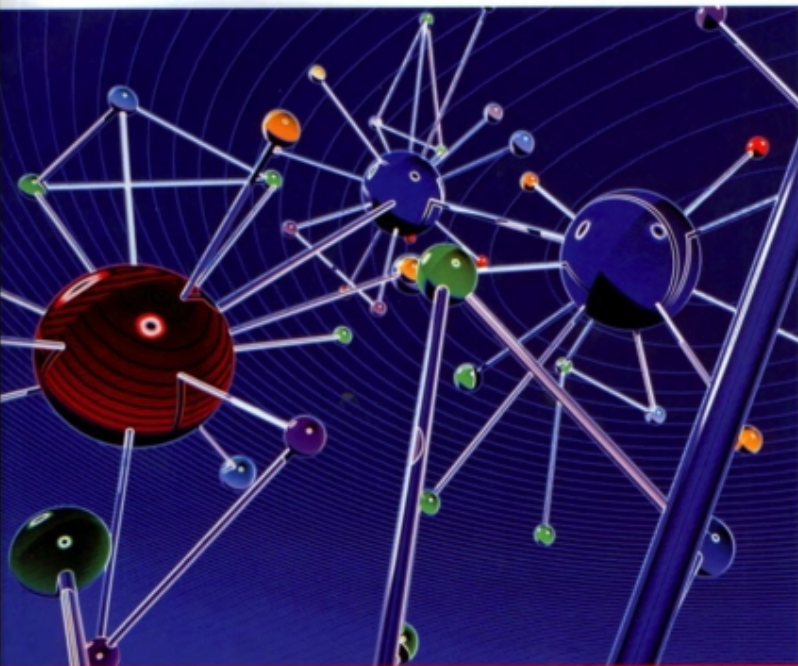


# QUANDO GRAFO VIROU COISA DA SAÚDE ?

**nature**  
REVIEWS

january 2011 volume 12 no. 1  
www.nature.com/reviews

**GENETICS**



## **NETWORK MEDICINE**

Developing and harnessing networks to study and treat disease

## **Molecular matchmaking**

How small RNAs pair with the correct Argonaute protein partners

**nature**  
REVIEWS

february 2004 volume 5 no. 2  
www.nature.com/reviews

**GENETICS**

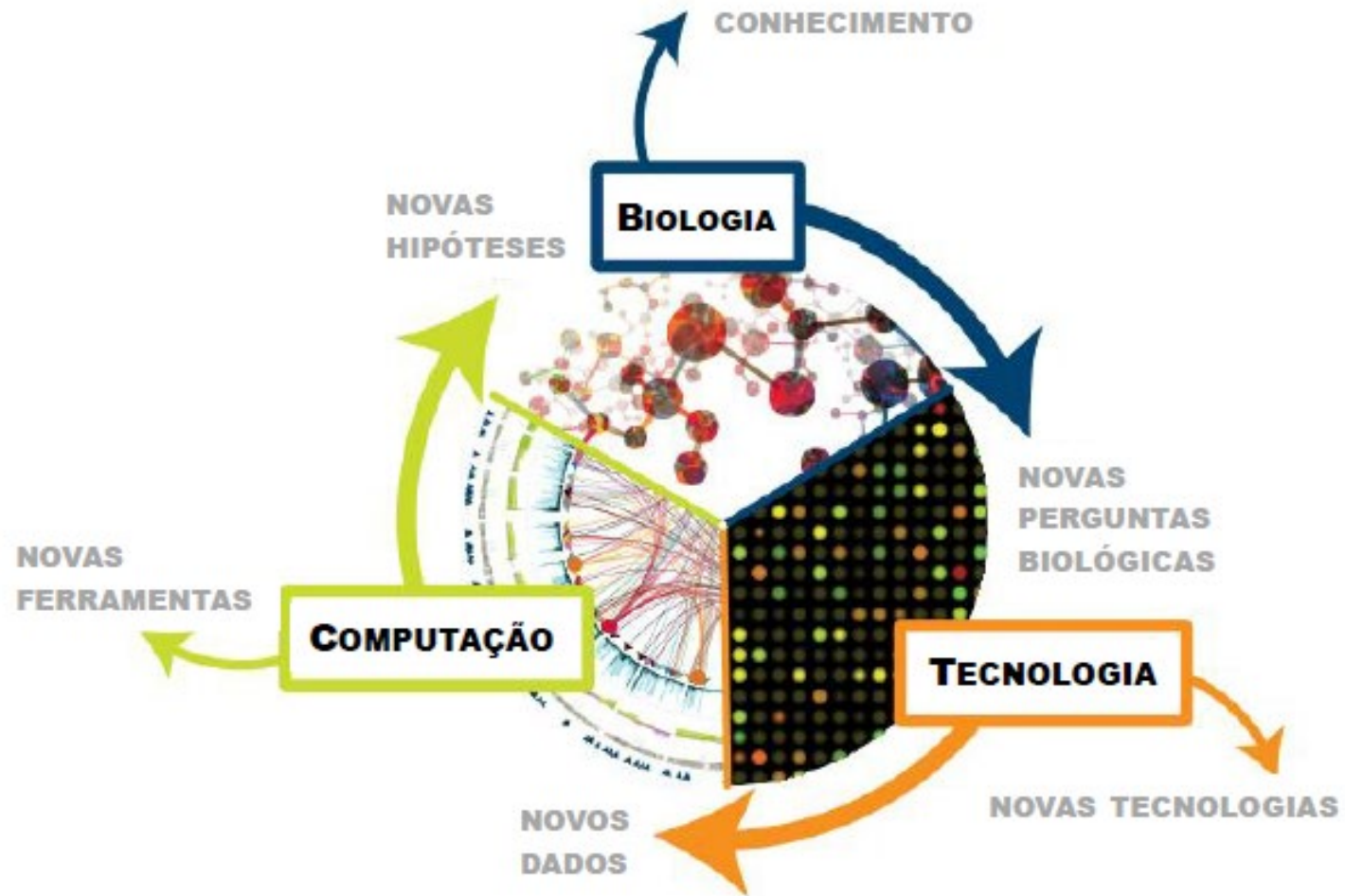


**TEORIA DE GRAFOS E ANÁLISE DE REDES EM SAÚDE**





# BIOLOGIA DE SISTEMAS



# MY GENES FRIENDS

HELLO. SIGN IN TO **MYGENEFRIENDS** TO START YOUR JOURNEY.

*'Because genes and diseases need friends too...*

Email

Password

Please fill out this field.

Login

Forgot password ?

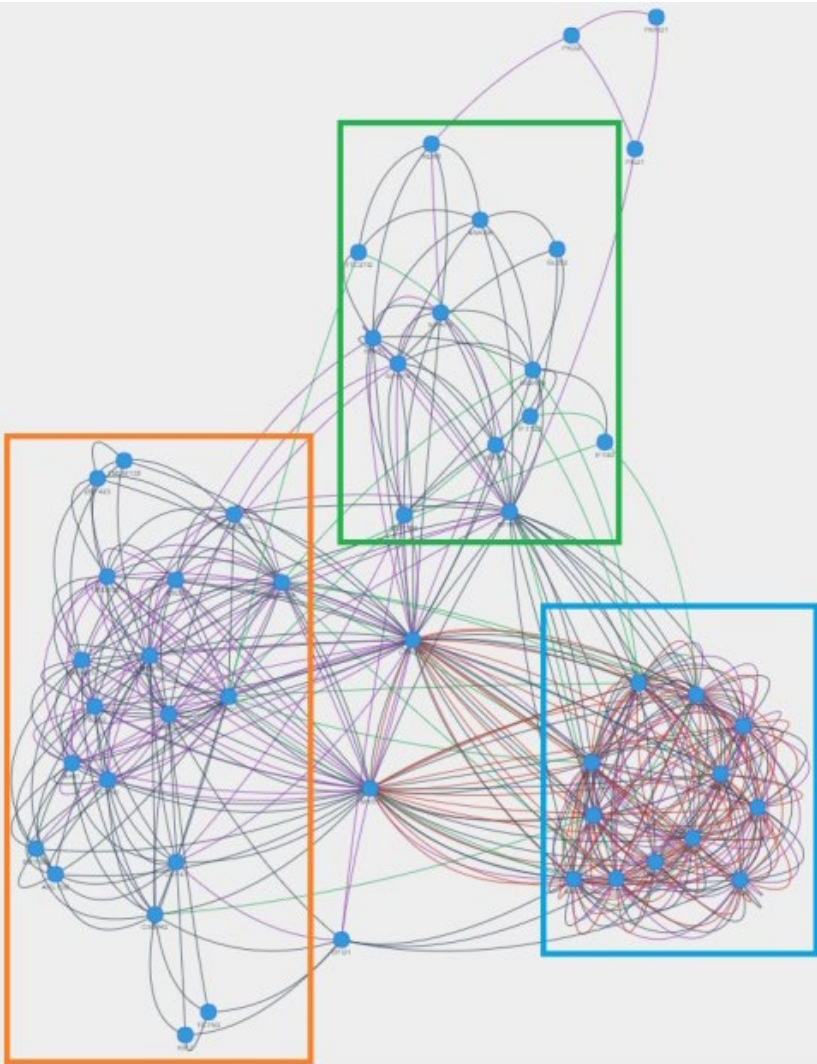
No account yet ? Click here to Register

 Here you can find and befriend new interesting genes and diseases that share your interests

Don't want to register yet ? Click here to login with a new [Demo Account](#)

**<http://lbgi.fr/genebook/login>**

# MY GENES FRIENDS



Dynamic network visualization of relationships between actors. Network of 52 genes related to Congenital Hepatic Fibrosis (CHF), a developmental disorder most frequently associated.

# INTELIGÊNCIA COMPUTACIONAL

TEORIA DE GRAFOS E REDES

FELIPE TORRES