

# INTRODUÇÃO À PROGRAMAÇÃO UTILIZANDO O R

Aula 1 – Conceitos básicos  
Parte 1

1º Meetup

# R-Ladies Floripa

Sábado, 25 de maio e 01 de junho, das 13h às 18h.

Minicurso:  
Introdução à  
programação  
usando o R e  
o R Studio

Quer aprender a  
programar mas não sabe  
por onde começar?  
Este curso é para você!



Organizadoras locais:



Aishameriane Schmidt  
@AishamerianeS



Camila Weber  
@camilatweber

Apoio: Grupo DOT e Aquarela Analytics



Mais informações e inscrições: <https://www.meetup.com/pt-BR/r-ladies-florianopolis/>



# AISHAMERICANE SCHMIDT

- 3/4 Técnica em Eletrônica* (Liberato, 2003)
- 1 Estatista Bacharel em Estatística* (UFRGS, 2010)
- 9/10 Economista* (UDESC, 2019?)
- 1 Mestra em Economia* (UFSC, 2019)



AISHAMERICANE  
SCHMIDT

*Trabalhou com estatística aplicada a*

- *Marketing,*
- *Pesquisa em saúde pública e genética,*
- *Produtos financeiros,*
- *Sistemas de recomendação*
- *Modelos preditivos em educação*
- *etc*



AISHAMERICANE  
SCHMIDT

*Não poderia viver de fazer programa*



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- *Modelos preditivos em educação*
- *etc*

*Não poderia viver de fazer programa*

KÄTLIN  
STACKE

$\frac{9}{10}$  Bacharel em Economia (UFSC, 2019)



# KÄTLIN STACKE

*Passou por estes lugares*

- *Clube de Finanças da (ESAG),*
- *Consulting Club (UFSC),*

*Possui experiência na área atuarial e  
governança corporativa.*



KÄTLIN  
STACKE

*Começou a programar no R na aula da Aisha*



KÄTLIN  
STACKE

Tem como meta continuar evolvendo  
o Pokémon no R



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$\frac{9}{10}$  Bacharel em Economia (UFSC, 2019)

*Passou por estes lugares*

- Clube de Finanças da (ESAG),
- Consulting Club (UFSC),

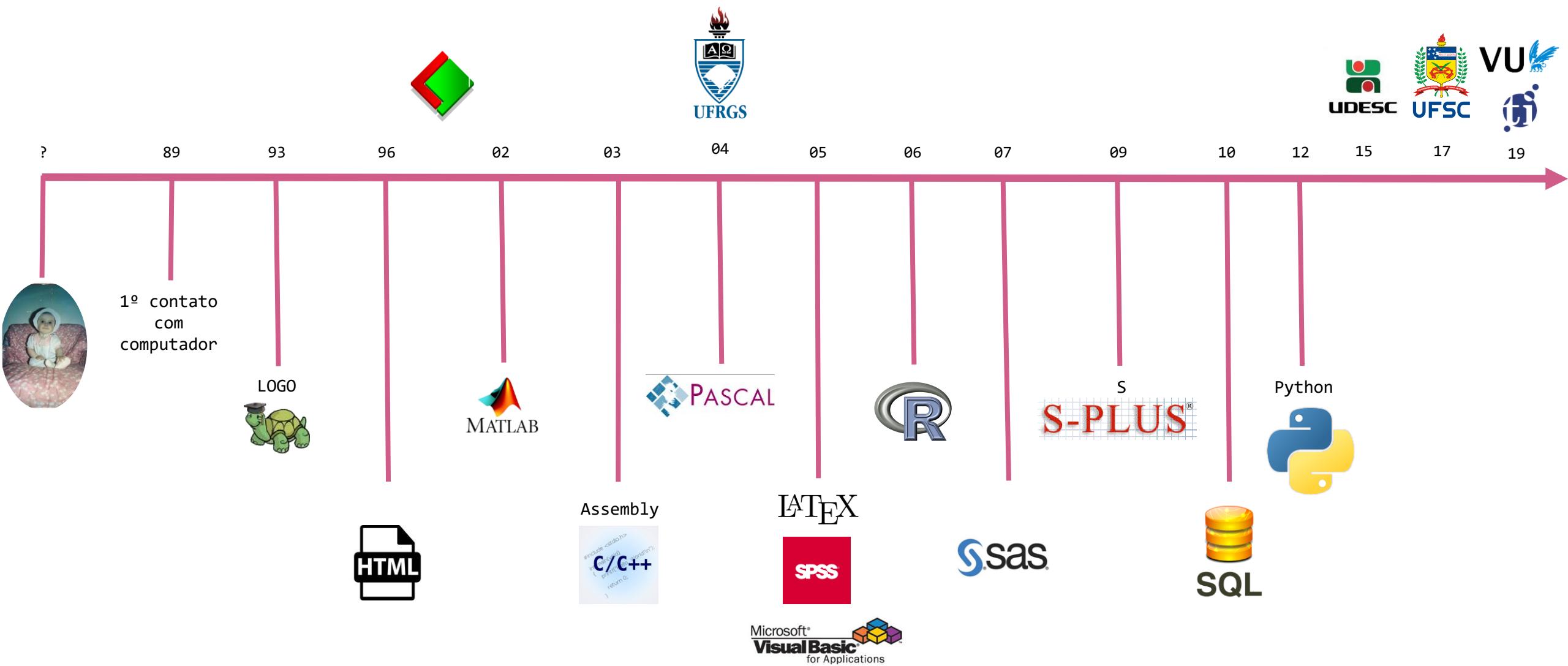
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*Começou a programar no R na aula da Aisha*

*Tem como meta continuar evoluindo o Pokémon no R*

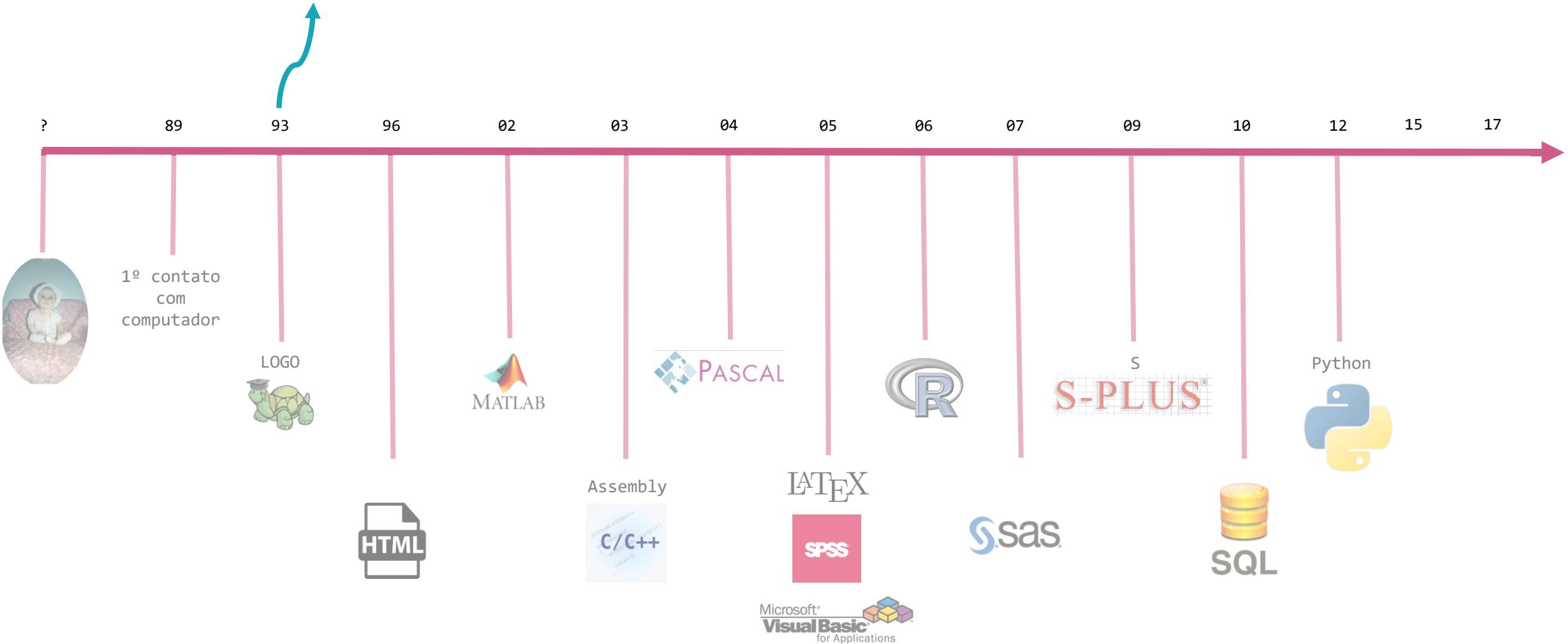


# Aishameriane Schmidt



Formatou o  
computador da  
família tentando  
instalar um jogo

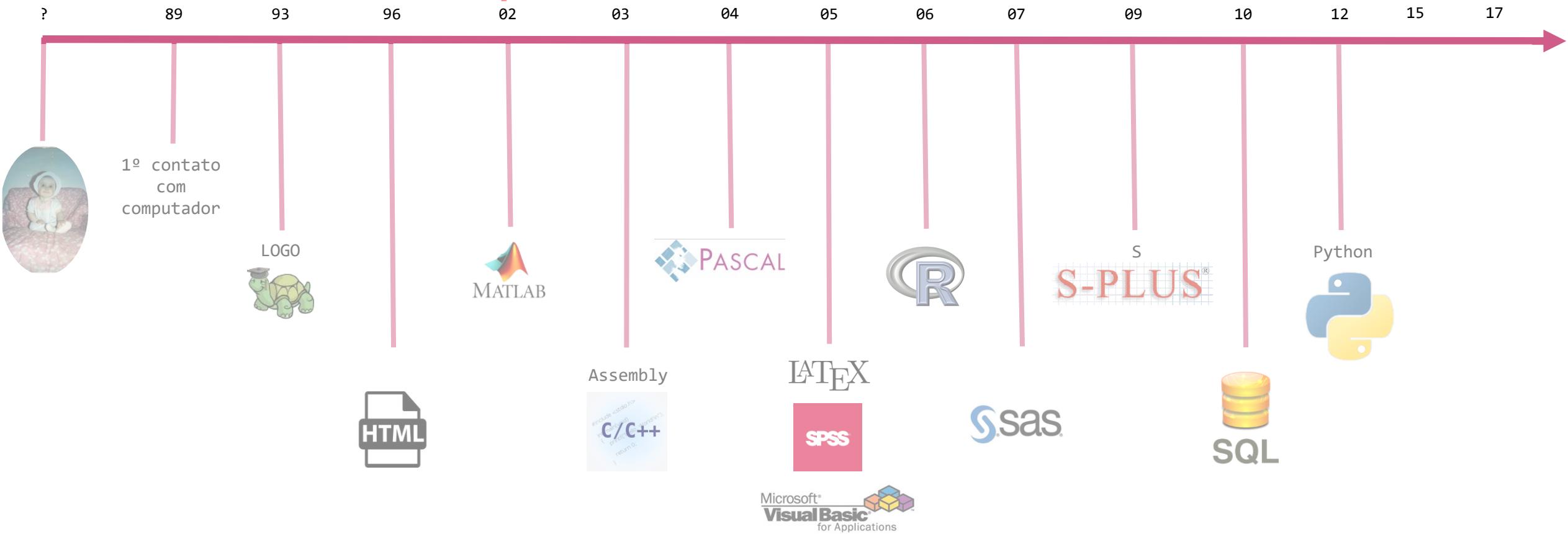
# Aishameriane Schmidt

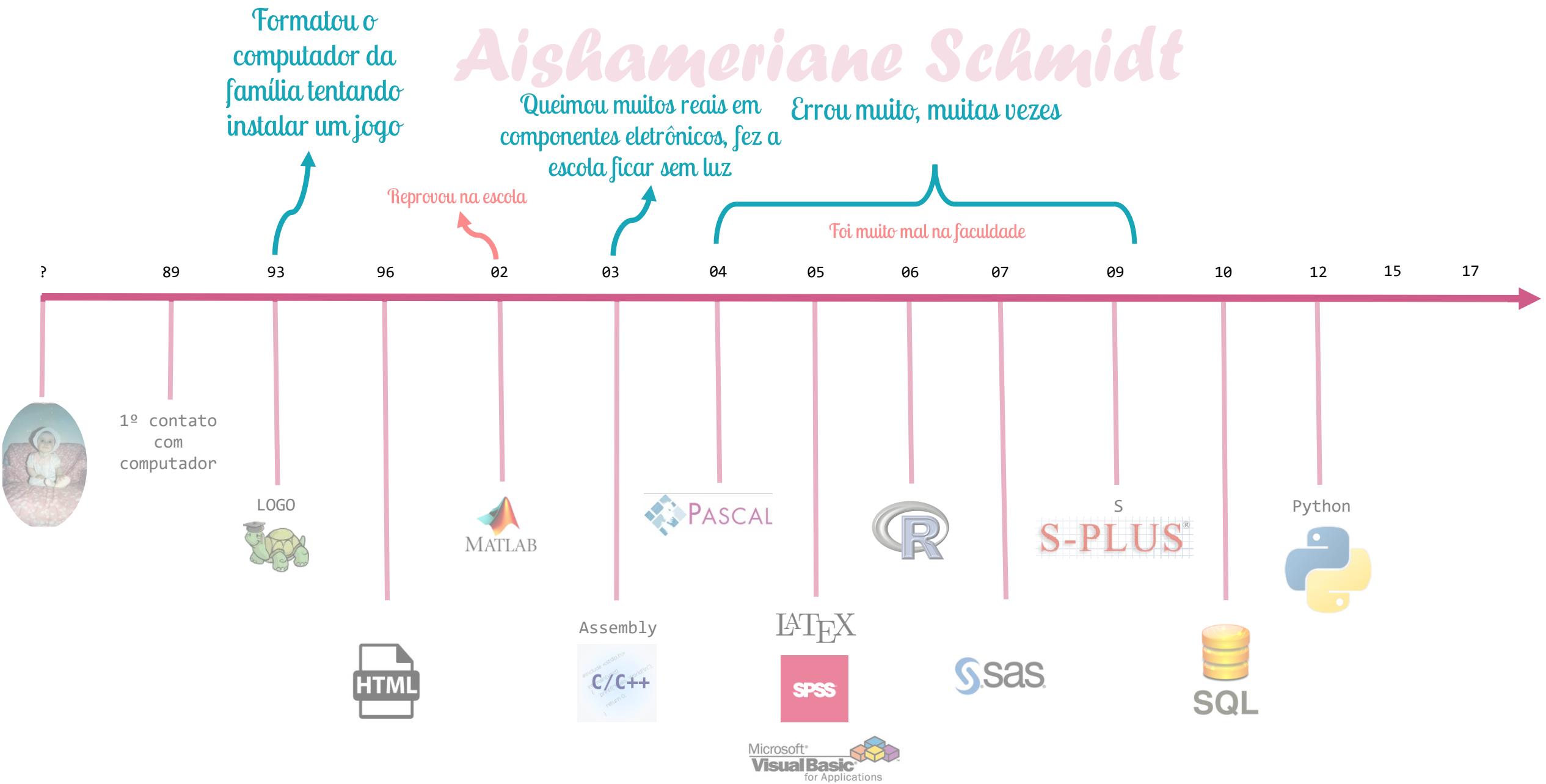


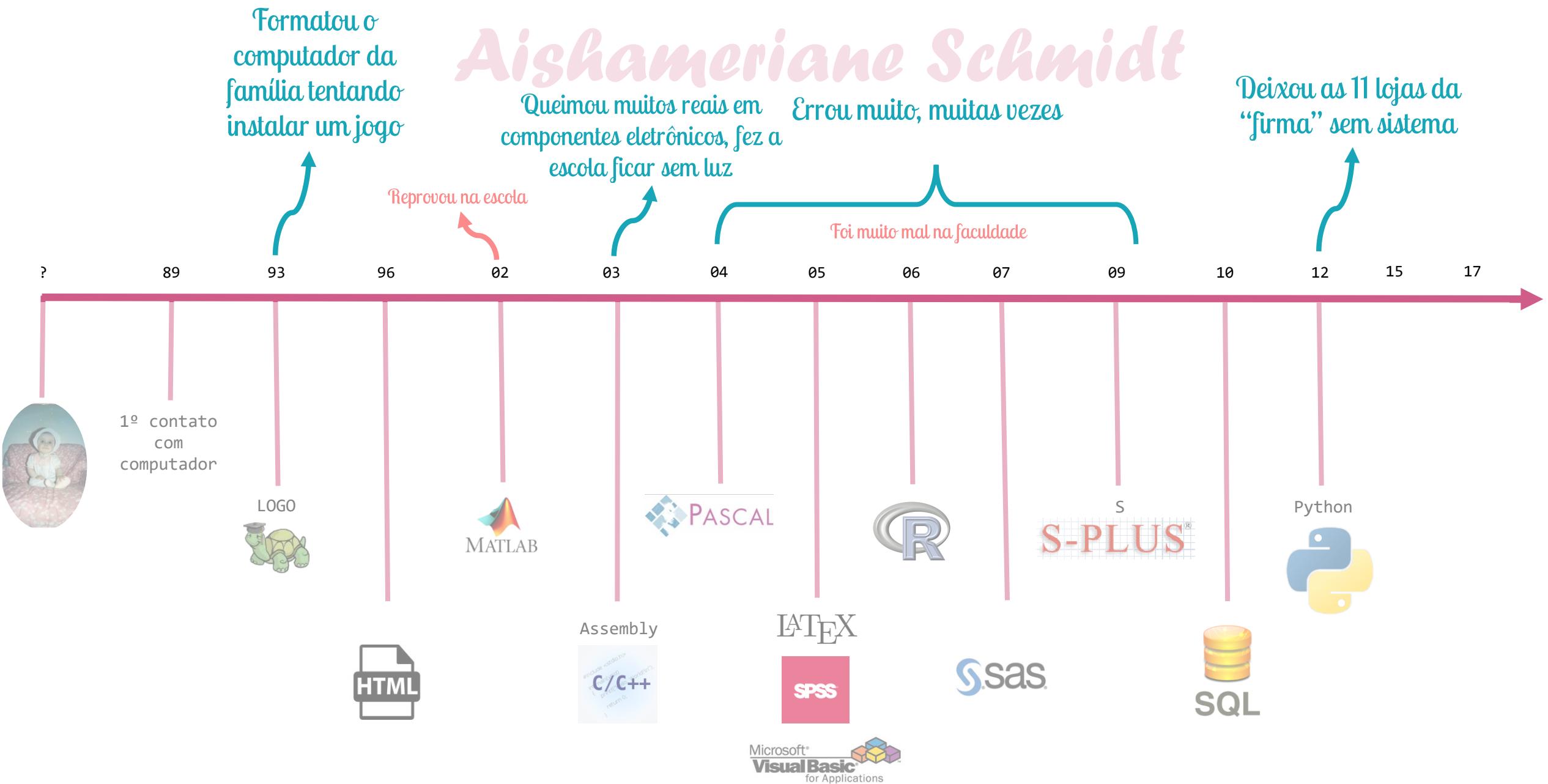
# Aishameriane Schmidt

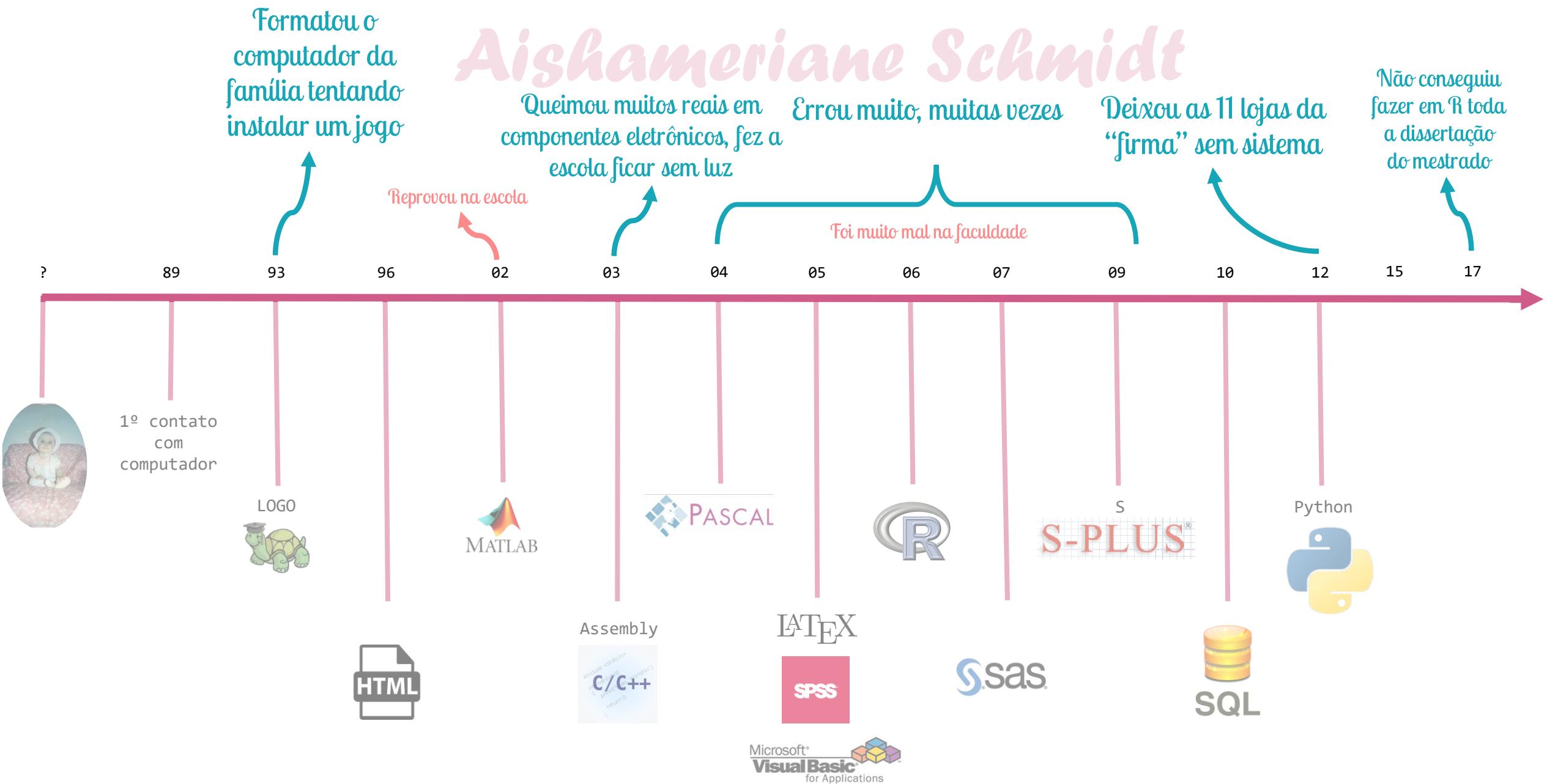
Formatou o computador da família tentando instalar um jogo

Queimou muitos reais em componentes eletrônicos, fez a escola ficar sem luz









# Avisos gerais

ATTENTION, PLEASE.  
ATTENTION.



1. Não existe almoço grátis



Custo de  
oportunidade das  
pessoas envolvidas  
na organização

Custo de  
oportunidade de  
você!

Custos se fosse um  
curso pago  
(R\$ 500)

Este curso existe como consequência da  
“balbúrdia” do ensino público no Brasil.

Obrigada, Fundação Liberato, UFRGS, UFSC e UDESC!

*2. Evite o celular*



E faça silêncio durante  
a explicação!



SHHHH!!

### 3. Recreio





Das 15:20 às 15:40

## *4. Material do curso*





Acesse o site do  
R-Ladies Floripa no  
Meetup!

5. “Sujando” as mãos no código



A close-up photograph showing a person's hands working on a pottery wheel. The hands are covered in wet clay, and they are shaping a small, rounded object. The pottery wheel is made of wood and is spinning rapidly, creating a blurred effect. In the background, there are some green plants and a person's hair. The overall atmosphere is focused and traditional.

*Exercícios práticos*

## *6. Ritmo do curso*





# 7. Limpeza e conservação





A woman with voluminous, curly blonde hair is standing in front of a shimmering, sequined curtain. She is wearing a bright yellow, sleeveless, sequined top. Her expression is neutral, and she is looking slightly to her right. The lighting is dramatic, highlighting her hair and the texture of the curtain.

*Can I get an amen?*

# AULA 1

- ✓ *Avisos gerais*
- ✓ *Programação: aspectos históricos e motivação*
- ✓ *R: histórico, aplicações e recursos*
- ✓ *Primeiro contato*
- ✓ *Usando o Rstudio*
- ✓ *Sujando as mãos:*
  - *Operações aritméticas*
  - *Booleanos*
  - *Matrizes*
  - *Condicionais e Loops*
  - *Funções*



# AULA 1

- ✓ *Avisos gerais*
- ✓ *Programação: motivação e recursos online*
- ✓ *R: histórico, aplicações e recursos*
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  - *Booleanos*
  - *Matrizes*
  - *Condicionais e Loops*
  - *Funções*



Por que programar?



Se você não é ele....





# Business Integrity Associate, Data Operations

(Menlo Park, CA)

## Requirements

- 5+ years experience doing quantitative analysis
- BA/BS in Computer Science, Math/Finance, Physics, Applied Economics, Statistics or other technical field. Advanced degrees preferred
- 4+ years of Excel and SQL required
- Development experience in at least one scripting language (PHP, Python, Perl)
- Experience with reporting systems and efficient data pipeline architecture
- 4+ years of initiating and driving projects to completion with minimal guidance
- Experience with statistical analysis, and a statistical package such as R, MATLAB, SPSS, SAS, or Stata preferred but not a must
- Strong communication skills, creative problem-solving and curiosity is a must
- Highly motivated and hard-working with ability to think clearly under pressure, both individually and in team environment
- Ability to break large, complex problems down into smaller pieces and distill that



# Recruiting Lead - Analytics (Data Engineering)

San Francisco, CA Mountain View, CA Menlo Park, CA

People & Recruiting

APPLY

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 Like  Share

**F**acebook's mission is to give people the power to build community and bring the world closer together. Through our family of apps and services, we're building a different kind of company that connects billions of people around the world, gives them ways to share what matters most to them, and helps bring people closer together. Whether we're creating new products or helping a small business expand its reach, people at Facebook are builders at heart. Our global teams are constantly iterating, solving problems, and working together to empower people around the world to build community and connect in meaningful ways. Together, we can help people build stronger communities — we're just getting started.

Facebook is hiring some of the best technical minds around and we need the best recruiting minds to match our business needs. As a Recruiting Lead, you will have the experience to grow with the rapidly expanding business. You will develop, drive, and execute on the staffing strategies for Data Engineering hiring. You will lead an organization of staffing professionals.

## RESPONSIBILITIES

- ✓ Provide innovative, scalable solutions to drive our hiring to meet FB business objectives
- ✓ Design customized and executable staffing plans while building excellent relationships with the recruiting team and Data Engineering client groups
- ✓ Create innovative sourcing strategies and ensuring a high-touch candidate experience
- ✓ Facilitate and lead meetings and key initiatives and projects with recruiting team and client groups
- ✓ Provide mentorship, guidance and career development to members of the Data Engineering recruiting teams
- ✓ Establish and maintain meaningful relationships with management and key cross-functional stakeholders internally (e.g. Legal, Finance, PR, Growth, Facilities, HR, etc.)
- ✓ Compile & analyze data and metrics to support business decisions and plans as necessary

## MINIMUM QUALIFICATIONS

- ✓ 5+ years of recruiting experience with technical and nontechnical organizations.
- ✓ 3+ years of leadership experience guiding recruiting teams.
- ✓ Experience managing teams.
- ✓ Data analysis and analytical experience.

# Economist



All times are in Pacific Daylight Time.

## Basic Qualifications

- PhD in Economics
- Experience with Stata, R or SAS
- Excellent verbal and written communication skills

## Preferred Qualifications

- Two to three years of experience in customer behavior modeling, pricing, private consulting or in academic research
- Strong background in econometrics, industrial organization, economic theory, and quantitative methods
- Strong research track record
- Experience using SQL and Python

# GEOGRAPHER

US Department of the Navy ★★★★★ 33,406 reviews - Quantico, VA 22134

\$47,016 - \$61,122 a year - Full-time, Part-time

Apply On Company Site



## Job

## Duties

## Summary

You will serve as a Geographer in the Marine Corps Intelligence Activity of HQ US MARINE CORPS.

All Defense Intelligence positions under the Defense Civilian Intelligence Personnel System (DCIPS) are in the excepted service by specific statute, 10 U.S.C. 1601. This position is in the excepted service and does not confer competitive status.

## Responsibilities

- You will apply geographic data compilation, geo-analysis, and other geographic methodology.
- You will assist in data-preparation for finished dissemination that involves searching, selecting, and compiling specific intelligence information.
- You will conduct preliminary research for interpretation and application of geographic concepts to online mapping applications.
- You will utilize basic intelligence principles, methods and established procedures to analyze and evaluate information.

## Qualifications

Your resume must demonstrate at least one year of specialized experience at or equivalent to the GG/GS-05 grade level or pay band in the Federal service or equivalent experience in the private or public sector. Specialized experience must demonstrate the following: 1) Assisting higher grade analysts in integration, dissemination, maintenance and archiving geospatial products; 2) Supporting the web-map based query and dissemination capabilities of GIS products and geo-data; 3) Constructing basic Structure Query Language (SQL) in accordance with organizational requirements.

# Macro Economist – New York, NY

Email this job 

- › Date: 17 May 2016
- › Location: United States, New York
- › Salary: 75,000 - 90,000\$ per Annum



## Macro Economist – New York, NY

Our client, a top independent research firm, is looking to add a Macro Economist to its US Economist team. The main responsibility of the Macro Economist will be to build and maintain economic models to aid in forecasting and scenario analysis of the United States macro economy.

This position will report to the Chief US Economist

### Requirements:

- 3+ years working in an Economist role
- Knowledge in Econometrics including software experience in Stata, R, and Matlab
- Experience with macroeconomic modeling required.
- Background using VAR, ECM, or Factor Analysis
- Desire to work in a team
- Ability to juggle multiple projects at once
- Research experience required
- Strong quantitative and qualitative abilities
- Strong background and understanding in macroeconomics
- Bachelors Degree in Economics, Finance, or Business. A masters and/or PhD in Economics is preferred.



## Operations and Logistics Manager - Porto Alegre

Uber

Porto Alegre - Rio Grande do Sul - Brazil

Posted 3 days ago

167 views

[Apply on company website](#)

[Save](#)

### WE'RE LOOKING FOR:

- Bachelor's degree in Economics, Finance, Statistics, Engineering or similar field.
- 3-6 years of Strategy Consulting, Accounting, or Banking background with previous experience using data to drive business decisions.
- Excellent excel skills, SQL skills preferred.
- Demonstrated leadership of leading initiatives and projects at your organization.
- Startup (all-hands-on-deck) approach.



## Data Journalist

Fractl ★★★★☆ 8 reviews - Delray Beach, FL 33445

Apply On Company Site



Job

Insights

origin, age, genetic information, disability, or veteran status. Improper interference with the ability of Fractl's employees to perform their job duties may result in discipline up to and including discharge.

### Required Skills and Expertise.

- Working knowledge of engaging, useful web content
- Working knowledge of various government and publicly available data
- Impeccable attention to detail. Written material with any typos or grammatical errors is entirely unacceptable
- Working familiarity with most (if not all) of the following: Tableau, HTML, Excel, Google Docs, Gmail, and Calendar. Bonus points for experience with other Adobe products, any additional design experience, any programming experience
- Quick to learn new platforms or systems, like Asana, Airtable, and Tableau
- You should be able to multitask and manage your time well. Organization and planning are paramount to your success
- Top-level Internet research skills-- you should be a Google Master
- Strategic, creative problem solving skills with the drive of a self-starter and resourcefulness to overcome obstacles independently
- Ability to manage yourself but also work within a team

Education and Experience



# LAR Economics and Business Analyst

Intel Corporation

Sao Paulo

Posted 106 days ago

2533 views

[Apply on company website](#)

[Save](#)

## Job description

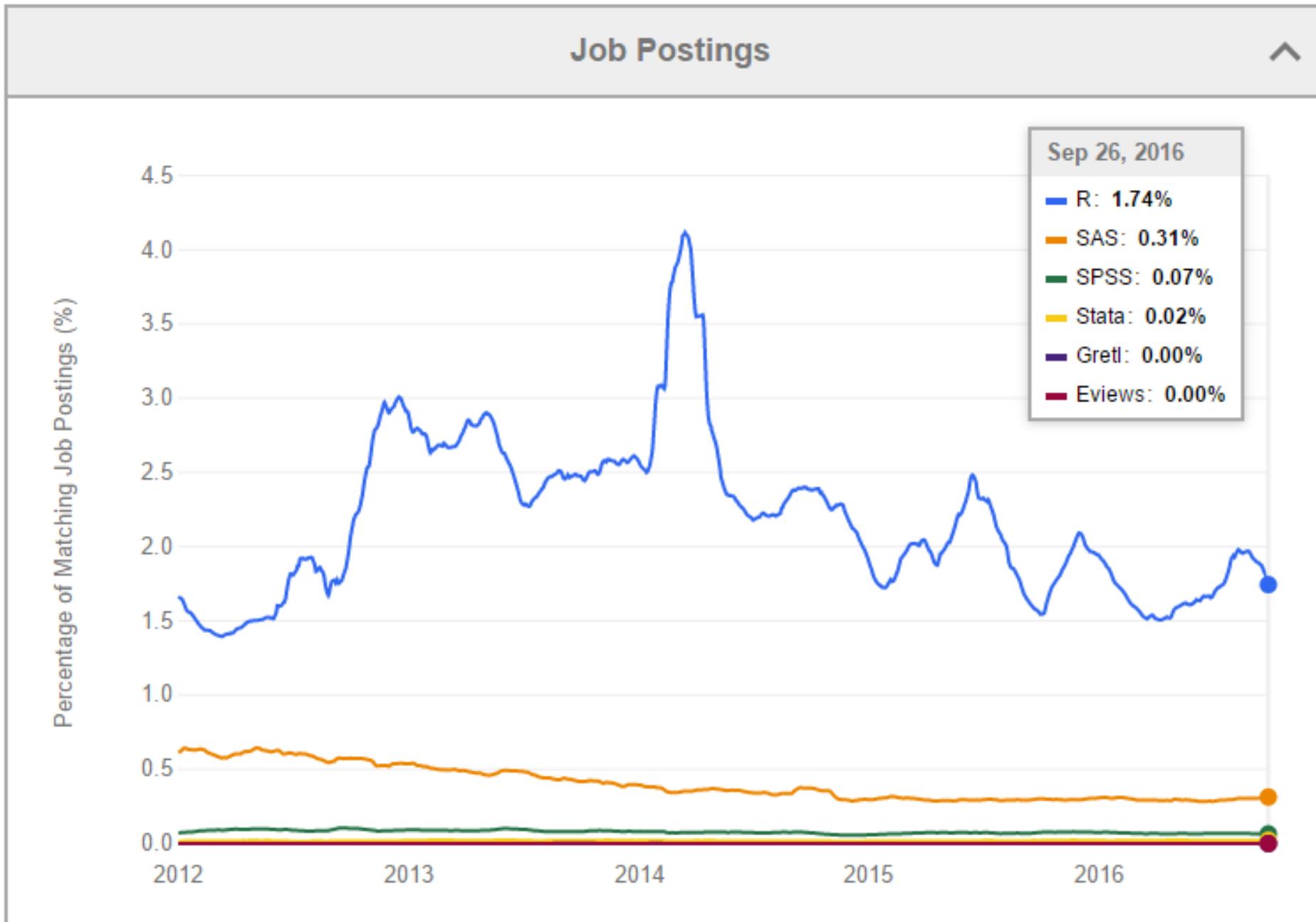
In this position, you will be responsible for developing a deep understanding of Latin American region (LAR) market trends and economics and applying models to forecast units, revenues, and product mix of PCs, servers, and other ICT devices. You will be developing and maintaining a high quality database using industry, economic, and company data. You will also be responsible for working with stakeholders to drive action based upon the forecasts. Stakeholders include Sales and Marketing Group (SMG), Microprocessor Marketing and Business Planning (MMBP), Technology Manufacturing Group (TMG) and Product Divisions. You will be expected to travel to other Intel sites across the globe to attend global forums.

## Desired Skills and Experience

You should possess an advanced degree with significant professional experience (preferably with experience in a position with responsibility for developing, maintaining, monitoring, and improving analytical business models). Additional qualifications include:

- Demonstrated competence in locating, understanding, and organizing market and ICT industry
- Experience with industry studies that will support a vertical approach to estimating demand
- Successfully supported requests for special studies, and developed presentations for management and for yourself
- Experience in complex processes such as forecasting, budgeting, or analytical marketing research
- Expertise in an area such as statistics, econometrics, economics, finance, or analytical marketing
- Knowledge of Big Data issues and methods.
- Demonstrated passion for working on complex problems
- History of being a strong contributor to an analytical team
- Adept with several software packages
- Excellent speaking and writing skills
- Ability to handle the demands of simultaneous projects
- Demonstrated the ability to work on your own or with other dedicated teammates
- Demonstrated a record of meeting deadlines and surpassing expectations

## Tendência nas ofertas de emprego por tipo de software no site Indeed.com – 2012 a 2016





# MISTAKES

IT COULD BE THAT THE PURPOSE OF YOUR LIFE IS  
ONLY TO SERVE AS A WARNING TO OTHERS.

É possível que o seu  
propósito de vida seja  
apenas servir de aviso  
para os outros

NBER WORKING PAPER SERIES

GROWTH IN A TIME OF DEBT

Carmen M. Reinhart  
Kenneth S. Rogoff

Working Paper 15639  
<http://www.nber.org/papers/w15639>

NATIONAL BUREAU OF ECONOMIC RESEARCH  
1050 Massachusetts Avenue  
Cambridge, MA 02138  
January 2010

**ABSTRACT**

We study economic growth and inflation at different levels of government and external debt. Our analysis is based on new data on forty-four countries spanning about two hundred years. The dataset incorporates over 3,700 annual observations covering a wide range of political systems, institutions, exchange rate arrangements, and historic circumstances. Our main findings are: First, the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90 percent of GDP. Above 90 percent, median growth rates fall by one percent, and average growth falls considerably more. We find that the threshold for public debt is similar in advanced and emerging economies. Second, emerging markets face lower thresholds for external debt (public and private)—which is usually denominated in a foreign currency. When external debt reaches 60 percent of GDP, annual growth declines by about two percent; for higher levels, growth rates are roughly cut in half. Third, there is no apparent contemporaneous link between inflation and public debt levels for the advanced countries as a group (some countries, such as the United States, have experienced higher inflation when debt/GDP is high). The story is entirely different for emerging markets, where inflation rises sharply as debt increases.

*“Quando a dívida externa chega a 60% do PIB, o crescimento anual decresce aproximadamente 2%”*

Johnny Isakson, a Republican from Georgia and always a gentleman, stood up to ask his question: “Do we need to act this year? Is it better to act quickly?”

“Absolutely,” Rogoff said. “Not acting moves the risk closer,” he explained, because every year of not acting adds another year of debt accumulation. “You have very few levers at this point,” he warned us.



# Does High Public Debt Consistently Stifle Economic Growth? A Critique of Reinhart and Rogoff

Thomas Herndon\*

Michael Ash

Robert Pollin

April 15, 2013

JEL CODES: E60, E62, E65

## Abstract

We replicate Reinhart and Rogoff (2010a and 2010b) and find that coding errors, selective exclusion of available data, and unconventional weighting of summary statistics lead to serious errors that inaccurately represent the relationship between public debt and GDP growth among 20 advanced economies in the post-war period. Our finding is that when properly calculated, the average real GDP growth rate for countries carrying a public-debt-to-GDP ratio of over 90 percent is actually 2.2 percent, not -0.1 percent as published in Reinhart and Rogoff. That is, contrary to RR, average GDP growth at public debt/GDP ratios over 90 percent is not dramatically different than when debt/GDP ratios are lower.

Replicamos o estudo de Reinhart e Rogoff e encontramos que (1) **erros de código**, (2) exclusão seletiva de dados da amostra e (3) ponderação não convencional das estatísticas descritivas levaram a sérios erros que representaram de maneira incorreta a relação entre déficit público e crescimento do PIB (...)

*“(...) Um erro na planilha excluiu por completo cinco países da análise (...) Foram calculadas as médias usando as células 30 a 44 ao invés de 30 a 49. (...) Este erro é responsável por um erro da magnitude de -0.3 pontos percentuais (...)"*

Fonte: <http://www.businessinsider.com/thomas-herndon-michael-ash-and-robert-pollin-on-reinhart-and-rogoff-2013-4>

	B	C	I	J	K	L	M
2			Real GDP growth Debt/GDP				
3			30 or less	30 to 60	60 to 90	90 or above	30 or less
4	Country	Coverage					
26			3.7	3.0	3.5	1.7	5.5
27	Minimum		1.6	0.3	1.3	-1.8	0.8
28	Maximum		5.4	4.9	10.2	3.6	13.3
29							
30	US	1946-2009	n.a.	3.4	3.3	-2.0	n.a.
31	UK	1946-2009	n.a.	2.4	2.5	2.4	n.a.
32	Sweden	1946-2009	3.6	2.9	2.7	n.a.	6.3
33	Spain	1946-2009	1.5	3.4	4.2	n.a.	9.9
34	Portugal	1952-2009	4.8	2.5	0.3	n.a.	7.9
35	New Zealand	1948-2009	2.5	2.9	3.9	-7.9	2.6
36	Netherlands	1956-2009	4.1	2.7	1.1	n.a.	6.4
37	Norway	1947-2009	3.4	5.1	n.a.	n.a.	5.4
38	Japan	1946-2009	7.0	4.0	1.0	0.7	7.0
39	Italy	1951-2009	5.4	2.1	1.8	1.0	5.6
40	Ireland	1948-2009	4.4	4.5	4.0	2.4	2.9
41	Greece	1970-2009	4.0	0.3	2.7	2.9	13.3
42	Germany	1946-2009	3.9	0.9	n.a.	n.a.	3.2
43	France	1949-2009	4.9	2.7	3.0	n.a.	5.2
44	Finland	1946-2009	3.8	2.4	5.5	n.a.	7.0
45	Denmark	1950-2009	3.5	1.7	2.4	n.a.	5.6
46	Canada	1951-2009	1.9	3.6	4.1	n.a.	2.2
47	Belgium	1947-2009	n.a.	4.2	3.1	2.6	n.a.
48	Austria	1948-2009	5.2	3.3	-3.8	n.a.	5.7
49	Australia	1951-2009	3.2	4.9	4.0	n.a.	5.9
50							
51			4.1	2.8	2.8	=AVERAGE(L30:L44)	

*“Everybody in this country  
should learn how to program a  
computer... Because it teaches  
you how to think”*

*Steve Jobs*

Fonte: Code.org (<https://youtu.be/nKIu9yen5nc>)

Tradução: todos neste país (EUA) deveriam aprender como programar um computador... porque isso te ensina a pensar.

# Como aprender a programar?



**I HAVE NO IDEA  
WHAT I'M DOING**



**THE FUTURE**

**IS MADE OF**

**MISTAKES!**

*Autonomia é essencial!*



Não idolatre nem idealize demais!







Programar é muito  
mais “olhar no  
Google” do que tirar  
coisas da sua  
cabeça!



Entender inglês, você precisa.

# *Alguns recursos para aprender mais sobre programação (em geral)*

- Code dot org  
<https://studio.code.org/>
- Coursera  
<https://www.coursera.org/>
- Khan Academy  
<https://www.khanacademy.org>
- Codecademy  
<https://www.codecademy.com>

# *Alguns recursos para aprender mais sobre programação (em geral)*

- Programming for Everybody  
<https://www.coursera.org/learn/python/home/welcome>
- Code Yourself  
<https://www.coursera.org/learn/intro-programming>
- Mathematical Thinking in Computer Science  
<https://www.coursera.org/learn/what-is-a-proof>
- Introdução à Ciência da Computação com Python  
<https://www.coursera.org/learn/ciencia-computacao-python-conceitos>

# O QUE É UM BOM PROGRAMA?

```
31 <?php endwhile; wp_reset_query(); ?>
32 <div class="cleaner"></div>
33 <p><a class="button" href="/archiv/page/2">Zobrazit další příspěvky &raquo;
34 </div><!-- /content -->
35 <?php get_sidebar(); ?>
36 <div class="cleaner"></div>
37 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(312); 
38 while ( $loop->have_posts() ) : $loop->the_post();
39 require ('part-homepage-cat-feed.php');
40 endwhile;
41 wp_reset_query(); ?>
42 <div class="cleaner"></div>
43 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(122);
44 while ( $loop->have_posts() ) : $loop->the_post();
45 require ('part-homepage-cat-feed.php');
46 endwhile;
47 wp_reset_query(); ?>
48 <div class="cleaner"></div>
49 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(6);
50 while ( $loop->have_posts() ) : $loop->the_post();
51 require ('part-homepage-cat-feed.php');
52 endwhile;
53 wp_reset_query(); ?>
54 <div class="cleaner"></div>
55 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(3);
56 while ( $loop->have_posts() ) : $loop->the_post();
57 require ('part-homepage-cat-feed.php');
58 endwhile;
59 wp_reset_query(); ?>
60 <div class="cleaner"></div>
61 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(6); ?>
```

- \ (( ' ) ) / -

**IT WORKS**  
**on my machine**

*Tradução: Funciona na minha máquina.*

# AULA 1

- ✓ *Avisos gerais*
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  - *Funções*





R





R é uma  
linguagem de  
programação



R é uma  
linguagem de  
programação



Baseado em S  
(1976)



R é uma  
linguagem de  
programação

Baseado em S  
(1976)

Bell Labs  
\$\$\$



R é uma  
linguagem de  
programação

Bell Labs  
\$\$\$

Baseado em S  
(1976)

Criado na  
Austrália  
(1991)



R é uma  
linguagem de  
programação

Bell Labs  
\$\$\$

Baseado em S  
(1976)

Criado na  
Austrália  
(1991)

Free  
Software!

# VANTAGENS DO R (*a.k.a porque o R é rei!*)

É livre

0. Liberdade de executar como desejar, para qualquer propósito
1. Estudar como o programa funciona e adaptá-lo
2. Liberdade de redistribuir cópias
3. Liberdade de distribuir cópias com versões modificadas.

# VANTAGENS DO R (*a.k.a porque o R é rei!*)

Sistema de  
Pacotes

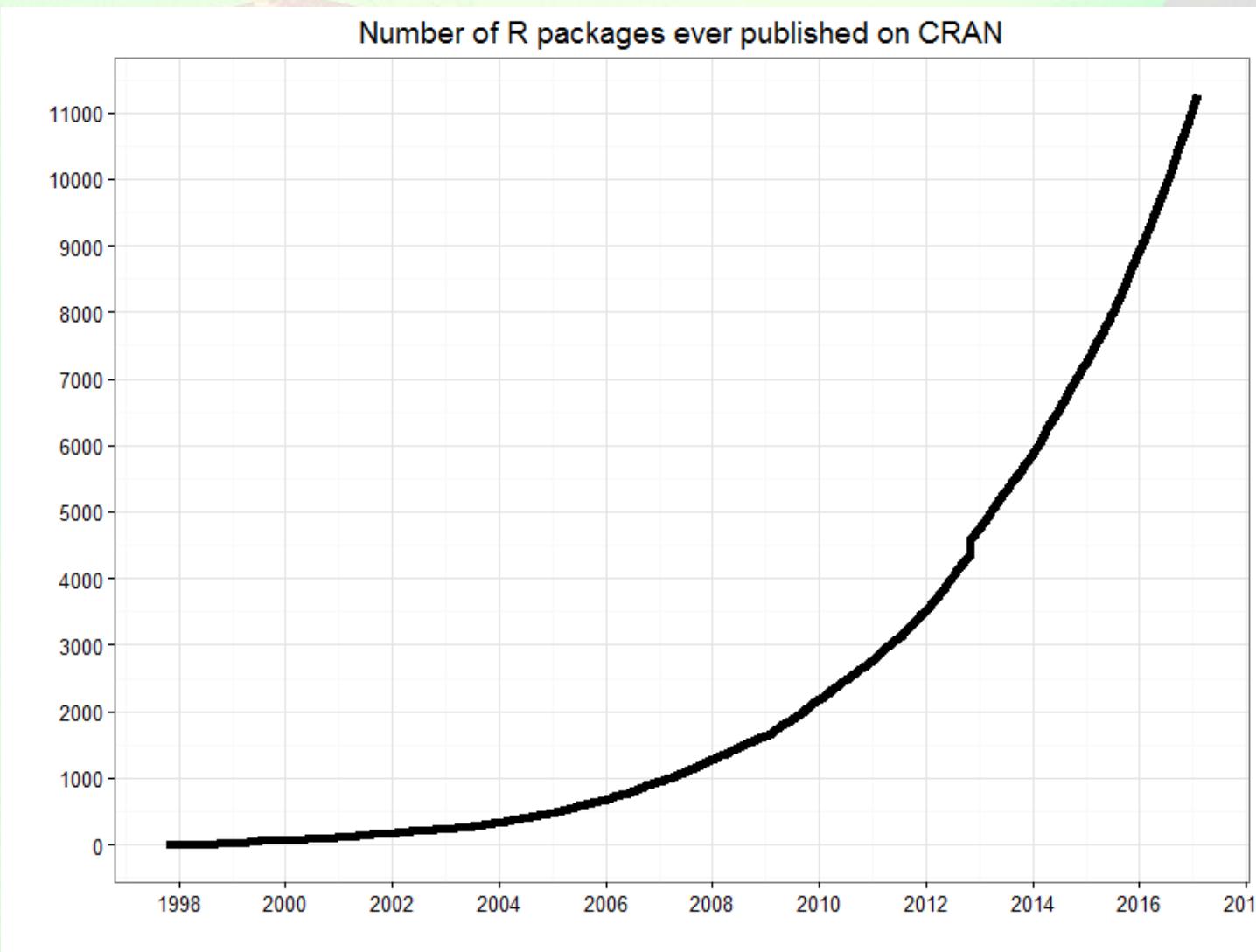
R = base + todo o resto

Qualquer pessoa pode desenvolver  
“pacotes” e disponibilizar

Existe uma “curadoria” de pacotes

Atualmente existem 8449 pacotes no CRAN  
11.166

# VANTAGENS DO R *(a.k.a porque o R é rei!)*



Fonte:  
<http://blog.revolutionanalytics.com/2017/01/cran-10000.html>

# VANTAGENS DO R (*a.k.a porque o R é rei!*)

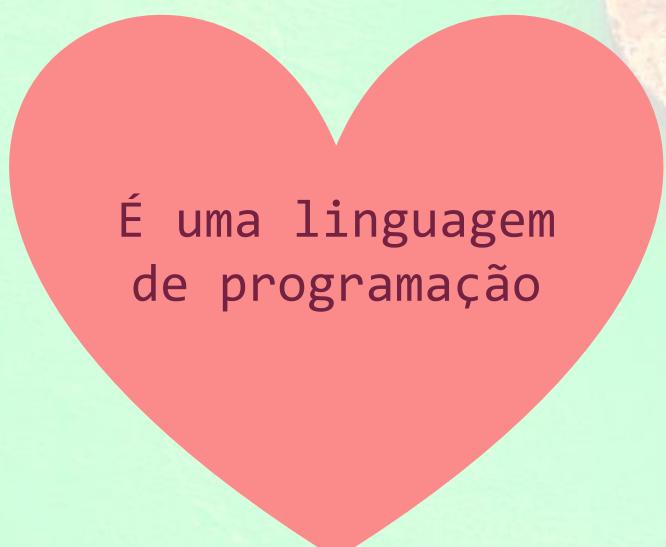
Comunidade

CRAN  
Comprehensive R Archive Network

Os pacotes são desenvolvidos pela comunidade

Fóruns de discussão, lista de e-mails

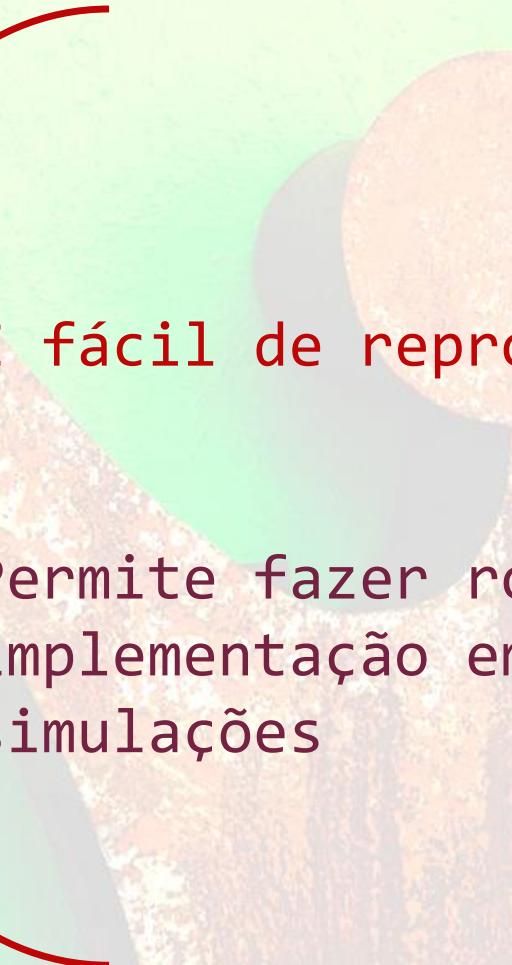
# VANTAGENS DO R (*a.k.a porque o R é rei!*)



É uma linguagem  
de programação

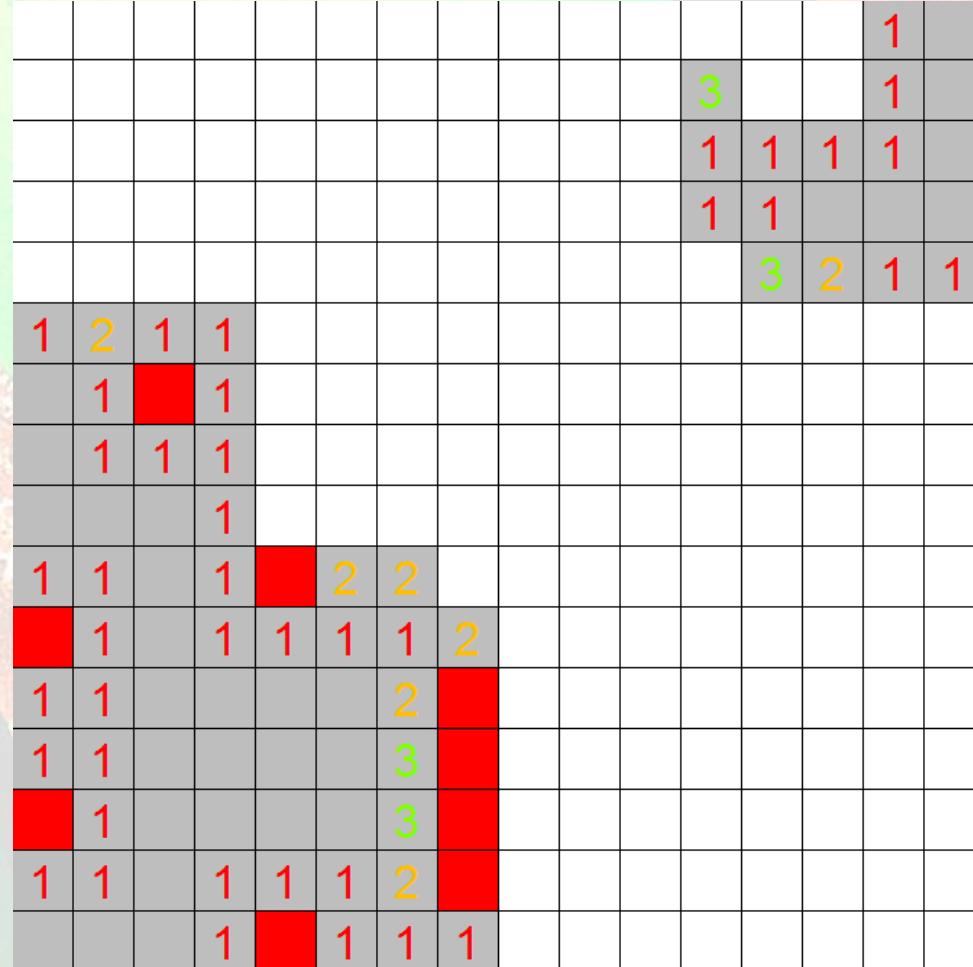
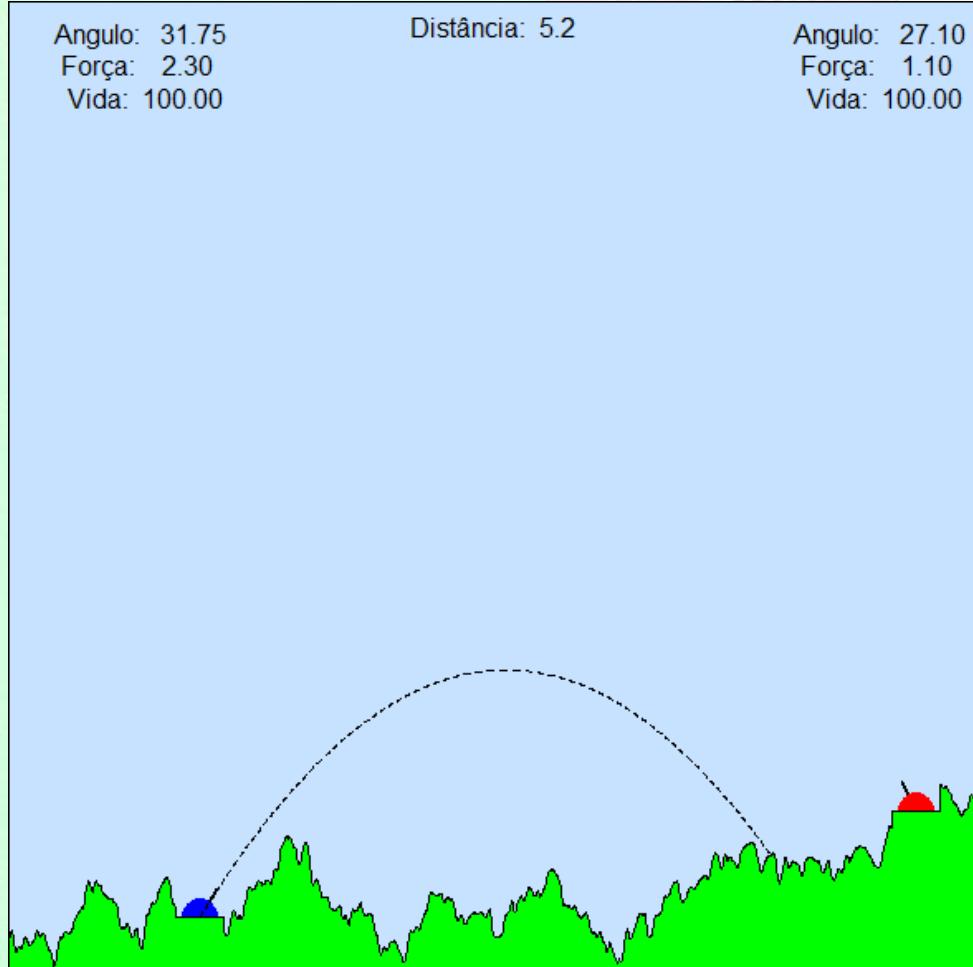


É fácil de reproduzir as análises



Permite fazer rotinas de difícil  
implementação em planilhas, como  
simulações

# VANTAGENS DO R (*a.k.a porque o R é rei!*)

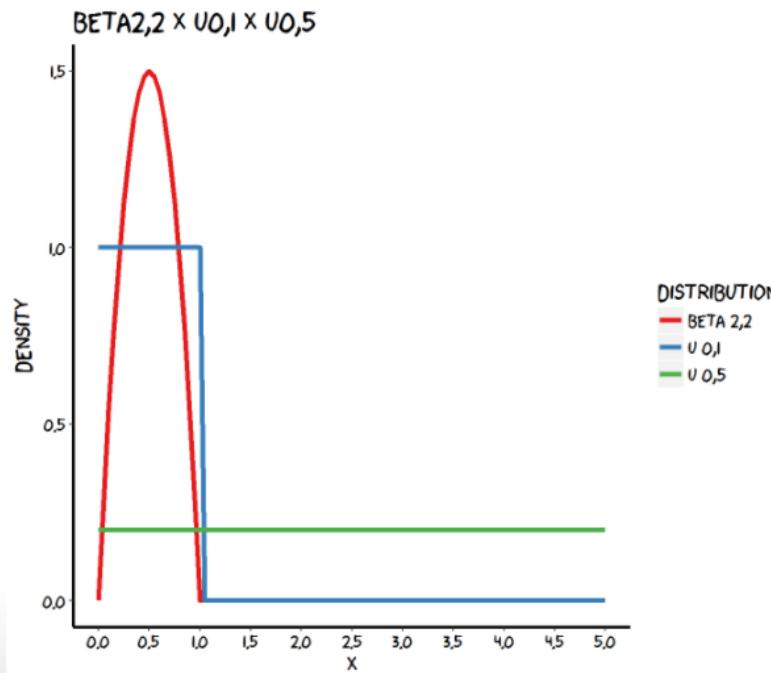


Jogos implementados em R: tanks (esq.) e campo minado (dir.).

Fonte: <http://www.dadosaleatorios.com.br/2015/10/r-tambem-pode-ser-diversao.html>

# VANTAGENS DO R (*a.k.a porque o R é rei!*)

## Importance sampling



## Métodos de Monte Carlo

### Ideias básicas

- Métodos de Monte Carlo são uma alternativa para resolução de integrais (especialmente em casos multivariados onde a dimensão do problema torna os algoritmos não estocásticos muito lentos);
- Uma vez que a abordagem bayesiana requer o cálculo de distribuições a posteriori que muitas vezes envolve a resolução de integrais, os algoritmos de MC acabam sendo muito úteis neste contexto;
- MC é baseado na ideia de reamostrar valores de uma distribuição de probabilidade (simulação estocástica). Utilizando um gerador de números pseudo-aleatórios podemos obter valores de qualquer distribuição (através da  $F^{-1}(\cdot)$ )

### Método

Considere a seguinte integral:

$$\int g(\theta)h(\theta|x)d\theta = \mathbb{E}[g(\theta)|x] \quad (01)$$

Podemos ainda nos utilizar da probabilidade condicional  $f(x|\theta) = \frac{f_{X,\theta}(x,\theta)}{\pi(\theta)} \Rightarrow f_{X,\theta}(x,\theta) = f(x|\theta)\pi(\theta)$  para reescrever  $h(\theta|x) = \frac{f(x|\theta)\pi(\theta)}{f_x(x)}$ . Como o denominador é uma constante, podemos simplesmente definir o problema da integral acima da seguinte maneira:

$$\int_{\Theta} g(\theta)f(x|\theta)\pi(\theta)d\theta \quad (02)$$

A primeira forma é como está definido o problema em (Paulino, Amaral., and Murteira 2003) (página 286) e a segunda é como está em (Robert 2007) (página 294).

(Murteira) Se pudermos simular uma amostra  $\theta_1, \dots, \theta_n$  da densidade a posteriori  $h(\theta|x)$ , o método de MC irá aproximar por uma média amostral:

*E as desvantagens?*





*Não pergunte para mim!*

# Alguns aspectos que podem ser um problema

- Tecnologia antiga

```
31 <?php endwhile; wp_reset_query(); ?>
32 <div class="cleaner"></div>
33 <a href="/archiv/page/2" class="button" style="float: right;">Zobrazit další příspěvky &raquo;
34 </div><!-- /content -->
35 <?php get_sidebar(); ?>
36 <div class="cleaner"></div>
37 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(312); ?></span></h2>
38 <?php $loop = new WP_Query('posts_per_page=6&cat=312'); ?>
39 while ($loop->have_posts()) : $loop->the_post();
40 require ('part-homepage-cat-feed.php');
41 endwhile;
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44 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(122); ?></span></h2>
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48 endwhile;
49 wp_reset_query(); ?>
50 <div class="cleaner"></div>
51 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(6); ?></span></h2>
52 <?php $loop = new WP_Query('posts_per_page=6&cat=6'); ?>
53 while ($loop->have_posts()) : $loop->the_post();
54 require ('part-homepage-cat-feed.php');
55 endwhile;
56 wp_reset_query(); ?>
57 <div class="cleaner"></div>
58 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(1); ?></span></h2>
59 <?php $loop = new WP_Query('posts_per_page=6&cat=1'); ?>
60 while ($loop->have_posts()) : $loop->the_post();
61 require ('part-homepage-cat-feed.php');
62 endwhile;
63 wp_reset_query(); ?>
```

Line 1, Column 1

# Alguns aspectos que podem ser um problema

- Tecnologia antiga
- Poucos recursos gráficos ‘poderosos’

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```

Line 1, Column 1

# Alguns aspectos que podem ser um problema

- Tecnologia antiga
- Poucos recursos gráficos ‘poderosos’

ggplot2

Line 1, Column 1

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61 require ('part-homepage-cat-feed.php');
62 endwhile;
63 <div class="cleaner"></div>
64 <h2 class="homepage_cat_feed"><span class="white"><?php echo get_cat_name(6); ?>
```

# Alguns aspectos que podem ser um problema

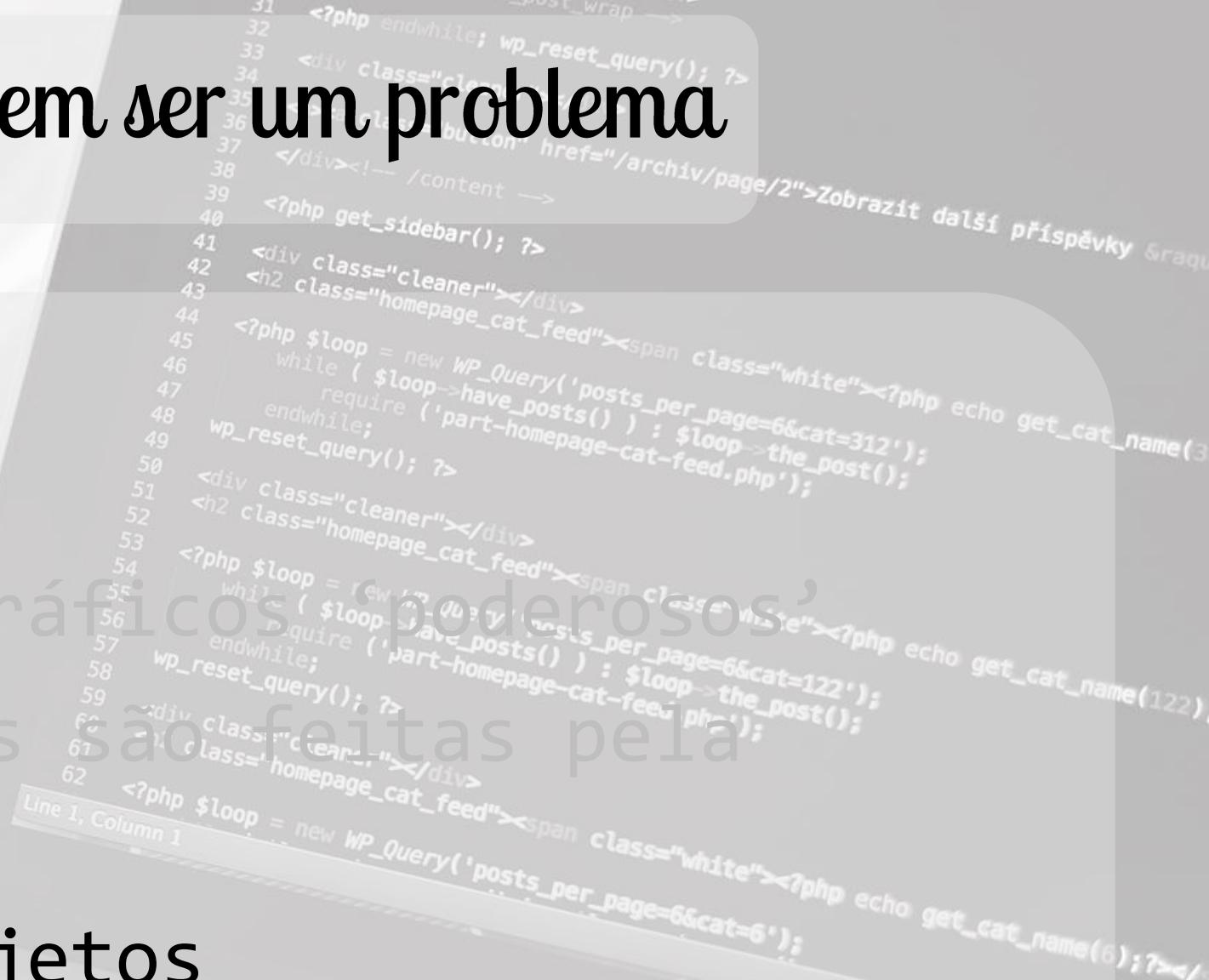
- Tecnologia antiga
  - Poucos recursos gráficos poderosos
  - As funcionalidades são feitas pela comunidade

em ser um problema

```
31 <?php endwhile; wp_reset_query(); ?>
32 <div class="cleaner"></div>
33 <div class="cleaner"></div>
34 <div class="cleaner"></div>
35 <div class="cleaner"></div>
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57 endwhile;
58 wp_reset_query(); ?>
59 <div class="cleaner"></div>
60 <div class="cleaner"></div>
61 <div class="cleaner"></div>
62 <?php $loop = new WP_Query('posts_per_page=2"); ?>
```

# Alguns aspectos que podem ser um problema

- Tecnologia antiga
- Poucos recursos gráficos ‘poderosos’
- As funcionalidades são feitas pela comunidade
- Armazenagem de objetos



```
31 <?php endwhile; wp_reset_query(); ?>
32 <div class="cleaner"><a href="/archiv/page/2">Zobrazit další příspěvky &gt;
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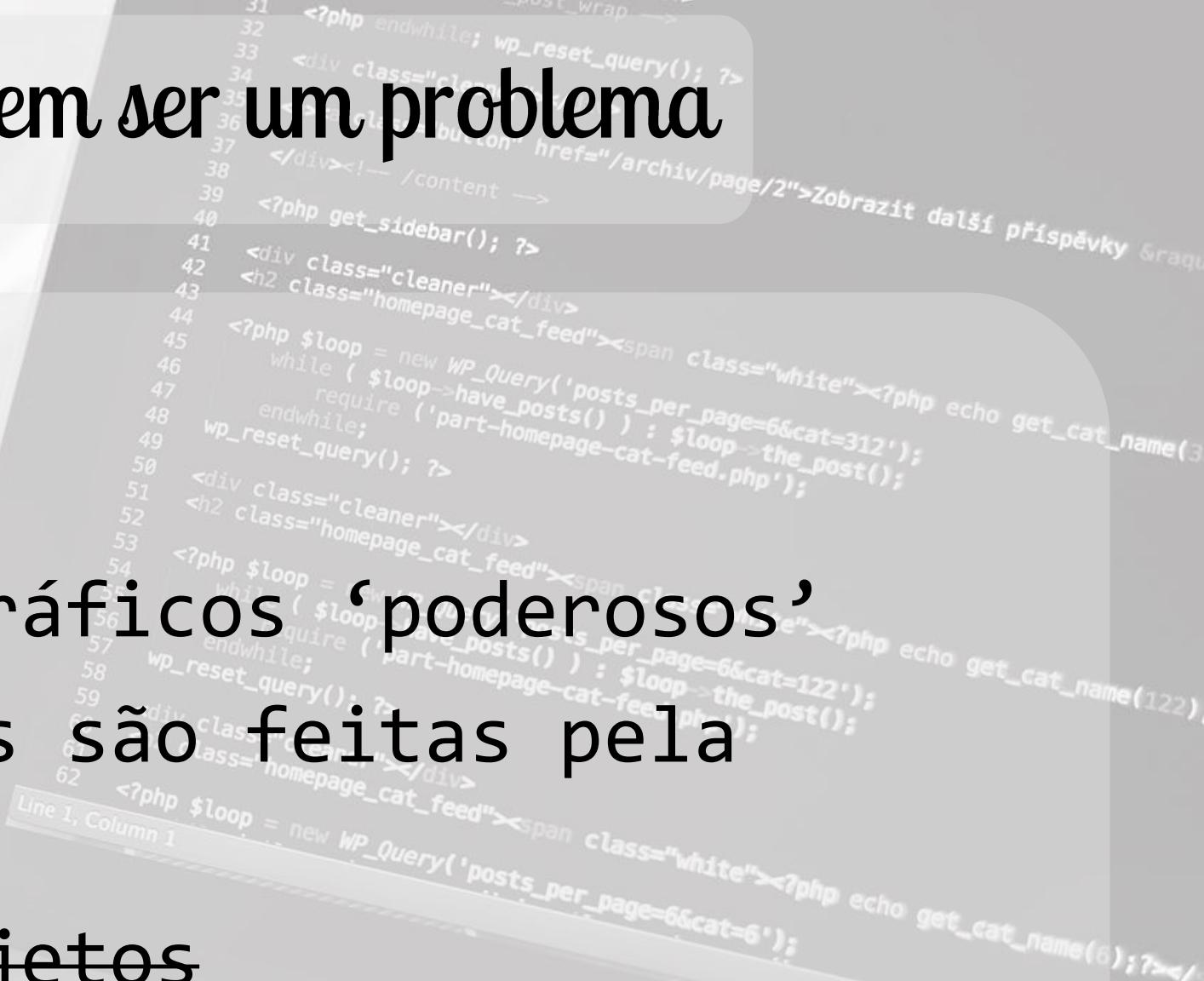
# Alguns aspectos que podem ser um problema

- Tecnologia antiga
- Poucos recursos gráficos ‘poderosos’
- As funcionalidades são feitas pela comunidade
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# Alguns aspectos que podem ser um problema

- Tecnologia antiga
- Poucos recursos gráficos ‘poderosos’
- As funcionalidades são feitas pela comunidade
- Armazenagem de objetos  
Novos pacotes



The background of the slide features a faint watermark of a computer screen displaying a block of PHP code. The code is part of a WordPress theme, specifically the homepage\_cat\_feed.php file. It includes loops for posts, sidebar calls, and category name outputs. The watermark is oriented diagonally from top-right to bottom-left.

```
31 <?php endwhile; wp_reset_query(); ?>
32 <div class="cleaner"></div>
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60 while ($loop->have_posts() ) : $loop->the_post();
61 require ('part-homepage-cat-feed.php');
62 endwhile;
63 <div class="cleaner"></div>
```

Se você não sabe estatística,  
o R não pode te ajudar.

Line 1, Column 1

```
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32 <div class="cleaner"></div>
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## *Tutoriais de R interativos*

TryR:

<http://tryr.codeschool.com/>

R Studio Primers:

<https://rstudio.cloud/learn/primers>

Tutoriais do Swirl:

<http://swirlstats.com/students.html>

Memrise - R reference card

<https://www.memrise.com/course/58531/r-reference-card/>



## *Tutoriais de R (não interativos)*

Estatística com R (FGV):  
<https://www.youtube.com/watch?v=8HQHf5XCS7g>

Página do professor Paulo Justiniano:  
<http://www.leg.ufpr.br/~paulojus/embra pa/Rembrapa/>

R tutorial:  
<http://www.r-tutor.com/r-introduction>

Blog do Prof. Marcelo Perlin  
<https://www.msperlin.com/blog/#posts>



## *Tutoriais de R (não interativos)*

Learn R programming (Tutorials Point):  
<http://www.tutorialspoint.com/r/>

Apostila de Rstudio  
<http://wp.ufpel.edu.br/cdshikida/apostilarstudio>

Using R for Data Analysis and  
Graphics:  
<https://cran.r-project.org/doc/contrib/usingR.pdf>



## *Cursos de R (gratuitos\*)*

R Programming:

<https://pt.coursera.org/learn/r-programming>

Statistics and R:

<https://www.edx.org/course/statistics-r-harvardx-ph525-1x>

R Basics:

<https://www.udemy.com/r-basics/>

# *Reference Cards*

R Reference Card by Tom Short

<https://cran.r-project.org/doc/contrib/Short-refcard.pdf>

Tradução em português:

[http://www.leg.ufpr.br/~walmes/cursoR/guia\\_rapido\\_R.pdf](http://www.leg.ufpr.br/~walmes/cursoR/guia_rapido_R.pdf)

## A COMUNIDADE DE R

R Brasil - Programadores

<https://www.facebook.com/groups/1410023525939155/>

Listas de e-mail oficiais

<https://www.r-project.org/mail.html>

R-br - lista brasileira oficial

<http://www.leg.ufpr.br/doku.php/software:rbr>

Stack Overflow - R

<http://stackoverflow.com/questions/tagged/r>

<http://pt.stackoverflow.com/questions/tagged/r>

## A COMUNIDADE DE R

Cross Validated - R

<http://stats.stackexchange.com/questions/tagged/r>

Blog - Dados Aleatórios

<http://www.dadosaleatorios.com.br/>

Blog - Análise Macro

<https://analisemacro.com.br/blog>

# Dúvidas?



