

# Profiling Cryptography Developers

Bachelor Project of Said Ali  
supervised by Mohammadreza Hazhirpasand

# Research Question

Correlation between  
crypto developer activity on Stack Overflow  
and  
crypto developer contribution on GitHub

# Pipeline



## Crypto tag

- Heuristic 1
- Heuristic 2



## Crypto user

- Stack Exchange



## Account

- Scraping
- Manual search



## Crypto file

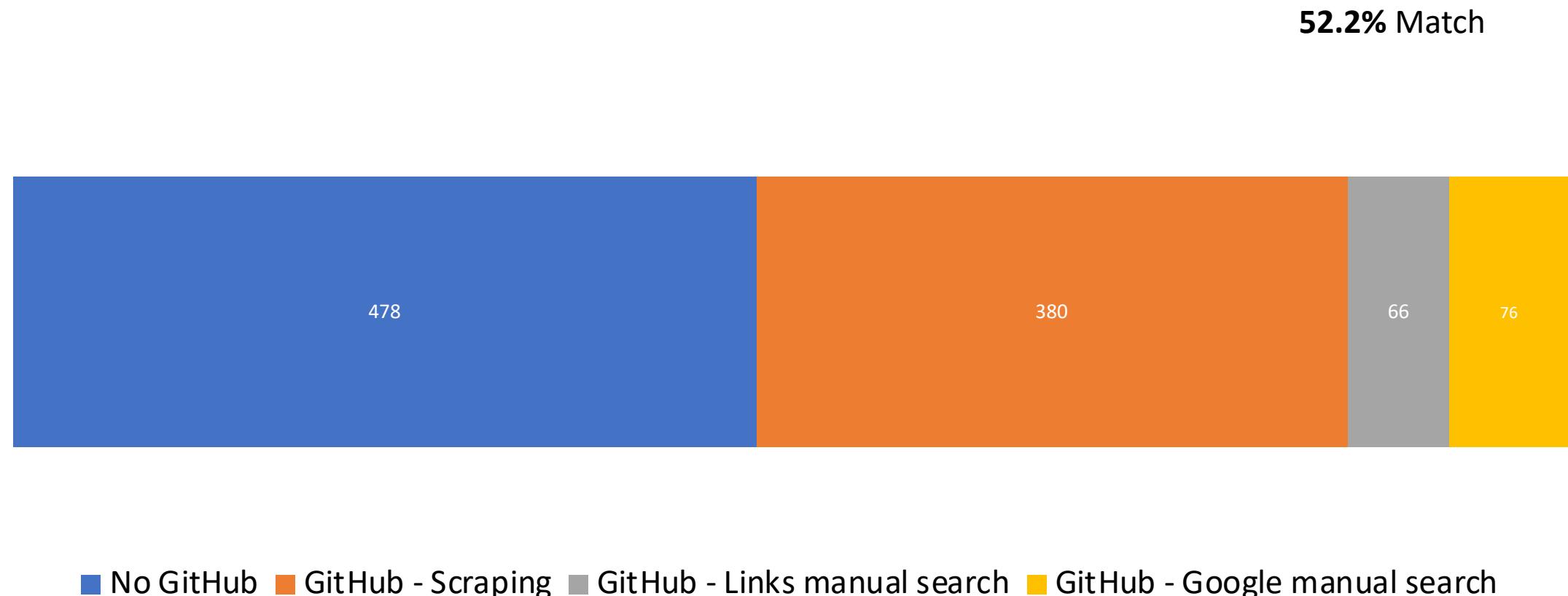
- GH repo API
- GH code API
- Scraping



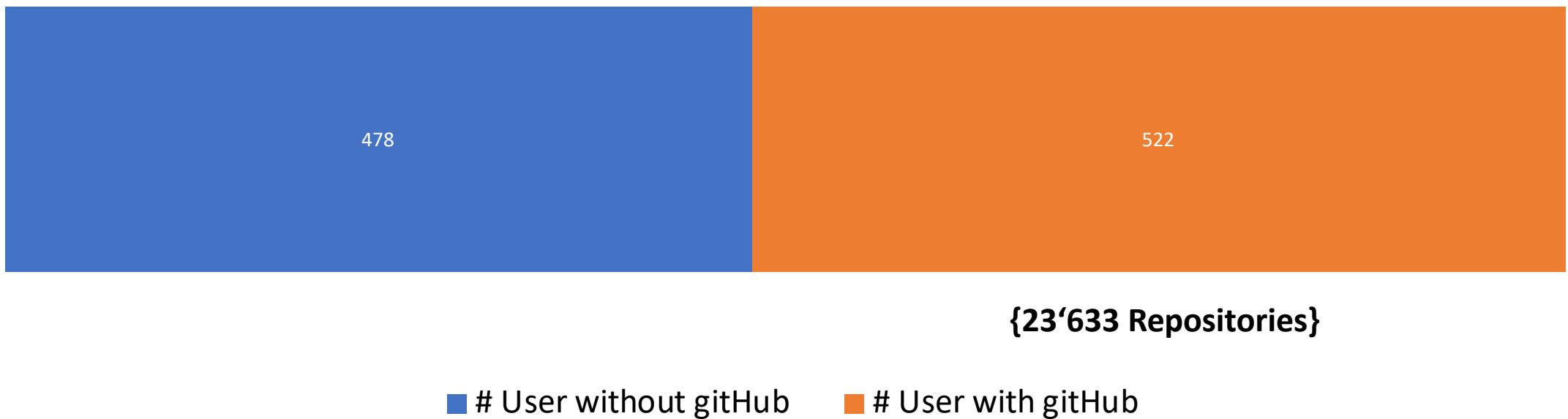
## Crypto contributor

- Git Blame
  - File author
  - File committer

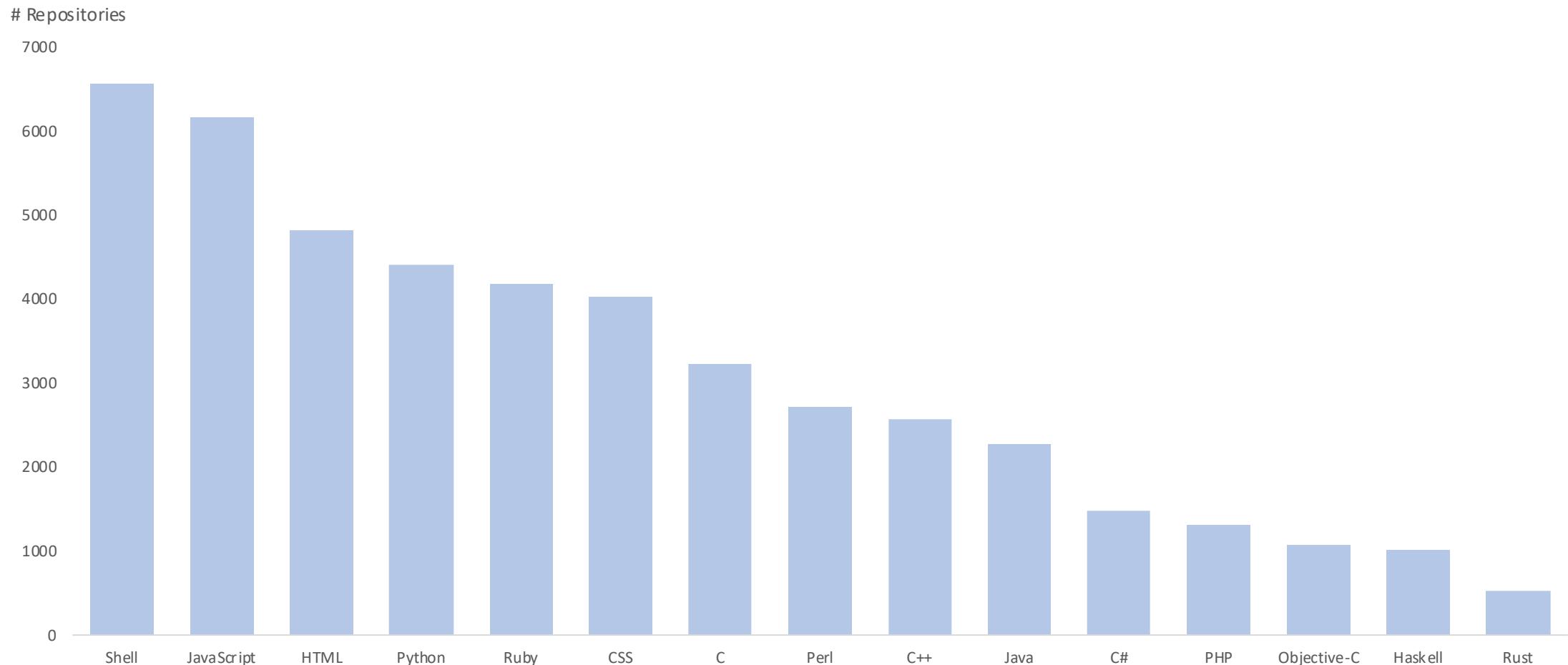
# Results



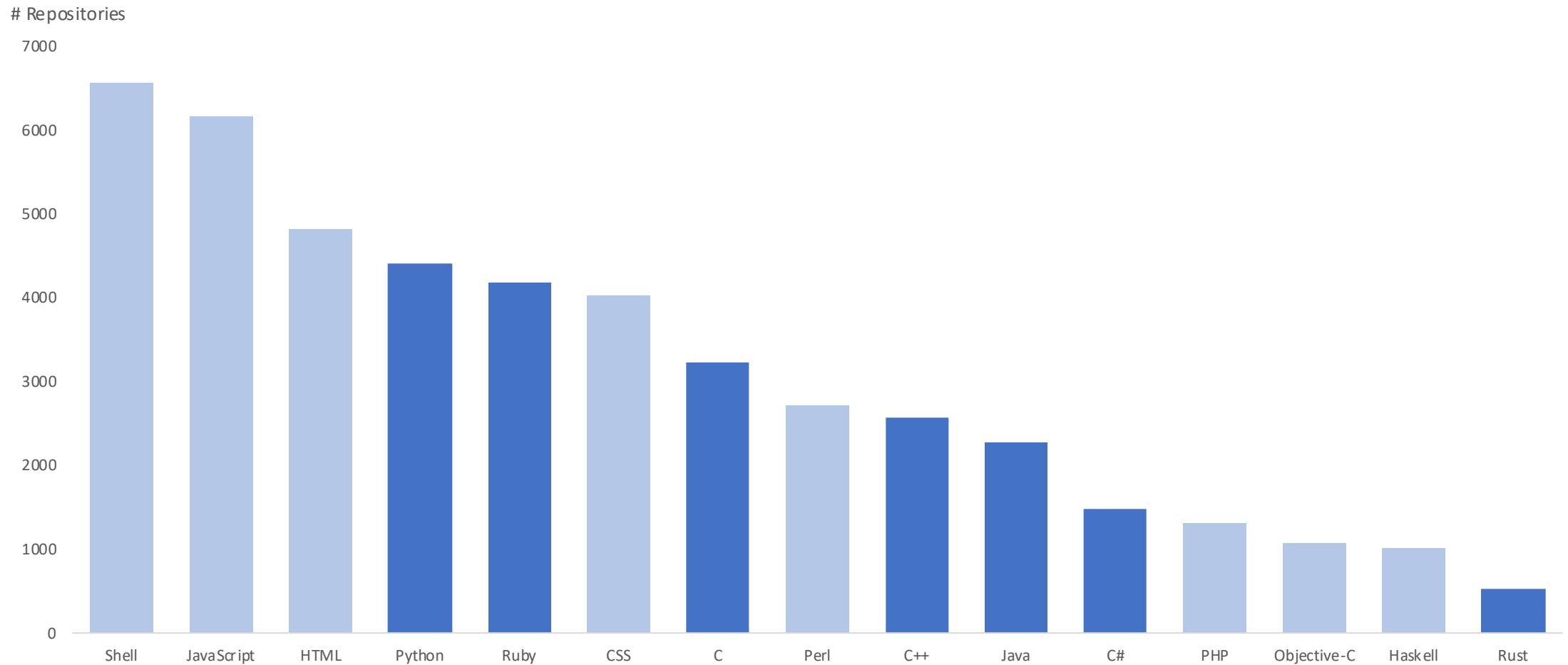
# Results



# Results



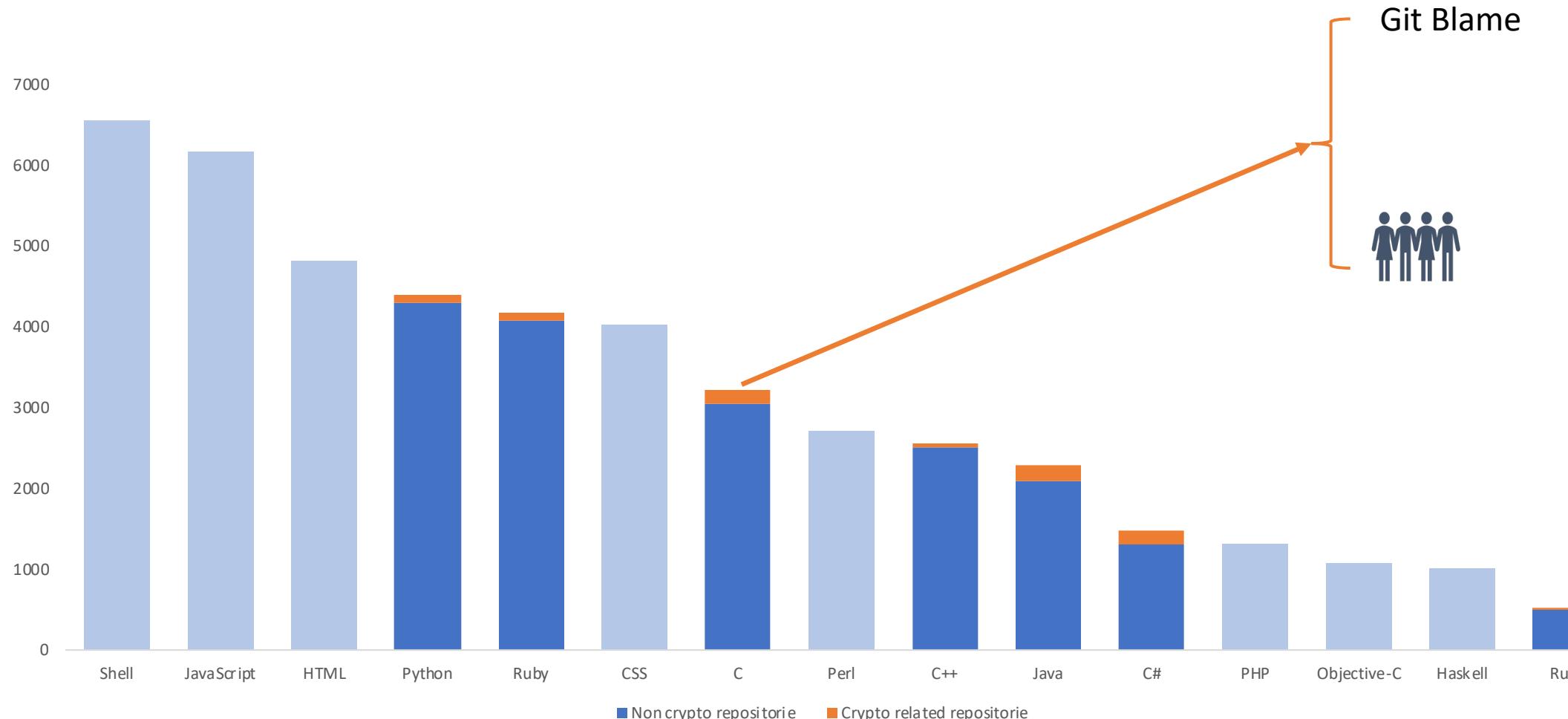
# Results



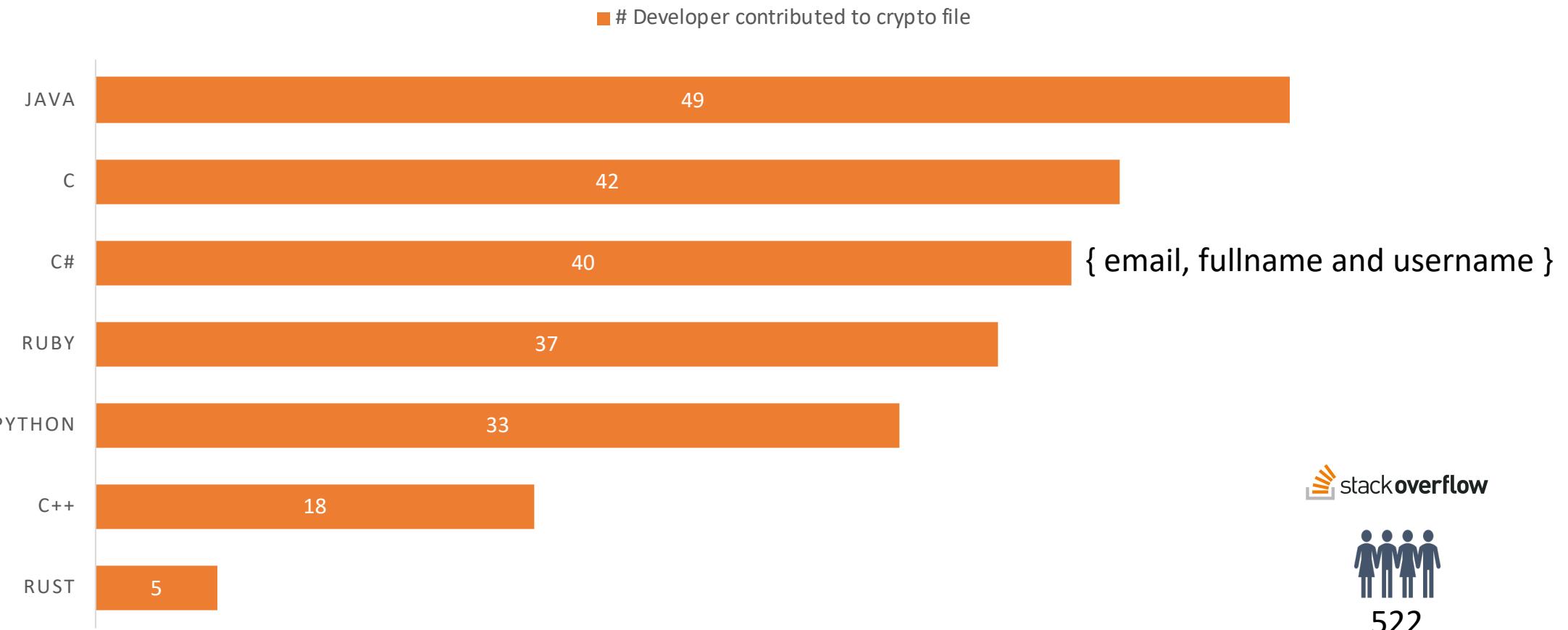
# Crypto libraries

Python	Ruby	C	C++	Java	C#	Javascript	Rust
from passlib.	require 'rbnacl'	include "tomcrypt_	include <botan/	Java.security	using Org.BouncyCastle	require("crypto")	use octavo
import passlib	require 'digest'	include <tomcrypt.h>	include "cryptlib.h"	Javax.crypto	using Sodium	aes.js	use recrypt
import pbkdf2_sha256	require 'openssl'	include "paillier.h"	include <cryptlib>		using System.Security.Cryptography	rsa.js	use ring
import nacl	require 'bcrypt'	include "rsa.h"	include "aes.h"		using PCLCrypto	hash.js	use crypto
from nacl		include "x509.h"	using CryptoPP::			nacl_facto	use openssl
import hashlib		include "crypto_"	include <des.h>			ry.js	use rustls
from hashlib		include <openssl/	include "blowfish.h"			sjcl.js	use md5
from crypto		include <themis/	include "secblock.h"			hashes.js	use blake2
from pyelliptic		include <wolfssl/					
import crypto		include "xxhash.h"	include "eccrypto.h"			require("js-nacl")	use digest
		include "aes.h"	include <helib/			require('crypto')	use themis
import bcrypt		include "md5.h"	include "cryptopp/			require('hashes')	
from bcrypt		include "sha1.h"	include <cryptopp/			require('crypto-js')	
		include "sha256.h"	include <openssl/			goog.module('goog.crypt	
		include "blowfish.h"				JSEncrypt()	
		include "des.h"				require('jsthemis	

# Results



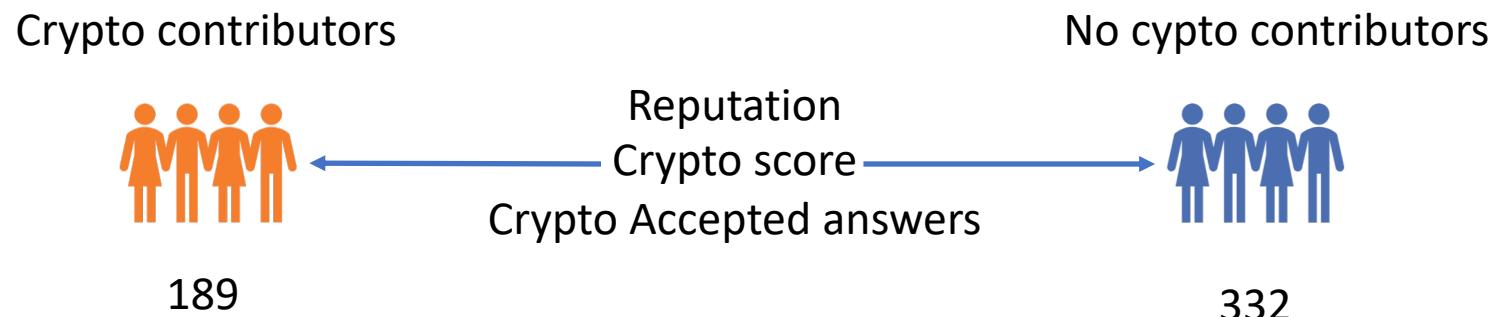
# Crypto contributors



# Data Analysis



# Overall Analysis



- Crypto contributors vs no crypto contributors
  - {reputation, crypto score and crypto accepted answers}
- Crypto contributors
  - {crypto score, crypto accepted answers, # crypto file contributions}
  - {crypto score-reputation-crypto accepted answers}

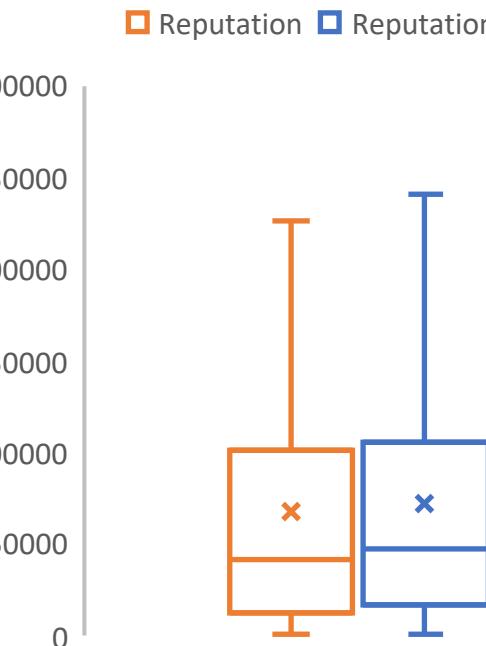
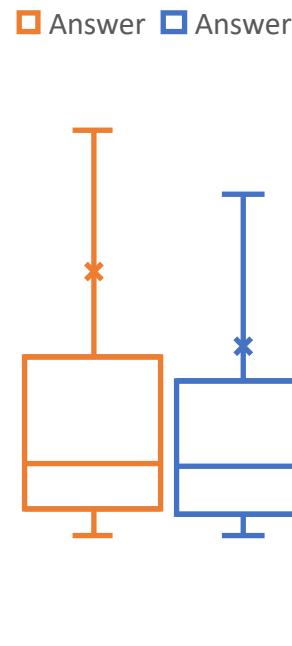
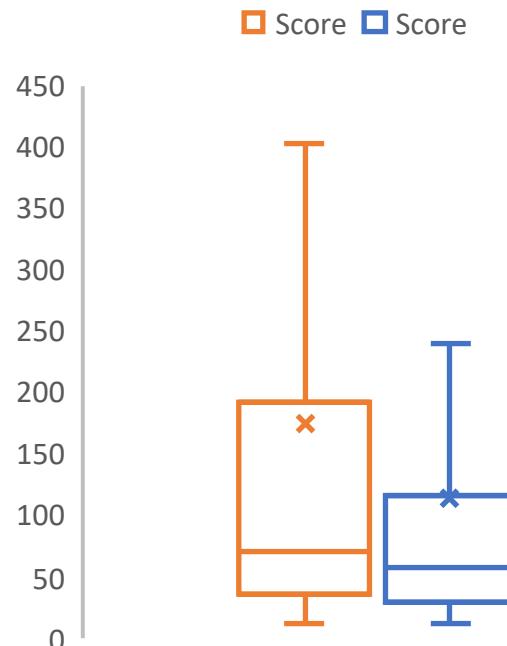
# Mann-Whitney U test

- Compares probability to get higher value
  - $H_0$  : difference between two groups is **not** statistically significant
    - accepted:  $p\text{-value} > \alpha=0.05$
    - medians of the two samples are identical.
  - $H_1$  : difference between two groups **is** statistically significant
- 
- **Non normal distribution**
  - **Independent variable of two categories**
  - **Independence of observations**

# Visual analysis

Crypto contributor

No crypto contributor



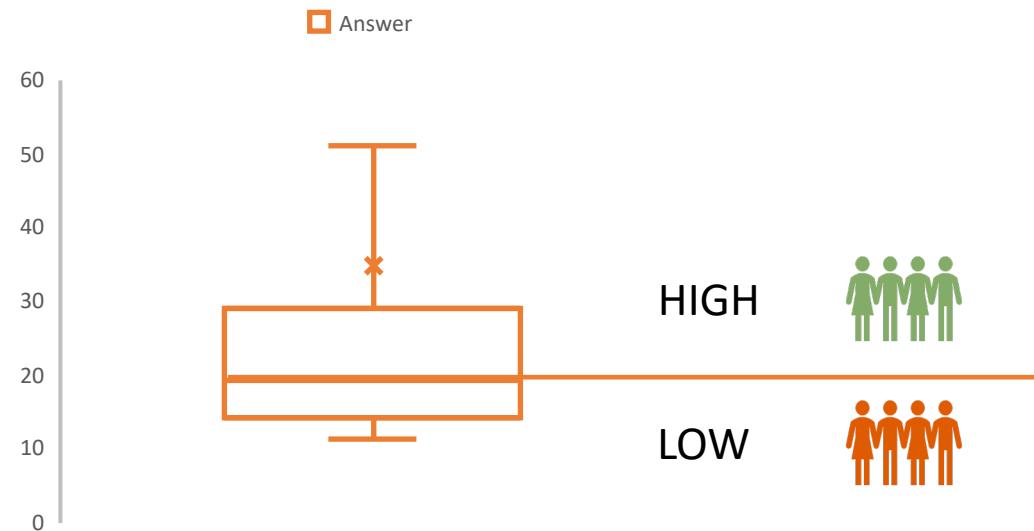
# Mann-Whitney U test

- Crypto contributors vs no crypto contributors
  - Score
    - $H_0$  accepted: p-value = 0.25 >  $\alpha$
  - Reputation
    - $H_0$  accepted: p-value = 0.29 >  $\alpha$
  - Answers
    - $H_0$  accepted: p-value = 0.458 >  $\alpha$

No significant difference

# Visual analysis

## Crypto accepted answers of crypto contributors



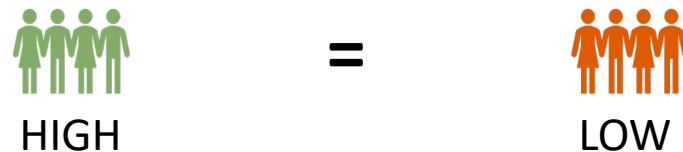
Mean **39.6**

Median **19**

Standard Deviation **60.5**

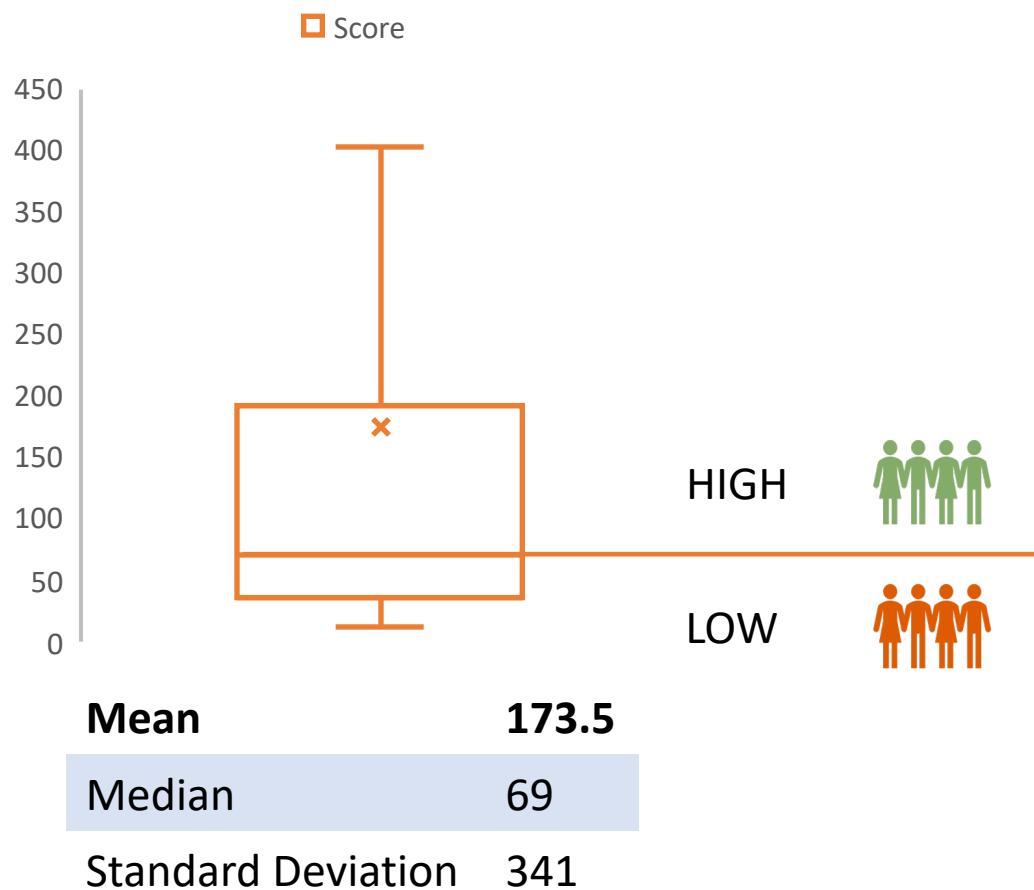
# Mann-Whitney U test

- Accepted answers of crypto contributors
  - # Crypto file contribution
    - $H_0$  accepted: p-value = 0.14 >  $\alpha$



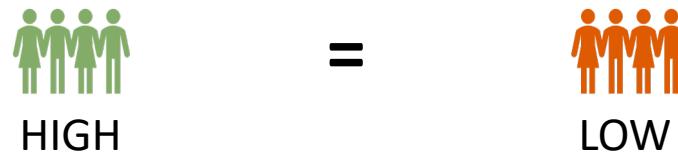
# Visual analysis

## Score of crypto contributors



# Mann-Whitney U test

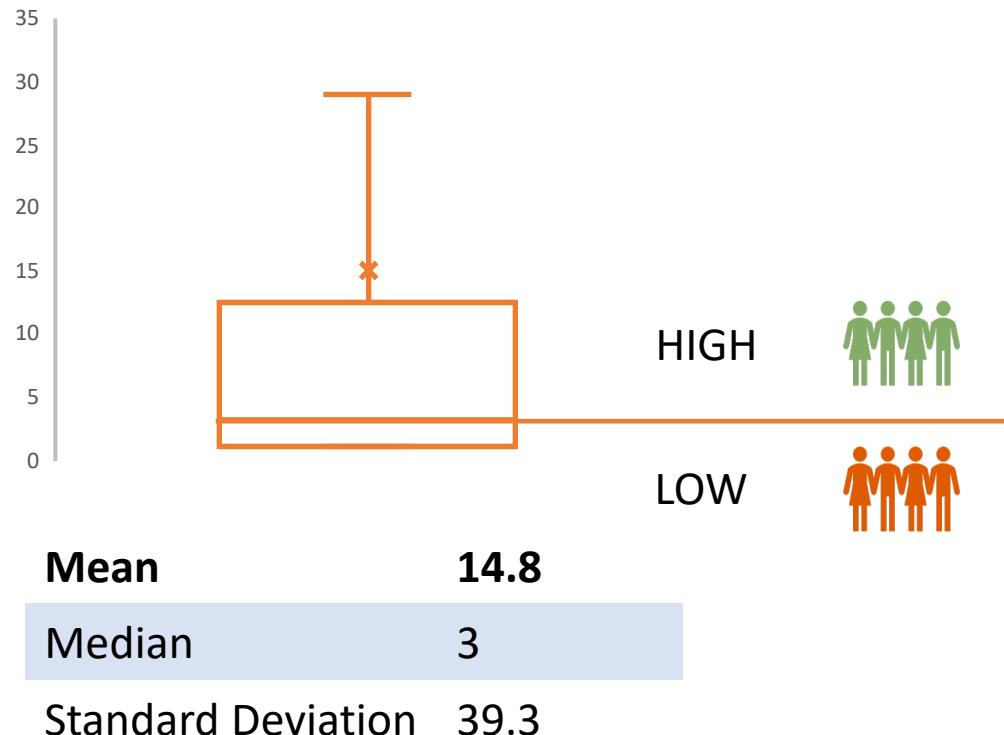
- Score of crypto contributors
  - # Crypto file contribution
    - $H_0$  accepted: p-value = **0.645668** >  $\alpha$



# Visual analysis

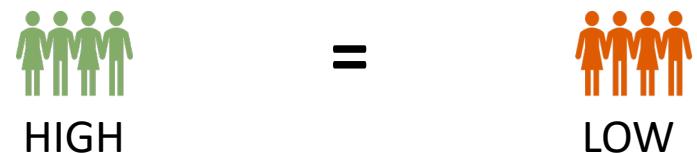
## Number of crypto file contribution

□ #Crypto file contribution



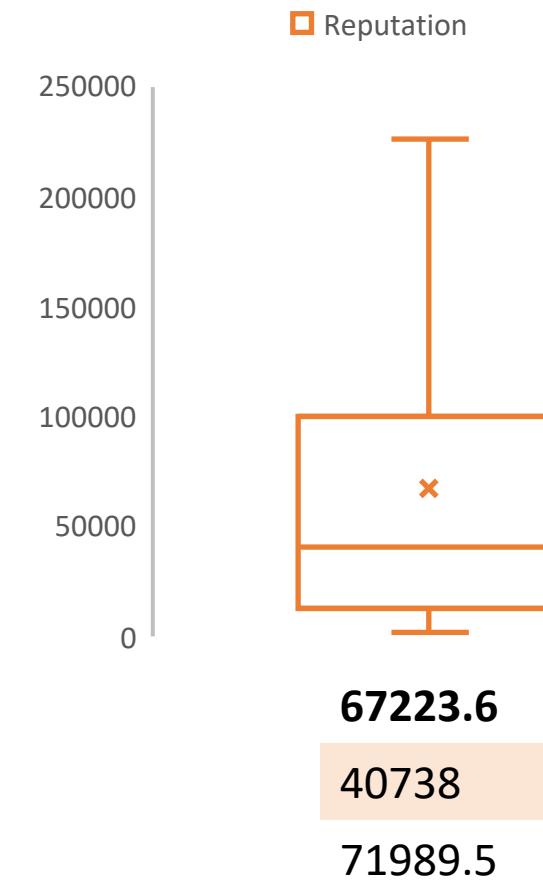
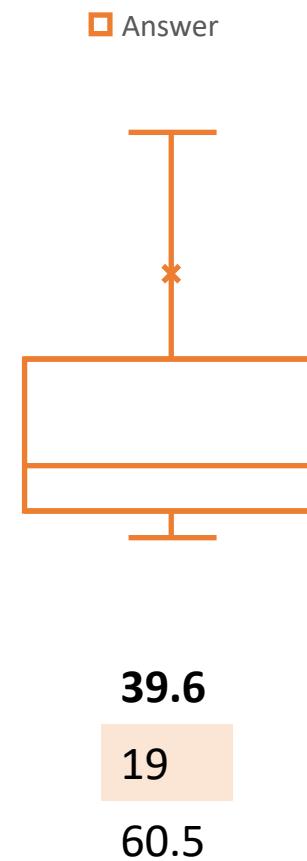
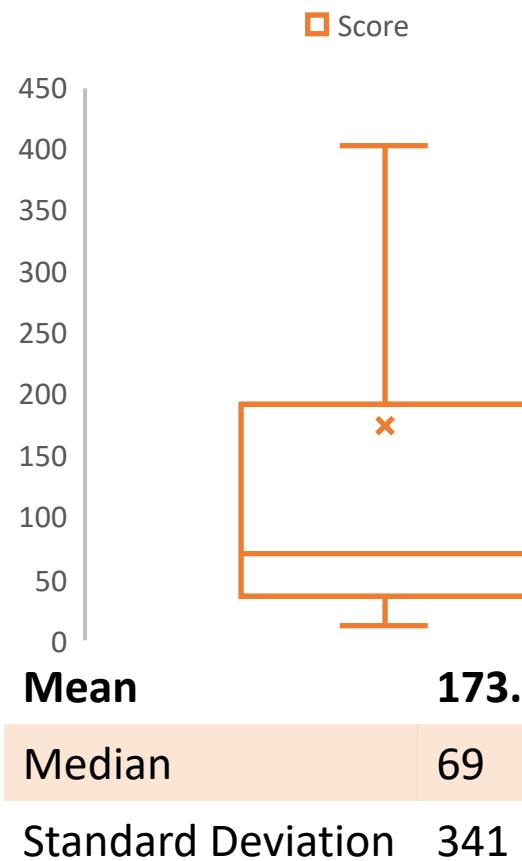
# Mann-Whitney U test

- Number of crypto file contribution
  - Score
    - $H_0$  accepted: p-value = 0.7462 >  $\alpha$
  - Reputation
    - $H_0$  accepted: p-value = 0.7422 >  $\alpha$
  - Answers
    - $H_0$  accepted: p-value = 0.2613 >  $\alpha$



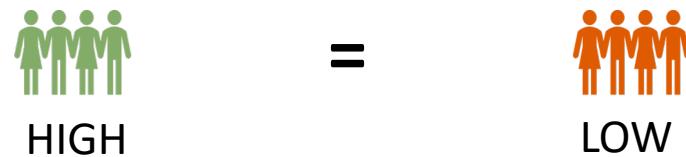
# Visual analysis

## Crypto activities of crypto contributors



# Mann-Whitney U test

- Crypto activites of crypto contributors
  - # Crypto file contribution
    - $H_0$  accepted: p-value = 0.39 >  $\alpha$



# Results

- No significant difference between crypto developer activity and crypto developer contribution



# Future Work

- Only GitHub
  - Add additional Q&A and development platforms
- Only one identity linkage
  - Email MD5
  - Identity linkage Software (TBIL)
- Other programming languages
- Crypto libraries

# Conclusion

stack overflow	stack overflow	GitHub	GitHub	GitHub
Crypto tag	Crypto user	Account	Crypto file	Crypto contributor
<ul style="list-style-type: none"> <li>• Heuristic 1</li> <li>• Heuristic 2</li> </ul>	<ul style="list-style-type: none"> <li>• Stack Exchange</li> </ul>	<ul style="list-style-type: none"> <li>• Scraping</li> <li>• Manual search</li> </ul>	<ul style="list-style-type: none"> <li>• GH repo API</li> <li>• GH code API</li> <li>• Scraping</li> </ul>	<ul style="list-style-type: none"> <li>• Git Blame</li> <li>• File author</li> <li>• File committer</li> </ul>

