

Stack Overflow Developer Survey

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- TECHNOLOGY TREND ANALYSIS

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4/23/2023

EXECUTIVE SUMMARY

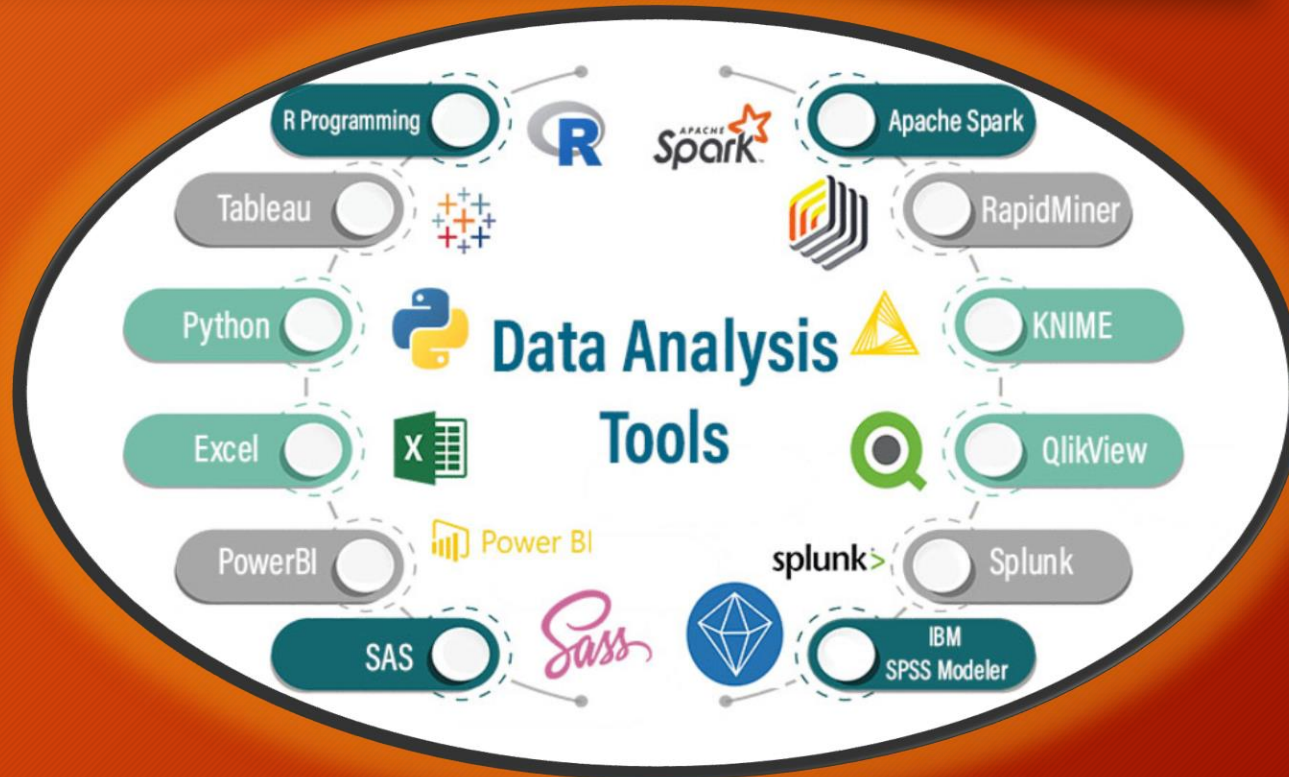
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- The annual surveys, conducted regularly by online programming knowledge sharing platform Stack Overflow, aim to collect data on technology usage and trends among developers.
- This presentation refers to analyzes obtained from a subset of databases obtained from surveys conducted in 2019 in which a total of 85,987 respondents were registered. The analyzes were performed using two datasets:
 1. Data Technologies Survey for Developers with 74,589 Respondents
 2. A survey on the demographic structure of developers with the participation of 11,398 respondents
- The presentation provides an analysis of the current situation in the field of users of software technologies, their aspirations for the coming year as well as their demographic structure.
- These findings are particularly relevant to current and aspiring interested in using software technologies
- Audience: Developers, HR professionals, Educators, Policy Makers, IT Industry Leaders, Students. Current, Aspirants, Professionals, Hobbyists.

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OBJECTIVES

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The main objectives of this presentation

- Obtaining knowledge about the situations in the world of users of software technologies.
- Using analytical technology to gain insight into technology trends used in software worldwide; predict technology trends that will be used in software around the world in the future; gain insight into the demographic structure of software technology users around the world.
- The knowledge obtained to serve for making decisions related to using software technologies.

OBJECTIVES

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The key questions answered by this presentation

- **Current Technology Usage**
 - Displays Top 10 Languages Worked With according to the survey
 - Displays Top 10 Database Worked With according to the survey
 - Displays Platform Worked With according to survey
 - Displays Top 10 Web Frame Worked With according to survey
- **Future Technology Trend**
 - Displays Top 10 Language Desires Next Year according to the survey
 - Displays Top 10 Database Desire Next Year according to the survey
 - Displays Platform Desire Next Year according to survey
 - Displays Top 10 Web Frame Desire Next Year according to the survey
- **Demographic**
 - Displays the Respondent classified by Gender according to the survey
 - Displays Respondent Count for Countries by survey
 - Displays Platform Desire Next Year according to survey
 - Displays the Top 10 Web Frame Desire Next Year according to the survey

METHODOLOGY

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- **Dataset Collections: download dataset in CSV format from Stack Overflow Developer Survey**
 - Demographic survey : m5_survey_data_demographics.csv
 - Technologies survey: m5_survey_data_technologies_normalised.csv
- **Data Wrangling (Munging):**
 - Cleaning, transforming, and enriching raw data into a more usable format for analysis. Using various SQL and Python techniques with appropriate required libraries, mainly Pandas, removing duplicates, correcting errors, handling missing data, transforming data into a consistent format, were performed.
- **Data Visualization:**
 - By using Pandas procedures, filtered data is obtained to show the results according to the set goals.
 - The filtered data, according to the set goals, were transferred to the IBM Cognos Analytics platform, with appropriate graphic charts to visualize the results.
- **Presentation:**
 - The presentation is prepared in PowerPoint with the desire to capture the results of the survey in a clear and simple way in order to be useful for those interested in the field of using software techniques.

RESULTS

Technology trends

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Overall data: in total 13 questions and 74,590 responders

	Respondent	LanguageWorkedWith	LanguageDesireNextYear	DatabaseWorkedWith	DatabaseDesireNextYear	PlatformWorkedWith	PlatformDesireNextYear	WebFrameWorkedWith	WebFrameDesireNextYear	DevEnviron	OpSys	Containers	BlockchainOrg	Blockchains
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	4.0	C	C	MySQL	MySQL	Linux	Linux	NaN	NaN	Eclipse	NaN	NaN	NaN	NaN
2	4.0	C++	C#	SQLite	SQLite	Windows	Windows	NaN	NaN	Vim	NaN	NaN	NaN	NaN
3	4.0	C#	JavaScript	NaN	NaN	NaN	NaN	NaN	NaN	Visual Studio	NaN	NaN	NaN	NaN
4	4.0	Python	SQL	NaN	NaN	NaN	NaN	NaN	NaN	Visual Studio Code	NaN	NaN	NaN	NaN
...
74585	25142.0	Go	Python	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
74586	25142.0	HTML/CSS	R	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
74587	25142.0	PHP	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
74588	25142.0	Python	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
74589	25142.0	R	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

74590 rows × 14 columns

RESULTS

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Technology trends

PROGRAMING LANGUAGES

PROGRAMING LANGUAGES TREND - PRESENTED DATA COMPARATIVELY

Programing Languages that are used the most

	Language	Count
---	-----	-----
1	JavaScript	8687
2	HTML/CSS	7830
3	SQL	7106
4	Bash/Shell/PowerShell	4642
5	Python	4542
6	Java	4506
7	C#	4288
8	TypeScript	3232
9	PHP	2913
10	C++	1946

Programing Languages most desired for next year

	Language	Count
---	-----	-----
1	JavaScript	6630
2	HTML/CSS	5328
3	Python	5239
4	SQL	5012
5	TypeScript	4088
6	C#	3591
7	Bash/Shell/PowerShell	3097
8	Java	2953
9	Go	2759
10	Kotlin	1890

RESULTS

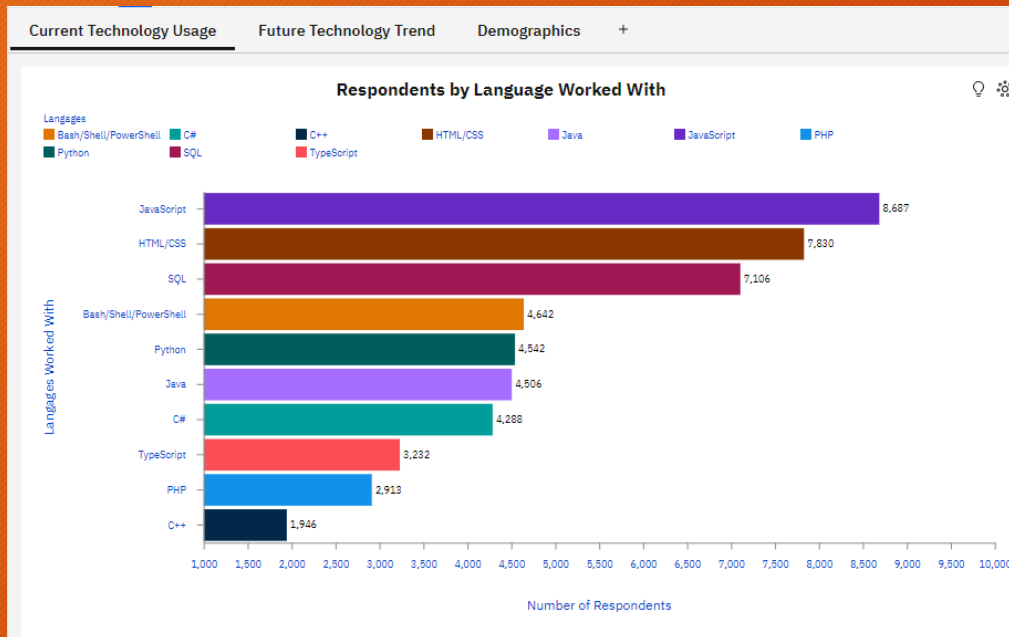
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Technology trends

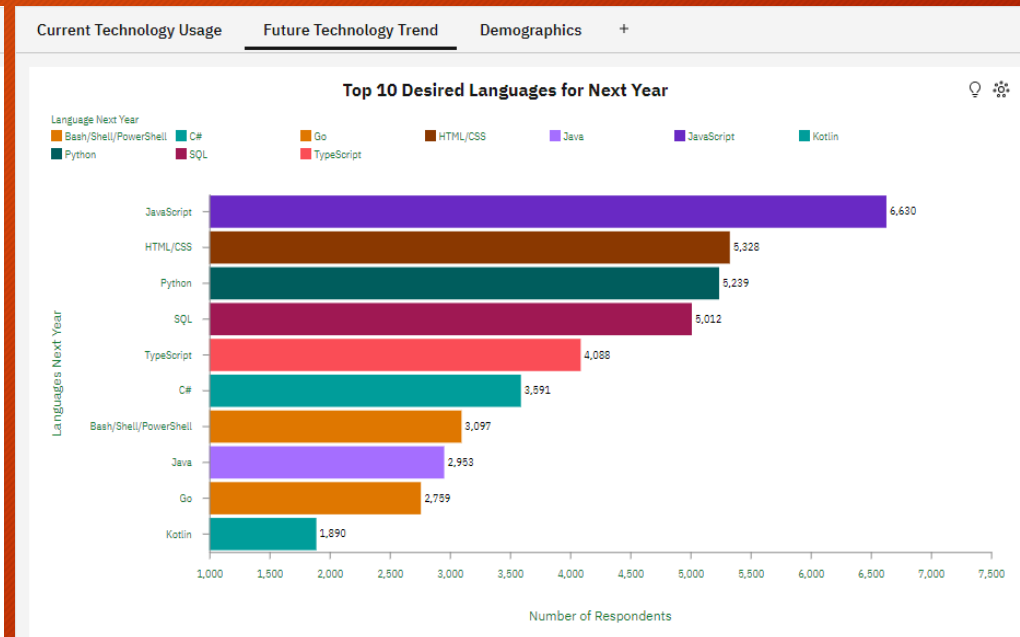
PROGRAMING LANGUAGES

PROGRAMING LANGUAGES TREND - GRAPH

Programing Languages that are used the most



Programing Languages most desired for next year



RESULTS

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Technology trends

PROGRAMING LANGUAGES

➤ Findings:

- The leading role in the use of programming languages of JavaScript and HTML/CSS indicates that most of the respondents are oriented towards WEB applications and this will continue in the next year.
- SQL is and will remain the leader for managing large databases for a long time.
- The growing interest in Python continuously indicates that a growing number of respondents are also oriented towards high-level, interpreted programming language that is widely used for general-purpose programming.
- 'C Sharp' (C#), as a modern object-oriented programming language, holds firm with high interest among the respondents, even records increased interest for the coming year.

➤ Implications:

- The results of this analysis unequivocally imply that the largest number of respondents are oriented towards web design.
- The rapid advancement of AI technology increases respondents' interest in Python with its vast number of libraries.
- Interest in database management remains high among respondents and is the third largest interest group in software technology.

RESULTS

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Technology trends

DATABASE

DATABASE TREND - PRESENTED DATA COMPARATIVELY

Database that are used the most

	Database	Count
---	:-----	-----
1	MySQL	5469
2	Microsoft SQL Server	4110
3	PostgreSQL	4097
4	SQLite	3248
5	MongoDB	3016
6	Redis	2508
7	Elasticsearch	1954
8	Oracle	1744
9	MariaDB	1709
10	Firebase	1314

Database most desired for next year

	Database	Count
---	:-----	-----
1	PostgreSQL	4328
2	MongoDB	3649
3	Redis	3331
4	MySQL	3281
5	Elasticsearch	2856
6	Microsoft SQL Server	2706
7	SQLite	2437
8	Firebase	1650
9	MariaDB	1385
10	DynamoDB	1044

RESULTS

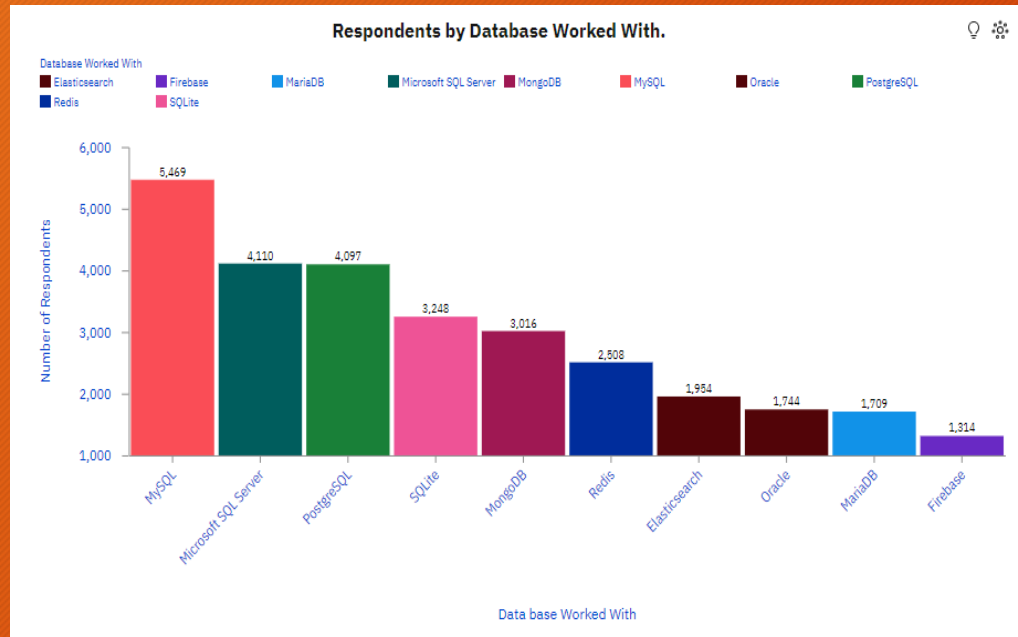
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Technology trends

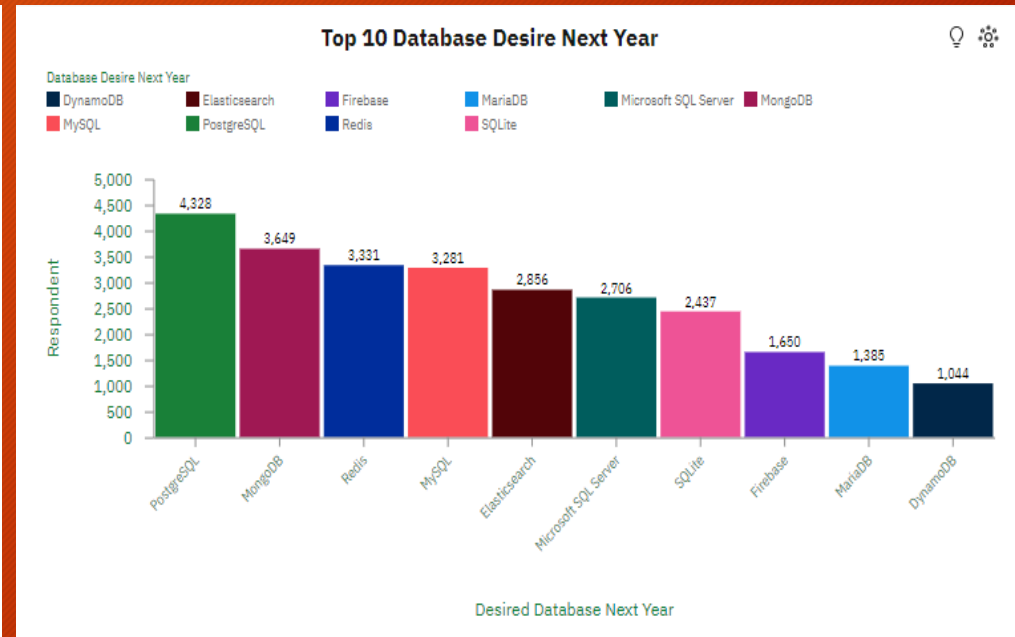
DATABASE

DATABASE TREND - GRAPH

Database that are used the most



Database most desired for next year



RESULTS

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Technology trends

DATABASE

➤ Findings:

- Currently, the most used database management language is MySQL, by a significant margin over the others. But the interest in its use in the coming year is significantly decreasing.
- Microsoft SQL Server and PostgreSQL are tied in developer usage behind MySQL among respondents. Unlike Microsoft SQL Server, for which interest is significantly decreasing, PostgreSQL is becoming the most desired database language for the coming year.
- The presence of Firebase among the ten most used databases is noticeable, and the interest in its use is increasing even more in the coming year.
- The most used NoSQL databases are MongoDB and Redis.

➤ Implications:

- PostgreSQL's features as a relational database management system known for its robustness, reliability, and scalability make it the most preferred database of the coming year.
- The increased interest and usability of a document-oriented database program that uses JSON-like documents with optional schemas also implies increased interest in MongoDB, which becomes the second most preferred database for the coming year among respondents.

RESULTS

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Technology trends

PLATFORMS

PROGRAM PLATFORMS- PRESENTED DATA COMPARATIVELY

Platforms that are used the most

	Platform	Count
---	:-----	-----:
1	Linux	5811
2	Windows	5563
3	Docker	4378
4	AWS	3588
5	Slack	2786
6	MacOS	2718
7	Android	2693
8	Microsoft Azure	1711
9	Raspberry Pi	1614
10	WordPress	1490

Platforms most desired for next year

	Platform	Count
---	:-----	-----:
1	Linux	5865
2	Docker	5804
3	AWS	4442
4	Windows	3888
5	Android	3231
6	Kubernetes	3201
7	MacOS	2593
8	Raspberry Pi	2525
9	Google Cloud Platform	2401
10	Slack	2359

RESULTS

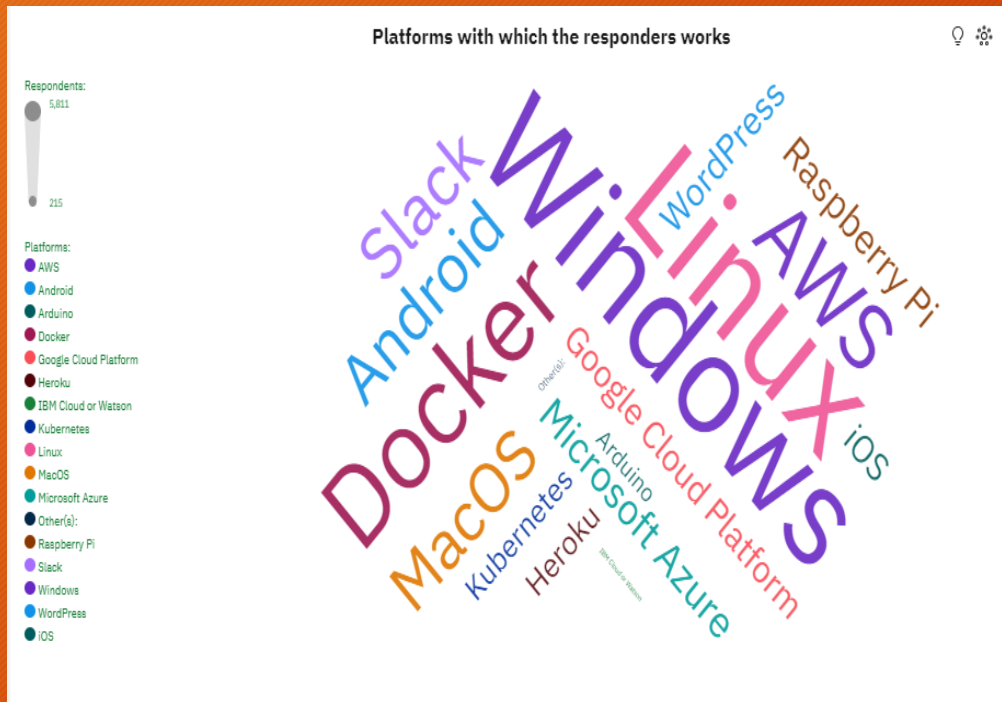
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Technology trends

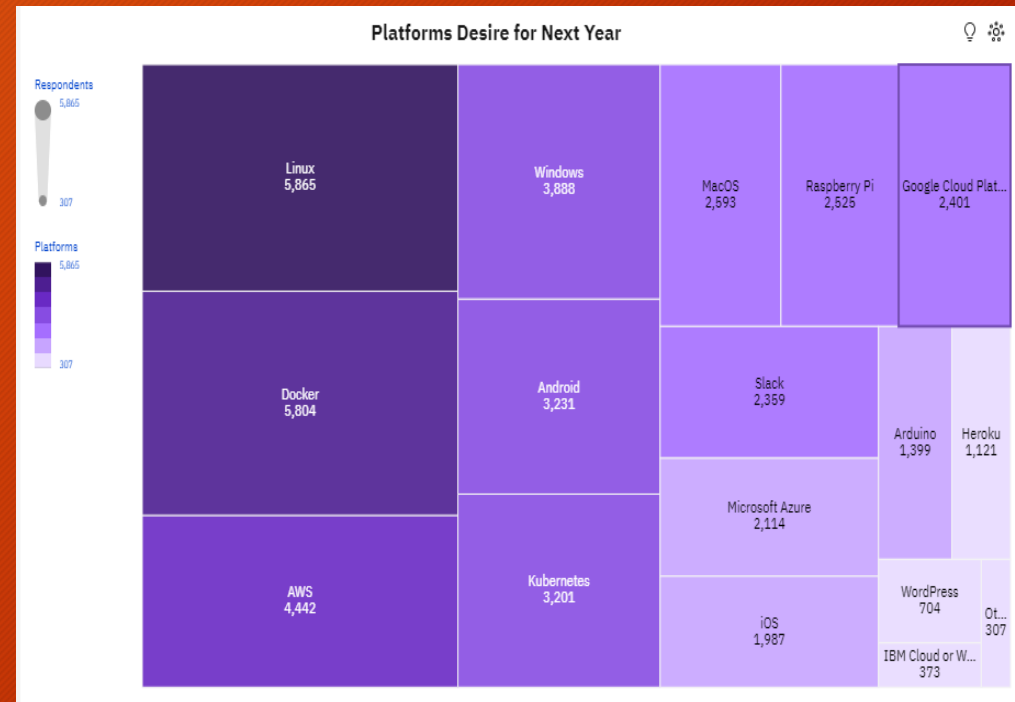
PLATFORMS

PROGRAM PLATFORMS - PRESENTED VISUALLY COMPARATIVELY

Platforms that are used the most



Platforms most desired for next year



RESULTS

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Technology trends

PLATFORMS

➤ Findings:

- Operating system platforms are understandably the most used, led by Linux and Windows. For the next year, interest in Windows is decreasing, but interest in containerization platform through Docker and Amazon Web Services (AWS) as Cloud computing platform is increasing.
- The significant use of Slack as a Collaboration platform is notable, but the interest decreases in the coming year, when the interest in Google Cloud Platform (GCP) and Kubernetes increases sharply.
- The interest among the respondents is slightly decreasing for using MacOS in the coming year, but the interest in Android as a Mobile application platform is increasing.

➤ Implications:

- Despite the fact that the interest in using Operating system platforms for the next year is significantly decreasing, still the largest part of respondents will work on these platforms.
- The containerization platform among respondents will remain in the coming year as the second most used platform, but with a dramatically increased interest. This is especially so as Docker ranks second in terms of interest and Kubernetes appears in the top 10 most preferred platforms.

RESULTS

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Technology trends

WEB FRAMEWORK

WEB FRAMEWORKS- PRESENTED DATA COMPARATIVELY

Web Frameworks that are used the most

	Web Framework	Count
---	:-----	-----
1	jQuery	4629
2	Angular/Angular.js	3327
3	React.js	3302
4	ASP.NET	3042
5	Express	2028
6	Spring	1728
7	Vue.js	1485
8	Flask	1186
9	Django	1176
10	Laravel	939

Web Frameworks most desired for next year

	Web Framework	Count
---	:-----	-----
1	React.js	4714
2	Vue.js	3143
3	Angular/Angular.js	3059
4	ASP.NET	2382
5	jQuery	2241
6	Express	1957
7	Spring	1564
8	Django	1504
9	Flask	1240
10	Ruby on Rails	970

RESULTS

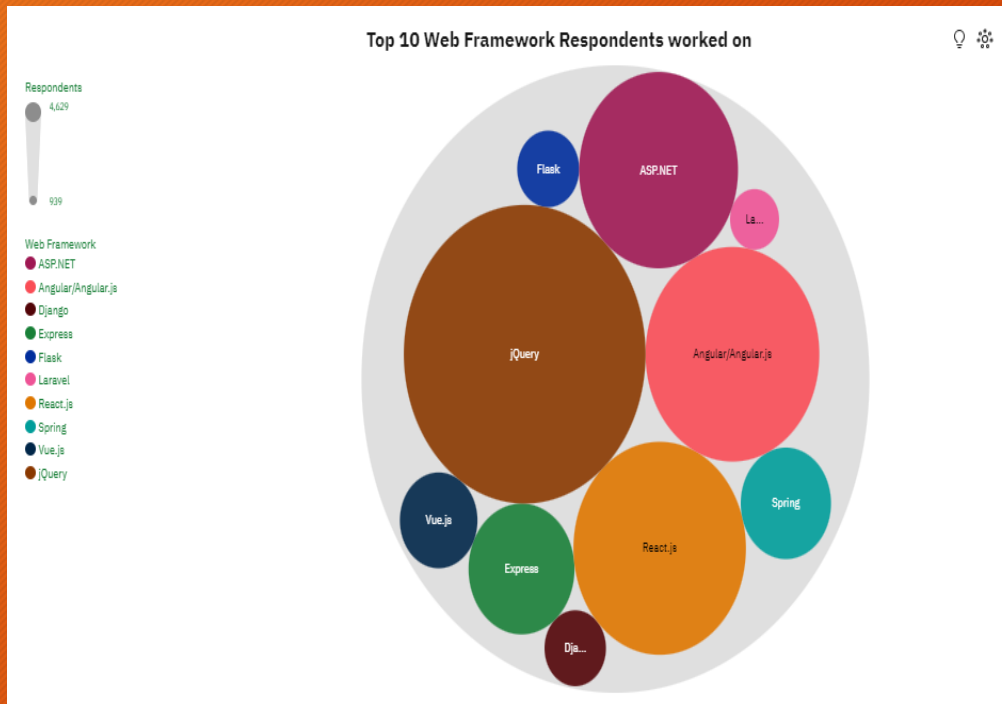
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Technology trends

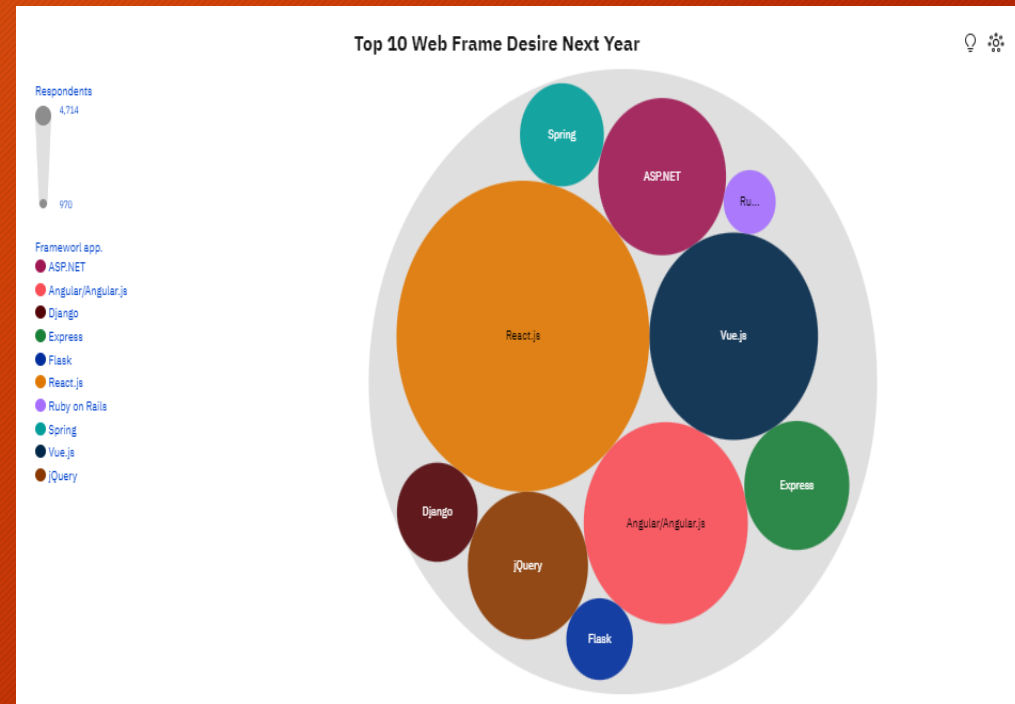
WEB FRAMEWORK

WEB FRAMEWORKS - PRESENTED VISUALLY COMPARATIVELY

Web Frameworks that are used the most



Web Frameworks most desired for next year



RESULTS

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Technology trends

WEB FRAMEWORK

➤ Findings:

- Popular JavaScript libraries and frameworks are leading in number of users among respondents. For the next year, the interest in jQuery is halved, while React.js becomes the most attractive.
- Interest in Vue.js is increasing almost threefold for the coming year, making it the second most preferred web platform.
- Interest in ASP.NET as a Microsoft .NET platform does not change in the following year, remaining in fourth position with a slightly reduced number of interested respondents.
- Flask and Django, as a web framework for Python, also slightly change their positions in the following year, but with a noticeable percentage increase in the number of interested respondents.

➤ Implications:

- Open source JavaScript libraries and frameworks are by far the most used and preferred, led by React.js and Angular. When Express and Vue.js are added as an open source web application framework for Node.js, which is a JavaScript runtime environment, it reaffirms that the most preferred programming language is JavaScript.
- The survey indicates that the usage, but the interest in usage and further with the intention to increase, is registered in web frameworks for Python, especially through Django and Flask

RESULTS

DEMOGRAPHIC

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Overall data: in total 14 questions and 11,397 block of answers

Respondent	MainBranch	Hobbyist	OpenSourcer	OpenSource	Employment	Country	Student	EdLevel	UndergradMajor	...	WelcomeChange	SONewContent	Age	Gender	Trans	Sexuality	Ethnicity	Dependents	SurveyLength	SurveyEase
0	4	I am a developer by profession	No	Never	The quality of OSS and closed source software ...	Employed full-time	United States	No	Bachelor's degree (BA, BS, B.Eng., etc.)	Computer science, computer engineering, or sof...	Just as welcome now as I felt last year	Tech articles written by other developers;Indu...	22.0	Man	No	Straight / Heterosexual	White or of European descent	No	Appropriate in length	Easy
1	9	I am a developer by profession	Yes	Once a month or more often	The quality of OSS and closed source software ...	Employed full-time	New Zealand	No	Some college/university study without earning ...	Computer science, computer engineering, or sof...	Just as welcome now as I felt last year	NaN	23.0	Man	No	Bisexual	White or of European descent	No	Appropriate in length	Neither easy nor difficult
2	13	I am a developer by profession	Yes	Less than once a month but more than once per ...	OSS is, on average, of HIGHER quality than pro...	Employed full-time	United States	No	Master's degree (MA, MS, M.Eng., MBA, etc.)	Computer science, computer engineering, or sof...	Somewhat more welcome now than last year	Tech articles written by other developers;Cour...	28.0	Man	No	Straight / Heterosexual	White or of European descent	Yes	Appropriate in length	Easy
3	16	I am a developer by profession	Yes	Never	The quality of OSS and closed source software ...	Employed full-time	United Kingdom	No	Master's degree (MA, MS, M.Eng., MBA, etc.)	NaN	Just as welcome now as I felt last year	Tech articles written by other developers;Indu...	26.0	Man	No	Straight / Heterosexual	White or of European descent	No	Appropriate in length	Neither easy nor difficult
4	17	I am a developer by profession	Yes	Less than once a month but more than once per ...	The quality of OSS and closed source software ...	Employed full-time	Australia	No	Bachelor's degree (BA, BS, B.Eng., etc.)	Computer science, computer engineering, or sof...	Just as welcome now as I felt last year	Tech articles written by other developers;Indu...	29.0	Man	No	Straight / Heterosexual	Hispanic or Latino/Latina;Multiracial	No	Appropriate in length	Easy
...
11393	25136	I am a developer by profession	Yes	Never	OSS is, on average, of HIGHER quality than pro...	Employed full-time	United States	No	Master's degree (MA, MS, M.Eng., MBA, etc.)	Computer science, computer engineering, or sof...	Just as welcome now as I felt last year	Tech articles written by other developers;Cour...	36.0	Man	No	Straight / Heterosexual	White or of European descent	No	Appropriate in length	Difficult
11394	25137	I am a developer by profession	Yes	Never	The quality of OSS and closed source software ...	Employed full-time	Poland	No	Master's degree (MA, MS, M.Eng., MBA, etc.)	Computer science, computer engineering, or sof...	A lot more welcome now than last year	Tech articles written by other developers;Tech...	25.0	Man	No	Straight / Heterosexual	White or of European descent	No	Appropriate in length	Neither easy nor difficult
11395	25138	I am a developer by profession	Yes	Less than once per year	The quality of OSS and closed source software ...	Employed full-time	United States	No	Master's degree (MA, MS, M.Eng., MBA, etc.)	Computer science, computer engineering, or sof...	A lot more welcome now than last year	Tech articles written by other developers;Indu...	34.0	Man	No	Straight / Heterosexual	White or of European descent	Yes	Too long	Easy
11396	25141	I am a developer by profession	Yes	Less than once a month but more than once per ...	OSS is, on average, of LOWER quality than pro...	Employed full-time	Switzerland	No	Secondary school (e.g. American high school, G...	NaN	Somewhat less welcome now than last year	NaN	25.0	Man	No	Straight / Heterosexual	White or of European descent	No	Appropriate in length	Easy
11397	25142	I am a developer by profession	Yes	Less than once a month but more than once per ...	OSS is, on average, of HIGHER quality than pro...	Employed full-time	United Kingdom	No	Other doctoral degree (Ph.D, Ed.D., etc.)	A natural science (ex. biology, chemistry, phy...	Just as welcome now as I felt last year	Tech articles written by other developers;Tech...	30.0	Man	No	Bisexual	White or of European descent	No	Appropriate in length	Easy

11398 rows × 20 columns

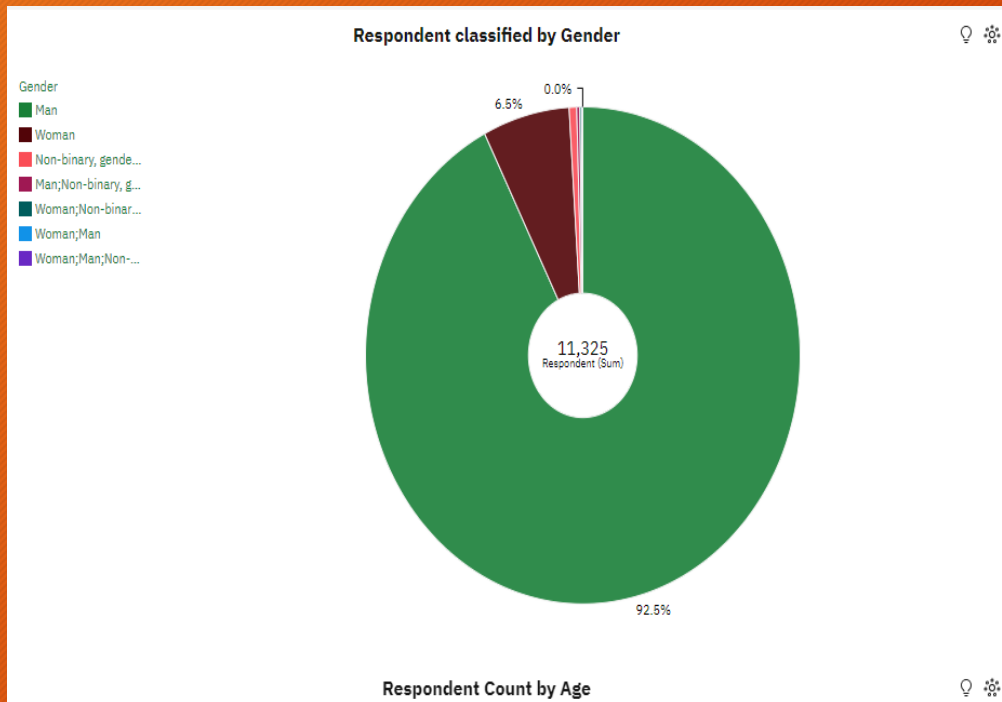
RESULTS

DEMOGRAPHIC

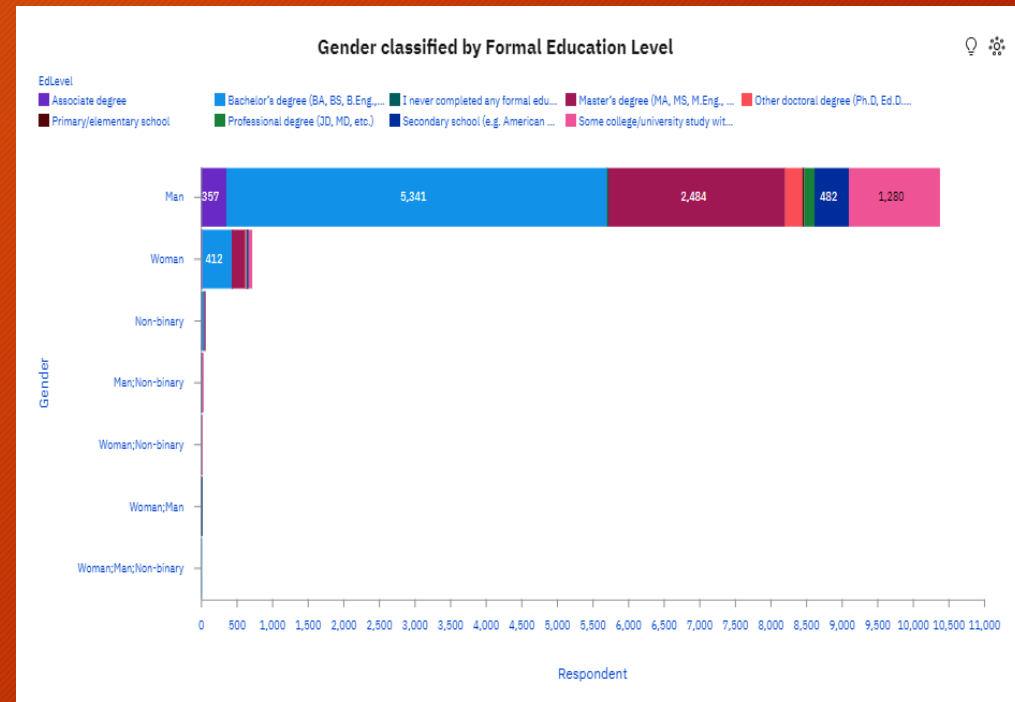
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GENDER CLASSIFIED BY RESPONDENTS AND EDUCATION - PRESENTED VISUALLY

Respondents classified by Gender



Gender classified by Formal Education



RESULTS

DEMOGRAPHIC

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GENDER CLASSIFIED BY RESPONDENTS AND EDUCATION - Finding & Implications

➤ Findings:

- A surprisingly large majority of respondents identified as 'Man' (92.5%) compared to a very small percentage (6.5%) who identified as 'Woman' in terms of their gender.
- An insignificantly small percentage (< 1%) who declared themselves with other classification of Gender were also registered.
- More than half of respondents by Gender 'Men' have a Bachelor's degree. The ratio of formal education among 'Women' is on the same level as 'Men'.

➤ Implications:

- The disproportionate ratio of respondents in terms of gender is disappointing due to the very low response to the survey by responders who identified as 'Woman'!
- The high degree of formal education is understandable because of the problems faced in working with software technologies.

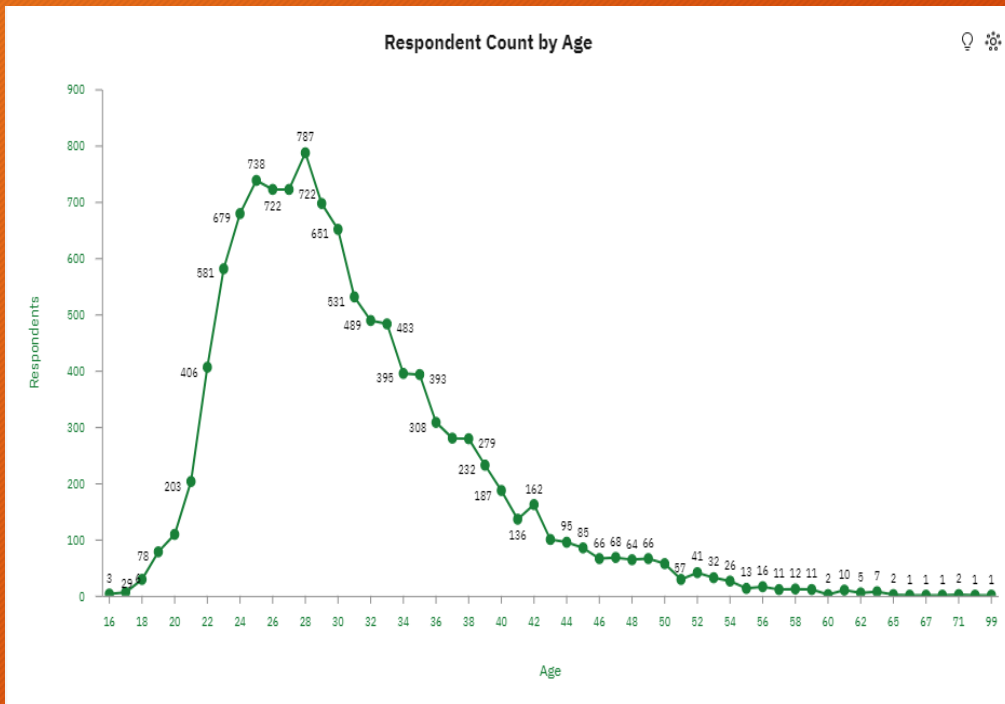
RESULTS

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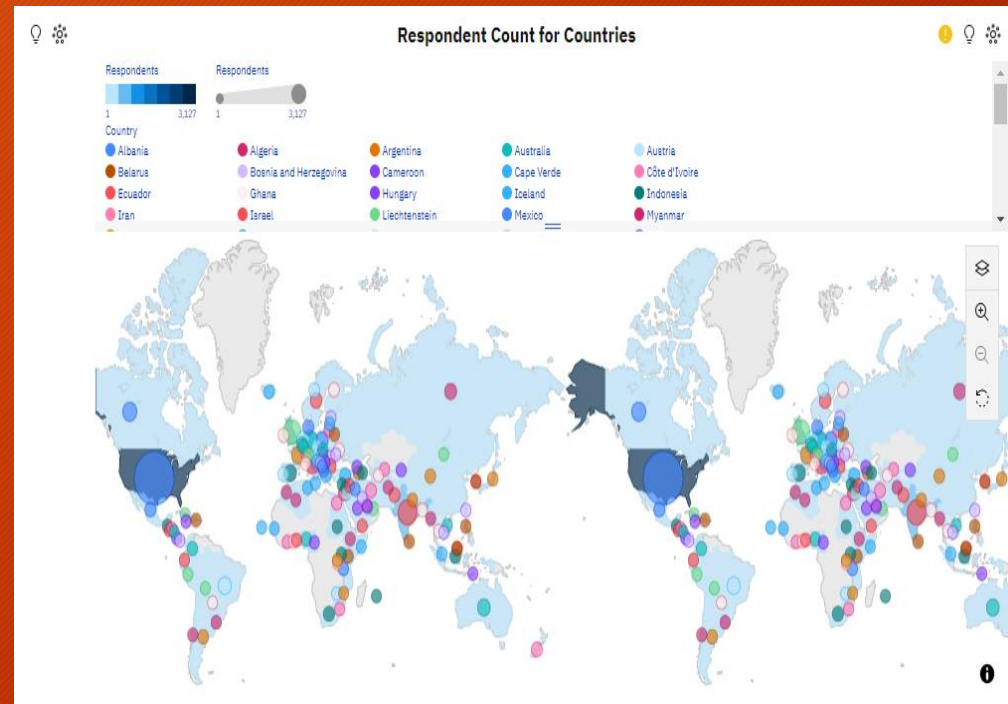
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RESPONDENTS CLASSIFIED BY AGE AND COUNTRY - PRESENTED VISUALLY

Respondents classified by Age



Gender classified by Country



RESULTS

DEMOGRAPHIC

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RESPONDENTS CLASSIFIED BY AGE AND COUNTRY - Finding & Implications

➤ Findings:

- Of the respondents, according to their age, the most represented are between the ages of 24 and 30, and the 28-year-olds are the most represented.
- Respondents from 135 countries were included in the survey. Most of them are from the US, with a number almost four times greater than the second ranked India. This is followed by the United Kingdom, Germany, Canada, etc.

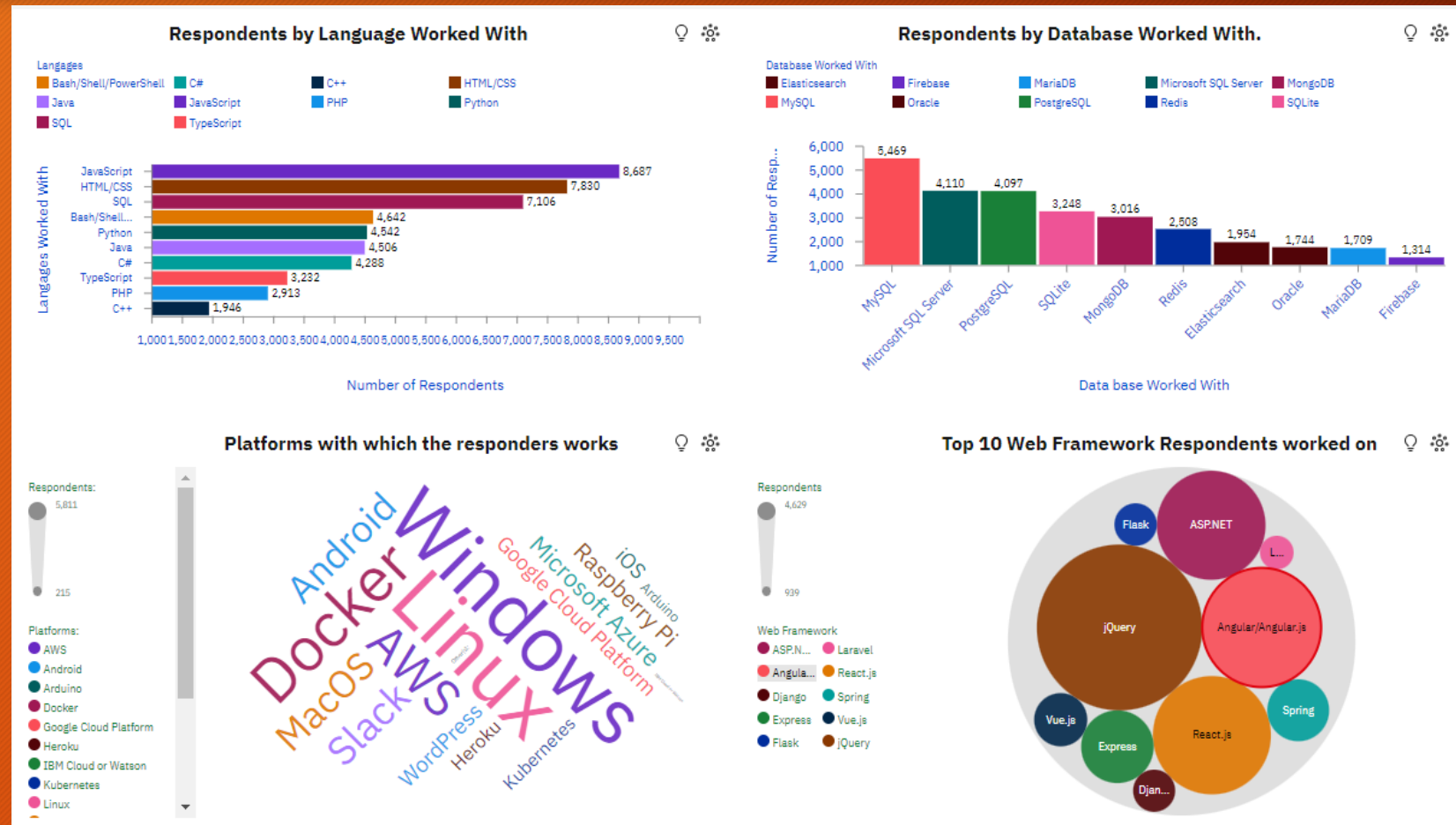
➤ Implications:

- At the age of under 20 and over 40, the response to the survey is extremely small, which is rather disappointing, because in those age categories there are significant intellectual capacities! The only respondent at the age of 99 and the three at the age of 16 should serve as a positive example and encouragement!
- The large number of countries from which respondents have registered is to be welcomed, but unfortunately the response from many countries is small, especially from China, where only 69 respondents have registered despite the large population and the technological breakthrough in informatics!

DASHBOARD

CURRENT TECHNOLOGY USE

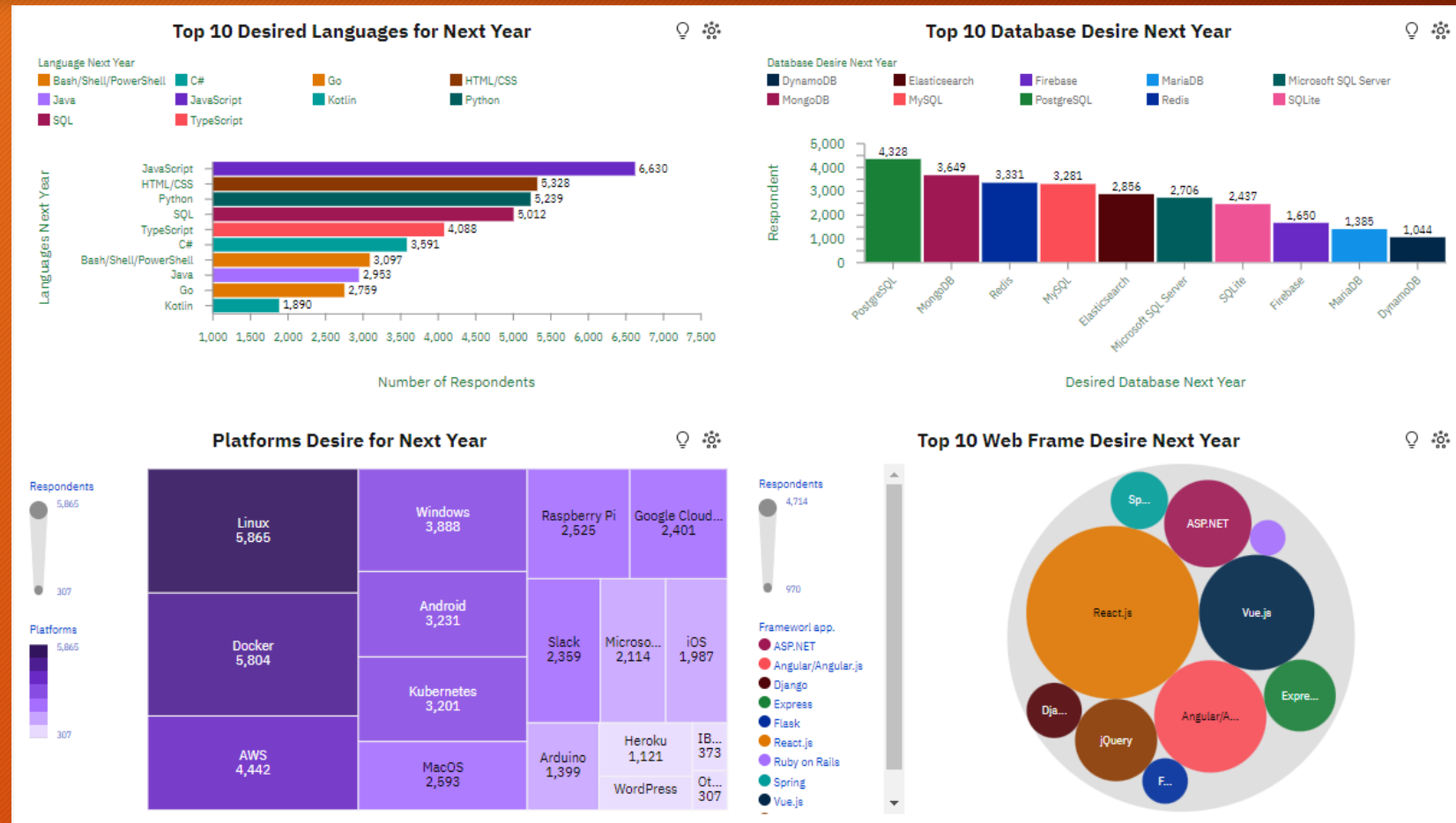
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DASHBOARD

FUTURE TECHNOLOGY TREND

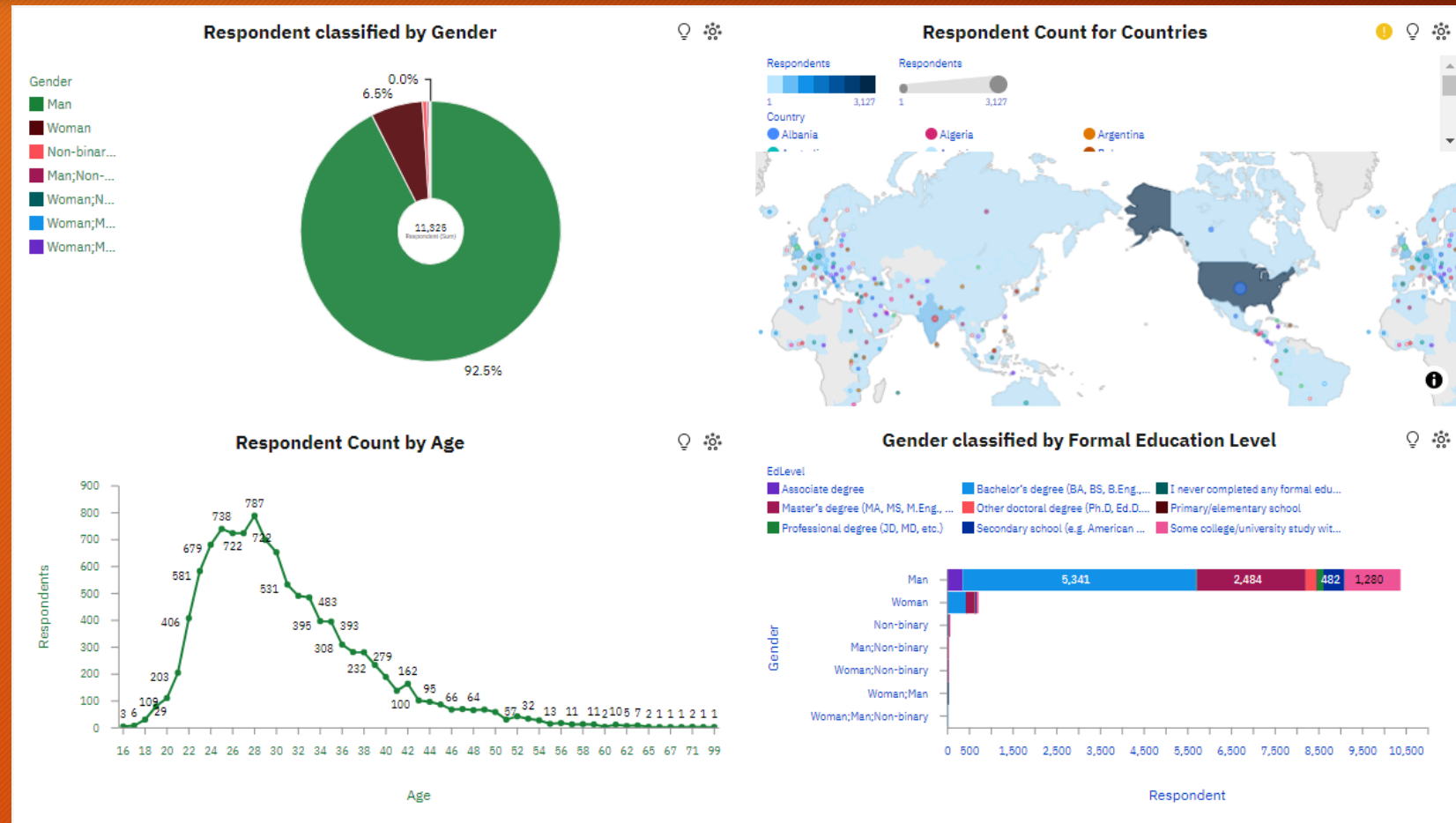
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DASHBOARD

DEMOGRAPHIC

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OVERALL

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Findings

- Java Script, HTML/CSS and in the future retains the leading interest among users of software technologies.
- A significantly increased interest is being shown for Python in the future.
- With Databases, the situation is more dynamic. PostgreSQL, MongoDB and Redis are much more attractive for the future than MySQL and Microsoft SQL Server.
- In the field of Web Frameworks, JQuery fatigue is evident, as is the growing interest in React.js, and especially Vue.js
- The result obtained from the demographic structure of the respondents in terms of gender is striking. Even 92.5% declared that they were men, and only 6.5% of respondents in the field of software technologies are women.

Implications

- Most of the respondents are oriented towards WEB software technologies, and they will maintain the same interest in the future.
- The analysis indicates a growing interest in interpreted programming languages.
- Interest in open source software for databases is also growing significantly.
- With such a small percentage of respondents who declare themselves as Women, the real picture is distorted in all segments of the population that deals with software technologies.

CONCLUSION

OVERAL

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- Developers who work on some functional programming languages, such as Clojure and F#, are the best paid in the field of software technologies. On the other hand, those who work in a web environment, as well as with a general-purpose interpreted programming language like Python, are rather less paid, but are still the most desired! I guess the answer lies in the following:
 - ❖ All the most desirable ones are open-source, and this brings with it huge advantages in their development. A huge community of developers who contribute to a wide range of open-source libraries, frameworks, help, support, ideas etc.
 - ❖ They are attractive, creative and dynamic in nature.
 - ❖ They are relatively easy to learn.
- The versatility of Python's usability is dynamically making it an increasingly sought-after and paid-for programming language.
- The general technological development and the needs of innovation are a generator for changes and advancement in software technologies.
- Software technologies need to expand their boundaries by eliminating age, gender and racial discrimination, as well as by including a growing number of countries of the world in the programming community.

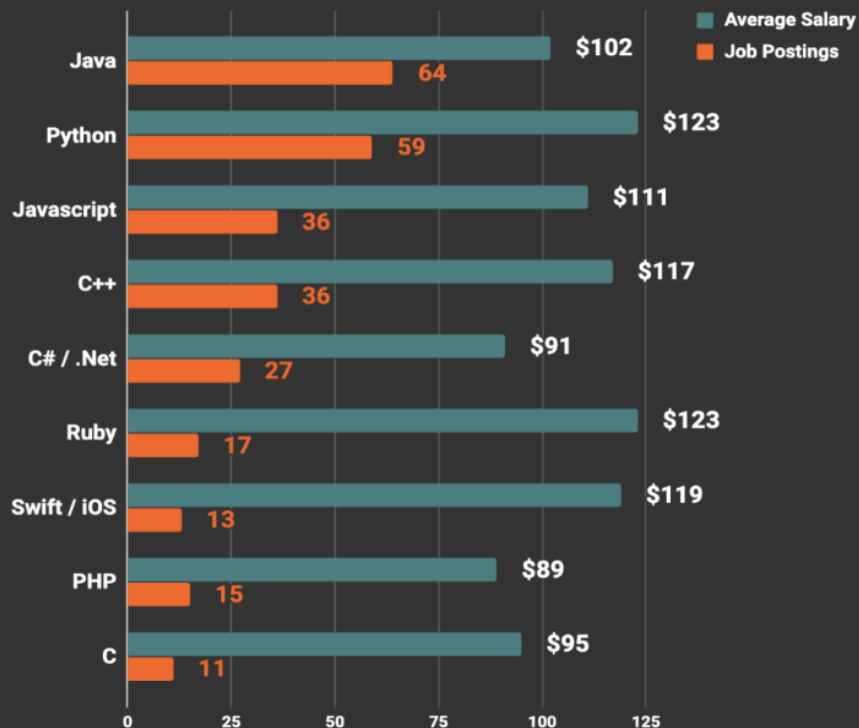
APPENDIX

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POPULAR PROGRAMING LANGAGES

Salary/Job Openings

Salary and job openings for popular programming languages, 2019
Figures, from Indeed, in thousands. Popularity based on TIOBE and StackOverflow indexes.



- Python remains the most incentivized in terms of salary and need for programmers among popular programming languages in the coming year.
- There is an equal need for developers in SQL, although they are less incentivized with a salary than Python for the next year.

Top Paying and Most Popular Programming Languages in 2020

Rank by Average Salary

1. Python	\$119,000
2. JavaScript	\$117,000
3. Java	\$104,000
4. C	\$103,000
5. C++	\$102,000
6. C#	\$97,000
7. PHP	\$94,000
8. SQL	\$92,000

Rank by Volume of Job Openings

1. Python	50,000
2. SQL	50,000
3. Java	45,000
4. JavaScript	38,000
5. C++	29,000
6. C#	21,000
7. PHP	13,000
8. C	9,000

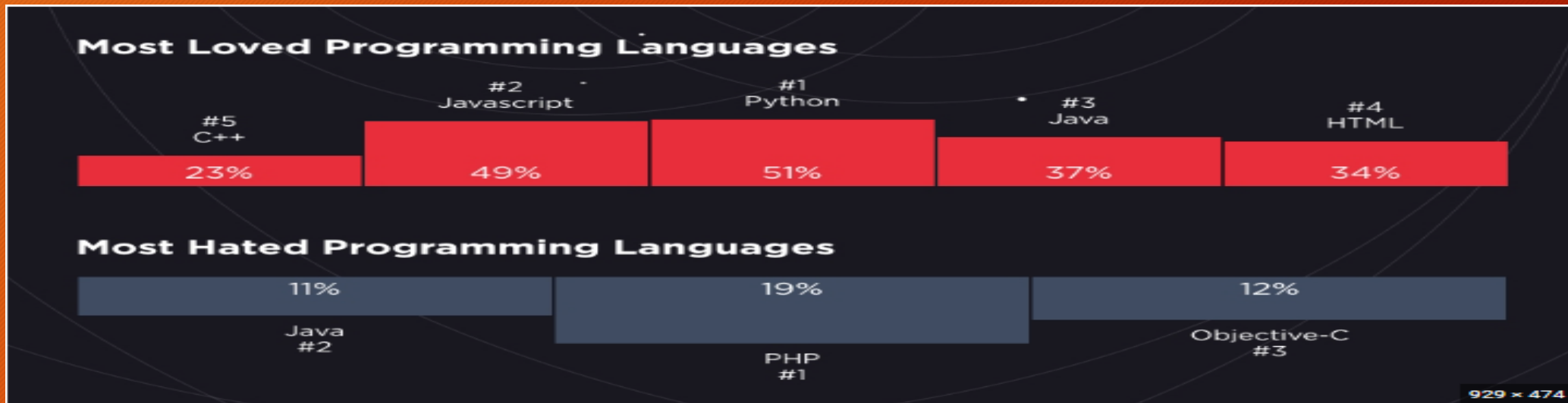
APPENDIX

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PROGRAMING LANGAGES

Popularity

Hired's 2019 Survey of Software Engineers presented new insights into the state of programming languages. 98,000 programmers participated in the survey to vote on, among other things, the most loved and hated programming languages, and the results are quite surprising. Java appear on both lists for the most loved and most hated programming language! The survey were conducted separately for both questions. The reason for the dislike was that it is not fun to code in Java. The biggest reason to love Java is the availability of resources for learning and developing software along with community tone and willingness to welcome newcomers.



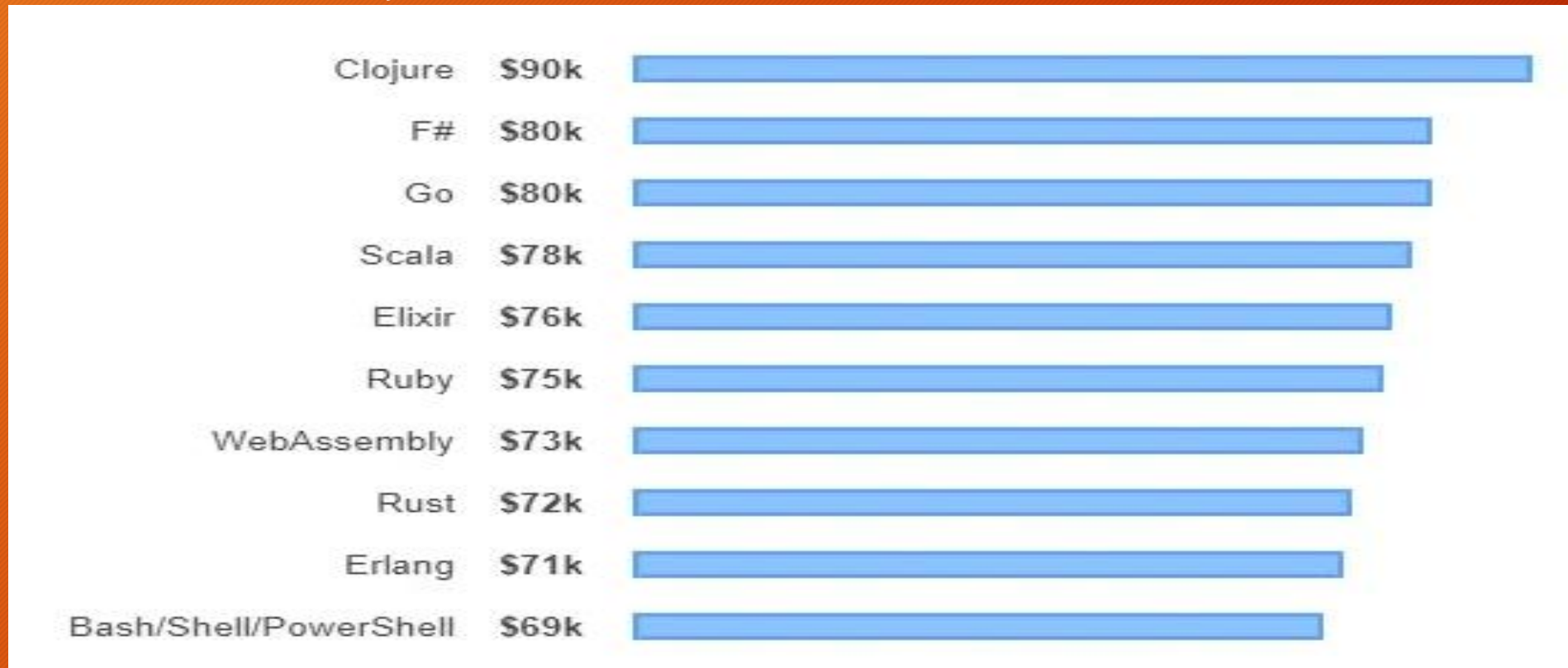
APPENDIX

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Programing Languages

Salary

Stack Overflow Survey 2020

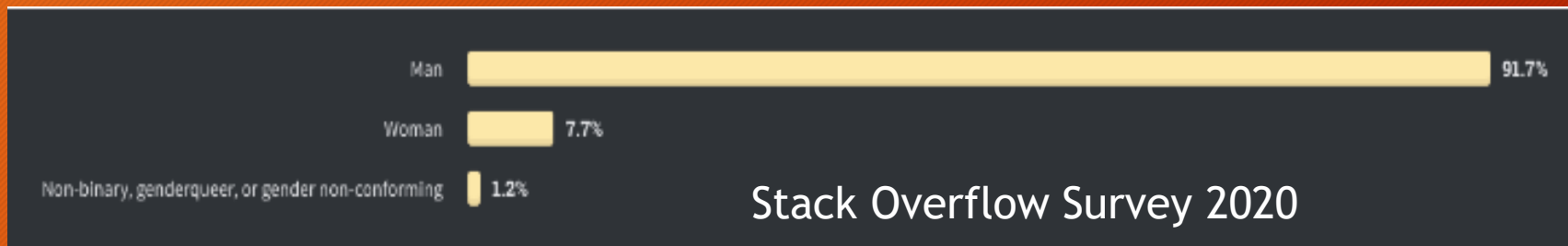
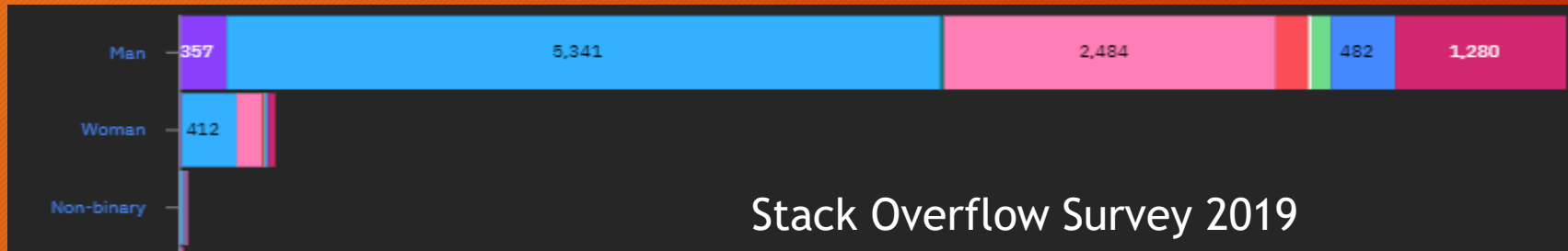


APPENDIX

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DEMOGRAPHIC

Gender



REFERENCES

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- Github/IBM-Capstone-Project: <https://github.com/Borache55/IBM-Capstone-Project>
- All data in the appendix is based on research by Stack Overflow
- Capston Project:
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- Stack Overflow Surveys: <https://insights.stackoverflow.com/survey>
- Slide 29-1/CodePlatoon: <https://www.codeplatoon.org/the-best-paying-and-most-in-demand-programming-languages-in-2019/>
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