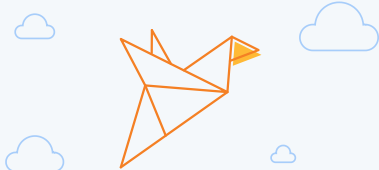




# Developer Survey Results 2019



## Overview

This year, nearly 90,000 developers told us how they learn and level up, which tools they're using, and what they want.

Stack Overflow's annual Developer Survey is the largest and most comprehensive survey of people who code around the world. Each year, we field a survey covering everything from developers' favorite technologies to their job preferences. This year marks the ninth year we've published our annual Developer Survey results, and nearly 90,000 developers took the 20-minute survey earlier this year.

Despite our survey's broad reach and capacity for informing valuable conclusions, we acknowledge that our results don't represent everyone in the developer community evenly. We have further work to do to make Stack Overflow the welcoming, inclusive, and diverse platform we want it to be, and this is reflected in our survey sample. We are committed to building on [steps we've taken in 2018](#) and improving in this area this year and beyond. Some of these survey results directly guide those efforts.

To address the characteristics of our data, be sure to check out where we summarize results by country or gender, highlight results for underrepresented racial/ethnic groups, or use survey weighting to correct for demographic skew.



**Look for this icon, which highlights differences between developer demographics.**

We looked at breakdowns by demographics throughout our analysis, and in most cases it did not have a significant effect. Look for the icon to see where we highlight results where it did have an interesting impact. Also be sure to check out a few new topics this year ranging from hours worked per week to the best music to listen to while coding!

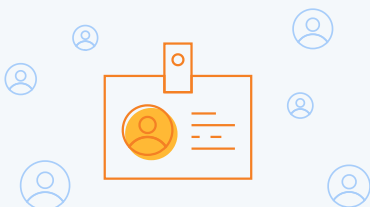
Want to dive into the results yourself? Check back in a few weeks, when the anonymized results of the survey will be available for download under the [Open Database License \(ODbL\)](#). We look forward to seeing what you find!



## Key Results

Here are a few of the top takeaways from this year's results.

- Python, the fastest-growing major programming language, has risen in the ranks of programming languages in our survey yet again, edging out Java this year and standing as the second most loved language (behind Rust).
- Over half of respondents had written their first line of code by the time they were sixteen, although this experience varies by country and by gender.
- [DevOps specialists](#) and site reliability engineers are among the highest paid, most experienced developers most satisfied with their jobs, and are looking for new jobs at the lowest levels.
- Of the top countries on our survey, China has developers that are the most optimistic, believing that people born today will have a better life than their parents. Developers in Western European countries like France and Germany are among the least optimistic about the future.
- When thinking about blockers to productivity, different kinds of developers report different challenges. Men are more likely to say that being tasked with non-development work is a problem for them, while gender minority respondents are more likely to say that toxic work environments are a problem.
- We asked respondents to think about the last time they solved coding problems with and without our site. The data indicates that Stack Overflow saves a developer 30 to 90 minutes of time per week!



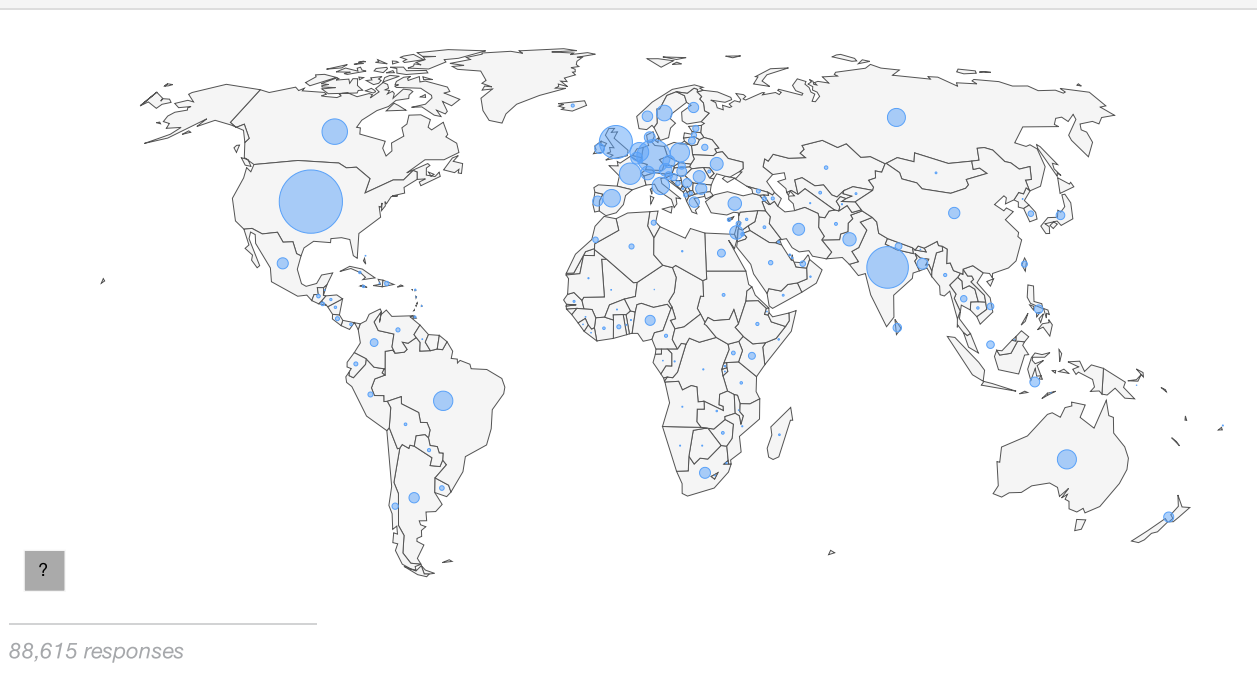
## Developer Profile

What we know about the developers who are writing the script for the future



## Geography

### Survey Respondents



### Monthly Stack Overflow Visits

### Professional Developers

Each month, about 50 million people visit Stack Overflow to learn, share, and build their careers. We estimate that 21 million of these people are professional developers and university-level students. The majority of our survey respondents this year were people who said they are professional developers or who code sometimes as part of their work, or are students preparing for such a career. About 4% of respondents code as a hobby but not as a profession, and just under 2% of respondents used to be professional developers but no longer are.

See our [Methodology](#) section for details on how developers around the world accessed our survey.



## Developer Roles

### Developer Type

#### All Respondents

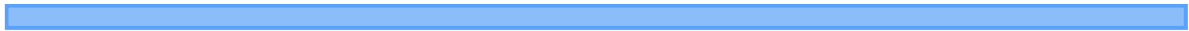
Developer, full-stack

**51.9%**



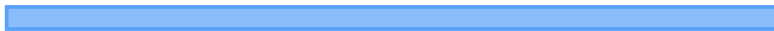
Developer, back-end

**50.0%**



Developer, front-end

**32.8%**



Developer, desktop or enterprise applications

**21.3%**



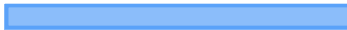
Developer, mobile

**18.1%**



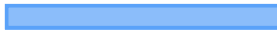
Student

**14.7%**



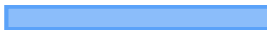
Database administrator

**11.7%**



Designer

**11.3%**



System administrator

**11.0%**



DevOps specialist

**10.9%**



Developer, embedded applications or devices

**8.9%**



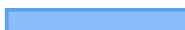
Data scientist or machine learning specialist

**7.9%**



Developer, QA or test

**7.8%**



Data or business analyst

**7.7%**



Academic researcher

**7.3%**



Engineer, data

**7.2%**



Educator

**5.5%**



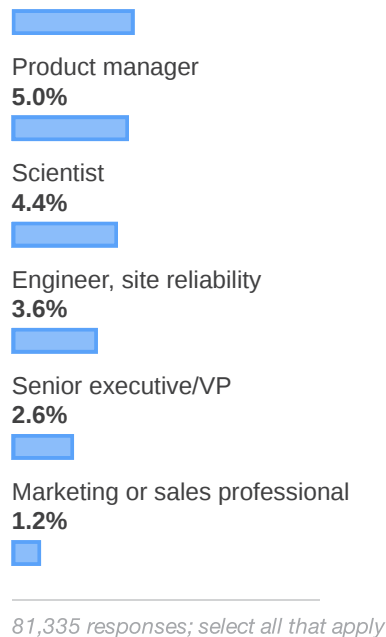
Developer, game or graphics

**5.5%**



Engineering manager

**5.2%**



### United States Unweighted

### ★ United States Weighted by Gender

About 50% of respondents identify as [full-stack developers](#), and about 17% consider themselves mobile developers. The median number of developer type identifications per respondent this year is 3, and the most common pairs are combinations of back-end, front-end, and full-stack developer. Pairs that are highly correlated include database administrator and system administrator, DevOps specialist and site reliability engineer, academic researcher and scientist, and designer and front-end developer.

Survey weighting is an approach used to analyze survey data when the survey sample doesn't match the underlying population well. For example, in our survey this year, 11% of US respondents identify as women, but data from the US Bureau of Labor Statistics estimates that [women's participation in the software developer workforce](#) is about twice that, more like 20%. We can use survey weighting to adjust for the mismatch between our survey sample and the population of developers. We know that there is a difference in [developer type representation by gender](#), so let's compare the overall proportions in our raw results for the United States with weighted proportions, assuming that we undersampled gender minorities at the rate indicated by the BLS report. When we use weighting, we see small increases in the representation of developer roles that have the most representation from women, like designers, and decreases in others with low representation from women, like DevOps.

We know there are more ways in which our survey sample doesn't match the underlying population of developers than only gender (including frequency of use of Stack Overflow), and the United States is not the only country for which we expect such a mismatch. The reason we're using this specific example of weighting here is that it is one where we know we have systemic sampling issues *and* we have an estimate about the expected population proportion. We can demonstrate the effect of our survey sample on our results, both in direction and magnitude.

## Contributing to Open Source

## All Respondents

Never  
36.3%



Less than once per year  
28.1%



Less than once a month but more than once per year  
23.1%



Once a month or more often  
12.4%



88,883 responses

## United States Unweighted

## United States Weighted by Gender

About 65% of professional developers on Stack Overflow contribute to open source projects once a year or more. Involvement in open source varies with language. Developers who work with Rust, WebAssembly, and Elixir contribute to open source at the highest rates, while developers who work with VBA, C#, and SQL do so at about half those rates.

## Coding as a Hobby

## All Respondents

Yes  
80.2%



No  
19.8%



88,883 responses

## United States Unweighted

## ★ United States Weighted by Gender

Many developers work on code outside of work. About 80% of our respondents say that they code as a hobby. Other responsibilities outside of software can reduce developers' engagement in coding as a hobby; developers who say they have children or other caretaking responsibilities are less likely to code as a hobby. Respondents who are women are also less likely to say they code as a hobby.



## Experience

### Years Since Learning to Code

#### All Respondents

Less than 5 years  
**20.5%**



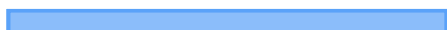
5 to 9 years  
**31.0%**



10 to 14 years  
**19.0%**



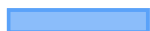
15 to 19 years  
**11.1%**



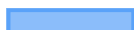
20 to 24 years  
**7.7%**



25 to 29 years  
**3.6%**



30 to 34 years  
**3.2%**



35 to 39 years  
**2.3%**



40 to 44 years  
**1.0%**



45 to 49 years  
**0.3%**



50 years or more  
**0.2%**



87,938 responses

#### Professional Developers

There is a wide range of experience levels among developers, and a full 45% of professional developers on Stack Overflow learned to code less than 10 years ago. See more on how [experience is related to gender](#).

### Years Coding Professionally

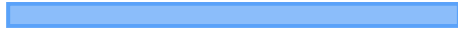
Less than 5 years  
**41.0%**



5 to 9 years  
**26.9%**



10 to 14 years  
**14.5%**



15 to 19 years  
**7.4%**



20 to 24 years  
**5.5%**



25 to 29 years  
**2.0%**



30 to 34 years  
**1.5%**



35 to 39 years  
**0.7%**



40 to 44 years  
**0.3%**



45 to 49 years  
**0.1%**



50 years or more  
**0.1%**



---

74,331 responses

Over 40% of respondents have less than five years of professional coding experience. Developers who work with languages such as VBA, F#, and Clojure have the most years of professional coding experience, while developers who work with languages like Python, PHP, and Kotlin have the fewest.

## Years of Professional Coding Experience by Developer Type

Senior executive/VP  
**14.5**



Engineering manager  
**12.8**

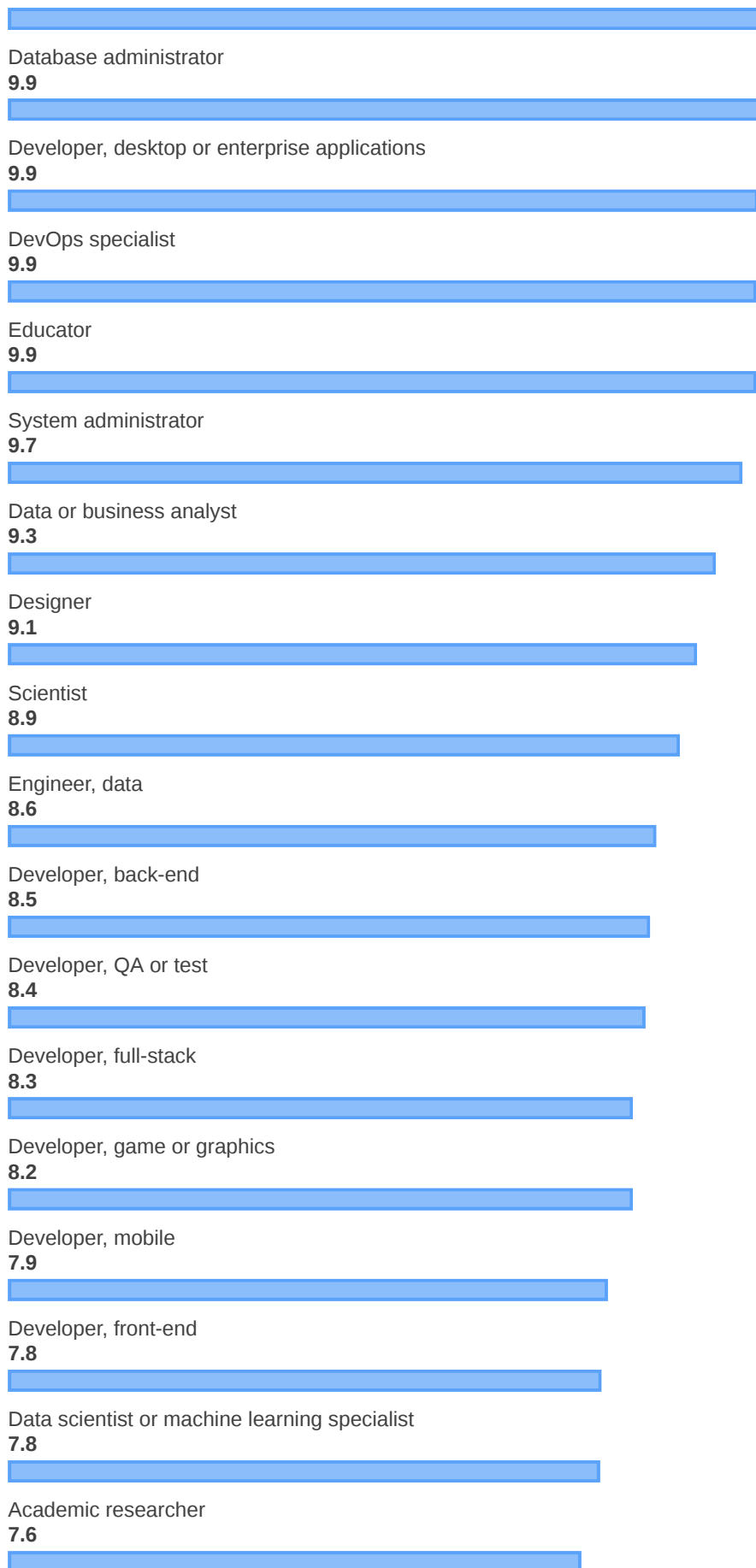


Engineer, site reliability  
**10.0**



Developer, embedded applications or devices  
**10.0**





Mean of 72,069 responses

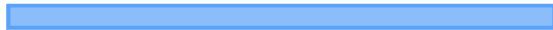
Developers who work in different areas of software development have different average amounts of experience. Aside from technical executives and managers, SREs and developers who build for embedded devices have the most experience, while academic researchers and data scientists have the fewest years of experience. The related roles and disciplines of site reliability engineering and DevOps are somewhat new, but the people working in this field are highly experienced.

## Writing That First Line of Code

### Overall

Younger than 10 years

**8.7%**



10 to 11 years old

**9.8%**



12 to 13 years old

**16.1%**



14 to 15 years old

**19.6%**



16 to 17 years old

**16.6%**



18 to 19 years old

**14.3%**



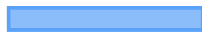
20 to 21 years old

**6.5%**



22 to 23 years old

**3.2%**



24 to 25 years old

**2.0%**



26 to 27 years old

**1.0%**



28 to 29 years old

**0.7%**



30 years old or older

**1.6%**



87,634 responses

### ★ By Country

### By Gender

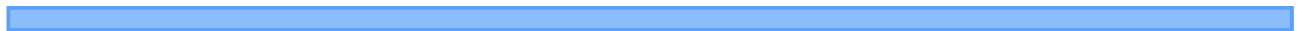
We asked respondents how old they were the first time they wrote a line of code or program, whether that was to make a webpage or say hello to the world. Overall, over half of respondents had written code by the time they were sixteen, but experience varies widely. There is two years' or more difference in the mean first age from countries like Australia and the UK compared to India and Brazil. If we control for developer age today, we see an even more dramatic disparity between India (where developers who are older today started coding later in life) and the UK (where developers who are older today started coding earlier in life). We also see differences with gender, with women writing their first code later than men and non-binary respondents writing code earlier than men.



## Education

### How Many Developers are Students?

No  
**75.6%**



Yes, full-time  
**18.1%**



Yes, part-time  
**6.2%**



*87,014 responses*

About one-quarter of respondents are enrolled in a formal college or university program full-time or part-time.

### Educational Attainment

#### All Respondents

I never completed any formal education  
**0.6%**



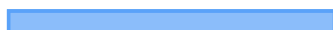
Primary/elementary school  
**1.6%**



Secondary school  
**10.0%**



Some college/university study without earning a degree  
**12.2%**

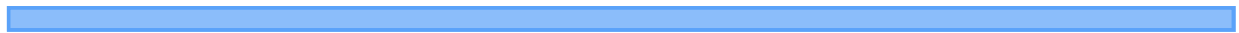


Associate degree  
**3.4%**



Bachelor's degree

**45.3%**



Master's degree

**22.7%**



Professional degree

**1.4%**



Doctoral degree

**2.8%**



86,390 responses

## Professional Developers

Worldwide, about three-fourths of professional developer respondents have the equivalent of a bachelor's degree or higher, consistent with what we've found in previous years. However, it is not that rare to find accomplished professional developers who have not completed a degree.

## Undergraduate Major

### All Respondents

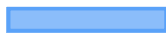
Computer science, computer engineering, or software engineering

**62.4%**



Another engineering discipline (ex. civil, electrical, mechanical)

**8.2%**



Information systems, information technology, or system administration

**6.9%**



Web development or web design

**4.5%**



A natural science (ex. biology, chemistry, physics)

**4.3%**



Mathematics or statistics

**3.9%**



A business discipline (ex. accounting, finance, marketing)

**2.4%**



A humanities discipline (ex. literature, history, philosophy)

**2.1%**



A social science (ex. anthropology, psychology, political science)

**1.8%**



Fine arts or performing arts (ex. graphic design, music, studio art)

**1.6%**



I never declared a major

**1.3%**



A health science (ex. nursing, pharmacy, radiology)

**0.4%**



75,614 responses

## Professional Developers

## Students

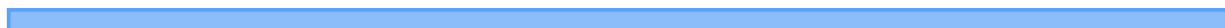
Of professional developers who studied at the university level, over 60% said they majored in computer science, computer engineering, or software engineering. This proportion is somewhat higher in currently enrolled students, and the proportion of respondents majoring in other engineering disciplines like electrical and mechanical engineering is lower among current students than among professionals.

## Other Types of Education

### All Respondents

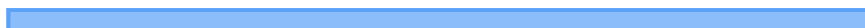
Taught yourself a new language, framework, or tool without taking a formal course

**85.5%**



Taken an online course in programming or software development (e.g. a MOOC)

**60.1%**



Contributed to open source software

**41.0%**



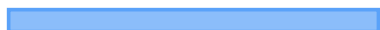
Received on-the-job training in software development

**39.3%**



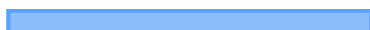
Participated in a hackathon

**26.0%**



Participated in online coding competitions (e.g. HackerRank, CodeChef, TopCoder)

**25.5%**



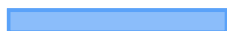
Taken a part-time in-person course in programming or software development

**18.7%**



Participated in a full-time developer training program or bootcamp

**15.4%**



Completed an industry certification program (e.g. MCPD)

**15.0%**

84,260 responses; select all that apply

## Professional Developers

Developers are lifelong learners; almost 90% of all developers say they have taught themselves a new language, framework, or tool outside of their formal education. Among professional developers, about 60% say they took an online course like a MOOC (up significantly from last year), and about a quarter have participated in a hackathon.



## Demographics

### Race and Ethnicity

#### All Respondents

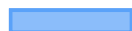
White or of European descent  
**70.8%**



South Asian  
**11.9%**



Hispanic or Latino/Latina  
**7.1%**



East Asian  
**5.9%**



Middle Eastern  
**4.7%**



Black or of African descent  
**3.6%**



Multiracial  
**2.3%**



Biracial  
**1.3%**



Native American, Pacific Islander, or Indigenous Australian  
**0.8%**



76,668 responses; select all that apply

## ★ Professional Developers

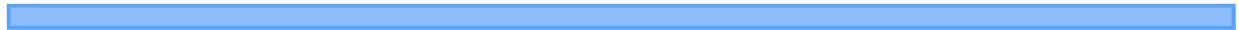
### Students

We asked our respondents about their racial/ethnic identities and see evidence that people of color continue to be underrepresented among developers, especially among professional developers. We see higher proportions of people of color in students than professional developers. We have seen incremental improvement in this area year over year. In the United States this year, 22% of respondents are people of color (meaning they chose one or more non-white options on this question); last year 19% of United States respondents were people of color. Like with gender representation, this gradual change is encouraging, but the overall participation levels indicate we still have work to do, both on Stack Overflow and as the tech industry more broadly.

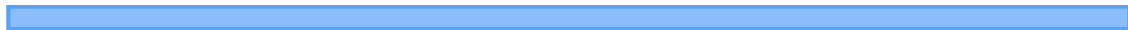
## Gender

### Gender Minorities by Country

United States  
**11.7%**



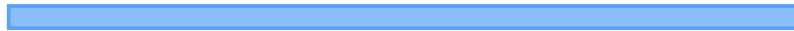
Canada  
**10.7%**



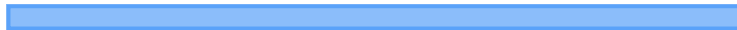
United Kingdom  
**8.6%**



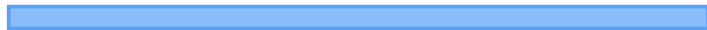
Australia  
**7.5%**



India  
**7.0%**



Netherlands  
**6.7%**



Germany  
**6.3%**



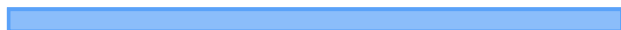
Russian Federation  
**6.1%**



Poland  
**5.9%**



Sweden  
**5.9%**



France  
**5.5%**



Spain

5.4%



Brazil

5.2%



Italy

3.7%



86,210 responses; % who identify as women or non-binary

## All Respondents

## Professional Developers

## ★ Students

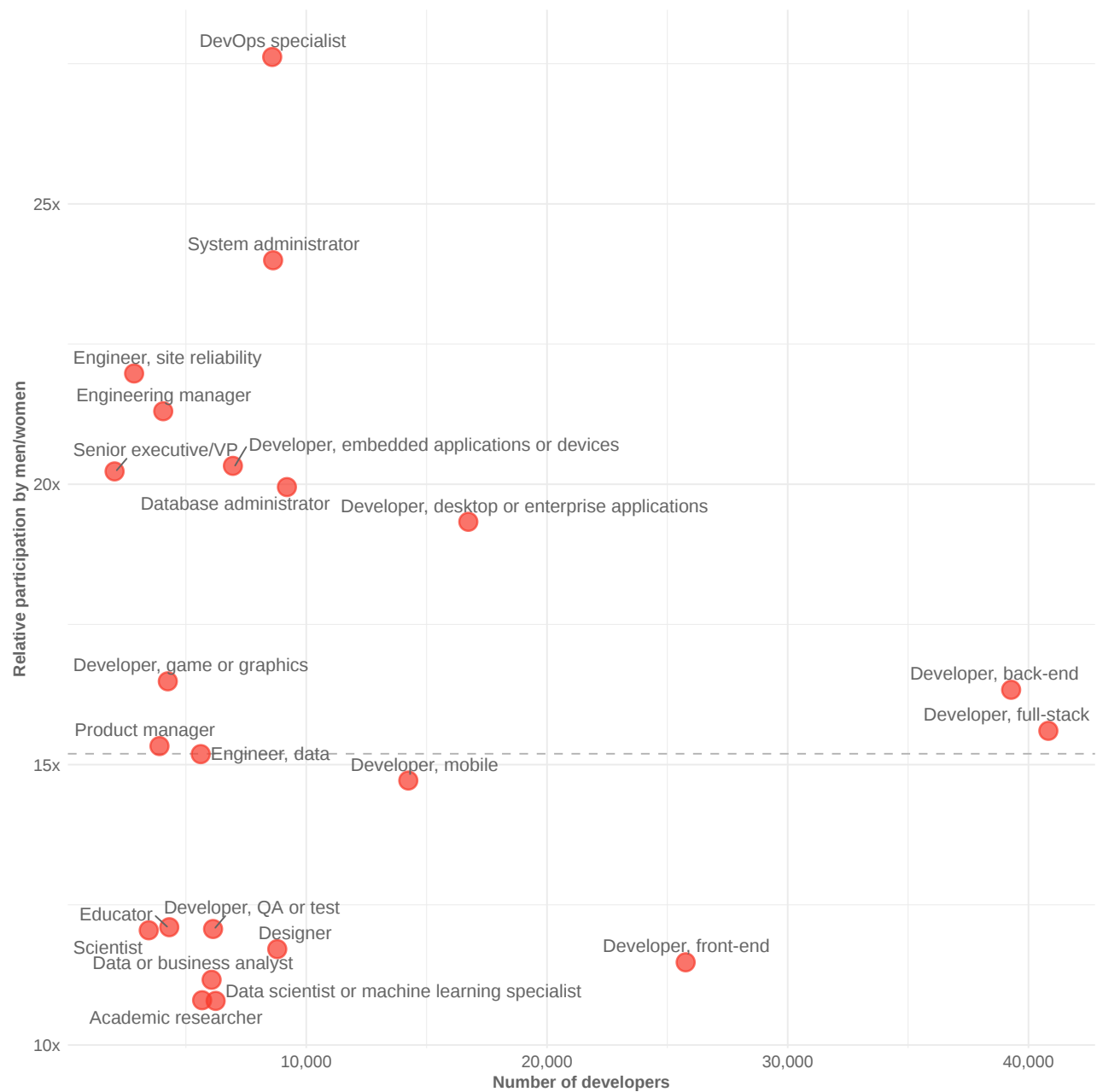
We asked our respondents about their gender identity, and found that about globally 90% of our respondents are men. In regions including the United States, India, and the UK, women are represented at higher levels among students than among professional developers.

This year 11% of US survey respondents are women, up from 9% on last year's survey. This represents incremental improvement in this area, but the continued low proportion points to problems with inclusion in the tech industry in general and on Stack Overflow in particular.

This year, 1.2% of respondents identified as transgender, about double from last year. The gender identification question allowed respondents to select all that apply, and the question about transgender identity was separate from the question about gender identity.

## Developer Role and Gender





The dashed line shows the average ratio of men's to women's participation

We see varying representation from men and women in different developer roles on our survey. *All* categories have dramatically more developers who identify as men than women but the ratio of men to women varies. Developer types above the line have respondents that are more likely than average to be men, and those below the line have respondents who are more likely than average to be women. Developers who are data scientists or academic researchers are about 10 times more likely to be men than women, while developers who are system admins or DevOps specialists are 25-30 times more likely to be men than women. Women have the highest representation as front-end developers, designers, data scientists, data analysts, QA or test developers, scientists, and educators.

## Experience and Gender

### Men

Less than 5 years

**19.3%**



5 to 9 years

**30.8%**



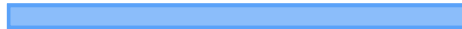
10 to 14 years

**19.4%**



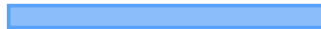
15 to 19 years

**11.6%**



20 to 24 years

**8.0%**



25 to 29 years

**3.8%**



30 to 34 years

**3.4%**



35 to 39 years

**2.4%**



40 to 44 years

**1.0%**



45 to 49 years

**0.3%**



50 years or more

**0.2%**



77,945 responses

## ★ Women

### Non-binary, genderqueer, or gender non-conforming

When we look at differences in years since learning to code by gender, we see evidence for the shifting demographics of coding as a profession, as well as retention problems in the tech industry for underrepresented groups. [Research shows](#), for example, that women leave jobs in tech at higher rates than men. Among our respondents, both in the United States and internationally, women are about twice as likely as men to have three years of coding experience or less. Companies interested in building a diverse developer workforce that is more reflective of society should focus on retention of their senior developers from underrepresented groups, along with thoughtful hiring from the population of more junior developers.

## Sexual Orientation

### All Respondents

Straight / Heterosexual

**93.0%**



Bisexual

**5.5%**



Gay or Lesbian

**2.7%**



76,147 responses; select all that apply

## Professional Developers

## Students

This is the second year we asked our respondents about their sexual orientation, and the proportions of respondents are mostly consistent since last year.

## Disability Status

### Mental Health and Differences

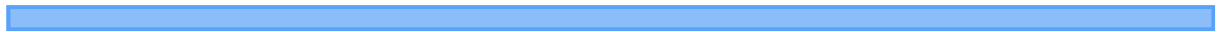
I have a mood or emotional disorder (e.g. depression, bipolar disorder)

**8.8%**



I have an anxiety disorder

**8.6%**



I have a concentration and/or memory disorder (e.g. ADHD)

**6.4%**



I have autism / an autism spectrum disorder (e.g. Asperger's)

**2.6%**



15,922 responses identified as having a mental difference

### ★ Physical Differences

Individuals with many forms of disability and difference are part of the developer community, including those with mental health challenges and physical disabilities. Mental health issues like depression and anxiety are particularly common among our respondents. In the United States, almost 30% of respondents said they deal with a mental health challenge, a higher proportion than other large countries such as the UK, Canada, Germany, or India.

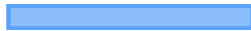
## Age

## All Respondents

Younger than 15 years  
**0.6%**



15 to 19 years  
**5.6%**



20 to 24 years  
**21.1%**



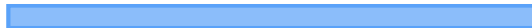
25 to 29 years  
**27.6%**



30 to 34 years  
**19.3%**



35 to 39 years  
**11.9%**



40 to 44 years  
**6.2%**



45 to 49 years  
**3.4%**



50 to 54 years  
**2.0%**



55 to 59 years  
**1.2%**



60 years and older  
**1.0%**



79,210 responses

## Professional Developers

About three-fourths of professional developers who took our survey are younger than 35.

## Age and Experience by Country

### Average Age

Australia  
**32.8**



United States  
**32.8**