Do you consent to participate in this study?

○ Yes (1)

○ No (2)

Thank you for providing your consent.

 You will now be presented with a series of questions to answer. ***Your responses to all our questions are highly important and contribute significantly to our research.*** We sincerely appreciate your valuable participation.

What is your age range?

○ 17 or under (1)

○ 18-24 years old (2)

○ 25-34 years old (3)

○ 35-44 years old (4)

○ 45-54 years old (5)

○ 55-64 years old (6)

○ 65+ years old (7)

In which country do you currently reside?

▼ Afghanistan (1) ... Prefer not to say (1358)

What is your primary language preference for both spoken and written communication?

○ Arabic (1)

○ Chinese (including Mandarin, Cantonese, and all other varieties) (2)

○ English (3)

○ French (4)

○ German (5)

○ Hindi (6)

○ Italian (7)

○ Japanese (8)

○ Korean (9)

○ Polish (10)

○ Portuguese (11)

○ Russian (12)

○ Spanish (13)

○ Vietnamese (14)

○ Prefer not to say (15)

○ Other (16) _____

How do you describe yourself?

- ○ Male (1)

- ○ Female (2)

- ○ Non-binary / third gender (3)

- ○ Prefer to self-describe (4)

_____

- ○ Prefer not to say (5)

What best describes your current employment status?

- ○ Working full-time (1)

- ○ Working part-time (2)

- ○ Unemployed and looking for work (3)

- ○ A homemaker or stay-at-home parent (4)

- ○ Student (5)

- ○ Retired (6)

- ○ Other (7) _____

If you are currently employed/working, which of the following best describes your role in the organization?

○ Data Scientist (1)

○ DevOps Engineer (2)

○ Project Manager (3)

○ QA/Test Engineer (4)

○ Researcher (5)

○ Software Architect (6)

○ Software Engineer/Developer (7)

○ UX/UI Designer (8)

○ Other (9) _____

○ Not Applicable (10)

How many years of general programming experience do you have?

○ Less than 1 year (1)

○ 1–2 years (2)

○ 3–5 years (3)

○ 6–10 years (4)

○ More than 10 years (5)

-- Thank you for providing your demographic information.

The next set of questions are related to your experience with writing/maintaining **unit tests**.

To what extent are you familiar with unit testing?

○ Extremely familiar (1)

○ Very familiar (2)

○ Moderately familiar (3)

○ Slightly familiar (4)

○ Not familiar at all (5)

Skip To: End of Survey If To what extent are you familiar with unit testing? = Not familiar at all

---

Which unit testing framework are you most experienced with?

○ JUnit (1)

○ NUnit (2)

○ PyTest (3)

○ MSTest (4)

○ PHPUnit (5)

○ Jasmine (6)

○ Mocha (7)

○ TestNG (8)

○ XCTest (9)

○ Other (10) _____

To what extent is writing unit tests part of your job/employment duties?

○ Not at all (1)

○ Very little (2)

○ Somewhat (3)

○ A lot (4)

○ Most of the time (5)

○ All of the time (6)

○ Not Applicable (7)

What is your primary Integrated Development Environment (IDE)?

○ IntelliJ IDEA (1)

○ Eclipse (2)

○ PyCharm (3)

○ Visual Studio (4)

○ Visual Studio Code (VS Code) (5)

○ Android Studio (6)

○ Xcode (7)

○ NetBeans (8)

○ Sublime Text (9)

○ Atom (10)

○ Vim (11)

○ CLion (13)

○ Other (12) _____

End of Block: Demographic

Start of Block: AssertMessages - Questions

The following set of questions are related to the optional ***assertion error message*** that is part of an assertion statement.

As a reminder, here are examples of assertion statements with the optional assertion error message indicated in purple:
C# (using NUnit 3 framework): Assert.AreEqual(expected, actual, "Values are not equal")
Java (using JUnit 4 framework): assertTrue("Condition is not true", condition)
Java (using JUnit 5 framework): assertEquals(expected, actual, "Values do not match")
PHP (using PHPunit): $this->assertEquals($expected, $actual, "Values are not equal");

Depending on the type and version of the testing framework, the assertion error message may be the first or last parameter in the assert method.

How frequently do you **include an assertion error message** in your assert method?

○ Always (1)

○ Very often (2)

○ Sometimes (3)

○ Rarely (4)

○ Never (5)

In the previous question your selected ${Q15/ChoiceGroup/SelectedChoices}, when asked how frequently you use messages within assert methods.
Please let us know why you selected this answer option.

_____

_____

_____

_____

_____

What **motivates you to include assertion error messages** in your assert methods? (Check all that apply)

- ☐ Adherence to coding standards (1)

- ☐ Help troubleshoot test case failures (2)

- ☐ Feedback from code reviews (3)

- ☐ Improve understandability of the test method (4)

- ☐ To serve as documentation for the test case (5)

- ☐ Other (6) _____

Under what conditions would you choose **not to include an assertion error message** in an assert method? (Check all that apply)

- ☐ Reduce development time (1)

- ☐ Reduce additional rework when modifying test case (2)

- ☐ I prefer to use code comments instead of assertion error messages (3)

- ☐ I prefer to keep my assert methods simple, clear and concise (4)

- ☐ I find the information present in the test execution log sufficient (5)

- ☐ I am unaware that an error message is an option (6)

- ☐ Other (7) _____

What factors or elements in the source code do you consider when **constructing assertion error messages**? (Check all that apply)

☐   The name of the test class (1)

☐   The name of the test method (2)

☐   The type of assert method containing the assertion error message (e.g., assertTrue, assertEquals, fail, etc.) (3)

☐   The source/production method under test (4)

☐   The variable or functions that are utilized as the actual/expected arguments in the assert method (5)

☐   Exception/Error handling code within the test method (6)

☐   Other assert methods, if any, that are also contained within the same test method (7)

☐   Other (8) _____

What are the typical **details that you include in an assertion error message**? Please rank the following options, with 1 being the most frequently used and 11 being the least frequently used. (Drag-and-drop rows)

_____ Description of the failure (1)
_____ Suggestions for resolution (2)
_____ Expected outcome (3)
_____ Actual outcome (4)
_____ Test method name (5)
_____ Links or references to relevant documentation or resources (6)
_____ Platform or environment details (7)
_____ Error code or error type (8)
_____ Reproduction steps (9)
_____ The name of the source/production method under test (10)
_____ Other (11)

How do you typically **compose an assertion error message**? Please rank the following options based on their frequency of usage, with 1 being the most frequently used and 3 being the least frequently used. (Drag-and-drop rows)

_____ Composed only of a String literal (e.g., assertEquals("Values are not equal",a,b);) (1)

_____ Composed of one or more variables/method calls (e.g. assertEquals(r.getDataValue(), a, b);) (2)

_____ Combination of String literals and variables/method calls appended together (e.g. assertFalse("too big: " + count, count >100); (3)

How would you **determine if an assertion error message is of poor quality**? Please rank the following options based on your evaluation criteria, with 1 being the most indicative of poor quality and 8 being the least indicative of poor quality. (Drag-and-drop rows)

_____ The message lacks clarity on why the test failed (1)

_____ The message does not include diagnostic data to troubleshoot the failure (2)

_____ The message contains excessive technical language/jargon (3)

_____ The message contains grammatical/punctuation/spelling mistakes (4)

_____ The message is too short (5)

_____ The message is excessively long (6)

_____ The message is only composed of only variables and/or method calls (e.g., assertTrue(obj.getStatus().toString(), actualValue); assertEquals(message, a, b);) (7)

_____ Other (8)

What are the **common challenges you encounter** when writing and maintaining assertion error messages? (Check all that apply)

☐ Striking the right balance between message conciseness and descriptiveness (1)

☐ Maintaining consistency in the structure and composition of the message across the test suite in the project (2)

☐ Making sure that the error messages accurately reflects failure (3)

☐ Keeping the messages up to date and relevant as the codebase evolves (4)

☐ Incorporating sufficient details to help with debugging/troubleshooting failures (5)

☐ Understanding the intent and context of assert methods written by other developers (such as in legacy code) (6)

☐ Other (7) _____

How often do you **review and update assert error messages to ensure they remain accurate and relevant**? Please rank the following options, with 1 being the most frequently used and 6 being the least frequently used. (Drag-and-drop rows)
_____ After every update to the production code (1)
_____ During regular code review processes with team members (2)
_____ When encountering test failures or issues related to the assert methods (3)
_____ Whenever there are significant changes or enhancements to the tested functionality (4)
_____ I never update assert methods after they are initially implemented (5)
_____ Other (6)

How do you **incorporate assertion error messages into the debugging process** of test case failures? (Check all that apply)

☐   I rely only on the assertion error message to identify the root cause of the failure (1)

☐   I utilize the assertion error message as a starting point and then apply additional debugging techniques to explore further (2)

☐   I combine the assertion error message with custom logging statements (3)

☐   I leverage debugging tools or IDE features alongside the assertion error message (4)

☐   I collaborate with team members to discuss and analyze assertion failure message (5)

☐   I do not rely on the assertion error message and prefer other techniques to identify the root cause of the failure (6)

☐   Other (7) _____

End of Block: AssertMessages - Questions