

TESTING ENGINEERING FUNDAMENTALS

Software Engineering Seminar

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Outline

1 Basic Concepts



2 Testing Levels



Outline

1 Basic Concepts

2 Testing Levels



Software Engineering

- **Software engineering** is the application of engineering principles to the design, development, and maintenance of software systems.
- It involves the use of systematic methods and tools to ensure that software is of high quality, reliable, and meets the needs of its users.
- The main goal of software engineering is to produce software that is cost-effective, efficient, and maintainable.
- It encompasses a wide range of activities, including requirements analysis, design, implementation, testing and maintenance.
- Software engineering is a collaborative discipline that involves collaboration between developers.
SDLC



Software Testing

- **Software testing** is the process of **evaluating** a software **system** or its components to determine whether it **satisfies** the specified **requirements** and to **identify** any defects.
- It involves executing the software under controlled conditions and evaluating the results against expected outcomes.
- The main goal of software testing is to ensure that the software is of high quality, reliable, and meets the needs of its users.
- It is an essential part of the **software development process** and is typically performed by independent testers or quality assurance teams.

Functional

Non-Functional

→ quality

Fix before user
detect them



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test
design

User's
infrastructure
resources



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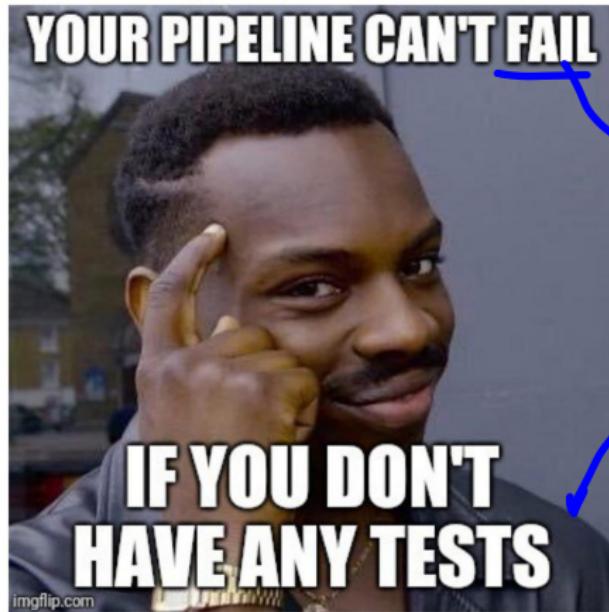


Q.A.
software developers
Unit test

Classical Philosophy

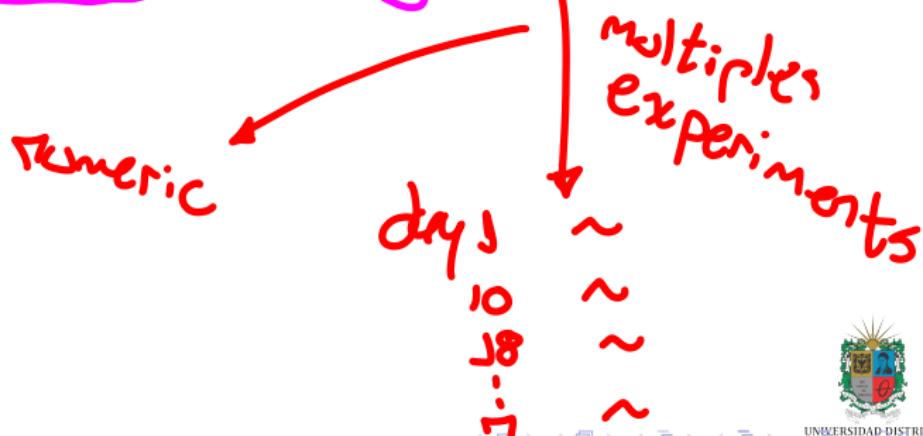
"If you don't have time to do it right, when will you have time to do it over?"

→ project management



Software Quality

- Software quality is the degree to which a software system meets the specified requirements and satisfies the needs of its users.
- It is a critical aspect of software development and is typically measured by a set of quality attributes, such as reliability, performance, usability and maintainability.
- Software quality is typically assessed through a combination of static analysis, dynamic analysis, and testing techniques.



Quality is a Key Factor

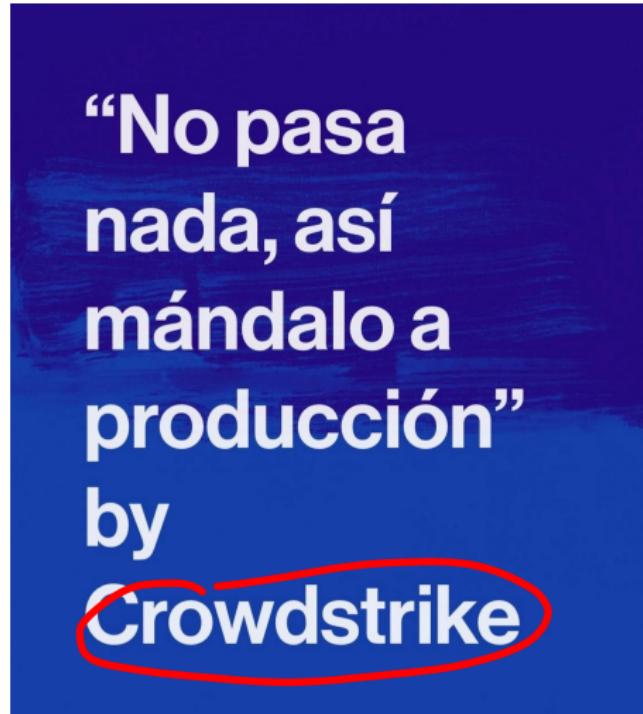


Figure: Microsoft Style!



Testing Engineering

- Testing engineering is the application of engineering principles to the design, development, and execution of tests for software systems
 - It involves the use of systematic methods and tools to ensure that software is of high quality, reliable, and meets the needs of its users.
 - The main goal of testing engineering is to produce software that is cost-effective, efficient, and maintainable through the use of automated testing and test-driven development (TDD) practices.
 - It encompasses a wide range of activities, including test design, execution, and test analysis.
 - Testing engineering is a collaborative discipline that involves collaboration between developers and testers to ensure that software is of high quality and meets the needs of its users.
- static code*
compilation error
steps
Execution time
Common



Testing Engineering

0292977

"q" + j => "qj"

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C → Sum (n1, n2) → 99999999, 99999999

Save money
but
study

design the test
before code
→ edge cases
happy path X



Testing Engineering

- **Testing engineering** is the application of engineering principles to the **design**, **development**, and **execution** of **tests** for software systems.
- It involves the use of **systematic methods** and **tools** to ensure that software is of **high quality**, **reliable**, and **meets the needs of its users**.
- The main goal of testing engineering is to produce software that is **cost-effective**, **efficient**, and **maintainable** through the use of **automated testing** and **test-driven development (TDD)** practices.
- It encompasses a wide range of activities, including **test design**, **test execution**, and **test analysis**.
- **Testing engineering** is a **collaborative** discipline that involves **collaboration** between **developers** and **testers** to ensure that software is of **high quality** and **meets the needs of its users**.

test plan

Product owner



Test-Driven Development (TDD)

~ last 30 years

- **Test-Driven Development** (TDD) is a *software development methodology* that emphasizes the use of [automated tests] to drive the design and development of software.
- It involves writing a test for a specific piece of functionality **before** writing the code to implement that functionality.
- The main goal of TDD is to produce software that is of *high quality*, reliable and meets the needs of its users through the use of automated testing and test-driven development practices.
- TDD is typically used in conjunction with other software development methodologies, such as Agile or Scrum, to ensure that software is developed in a collaborative and iterative manner.



programming
contest



Test-Driven Development (TDD)

- **Test-Driven Development (TDD)** is a *software development methodology* that emphasizes the use of **automated tests** to drive the design and development of software.
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- TDD is typically used in *conjunction* with other software development methodologies, such as **Agile** or **Scrum**, to ensure that software is developed in a **collaborative** and **iterative** manner.



Quality Guidelines

- Quality guidelines are principles that guide the design of a system to ensure that it meets the needs of its users.
- They include reliability, scalability, maintainability, and usability guidelines.
- They are *important* for ensuring that a **system** is robust, efficient, and effective.

~ 30

great product sells
stable



Reliability Guidelines

- Reliability guidelines are *principles* that *guide* the design of a system to ensure that it is reliable and dependable.
- They include fault-tolerance, redundancy, and error-handling guidelines.
- They are *important* for ensuring that a system is robust and resilient to failures.



Scalability Guidelines

- Scalability guidelines are principles that guide the design of a system to ensure that it is scalable and flexible.
- They include modularity, extensibility, and performance guidelines.
- They are important for ensuring that a system can grow and adapt to changing requirements.

(Noise & signal) → test

→ users demand

→ microservices

→ auto scaling



Maintainability Guidelines

- **Maintainability guidelines** are *principles* that *guide* the design of a system to ensure that it is *easy* to *maintain* and *update*.
- They include **modularity**, **documentation**, and **versioning** guidelines.
- They are *important* for ensuring that a **system** can be **easily maintained** and **updated** by its **developers**.



Quality Standards

- **Quality standards** are **benchmarks** that *define* the level of quality that a system must meet.
- They include **ISO 9000**, CMMI, and Six Sigma standards.

get new

9000 - Focus CMMI



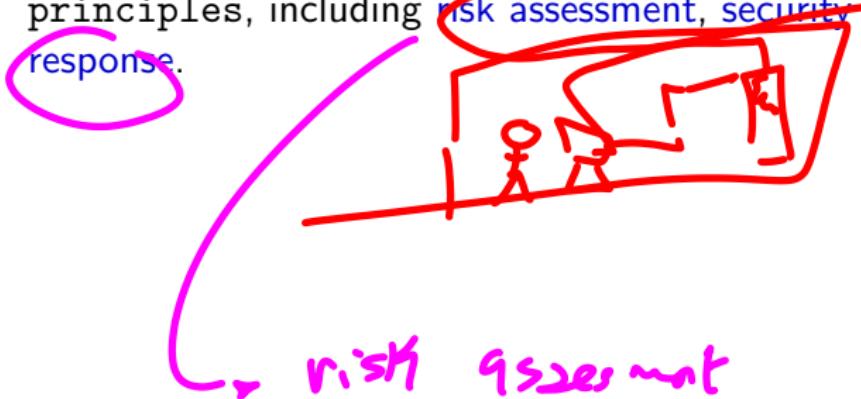
ISO 9000

- ISO 9000 is a quality standard that defines the requirements for a quality management system.
- It is designed to help organizations ensure that they meet the needs of their customers and stakeholders.
- It is based on a number of quality management principles, including customer focus, leadership, and continuous improvement.



ISO 27001

- ISO 27001 is a quality standard that defines the requirements for an information security management system.
- It is designed to help organizations protect their information and ensure that it is secure and confidential.
- It is based on a number of information security management principles, including risk assessment, security policies, and incident response.



CMMI → Certified at enterprise

- CMMI is a quality standard that defines the requirements for a mature software development process.
- It is designed to help organizations improve their software development processes and deliver high-quality products to their customers.
- It is based on a number of best practices for software development, including requirements management, project planning, and process monitoring.

→ S → min 3

→ naturelle process



Six Sigma

- **Six Sigma** is a quality standard that defines the **requirements** for a **process** that is capable of producing high-quality products.
- It is designed to help organizations improve their processes and reduce defects in their products and services.
- It is based on a number of quality management principles, including data-driven decision-making, process improvement, and customer focus.

PICM



Outline

1 Basic Concepts

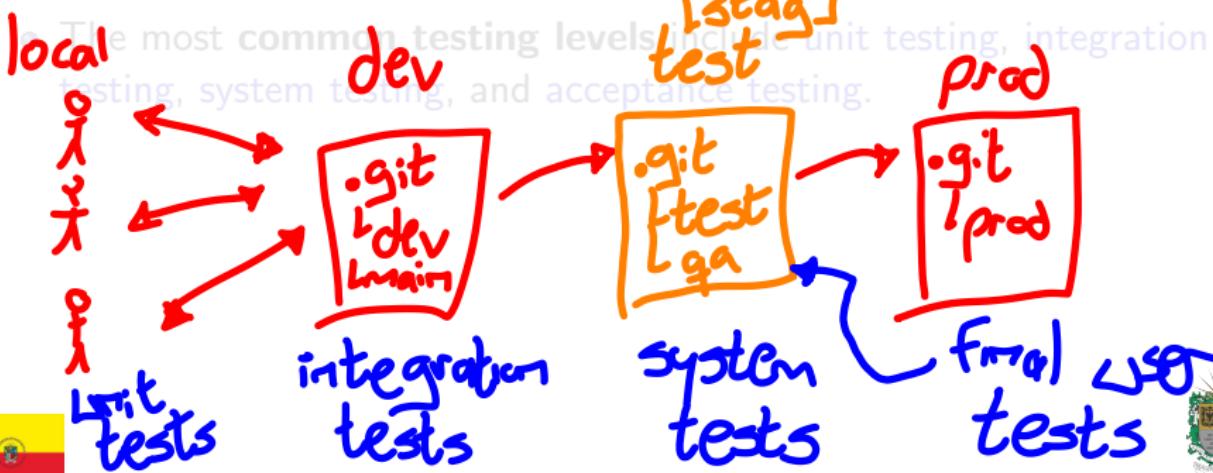
2 Testing Levels



Testing Levels

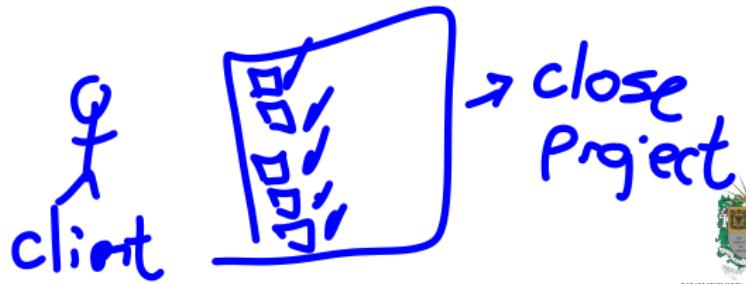
DEV-001 → feature/dev-001
bug/dr-co.

- Testing levels refer to the different stages of testing that a software system goes through during its development lifecycle.
- Each level of testing has its own set of objectives, techniques, and tools.
- The **main goal** of testing levels is to ensure that the software is of high quality, reliable, and meets the needs of its users.



Testing Levels

- **Testing levels** refer to the **different stages** of testing that a software system goes through during its **development lifecycle**.
- **Each level** of testing has its own set of **objectives**, **techniques**, and **tools**.
- The **main goal** of testing levels is to **ensure** that the software is of high quality, reliable, and meets the needs of its users.
- The most **common testing levels** include unit testing, integration testing, system testing, and acceptance testing.

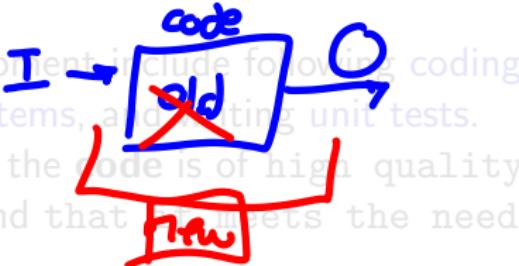


Base Code Quality & Good Practices

- Base code quality refers to the fundamental principles and practices that ensure that the code is of high quality, maintainable, and efficient.
- It includes practices such as code reviews, code refactoring, and code documentation.
- Good practices in software development include following coding standards, using version control systems, and writing unit tests. These practices help to ensure that the code is of high quality, maintainable, and efficient, and that it meets the needs of its users.

I
dev

I
Reviewers

Pull Request
main

- Demo Time
- headers
 - params, returns, description
 - multi-line explain non-obvious



Base Code Quality & Good Practices

- **Base code quality** refers to the fundamental principles and practices that ensure that the **code** is of high quality, maintainable, and efficient.
- It includes **practices** such as **code reviews**, **code refactoring**, and **code documentation**.
- **Good practices** in software development include following **coding standards**, using **version control systems**, and writing **unit tests**.
These practices help to ensure that the **code** is of high quality, maintainable, and efficient, and that it meets the needs of its users.

PEP 8

Java - Camel

Python snake

Docs → Google

Demo Time!

Get tags?
changes control?



Static Analysis

- **Static analysis** is a *(software testing technique)* that involves **analyzing the source code** of a software system **without executing it**.
- The **main goal** of static analysis is to identify **potential defects, vulnerabilities, and code quality issues** in the **source code**.
- Static analysis tools can automatically analyze the source code and provide feedback on potential issues, such as coding standards violations, security vulnerabilities, and performance issues.
- *Static analysis* is typically performed early in the software development process.

Demo Time!



Static Analysis

- **Static analysis** is a *software testing technique* that involves **analyzing** the **source code** of a software system **without executing it**.
- The **main goal** of static analysis is to identify **potential defects**, **vulnerabilities**, and **code quality issues** in the source code.
- **Static analysis tools** can **automatically** analyze the **source code** and provide feedback on potential **issues**, such as **coding standards violations**, **security vulnerabilities**, and **performance issues**.
- **Static analysis** is typically performed **early** in the software development process.

Demo Time!



PyLint



Unit Testing

- **Unit testing** is a software testing technique that involves testing individual units or components of a software system in isolation.
- The main goal of unit testing is to identify defects and issues in the source code at an early stage of the software development process.
- Unit tests are typically written by developers and are executed automatically as part of the software development process.
- Unit testing is typically performed after the code has been written and before the code is integrated into the larger software system.
- Unit testing is an essential part of the software development process and is typically performed using unit testing frameworks such as JUnit, NUnit, or pytest.

Demo Time!



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↓
aviod bad code
in main branch



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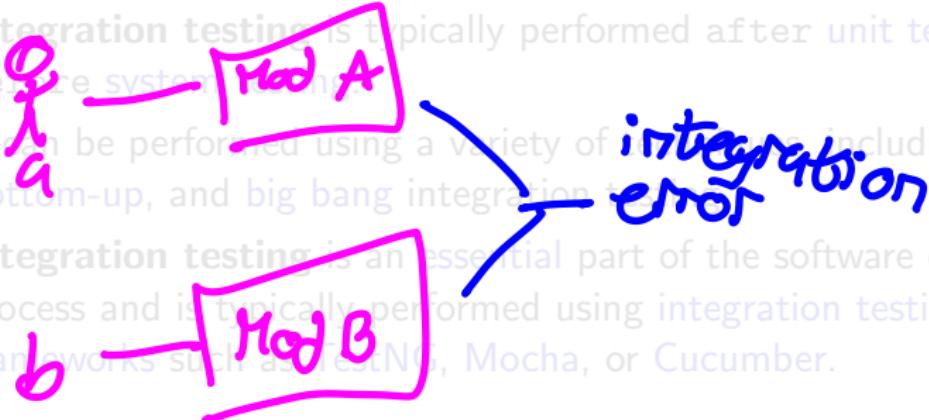
T
Java *T*
Node *Python*

Demo Time!



Integration Testing

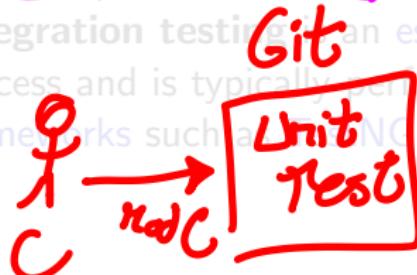
- **Integration testing** is a *software testing technique* that involves testing the interactions between different components or units of a software system.
- The main goal of integration testing is to identify defects and issues in the interactions between different components or units of the software system.

- Integration testing is typically performed after unit testing and before system testing.
 - It can be performed using a variety of approaches, including top-down, bottom-up, and big bang integration.
 - Integration testing is an essential part of the software development process and is typically performed using integration testing frameworks such as TestNG, Mocha, or Cucumber.
- 



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Integration Testing Techniques

- **Top-down integration testing** is a technique that involves testing the higher-level components of a software system first, and then gradually integrating and testing the lower-level components.
- **Bottom-up integration testing** is a technique that involves testing the lower-level components of a software system first, and then gradually integrating and testing the higher-level components.
- **Big bang integration testing** is a technique that involves integrating and testing all components of a software system at once, without any prior integration testing.

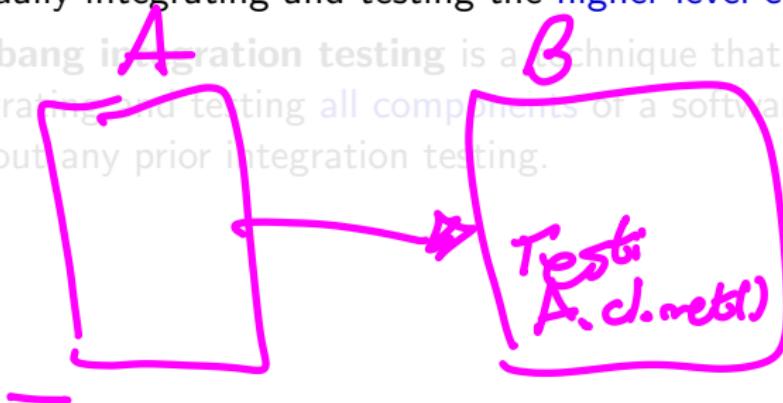
Test:
Imports B

Main Test:
 $a = Ad$
 $b = Bd$



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- **Big bang integration testing** is a technique that involves integrating and testing **all components** of a software system at once, without any prior integration testing.

Top &



API Testing → web services

- API testing is a software testing technique that involves testing the application programming interfaces (APIs) of a software system.
- The main goal of API testing is to identify defects and issues in the APIs of the software system, including their functionality, performance, and usability.
- API testing is typically performed after integration testing and before system testing.
- It can be performed using a variety of techniques, including functional, non-functional, and regression testing.
- API testing is an essential part of the software development process and is typically performed using API testing frameworks such as Postman, SoapUI, or RestAssured.

Main.py *subapi2.py*
Integration
Test Demo Time!



API Testing

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Input vs output **Performance**

Demo Time!

add
↓
test
old
code is working



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Demo Time!



System Testing

- **System testing** is a *software testing technique* that involves **testing the entire software system as a whole.** → **MVP**
- The **main goal** of system testing is to identify defects and issues in the software system as a whole, including its functionality, performance, and usability.
- System testing is typically performed after integration testing and before acceptance testing.
- It can be performed using a variety of **techniques**, including functional, non-functional, and regression testing.
- System testing is an essential part of the software development process and is typically performed using system testing frameworks such as Selenium, Appium, or Robot Framework.



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System Testing Techniques

- **Functional testing** is a technique that involves testing the functionality of a software system to ensure that it meets the specified requirements.
- Non-functional testing is a technique that involves testing the non-functional aspects of a software system, such as its performance, *legit*, and security.
funcional
- Retesting is a technique that involves retesting a software system after changes have been made to ensure that the changes have not introduced any new defects.
stories
acceptance
criterio



System Testing Techniques

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LIX/UX
- Product quality*



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Stress Testing

- **Stress testing** is a *software testing technique* that involves testing the software system under extreme conditions to determine its stability and performance.
- The main goal of stress testing is to identify defects and issues in the software system when it is subjected to high loads or stressful conditions.
- Stress testing is typically performed after system testing and before acceptance testing.
- It can be performed using a variety of techniques, including load testing, performance testing, and scalability testing.
- Stress testing is an essential part of the software development process and is typically performed using stress testing frameworks such as JMeter, Gatling, or Locust.



Demo Time!



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Demo Time!



Acceptance Testing

- **Acceptance testing** is a *software testing technique* that involves testing the software system to ensure that it meets the needs of its users. *User stories*
- The **main goal** of acceptance testing is to identify defects and issues in the software system from the perspective of the end user.
- Acceptance testing is typically performed after system testing and before deployment.
→ close the project
- It can be performed using a variety of **techniques**, including user acceptance, alpha, and beta testing.
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Demo Time!



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test/QA

environment

Demo Time!



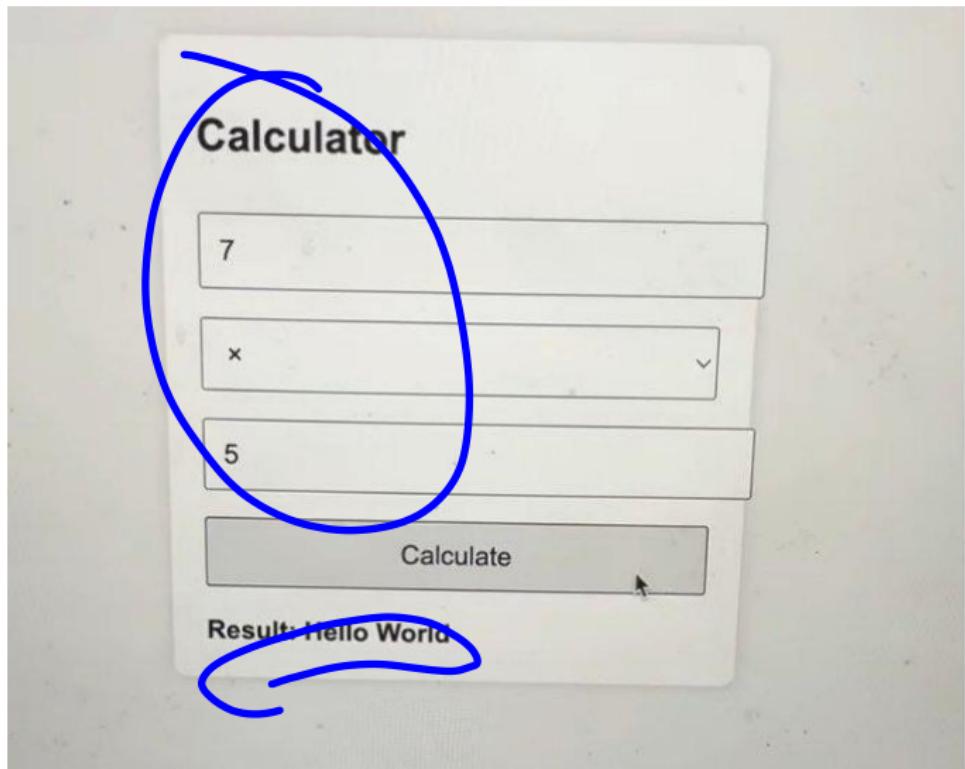
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Demo Time!



Feature Error



Outline

1 Basic Concepts

2 Testing Levels



Thanks!

Questions?



Repo: www.github.com/EngAndres/ud-public/tree/main/courses/software_engineering_seminar

