Testing Engineering Fundamentals

Software Engineering Seminar

Author: Eng. Carlos Andrés Sierra, M.Sc.
cavirguezs@udistrital.edu.co

Professor Lecturer
Computer Engineering Program
School of Engineering
Universidad Distrital Francisco José de Caldas

2025-II

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Outline

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Outline

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Quality is a Key Factor

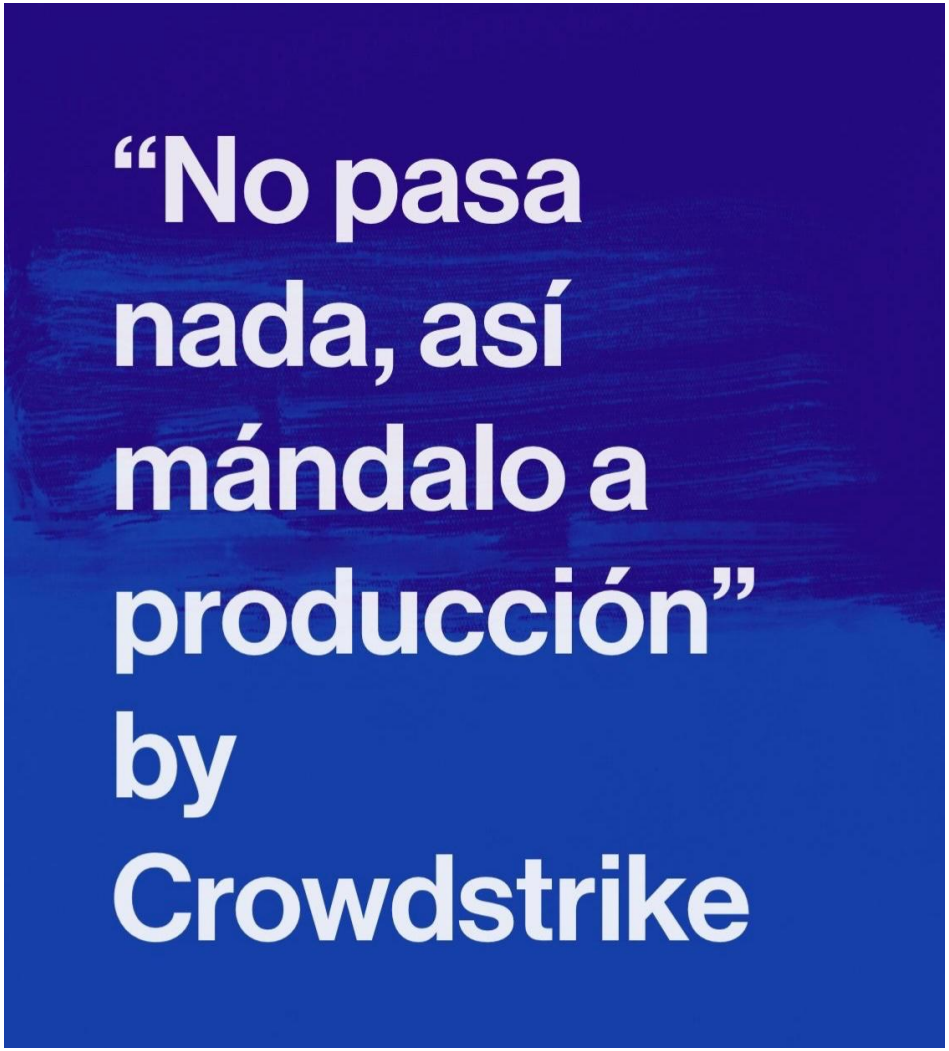


Figure: Microsoft Style!

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, 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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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-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.
- 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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.
- 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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

CMMI

- **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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Outline

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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`.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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`.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

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.

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

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 techniques, including top-down, bottom-up, and big bang integration testing.
- **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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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 techniques, including top-down, bottom-up, and big bang integration testing.
- **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.

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 techniques, including top-down, bottom-up, and big bang integration testing.
- **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.

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.

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.

API Testing

- **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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

API Testing

- **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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

API Testing

- **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.

System Testing

- **System testing** is a *software testing technique* that involves testing the entire software system as a whole.
- 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.

System Testing

- **System testing** is a *software testing technique* that involves testing the entire software system as a whole.
- 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.

System Testing

- **System testing** is a *software testing technique* that involves testing the entire software system as a whole.
- 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.

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, usability, and security.
- **Regression testing** 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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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, usability, and security.
- **Regression testing** 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.

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, usability, and security.
- **Regression testing** 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`.

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.

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.

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.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.
- 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*.
- It can be performed using a variety of **techniques**, including user acceptance, alpha, and beta testing.
- **Acceptance testing** is an essential part of the software development process and is typically performed using acceptance testing frameworks such as Cucumber, FitNesse, or Behave.

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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.
- 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*.
- It can be performed using a variety of **techniques**, including user acceptance, alpha, and beta testing.
- **Acceptance testing** is an essential part of the software development process and is typically performed using acceptance testing frameworks such as Cucumber, FitNesse, or Behave.

Acceptance Testing

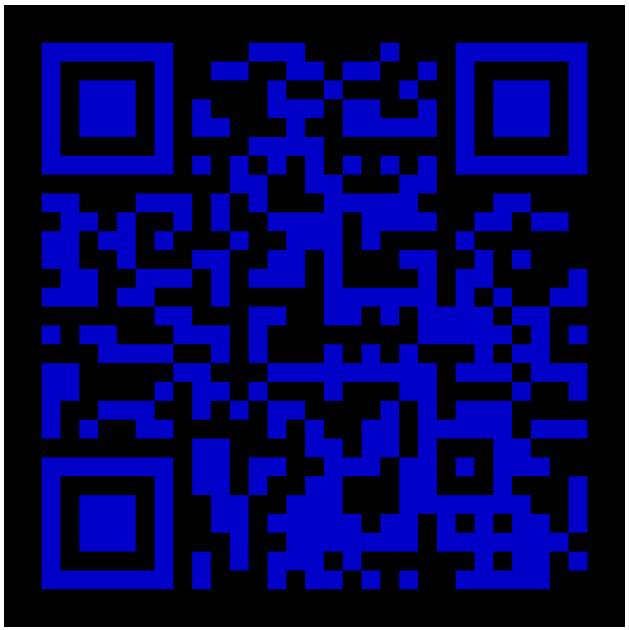
- **Acceptance testing** is a *software testing technique* that involves testing the software system to ensure that it meets the needs of its users.
- The **main goal** of acceptance testing is to identify defects and issues in the software system from the perspective of the end user.
- **Acceptance testing** is typically performed after system testing and *before deployment*.
- It can be performed using a variety of **techniques**, including user acceptance, alpha, and beta testing.
- **Acceptance testing** is an essential part of the software development process and is typically performed using acceptance testing frameworks such as Cucumber, FitNesse, or Behave.

Outline

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

Thanks!

Questions?



www.linkedin.com/in/casierrav

UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS