1. Smoke Testing

Definition : Often called "Build Verification Testing," smoke testing is a shallow but wide approach. It's the first line of defense after a new software build is received. The goal isn't to find deep bugs but to ascertain if the application is "on fire" or too broken to warrant further, more expensive testing. It's like turning on a new car's engine and checking if the headlights, brakes, and windshield wipers work before taking it for a drive.

Real-World Scenario: E-commerce Website Deployment

- Situation: The development team deploys a new build of an e-commerce site every night.
- Smoke Test Action: Before the testing team starts their in-depth regression suite the next morning, they perform a smoke test. They:
    1. Launch the application URL.
    2. Log in with a valid user credential.
    3. Search for a product.
    4. Add a product to the cart.
    5. Proceed to the checkout page (without completing the payment).
- Outcome: If any of these critical paths fail (e.g., the login is broken, the cart is empty), the build is rejected and sent back to development. This saves the testing team from wasting a full day testing a fundamentally broken application.

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2. Sanity Testing

Elaborate Explanation: Sanity testing is a narrow, deep, and focused test performed after a specific bug fix or a minor change. It answers the question: "Did the fix work, and did it break anything immediately obvious in that specific

area?" It's not about testing the whole system, but rather doing a "sanity check" on the change.

Real-World Scenario: Banking App - Fixing Login Issue

- Situation: A bug was reported where users with apostrophes in their last names (e.g., O'Conner) couldn't log in. The developers claim to have fixed it.
- Sanity Test Action: The tester focuses *only* on the login functionality for this specific case. They:
    1. Attempt to log in with a user account named "O'Conner".
    2. Verify successful login and proper dashboard landing.
- Outcome: The test confirms the fix works. The tester does not check fund transfers or statement downloads because those areas were not touched by this code change.

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3. Regression Testing

Elaborate Explanation: This is a comprehensive test to ensure that new features, bug fixes, or configuration changes have not adversely affected the existing, previously working functionality. As software evolves, regression testing becomes critical to prevent "software rot" where new code breaks old features.

Real-World Scenario: Social Media App - Adding "Stories" Feature

- Situation: A social media app introduces a new "Stories" feature. The code for this feature is intertwined with the existing code for posts, comments, and profiles.
- Regression Test Action: After deploying the "Stories" code, the testing team executes a large regression test suite that includes:
    - Creating a new text post.

    - Adding a comment to a photo.
    - Updating a user profile picture.
    - Sending and accepting a friend request.
- Outcome: This ensures that the exciting new "Stories" feature didn't accidentally break the core functionality that users rely on every day.

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4. Integration Testing

Elaborate Explanation: This testing focuses on the interfaces and interaction between integrated units or modules. The main challenge is that individual modules, often developed by different teams, might work perfectly in isolation but fail when they need to communicate with each other.

Real-World Scenario: Online Travel Booking System

- Situation: A travel website has three separate modules: `FlightSearch`, `PaymentGateway`, and `EmailNotification`.
- Integration Test Action: Testers perform scenarios that flow through these modules:
    1. `FlightSearch` finds a flight and sends the booking details to `PaymentGateway`.
    2. `PaymentGateway` processes a mock payment and confirms the booking.
    3. The confirmation trigger sends a signal to `EmailNotification` to dispatch a booking confirmation email.
- Outcome: A defect might be found where the `EmailNotification` module crashes because it cannot parse the date format sent by `FlightSearch`. This interface defect is caught during integration testing.

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5. System Testing

Elaborate Explanation: This is end-to-end testing of the *complete*, *integrated* system to verify that it meets all the specified requirements. It tests both functional and non-functional aspects (like performance, security) in an environment that closely mimics production.

Real-World Scenario: New University Admission Portal

- Situation: A university has built a new admission portal. All modules (application form, document upload, fee payment, status tracker) have been integrated.
- System Test Action: The test team validates the entire business workflow:
    1. A prospective student creates an account.
    2. They fill out the multi-page application form.
    3. They upload their transcripts and recommendation letters.
    4. They pay the application fee online.
    5. They log out and later log back in to check their application status.
- Outcome: This validates that the entire system, as a unified whole, works according to the business requirements before it is handed over to the university staff for UAT.

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6. User Acceptance Testing (UAT)

Elaborate Explanation: UAT is the final phase, where the actual end-users (or clients) determine if the system is ready for release. The goal is not to find bugs, but to gain confidence that the software supports their daily business processes and is "fit for purpose."

Real-World Scenario: New Inventory Management Software for a Retail Store

- Situation: A software company has developed a custom inventory system for a retail chain.
- UAT Action: The store managers and warehouse staff (the real users) are given access to the system in a UAT environment. They perform tasks they do in their real jobs:
    - Receiving a new shipment of goods.
    - Updating stock levels.
    - Processing a sale at the checkout.
    - Running a "low stock" report.
- Outcome: The users provide feedback like, "The process for receiving goods takes 10 steps, but our old process only took 5. This is not efficient for us." This feedback is about business workflow, not technical bugs, and is crucial for final acceptance.

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7. Performance Testing

Elaborate Explanation: This is an umbrella term for testing how a system performs under various load conditions. It includes checking speed, scalability, stability, and resource usage.

Real-World Scenario: Tax Filing Website Before Deadline

- Situation: A government tax filing portal expects a massive surge in users on the filing deadline day.
- Performance Test Action: Using a tool like JMeter, the team simulates:
    - Load Test: 10,000 users logging in and filing forms simultaneously (the expected peak load).
    - Stress Test: 15,000 users to see when the system breaks and how it recovers.
    - Endurance Test: 5,000 users continuously using the system for 48 hours to check for memory leaks.

- Outcome: They discover that the database connection pool is exhausted under a load of 12,000 users, causing errors. This is fixed before the actual deadline day.

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8. Load Testing

Elaborate Explanation: A subset of performance testing, load testing specifically evaluates system behavior under *expected* user load. The goal is to identify performance bottlenecks and ensure the system meets its performance objectives during normal and peak usage.

Real-World Scenario: Online Ticket Booking for a Concert

- Situation: A popular band's concert tickets go on sale online at 10 AM. The website expects 50,000 concurrent users to be searching and buying tickets.
- Load Test Action: The team creates a script that simulates users searching for tickets, selecting seats, and completing purchases. They gradually ramp up the virtual users to 50,000 and monitor the application's response time and error rates.
- Outcome: The test reveals that the response time for the "Select Seat" API increases from 200ms to 5 seconds under full load, leading to user frustration. The team can then optimize this before the real sale.

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9. Usability Testing

Elaborate Explanation: This testing is about the user experience (UX). It assesses how easy and intuitive it is for a user to accomplish their goals. It's

qualitative and focuses on design, navigation, clarity, and overall user satisfaction.

Real-World Scenario: New Food Delivery Mobile App

- Situation: A startup has designed a new app for ordering food.
- Usability Test Action: They invite a group of target users (people who regularly order food online) to a lab. They are given tasks like "Find a Italian restaurant that delivers in under 30 minutes and place an order for a margherita pizza." Researchers observe where users hesitate, get confused, or make errors.
- Outcome: Feedback such as, "The 'Apply Coupon' button is hidden; I didn't see it," or "It took me too many clicks to change my delivery address," is gathered and used to improve the app's design.

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10. Security Testing

Elaborate Explanation: This process identifies vulnerabilities, threats, and risks in a system and protects it from malicious attacks. It ensures the software's data is confidential, integrity is maintained, and services are available to authorized users.

Real-World Scenario: Healthcare Patient Portal

- Situation: A portal contains sensitive patient health records (PHI), which are highly regulated.
- Security Test Action: A security tester (or ethical hacker) attempts to:
    - Break Authentication: Use SQL injection to bypass login.
    - Break Authorization: Access another patient's records by manipulating the URL (Insecure Direct Object Reference).
    - Check Data Protection: Ensure all data is encrypted in transit (HTTPS) and at rest.

- Outcome: They find that user session tokens don't expire quickly enough, allowing for session hijacking. This critical vulnerability is fixed before launch.

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11. Ad-hoc Testing

Elaborate Explanation: This is the least formal type of testing, performed without any planning or documentation. It relies entirely on the tester's skill, intuition, and experience to "break" the application in ways that structured testing might not anticipate.

Real-World Scenario: A New Video Game

- Situation: A tester is given a new level in a video game to check. They have no formal test cases.
- Ad-hoc Test Action: The tester, using their knowledge of common game bugs, might:
    - Try to walk through walls.
    - Spam the jump button repeatedly.
    - Collect a power-up and immediately pause/unpause the game.
    - Suddenly disconnect the network cable during an online match.
- Outcome: They might discover a sequence of actions that causes the game to crash, a bug that would never be found by following a predefined test script.

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12. Exploratory Testing

Elaborate Explanation: While often grouped with Ad-hoc, Exploratory Testing is more structured. It is a simultaneous process of learning, test design, and test execution. Testers explore the software with a mission (a "charter") but without pre-defined steps, using their curiosity to guide them.

Real-World Scenario: A New Feature in a Project Management Tool

- Situation: A new "Automated Workflow" feature is added, allowing users to create custom rules.
- Exploratory Test Action: The tester's charter is: "Explore the new workflow builder and identify any usability or functional issues." The tester starts creating rules, sees what happens, learns the system's behavior, and designs new tests on the fly. They might think, "What if I set a rule that conflicts with another rule?" and then immediately test that scenario.
- Outcome: They find that under a specific combination of rules, the system sends duplicate email notifications. This creative, investigative approach uncovers complex, scenario-based defects.

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13. Compatibility Testing

Elaborate Explanation: This ensures that the software works as intended across different environments, including various hardware, operating systems, networks, and mobile devices.

Real-World Scenario: A New Mobile Game

- Situation: A game is developed for Android and iOS.
- Compatibility Test Action: The game is tested on a matrix of devices:
    - OS Versions: Android 10, 11, 12, 13 / iOS 14, 15, 16.
    - Device Models: Samsung Galaxy S series, Google Pixel, OnePlus, iPhone 12, 13, 14, iPad.

    - Screen Sizes & Resolutions: Various screen sizes and aspect ratios.
    - Network Types: 4G, 5G, Wi-Fi.
- Outcome: The game is found to crash on a specific Samsung model running Android 12 due to a GPU driver issue, which is then addressed.

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14. Cross-Browser Testing

Elaborate Explanation: A subset of compatibility testing, this is specific to web applications. It verifies that a website or web app functions and appears consistently across different browsers (Chrome, Firefox, Safari, Edge) and their versions.

Real-World Scenario: A Redesigned Corporate Website

- Situation: A company launches a new, modern website with complex CSS animations and JavaScript.
- Cross-Browser Test Action: The site is tested on:
    - Chrome 115, Firefox 116, Edge 115, Safari 16.
    - The testing focuses on:
        - Does the layout render correctly?
        - Do the interactive elements (dropdowns, sliders) work?
        - Are the fonts and images loading properly?
- Outcome: The team discovers that the CSS Grid layout is completely broken in an older version of Safari, causing the page to be unusable. The developers can then write a fallback or apply a specific fix for that browser.