

LEVELS OF TESTING

Software testing can be performed at different levels of the software development process. Performing testing activities at multiple levels help in the early identification of bugs and better quality of software product. In this ,the different levels of testing namely – Unit Testing, Integration Testing, System Testing, and Acceptance Testing is dicussed.

- **Unit Testing**
- **Integration Testing**
- **System Testing**
- **Acceptance Testing**



Unit Testing

- The first level of testing involves **analyzing each unit or an individual component** of the software application.
- Unit testing is also the first level of **functional testing**. The primary purpose of executing unit testing is to validate unit components with their performance.

- A unit component is an individual function or regulation of the application, or we can say that it is the smallest testable part of the software. The reason of performing the unit testing is to test the correctness of inaccessible code.
- Unit testing will help the test engineer and developers in order to understand the base of code that makes them able to change defect causing code quickly. The developers implement the unit.
- **Advantage** – Error can be detected at an early stage saving time and money to fix it.
- **Limitation** – Integration issues are not detected in this stage, modules may work perfectly on isolation but can have issues in interfacing between the modules.

Integration Testing

- **Integration testing** is the second level of testing in which we test a group of related modules.
- It aims at finding interfacing issues b/w the modules i.e. if the individual units can be integrated into a sub-system correctly.
- It is of four types – Big-bang, top-down, bottom-up, and Hybrid.
 1. In **big bang integration**, all the modules are first required to be completed and then integrated. After integration, testing is carried out on the integrated unit as a whole.
 2. In **top-down integration** testing, the testing flow starts from top-level modules that are higher in the hierarchy towards the lower-level modules. As there is a possibility that the lower-level modules might not have been developed while beginning with top-level modules.

So, in those cases, stubs are used which are nothing but dummy modules or functions that simulate the functioning of a module by accepting the parameters received by the module and giving an acceptable result.

3. **Bottom-up integration testing** is also based on an incremental approach but it starts from lower-level modules, moving upwards to the higher-level modules. Again the

higher-level modules might not have been developed by the time lower modules are tested. So, in those cases, drivers are used. These drivers simulate the functionality of higher-level modules in order to test lower-level modules.

4. **Hybrid integration testing** is also called the Sandwich integration approach. This approach is a combination of both top-down and bottom-up integration testing. Here, the integration starts from the middle layer, and testing is carried out in both directions, making use of both stubs and drivers, whenever necessary.

System Testing

- **System Testing** is the third level of testing.
- It is the level of testing where the complete integrated application is tested as a whole.
- It aims at determining if the application conforms to its business requirements.
- System testing is carried out in an environment that is very similar to the production environment.
- In system testing, we will go through all the necessary modules of an application and test if the end features or the end business works fine, and test the product as a complete system.
- In simple words, we can say that System testing is a sequence of different types of tests to implement and examine the entire working of an integrated software computer system against requirements.

Acceptance Testing

- **Acceptance testing** is the final and one of the most important levels of testing on successful completion of which the application is released to production.
- It aims at ensuring that the product meets the specified business requirements within the defined standard of quality.
- There are two kinds of acceptance testing- alpha testing and beta testing.

1. When acceptance testing is carried out by testers or some other internal employees of the organization at the developer's site it is known as **alpha testing**.
2. User acceptance testing done by end-users at the end-user's site is called **beta testing**.