Software Testing

Objective

To identify all defects existing in software and rename them and achieve error-free operations in an understated condition for a stated period of time.

Faults or defects: Any deviation from the specification and standard

Errors: Faults or defects detected during reviews

Bugs: faults or defects whose existence is detected during testing.

Note: Debugging is undertaken to find a exact faults

What is Software Failure?

1. Software failure is said to have occur when the program execution result in outcome which are inconsistent with the expectation.
2. It can happen irrespective of the presence of fault

Example: Delay in response and poor response

3. Possible reasons for failure are
   -> incorrect use
   -> incorrect documentation
   -> incomplete requirements

Note: A defective product can work without failures if the effective part of the code is not executed.

Role of Testing in Software Development

- Primary
  - To confirm that system needs the requirement that is it confirm to requirement Specification
- To find all (!) the softwares bugs

- Secondary
  - Instill confidence in all concerned:
    - Developers
    - Higher management
    - Customers
    - Quality Groups
    - Auditors
  - Continuously improve:
    - Software development process
    - Software testing process

Definition of Testing

Testing is the process of executing a program with an intention of finding errors or bugs in it. This is one of the essential steps in software development life cycle. Hence it is the responsibility of the coder to build his software error free

Verification

It is the process of evaluating a system or component to determine whether products of a given development phase satisfy the condition imposed at the start of that phase.

Validation

It is the process of evaluating a system or component during or at the end of development process to determine whether it satisfies the specific requirements.
Testing = Verification + validation

Characteristics of Software Testing

- Simplicity:

The code written should extent the phases of simplicity and code, structural and functional simplicity. Hence it is known fact that"If there is less requirement of testing we can test them in very less time" . Reduce complex architecture and logic to simplicity test

- Understandability:

  change to the design are communicated to the tester
- Controllability:

  The degree to which testing cream be automated and optimised
- Observability:

  The result of each test case are readily observed variables are visible during execution . Source code is available

- Operability :

  It operates clearly of implemented with quality in mind
- Decomposability:

  Testing can be targeted independently and modules can be tested independently
- Stability:

  Few changes are requested during testing, the software recovers well from failures

What should we test?

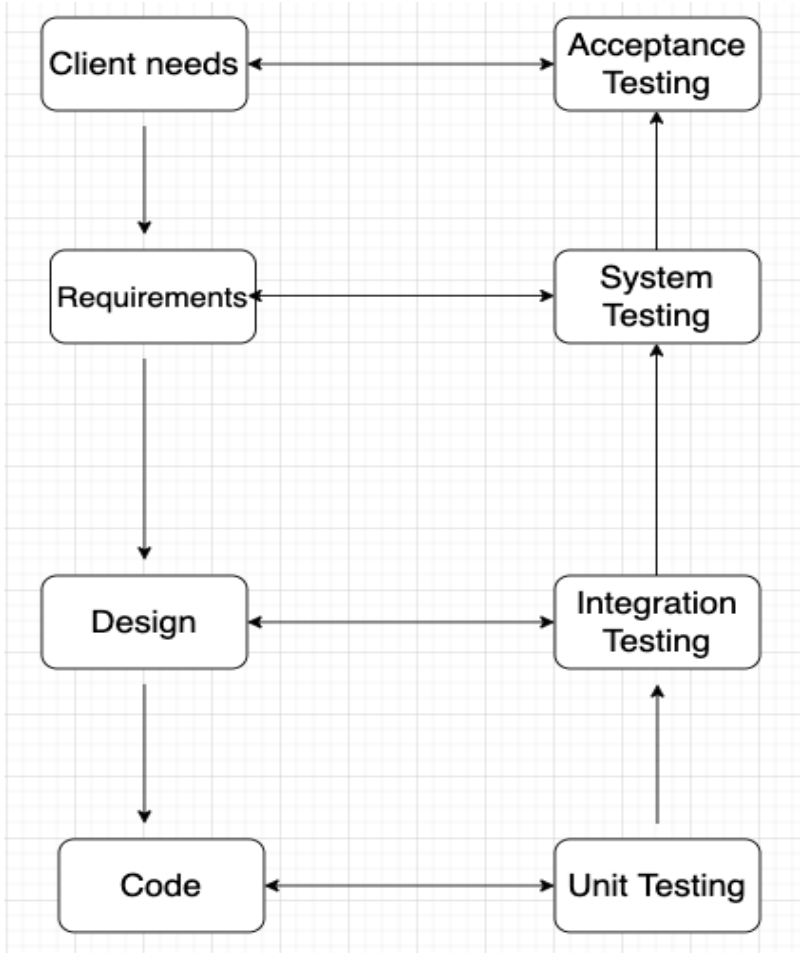
In the software life cycle earlier the errors are discovered the lowest is the cost of removable
Although software testing is itself an expensive activity yet launching of software may lead to cost potentially much higher than that of testing especially in system where human safety is involved .

Who should do Testing?

- Testing requires the developers to find errors from software .
- It is difficult for software developers to point out errors from their own creation.
- Many organisations have made distinction between development and testing phase by moving different people responsible for each phase .

Levels of Testing or Stages in Testing Process

Testing is usually relief upon the faults remaining from earlier stages in addition to the faults introduced during coding itself. Due to this, different level of testing are used in the testing process . Each level of testing aims to test different level of the systems. The basic level are Unit testing, Integration testing and acceptance testing. The different level of testing attempt to detect different types of faults . The relation of the faults used in the different in phases

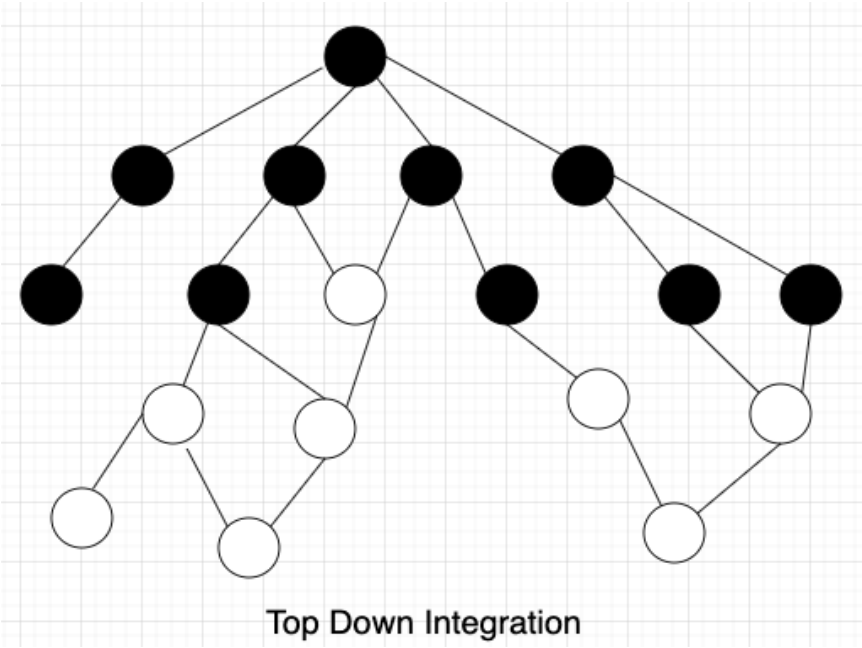

Client needs
Acceptance Testing
Requirements
System Testing
Design
Integration Testing
Code
Unit Testing

- Unit Testing :

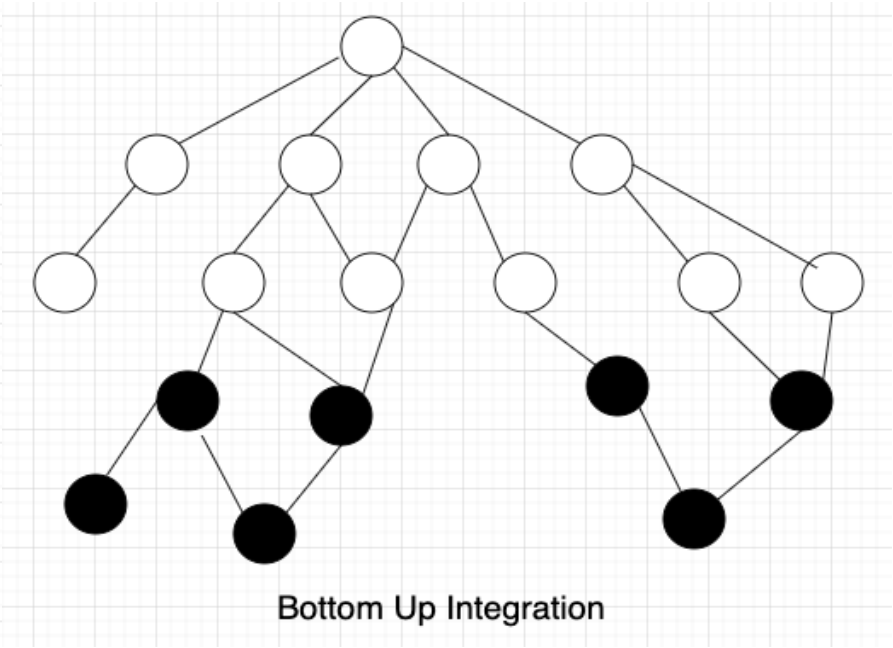
The first level of testing is called unit testing. It is essential for verification of cost produced by individual programmers and it's typically done by the programmers module

- Integration Testing -

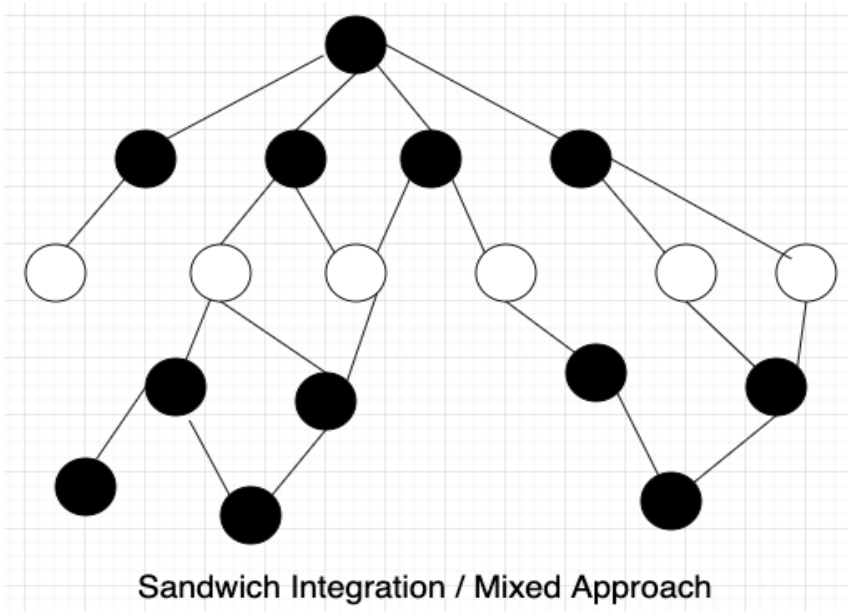
The next level of testing is also known as integration testing. In this many unit tested modules are combined into sub systems which are then tested. The goal here is to see if the modules can be integrated properly. Hence the complex is on testing interface between modules . This testing activity can be considered testing the designs .



Top Down Integration



Bottom Up Integration

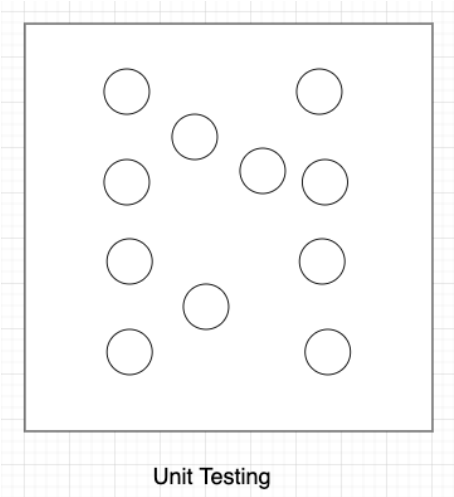


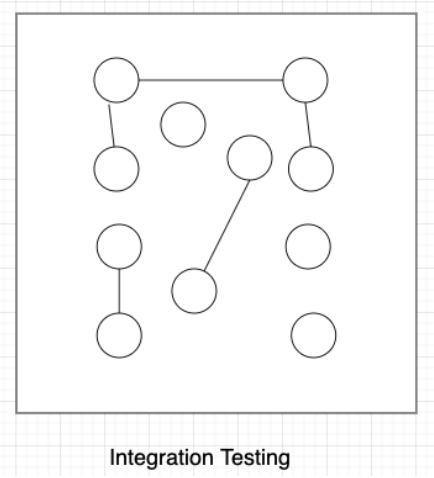
Big Bang Approach:

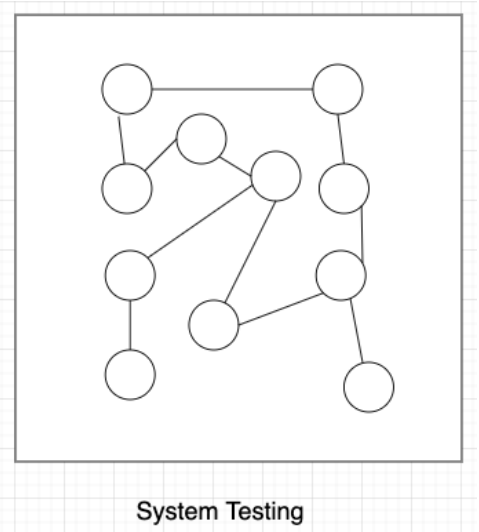
All the submodules are integrated in a single step and test it together. This is feasible for small systems.

- System testing:

Here the entire software system is tested. It refers document for this process is the requirements document and the goal is to see if the software meets its requirements.







- Alpha Testing:

The test performs at the developers site before the system is finally installed in the real working environment (user’s site) is known as Alpha testing. It involves testing the system with live data applied by the organisation rather than by the test date used by the system designer. Sometimes it is called acceptance testing.

- Beta Testing:

The test performed at the customers / and users sites beta testing is conducted in real environment that cannot be controlled by the developer. Testing should be repeated if any modification is done based on the feedback given by the user users sometimes it is called as a regression testing.

- Stub Testing:

It is used in testing module, especially where module are written and tested in a top-down fashion, where are few lines of code are used to substitute the subordinate modules.

- Acceptance testing :

Acceptance testing is often performed with realistic data of the client to demonstrate the the software satisfactory. It may be done in the setting in which the software is eventually function. Acceptance testing essentially test of the system satisfactory solves the problem for which it was commissioned . These level of testing are performed when the system is being from the components that have been coded.

- Regression Testing:

There is another level of testing that is performed when some changes are more to the existing system . We know that fundamental to software ; Any software must undergo changes however when modification is made to an existing system, testing also has to be done to make sure that modifications not had any undesirable side effects of making some of the earlier services faulty. That is beside ensure that the desired behaviour of the new services ; testing has to ensure that the desired behaviour of the old services is maintained . This is the lack of regression testing .

NOTE:

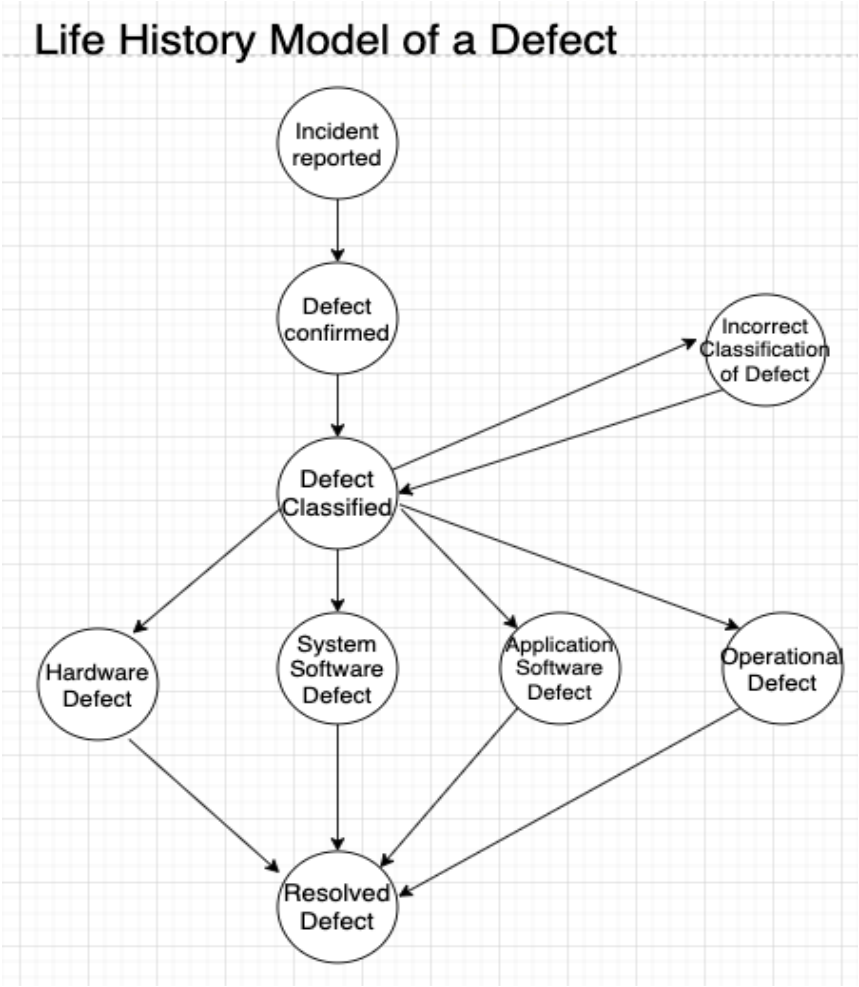
- Regression testing involves re-running of test cases

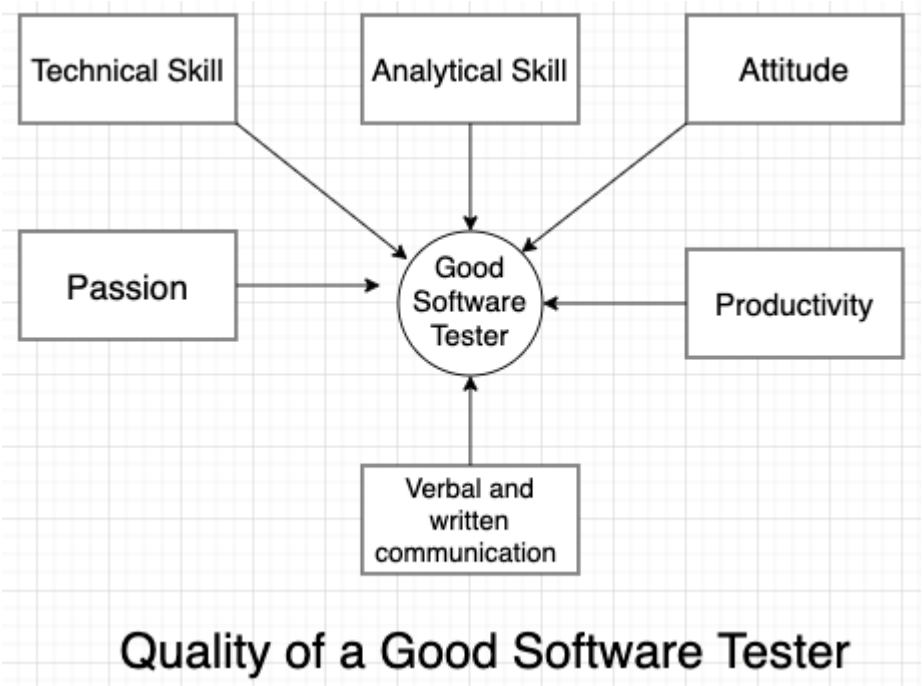
  * It is done under changes or enhancements and each increment operation.

  * Existing function are not affected .

  * No new errors are introduced.

Life History Model of a Defect




Technical Skill
Analytical Skill
Attitude
Passion
Good Software Tester
Productivity
Verbal and written communication
Quality of a Good Software Tester

Testing Procedure

* Prepare a test plan
* Review the test plan
* Evolve the test criteria
* Generate test cases
* Prepare test script

* Create require test environment
*Execute test by -
  -Initiating application under test
  -Apply as input already generated test cases
*Complies actual resolved with expected results
*See the outcome test failed or test passed
Note: The test failed is used here when the expected results are not achieved

Testing Classification / Techniques

- Classification of testing
  - static and dynamic
  - functional and structural
  - black box and white box
  - levels of testing

- alpha and beta testing
- exception testing (weather the code throws a desired exception or not)
- suspicion testing (some thing wrong)
- cross-platform testing

- Testing techniques:
- Test -coverage based testing
  - statement coverage
  - condition coverage
  - branch coverage

    - path coverage
- Domain best testing
    - equivalence practice meaning
    - boundary value analysis
    - decision tables tables

Testing Type

	Manual	Automated
Static	Inspection	Syntax Checking
Dynamic	Walkthrough	Unit Testing
	Desk Checking	Integration Testing
		System Testing

- Static testing:

It is the software testing technique where testing is carried out without executing the code.this type of testing comes under verification. it refers to non executable files like requirement analysis, audits, desk checks, inspections and walkthrough. it is employed to verify the correctness of requirements, design and code before execution of test cases.

- Dynamic testing:

It is the software testing technique that testing is carried out with executing the code .this type of testing comes under validation. it is used to describe the development and execution of test cases, test procedures and structures, use of test logs etc. there are two common way to perform dynamic testing which are blackbox and whitebox testing.

Static Testing	Dynamic Testing
1. It is performed in the early stage of the software development	1. It is performed at the later stage of the software development
2. Whole code is not executed	2. Whole code is executed
3. It prevents the defects	3. It finds and fixes the defects
4. It performed before code deployment	4. It performed after code deployment
5. Less costly	5. Highly costly
6. It involves checklist for testing processes	6. It involves test cases for testing process
7. It includes walkthrough, code review, inspections etc	7. It involves functional and non functional testing
8. It generally take shorter time	8. It usually takes longer times.It involves running several test cases.
9. It can discover variety of bugs.	9. It expose the bugs that explorable through executions hence discover only limited types of bugs

- Manual testing:

Manual testing includes testing a software manually without using any automated tools or any script. In this type, the test takes over the role of an end user and tests the software to identify any unexpected behaviour or bye. are different stages for manual testing such as unit testing, integration testing, system testing and user acceptance testing. Test you use test plans, test cases for test scenarios to test a software to ensure the completeness of testing. In manual testing, testers explore the software to identify errors in it.

- **Automated testing: (large and critical projects and availability of time) :**

automated testing, which is also known as test automation. when the tester unites scripts and uses another software to test the project. this process involves automation of a manual process . Automation testing is is used to re- run the test scenario that work performed manually, quickly and repeatedly. Apart from regression testing, automation testing is also used to test the application from load performance and stress point of view. it increases that test coverage improves accuracy and saves time and money in comparison to manual testing.

- Inspections:

inspections are formal group of activities by participants manually examine code for occurrence of well known errors, syntax, grammar and some other routine errors can be checked by automated inspection software. so manual inspection checks are used for more subtle (small changes) errors.this is to the programmers with feedback that enables them to avoid making the same type of errors in future work. it is a testing technique in which participants examine program code for predictable language – specific errors.

- **Walkthrough:**

It is a very effective method of detecting errors in code. code walkthrough should be done frequently when the pieces of work received are relatively small or before the work is formally tested.Authors present their developed artifact to and audience of peers. years questions and comments on the artifact (something made or given shape) to identify as many defects as possible. it involves no prior preparation by the audience . Usually involves minimal documentation of either the process or any arising issues. A walkthrough is an evaluation process which is an informal meeting which is not required preparation .
The product is described by the produced and queries for the comments if participants full stop the results are the information to the participants about the product instead of correcting it.

Inspection	Walkthrough
1. It is formal	1. It is informal.
2. Initiated by the project team team.	2. Initiated by the author (programmer)
3. Planned meeting with fixed roles assigned to all the members involved.	3. Unplanned
4. Readers needs the product code everyone inspect it and comes up with defects.	4.Author read the product code and his team mate come up with defects or suggestions.
5. Recorder records the defects	5. Author makes a note of defects and suggestion offered by teammate.

- # Desk checking

walkthrough is another testing technique in which the program code is sequentially executed manually by the reviewers.code is also important in checking, and informal process with the programmer and someone else who understands the basic of the programs walkthrough the code with paper and pencil. the program executes each instruction using test cases that may or may not be written down.In one sense, the review or after the computer, mentally checking its types and its results for the entire set of computer instructions.

Notes: static technique with text syntax. syntax checking is typically done by a compiler. others in syntax are uncovered but the code is not executed. for the other three automatic techniques the code is executed.

- **Black Box Testing**

The technique of testing without having any knowledge of the internal working of the application is called black box testing.the tester only knows the input that can be given to the system and what output the system should give. This form of testing is also called functional or behavioural testing.

black box testing is concerned with proper execution of the program specification. in this testing each function or subprogram used in the main program is first identify. Test cases are revised to test each function or subprogram separately. Test cases are decided solely on the basis of the requirement specification of the program and not on the basis of coding up the modules.

Examples: In a payroll system, calc_grosspay(), print_payslip () maybe the functions, used to calculate gross pay and printing of payslip.

The testing attempts to find the following errors:

- Interface Error
- Incorrect or missing functions
- Errors in external database access
- Performance errors
- Initialisation and termination errors

- **White Box Testing**

White box testing is the detailed investigation of internal logic and structure of the code. white box testing is concerned with the implementation of the program. In this type, testing different programming structures and data structures used in the program are tested for proper operations. It is called structural testing for glass testing or open box testing. The tester needs to have a look inside the source code and find out which unit of the code is behaving inappropriately.

- **Grey Box Testing**

Grey box testing is a technique to test the applications with having a limited knowledge of the internal working of an application.The tester has access to design documents and the database. Having this knowledge, a tester can prepare better test data and test scenario, while making a test plan.

- **Comparison**

Black Box Testing	Grey Box Testing	White Box Testing
The internal workings of an application need not be known.	The tester has limited knowledge of the internal workings of the application.	Tester has full knowledge of the internal workings of the application.
Also known as closed-box testing, data-driven testing, or functional testing.	Also known as translucent testing, as the tester has limited knowledge of the insides of the application.	Also known as clear-box testing, structural testing, or code-based testing.
Performed by end-users	Performed by end-users	Normally done by

It is exhaustive and the least time-consuming.	Partly time-consuming and exhaustive.	The most exhaustive and time-consuming type of testing.
Not suited for algorithm testing.	Not suited for algorithm testing.	Suited for algorithm testing.
This can only be done by trial-and-error method.	Data domains and internal boundaries can be tested, if	Data domains and internal boundaries can be better

- Testing strategies:

A workable test strategy must be prepared in accordance with established design specification. It includes the following item:

- Output expected from the system
- Criteria for evaluating outputs
- A volume of test data.
- Procedure for using test data
- Personnel and training requirements

Note:

1. It should be developed for each project.

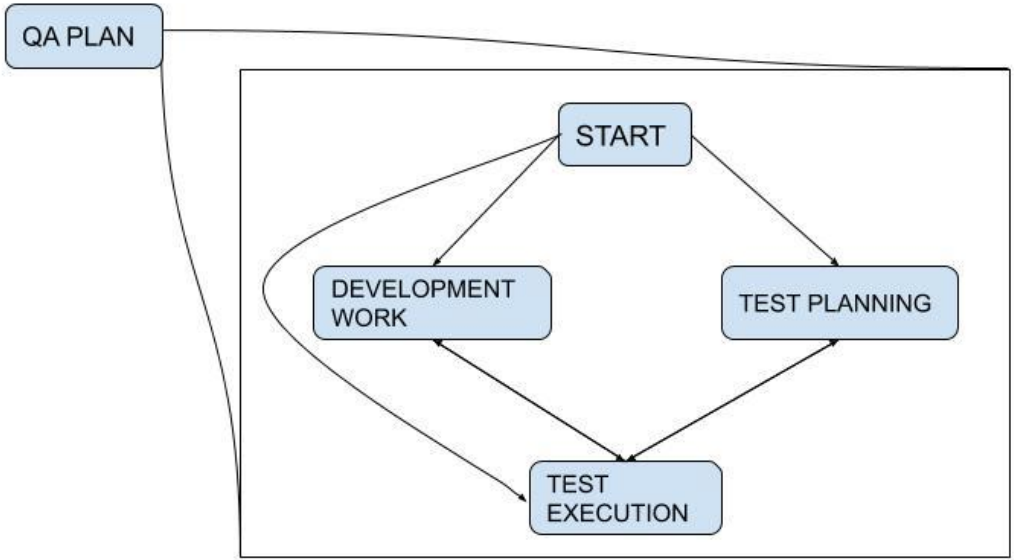
2. It should define the scope and general direction for testing of a project.

- Test Plan:

Power cable test plan must be prepared in accordance with the established design specifications. It includes the following items:

- Outputs expected from the system.
- Criteria for evaluating outputs.
- A volume of test date.
- Procedure for using this data.
- Personnel and training requirements.

- Test Planning:



Reviews:

Review is the only mechanism for early detection of errors.

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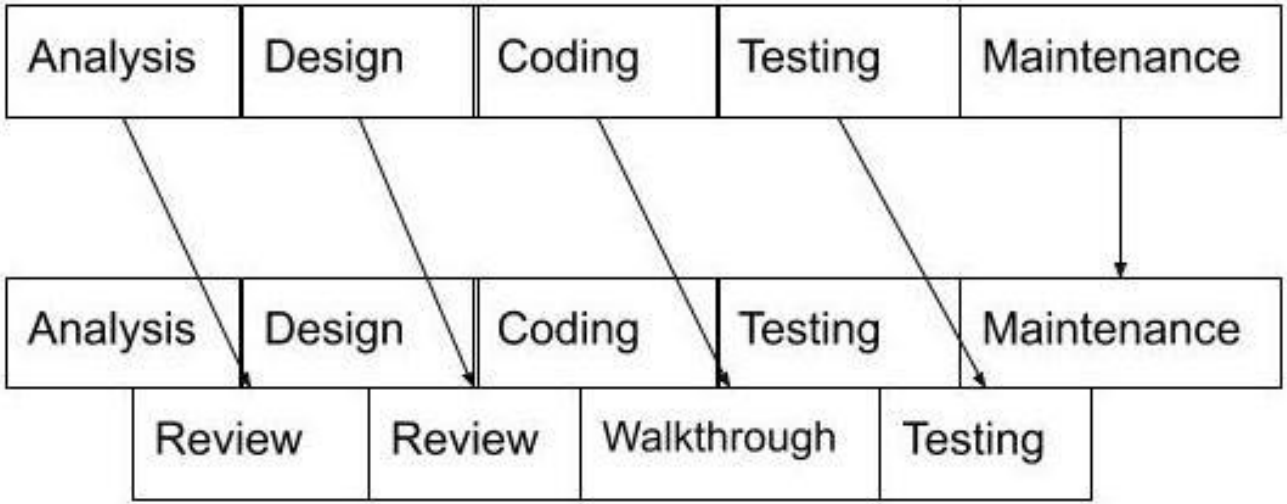

ERROR DETECTION

A good review results in:

- Better initial product quality.
- Correct baseline for subsequent.
- Blindness to own errors.
- Improved management control.
- Openness about everybody is work.

Types of Reviews:

- Business review-Studies states of financial and other business targets.
- Management review-Studies quality management system for its adequacy.
- Project review-Consider the projects ability to meet its requirement.
- Work product review- Involve methodical examination of work product.

Eg. Review of project plan, SRS, design.

Work product reviews:

- Objective

  -Early Detection of Defects.

  -Dissemination of Knowledge.
- Involves methodological examination of work product.
- Generally conducted by peers.
- They are creative and difficult.
- I am just confirming that the work product meets its intended requirements.
- Concentrate on detecting the defects or areas requiring changes.

- Techniques used:
  - Inspection
  - Review
  - Walkthrough

Review Checklist:

- Checklist form an important aid for reviewers.
- The focus the reviewers attention on key requirements of the items being reviewed.
- Compliance with Standard.
- Use for processes.
- Completeness.

- Correctness.
- Meeting entry criteria.
- Rules for development of product i.e process related issues.
- Maintainability of work product.
- Meeting exit criteria.