BITS Pilani
Pilani Campus

SE ZG501
Software Quality Assurance and Testing
Module – Session 8

Effective Test Management and Planning

- During the testing phase of software development, testing activities are managed well to complete the testing process smoothly and on time as well.

- **Test Management** is a process where testing activities are managed to ensure high-quality and high-end testing of software applications.

- This method consists of tracking, organization, controlling processes and checking the visibility of the testing process to deliver a high-quality software application.

- Test management is concerned with both test resource and test environment management.

- It is the role of test management to ensure that new or modified service products meet the business requirements for which they have been developed or enhanced.

- It makes sure the software testing process runs as expected.

key elements of Test Management

- **Test organization**
- **Test planning**
- **Detailed test design and test specifications**
- **Test monitoring and assessment**
- **Product quality assurance**

TEST ORGANIZATION

- Test organization involves structuring and managing the testing process by defining clear roles and responsibilities within the team. It includes:

- Establishing a structured framework for testing activities.

- Reviewing the project scope and creating high-level test plans.

- Scheduling resources and defining timelines.

- Setting up configuration standards and preparing the test environment.

A well-organized test setup ensures efficient execution, better collaboration, and higher software quality.

- Since testing is viewed as a process, it must have an organization such that a testing group works for better testing and high quality software.

- The testing group is responsible for the following activities:

  - Maintenance and application of test policies

  - Development and application of testing standards

  - Participation in requirement, design, and code reviews

  - Test planning

  - Test execution

  - Test measurement

  - Test monitoring

  - Defect tracking

  - Acquisition of testing tools

  - Test reporting

The staff members of such a testing group are called test specialists or test engineers or simply testers.

A tester is not a developer or an analyst. He does not debug the code or repair it.

He is responsible for ensuring that testing is effective and quality issues are being addressed.

Skills a Tester

1. Personal and Managerial Skills: -

- Testers must be able to contribute in policy-making and planning the testing activities.
- Testers must be able to work in a team.
- Testers must be able to organize and monitor information, tasks, and people.
- Testers must be able to interact with other engineering   professionals, software quality assurance staff, and clients.
- Testers should be capable of training and mentoring new testers.
- Testers should be creative, imaginative, and experiment-oriented.
- Testers must have written and oral communication skills.

2. Technical Skills: -

- Testers must be technically sound, capable of understanding software engineering principles and practices.

- Testers must be good in programming skills.

- Testers must have an understanding of testing basics, principles, and practices.

- Testers must have a good understanding and practice of testing strategies and methods to develop test cases.

- Testers must have the ability to plan, design, and execute test cases with the goal of logic coverage.

- Testers must have technical knowledge of networks, databases, operating systems, etc. needed to work in a the project environment.

- Testers must have the knowledge of configuration management.

- Testers must have the knowledge of test ware and the role of each document in the testing process.

- Testers must have known about quality issues and standards.
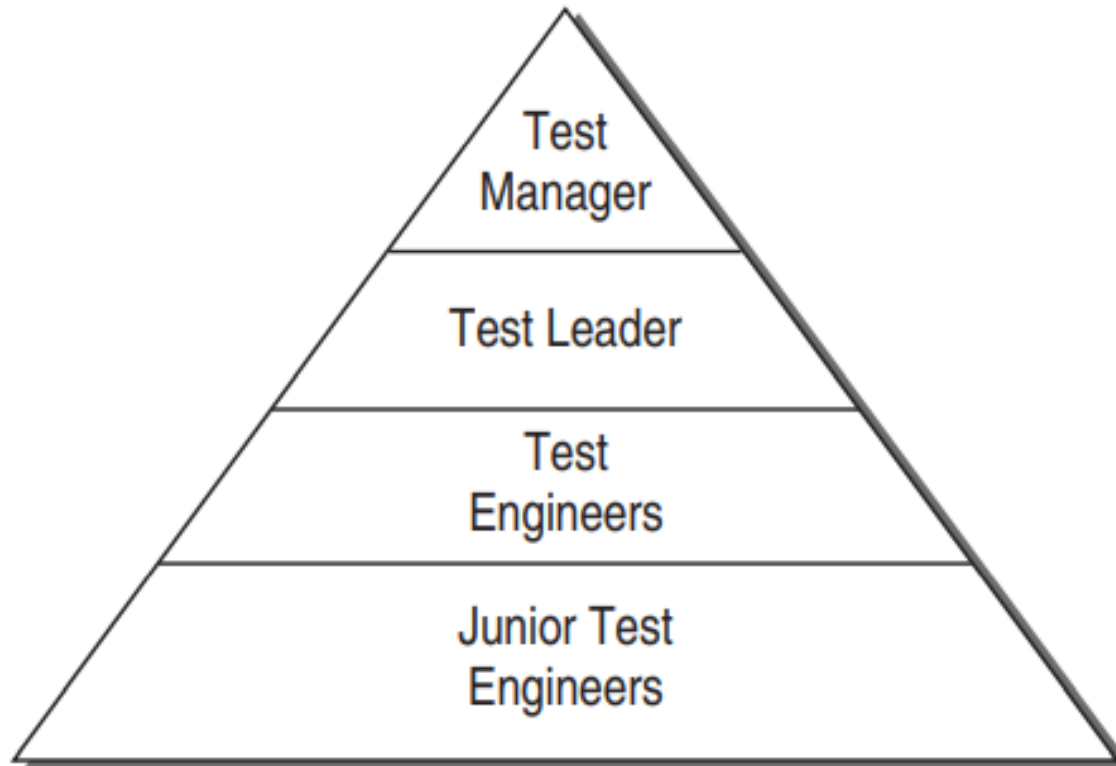
STRUCTURE OF TESTING GROUP

Figure 9.1   Testing Group Hierarchy

Test Manager

A **Test Manager** holds the highest position in the testing hierarchy and is responsible for managing the testing process efficiently.

Key Responsibilities:

1. Acts as the main point of contact between the testing team, project management, quality assurance, and marketing.

2. Defines **test strategies**, prepares the **master test plan**, and schedules testing activities.

3. Communicates with customers regarding **quality-related issues**.

4. Acquires **testing resources**, including tools and infrastructure.

5. **Monitors testing progress** and ensures smooth execution.

6. Participates in **static verification meetings** for reviewing documents and test cases.

7. **Manages the test team**, including hiring, evaluating, and, if necessary, dismissing members.

Test Leader: Assists the test manager in meeting testing and quality goals. To lead a team of test engineers who are working at the leaf-level of the hierarchy.

- i. Planning the testing tasks given by the test manager.
- ii. Assigning testing tasks to test engineers who are working under him.
- iii. Supervising test engineers.
- iv. Helping the test engineers in test case design, execution, and reporting.
- v. Providing tool training, if required.
- vi. Interacting with customers.

Test Engineers: Test engineers are highly experienced testers.

- i. Designing test cases.
- ii. Developing Developing automated testing frameworks to execute test cases efficiently..
- iii. Set-up test laboratories and environment.
- iv. Maintain the test and defect repositories.

Junior Test Engineers: -

- Junior test engineers are newly hired testers. They usually are trained about the test strategy, test process, and testing tools.

- They participate in test design and execution with experienced test engineers.

Test Estimation and Scheduling

- Test estimation techniques refer to the methods and approaches used to determine or estimate the effort, time, and resources required for testing activities in software development projects.

- Software test estimation is a managerial task that involves assessing and approximating the required time, resources, and costs for executing tests in a specific environment.

- It serves as a projection that aids in preventing time constraints and exceeding budgets.

Why Test Estimation?

How long will this testing take?

How much will it cost?

Why Test Estimation?

Project Planning: With correct estimations done, the overall project timeline can be kept under check. Project managers can create realistic schedules and allocate resources as per need if they know the time required for testing activities well in advance. This allows for effective coordination with development and other project activities.

Resource Allocation: With test estimations in place, the resource allocations: namely number of testers, testing tools, and testing environments required, can be allocated carefully and efficiently. It helps to ensure that overallocation or underutilization of resources is avoided.

Budgeting and Cost Control: Budgets are key to project success. Efficient testing estimation helps predict costs like **personnel, infrastructure, and tools**, enabling accurate budgeting, expense monitoring, and cost control

Risk Management: Estimation identifies potential testing risks, highlighting areas needing extra attention or resources. This enables proactive risk mitigation strategies.

Stakeholder Expectations: Estimation helps set realistic expectations regarding deadlines, costs, and potential risks for project stakeholders, including clients, managers, and development teams.

Project Optimization: Accurate estimation allows for better planning and optimization of testing activities. It helps identify opportunities for process improvements, resource optimization, and automation, leading to increased efficiency and productivity in the testing process.

What to Estimate?

Estimate of what?

- Resources
- Times
- Human Skill
- Cost

Resources: Resources are required to **carry out** any project tasks. They can be people, equipment, facilities, funding, or anything else required for the completion of a project activity.

Times : Time is the most valuable resource in a project. Every project has a deadline to delivery.

Human Skills : Human skills mean the **knowledge** and the **experience** of the Team members. They affect to your estimation. For example, a team, whose members have low testing skills, will take more time to finish the project than the one which has high testing skills.

Cost: Cost is the project **budget**. Generally speaking, it means **how much money** it takes to finish the project.

How to estimate?
Software Test Estimation Techniques

Estimation Method	Simple Explanation
Work Breakdown Structure	Breaks large tasks into smaller, manageable parts for easier execution.
3-Point Estimation	Estimates tasks based on three scenarios: Best case, Most likely, and Worst case.
Wideband Delphi Method	Experts discuss and agree on the most accurate estimate.
Functional Point Analysis	Estimates tasks based on size, cost, and time required.
Agile Estimation	Uses past data and continuously updates estimates with new information.
Distribution in Percentage	Assigns effort to different project stages using percentages to balance workload.

Example : Bank Case Study

Work Breakdown Structure (WBS)
- Breaking down the test project into small pieces

Three Point Estimation
- Estimation method is based on statistical data

Functional Point Method
- Measure the size and give weightage to each function point

- **Combine these techniques to find the estimate.**

Following 4 Step process to arrive at an estimate

Step 1) Divide the whole project into the smallest tasks

Step 2) Allocate each task to team members

Step 3) Estimate the effort required to complete each task

Step 4) Validate the estimation

Quick Brain Teaser: Mastering Test Management! 🚀

Which of the following are key elements of Test Management?

A) Test organization

B) Test planning

C) Software debugging

D) Detailed test design and specifications

E) Test monitoring and assessment

Answer Reveal: Test Management Essentials!

Which of the following are key elements of Test Management?

A) Test organization
B) Test planning
C) Software debugging
D) Detailed test design and specifications
E) Test monitoring and assessment

Correct Answers: A, B, D, E, and F.

Step 1) Divide the whole project task into subtasks

Work Breakdown Structure technique. : a complex project is divided into modules. The modules are divided into sub-modules. Each sub-module is further divided into functionality. It means divide the whole project task into the **smallest** tasks.

- Using Work Break Down
  structure to break out
  the Bank project
  into 5 smaller tasks
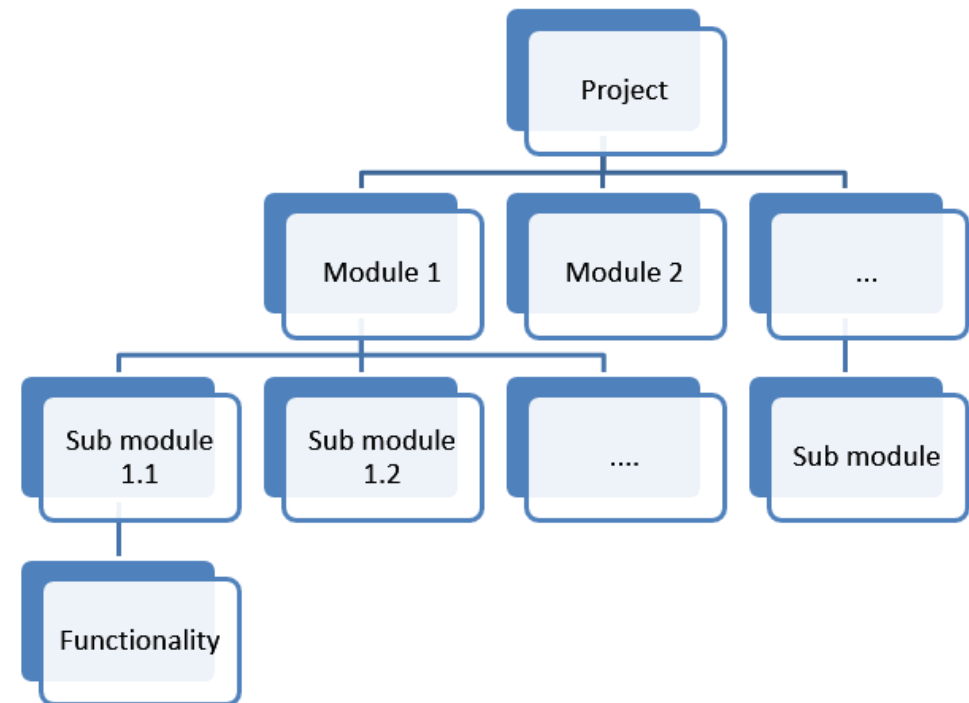
- After that, you can break down each task into subtasks. The purpose of this activity is to create tasks as detailed as possible.

Analyze software requirement specification

Create the Test Specification

Execute the test cases

Report the defects
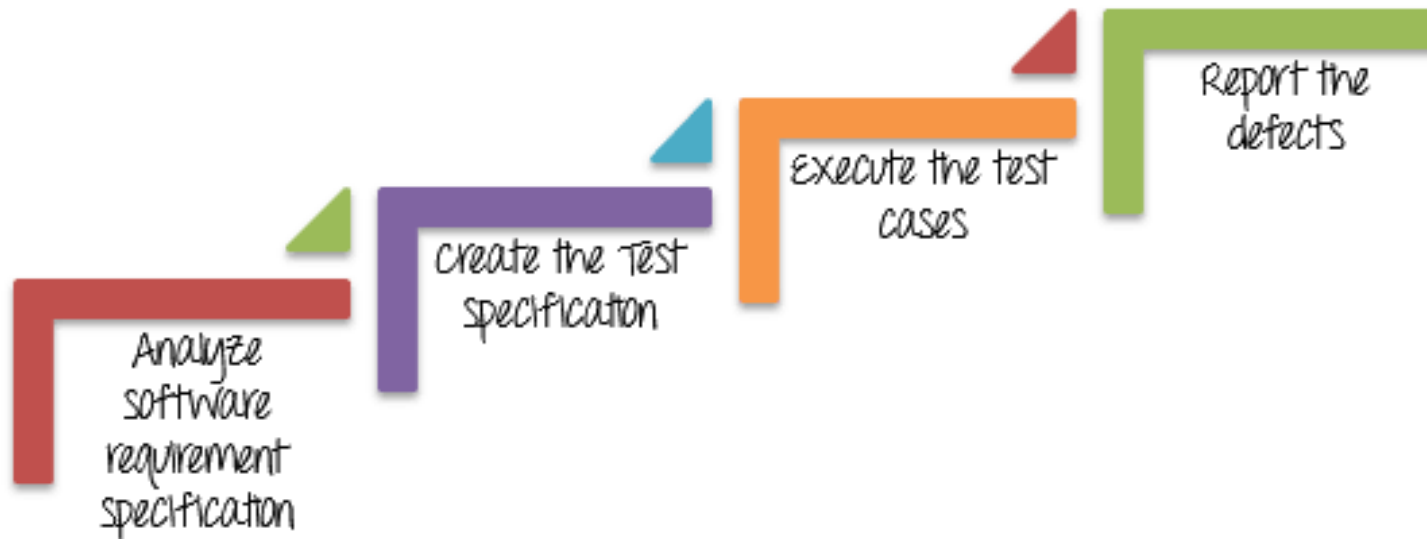
Task	Sub task
Analyze software requirement specification	Investigate the soft requirement specs
	Interview with the developer & other stakeholders to know more about the website
Create the Test Specification	Design test scenarios
	Create test cases
	Review and revise test cases
Execute the test cases	Build up the test environment
	Execute the test cases
	Review test execution results
Report the defects	Create the Defect reports
	Report the defects

Step 2) Allocate each task to team member

Each task is assigned to the **appropriate** member in the project team.

Task	Members
Analyze software requirement specification	All the members
Create the test specification	Tester/Test Analyst
Build up the test environment	Test Administrator
Execute the test cases	Tester, Test Administrator
Report defects	Tester

Step 3) Effort Estimation For Tasks

There are 2 techniques which you can apply to estimate the effort for tasks

- **Functional Point Method**
- **Three Point Estimation**

Method 1) Function Point Method
to estimate the effort for tasks

- The Test Manager estimates Size, Duration, and Cost for the tasks

Step A) Size

Step B) Duration

Step C) Cost

Step A: Estimating Task Size

After breaking the project into smaller tasks using the **Work Breakdown Structure (WBS)** method, the next step is to estimate the size of each task.
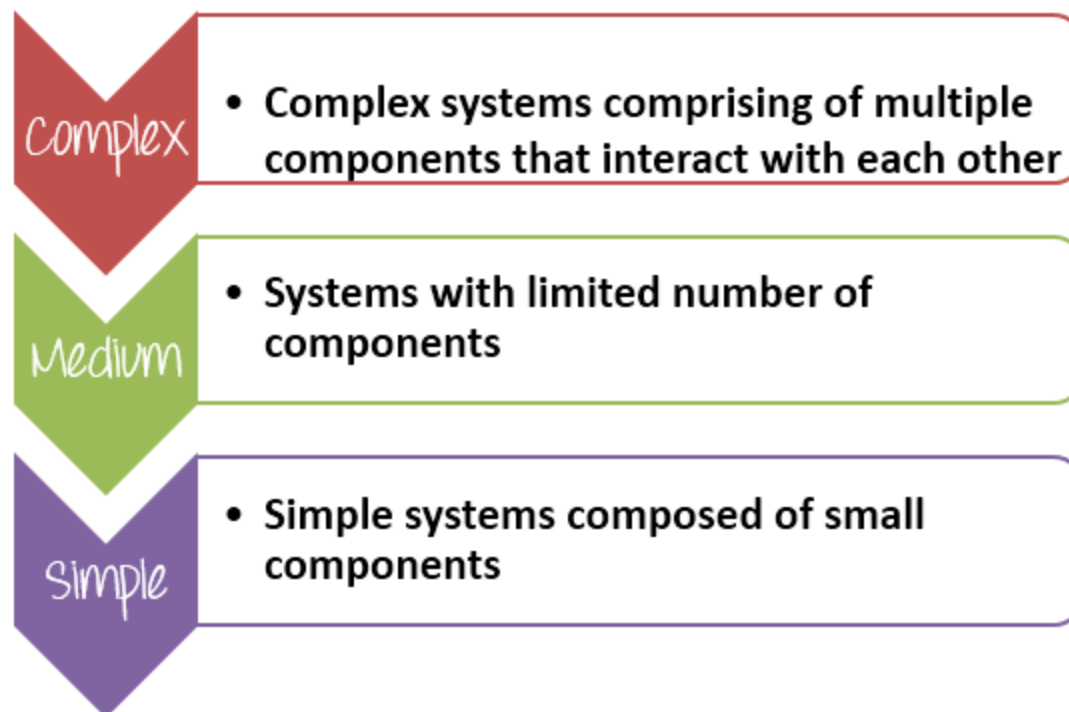
Example:

Task – *"Create the test specification"*

The size of this task depends on the number of system functions.

- **More functions → Larger and more complex task**

- **Fewer functions → Smaller and easier task**

A system with many features increases complexity and requires more effort to complete.

Prior to start actual estimating tasks effort, functional points are divided into three groups like **Complex**, **Medium Simple** as following:

Complex
- Complex systems comprising of multiple components that interact with each other

Medium
- Systems with limited number of components

Simple
- Simple systems composed of small components

Based on the complex of software functions, the Test Manger has to give enough **weightage** to each functional point. For example

Group	Weightage
Complex	5
Medium	3
Simple	1

Let's take a simple example exercise

- By looking at SRS   the software specification of   Bank website, where the software engineer have already described the software modules in detail, we can determine the **complexity** of website's features by giving the weightage for each modules.

- More complex the function point, more is the effort to test it is. The website is divided into **12 function** points, you can determine the **complexity** of each function points as follows-

No.	Module Name	Applicable Roles	Description	Weightage
1.	Balance Enquiry	Manager Customer	**Customer:** A customer can have multiple bank accounts. He can view balance of his accounts only **Manager:** A manager can view balance of all the customers who come under his supervision	3
2.	Fund Transfer	Manager Customer	**Customer:** A customer can have transfer funds from his "own" account to any destination account. **Manager:** A manager can transfer funds from any source bank account to destination account	5

3.	Mini Statement	Manager Customer	A Mini statement will show last 5 transactions of an account **Customer:** A customer can see mini-statement of only his "own" accounts **Manager:** A manager can see mini-statement of any account	3
4.	Customized Statement	Manager Customer	A customized statement allows you to filter and display transactions in an account based on date, transaction value **Customer:** A customer can see Customized-statement of only his "own" accounts **Manager:** A manager can see Customized - statement of any account	5

5.	Change Password	Manager Customer	**Customer:** A customer can change password of only his account. **Manager:** A manager can change password of only his account. He cannot change passwords of his customers	1
6.	New Customer	Manager	**Manager:** A manager can add a new customer. **Manager:** A manager can edit details like address, email, telephone of a customer.	3
7.	New Account	Manager	Currently system provides 2 types of accounts • Saving • Current A customer can have multiple saving accounts (one in his name, other in a joint name etc). He can have multiple current accounts for different companies he owns.	5

8.	Edit Account	Manager	**Manager:** A manager can add an edit account details for an existing account	1
9.	Delete Account	Manager	**Manager:** A manager can add a delete an account for a customer.	1
10.	Delete Customer	Manager	A customer can be deleted only if he/she has no active current or saving accounts **Manager:** A manager can delete a customer.	1
11.	Deposit	Manager	**Manager:** A manager can deposit money into any account. Usually done when cash is deposited at a bank branch.	3
12.	Withdrawal	Manager	**Manager:** A manager can withdraw money from any account. Usually done when cash is withdrawn at a bank branch.	3

STEP B) Estimate duration for the task

After classifying the **complexity** of the function points, you have to estimate the **duration** to test them. Duration means **how much** time needs to finish the task.

$$\text{Total Effort} = \text{Total Function Points} * \text{Estimate defined per Function Points}$$

Key Components:

1. **Total Effort:** The total time and resources required to test all functions of the website.

2. **Total Function Points:** The total number of functional modules in the website.

3. **Effort per Function Point:** The estimated time required to test one function point. This value depends on the **productivity** of the team member assigned to the task.

Suppose your project team has estimated defined per Function Points of 5 hours/points. You can estimate the total effort to test all the features of Bank website as follows:

	Weightage	# of Function Points	Total
Complex	5	3	15
Medium	3	5	15
Simple	1	4	4
Function Total Points			34
Estimate define per point			5
Total Estimated Effort (Person Hours)			170

So the total effort to complete the task **"Create the test specification"** of Bank website is is around 170 man-hours.

1 man hour = work completed in an hour of uninterrupted effort by an average worker.

Resource Allocation and Cost Estimation

- Once the required effort is determined, you can allocate resources by assigning team members and tools to the task. This helps in estimating the **time required** (duration) to complete the task effectively. Based on this estimation, you can also assess both **labor and non-labor costs**.

- This process highlights the importance of skilled team members. **Experienced and talented team members** can complete tasks more efficiently, reducing the overall time required. As a result, your project is more likely to be completed **on time or even ahead of schedule**.

STEP C) Estimate the cost for the tasks

"How much does it cost?"

- Suppose, on average your team salary is $5 per hour.

- The time required for "Create Test Specs" task is 170 hours. Accordingly, the cost for the task is 5*170= $850.

- Now you can calculate budget for other activities in WBS and arrive at overall budget for the project.

Method 2) Three Point Estimation

- Three-Point estimation is one of the techniques that could be used to estimate a task.

- The simplicity of the Three-point estimation makes it a very useful tool for a Project Manager that who wants to estimate.

- In three-point estimation, **three** values are produced initially for every task based on **prior experience** or **best-guesses** as follows

a	• The best-case estimate
m	• The most likely estimate
b	• The worst case estimate

When estimating a task, the Test Manager needs to provide three values, as specified above.

The three values identified, estimate what happens in an **optimal state**, what is the **most likely**, or what we think it would be the **worst case scenario.**

Example: "**Create the test specification**", for bank website

You can estimate as following

The **best case** to complete this task is **120** man-hours (around 15 days). In this case, you have a talented team, they can finish the task in smallest time.

The **most likely** case to complete this task is **170** man-hours (around 21 days). This is a normal case, you have enough resource and ability to complete the task

The **worst case** to complete this task is **200** man-hours (around 25 days). You need to perform much more work because your team members are not experienced.

Now, assign the value to each parameter as below

$$a = 120 \quad m = 170 \quad b = 200$$

The effort to complete the task can be calculated using **double-triangular distribution** formula as follows-

$$E = (a + 4m + b)/6$$

$$E = (120 + 4 * 170 + 200)/6$$

$$E = 166.6 \ (man - hours)$$

- Parameter E is known as **Weighted Average.**
- It is the estimation of the task "Create the test specification".

In the above estimation, you just determine a **possible** value, and not a **certain** one., we must know about the **probability** that the estimation is correct. You can use the other formula:

Since estimation involves uncertainty, it is essential to understand the **probability** that the estimated effort is correct

$$SD = (b - a)/6$$

$$SD = (200 - 120)/6$$

$$SD = 13.33 \ (man - hours)$$

To measure this uncertainty, we use **Standard Deviation (SD)**, which quantifies how much the actual effort may **deviate from the estimated value**..

- Now you can conclude the estimation for the task "Create the test specification"

- To complete the task "Create the test specification" of Bank website, you need **166.6 ± 13.33** Man-hour (153.33 to 179.99 man-hour)

THANK YOU