

- * What is project scheduling? what are basic principles of project scheduling? different tasks of project scheduling.

Project scheduling :

It is the process of planning and organizing tasks, activities and resources needed to complete a software project within a specified timeline. It involves defining the sequence of activities, estimating the time required for each activity, assigning resources and setting milestones to ensure that the project progresses smoothly & meets its deadlines.

Basic principles of project scheduling :

- Compartmentalization :

The project must be compartmentalized into a no. of manageable activities, actions and tasks. To accomplish compartmentalization, both product & process are decomposed.

- Interdependency :

The interdependency of each compartmentalization activity, action or task must be determined.

Some task must occur in sequence while others can occur in parallel.

- Time allocation :

Each task to be scheduled must be allocated some no. of work units. In addition, start date and completion date should be assigned and whether the work will be done full-time or part-time.

- Effort Validation :

As time allocation occurs, the project manager must ensure that no more than the allocated no. of people have been scheduled at any given time

- Defined Responsibilities :

Every task that is scheduled should be assigned to a specific team member

- Define outcomes :

Every task that is scheduled should have a defined outcome. For small projects, the outcome is normally a work product or a part of work product.

- Defined milestones :

Every task or group of tasks should be associated with a project milestone. A milestone is accomplished when one or more work products has been reviewed for quality.

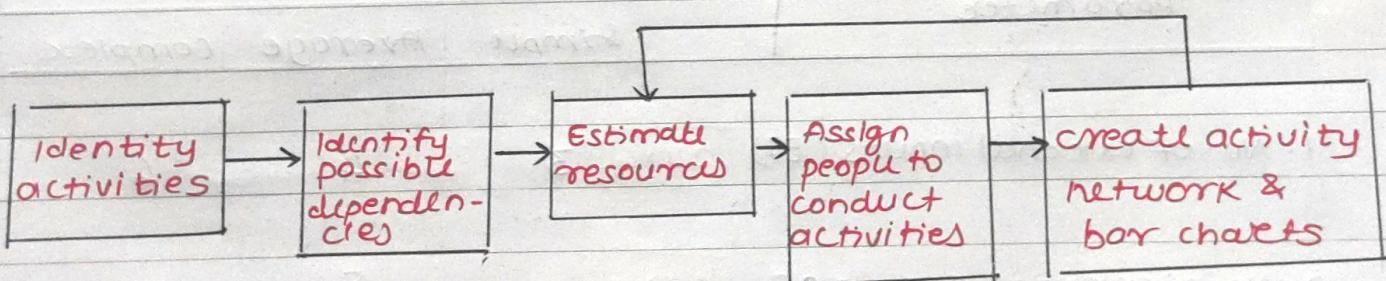


Fig. Project scheduling process

* Discuss the following with suitable example:

(i) FP-Based Estimation (Allan J. Albrecht)

- FPA is used to make estimate of the SW project, including its testing in terms of functionality or function size of SW product. However, functional point analysis may be used for the test estimation of the product.

- The functional size of the product is measured in terms of function point, which is standard of measurement to measure SW applications.

- FP's of an application is found out by counting the number and types of functions used in the applications. Various functions used in an application can be put under five types, as shown in Table:

eg

Measurement Parameter	Count	Weighting Factor		
		Simple	Average	Complex
1. No. of external inputs (EI)	24×4	3	4	6
2. No. of external O/P (EO)	46×4	4	5	7
3. No. of external Inquiries (EQ)	8×6	3	4	6
4. No. of internal files (ZF)	4×10	7	10	15
5. No. of external interface (EI)	2×5	5	7	10

- The function point (FP) is thus calculated with following formula:

$$FP = \text{Count} - \text{total} * [0.65 + 0.01 * \sum(F_i)]$$

\downarrow
summation of
14 questions

May 70

$$= \text{Count} - \text{total} * CAF$$

$$\sum F_i = 43$$

$$FP = 378 * [0.65 + 0.01 * 43]$$

$$= 378 * [1.08]$$

$$= \underline{\underline{408}}$$

$$\text{cost per function} = \frac{\text{cost}}{\text{productivity}} = \frac{7755}{11.1} = \underline{\underline{\$700}}$$

(ii) Object Point (OP)-based estimation:

- Object point based estimation is a SIW estimation technique that estimates the size of a SIW project based on no. of object or classes in the system. Each object or class is assigned a certain no. of "Object points" based on its complexity & functionality.
- Following are the steps involved in OP based estimation:
 - Identify classes/ objects
 - Assign Attribute & Methods
 - Assign Object points
 - Calculate Total Object Points
 - Convert Object points to effort/time Estimates

Class	Attributes	Methods	Complexity	Object Points
Product	Name, Price, Description	GetPrice(), SetPrice()	Low	5
ShoppingCart	Items, TotalPrice	AddItem(), RemoveItem()	Medium	8
User	Username, Password	Login(), Logout()	Low	5
Payment	Amount	ProcessPay()	Medium	7

Total Object Points = $5 + 8 + 5 + 7$
 $= \underline{25}$

* Explain COCOMO Model for project estimation with suitable example.

* COCOMO Model.

- constructive cost Model
- It is the model allow to estimate the cost, efforts and schedule when planning a new software development activity.
- In COCOMO Model It estimate the effort, cost and people required for the project time
- It is used for quick rough estimation of project before cost and duration during the early stages of software development.

* The COCOMO Model calculate cost, time effort on the project type.

- ① organic type
- ② semi-detached type.
- ③ Embedded type.

- It consist of three sub-model's.

	Application generator's & composition aids	
End user programming	Application composition	Infrastructure
	System Integration	

* Estimation of Development Efforts and Time

1] Formula for estimating the efforts.

① organic efforts

$$= 2.4 (\text{KLOC})^{1.05} \text{ PM (Person Months)}$$

② semidetached effort's

$$= 3.0 (\text{KLOC})^{1.12} \text{ PM}$$

③ Embedded Effort's

$$= 3.6 (\text{KLOC})^{1.20} \text{ PM}$$

2] Formula for estimating the development time

① organic effort's

$$= 2.5 (\text{Effort's})^{0.38} \text{ Month's}$$

② semidetached eff

$$= 2.5 (\text{Effort's})^{0.35} \text{ Month's}$$

③ Embedded

$$= 2.5 (\text{Effort's})^{0.32} \text{ Month's.}$$

* Example :-

1] Assume the size of an organic type software product has been estimated to be 32000 lines of source code. Assume that the average salary of software engineer be Rs : 15000/- per Month calculate the effort's

Solution :-

As per COCOMO estimation formula for organic software.

$$\text{Effort's} = 2.4 \times (32)^{1.05} = 91 \text{ PM}$$

$$\text{Time} = 2.5 \times (91)^{0.38} = 14 \text{ Months.}$$

$$\text{cost of development} = 14 \times 15,000 = 210,000$$

* Advantages :-

1. It is simple.
2. It provide easily Estimation.

* Disadvantages :-

1. Limited Accuracy.
2. It has Fixed Model.

* LOC Estimation

- Line of code Estimation
- As the name is LOC it count the total non number of code in the project.
- the unit of LOC are :-
 - 1. KLOC
 - thousand line of code

2. NLOC

- Non comment's line of code.

3. KDSI

- Thousand's of Delivered source Instruction.
- the size is estimates by comparing it with the existing system of same kind.

* LOC example :-

Module

① Login module	600
② Config module	600
③ mode setting	600
④ Initialization	600
⑤ Result	600

∴ Total LOC = $600 \times 5 = 3000$ LOC

∴ Total Lab cost = $3000 \times 500 = 1500000$ Rs

As per review over historical

data we have 600 LOC per month

∴ Total Lab cost = $600 \times 500 = 300000$ Rs

∴ Total Project cost = $300000 \times 10 = 3000000$ Rs

∴ Total Lab cost per month = $600 \times 500 = 300000$ Rs

∴ Total Project cost = $3000000 \times 10 = 30000000$ Rs

∴ Total Lab cost per month = $30000000 / 600 = 50000$ Rs

∴ Total Project cost = $30000000 / 600 = 50000$ Rs

∴ Total Project cost = $30000000 / 600 = 50000$ Rs

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∴ Total Project cost = $30000000 / 600 = 50000$ Rs

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* Process Based estimation:-

* Problem Based estimation

* Problem Based estimation

The Problem based estimation is conducted using LOC and Function Point based estimation.

LOC and FP based data are used in two ways doing software estimations:

① These are useful to estimate size of each elements of software.

② The baseline metrics are collected from past projects and LOC and FP data is used to develop cost and effort value for project.

③ Then the software problem is decomposed into function that can be estimated individually.

④ LOC and FP is applied for each function.

⑤ Function estimate is then combined to obtain an overall estimation for entire project.

* Example on LOC:

* LOC example :-

module

- ① login module * 600 LOC
- ② config module 600
- ③ mode setting 600
- ④ Initialization 600
- ⑤ Result 600

at cost per LOC = 5000

Total cost = 3000 * 5000 = 1500000

As per review over historical

at data we have 5000 LOC per month

cost per LOC = 5000

- 5000 LOC per month
- 5000 LOC cost per month

5000 LOC per month = 5000 * 5000 = 2500000

Cost per month = 2500000 / 5000 = 500

for 10 months = 500 * 10 = 5000

• Total Proj. Cost = 3000 * 10 = 30000

• Total Proj. Cost = 3000000

• Total Proj. Months = 3000 / 500 = 6

• 6 person

• 6 person * 6 months = 36 months

• 36 months * 30 days = 1080 days

• 1080 days

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* Process based estimation.

- This is most commonly used estimation technique for estimating the project based on processes used.
- In this technique, Process is decomposed into relatively set of tasks and effort required to accomplish each task is estimated.

* Example:- Video game

	Activity	Pre-requisite	moder.	Coding	Test	Deployment	Total
Functionality	gatheri ng						
↓							
Logic module							
config module							
mode setting							
initialize							
Result							
Total	27	09	08	03	07	33	
Effort	21	27	24	09	21		

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lets take 5000 avg job cost + 33

per month

$$\text{Total Proj. cost} = 5000 \times 33 \\ b = 16500$$

Total effort = 33 person

1 month

Q

14) What is estimation with use cases?

Explain estimation using use case
points with help of example?

Software project estimation

a process of predicting the times

effort cost and scope of project

* Estimation with use case:

- use case point CUCP method

for estimating software development effort based on complexity of use case.

① Identify use cases:

- List all use cases that describe interaction between user and system.

② Assign weight:

- Assign weight to each use case based on its complexity.

③ Calculate use case points:

- multiply the no. of use cases by their respective weights to get total use case points.

④ Adjust environmental factors:

- consider factors like technical complexity, experience of development team and other environmental factors that may influence project effort.

⑤ Estimate effort:

use use case point to estimate effort required for development using historical data.

* Examples: E-commerce and Banking

Let's say 400 are estimating development effort for an e-commerce website.

- ① user registration - $5 \times 5 = 25$
- ② Browsing products - $10 \times 3 = 30$
- ③ Adding item to cart - $5 \times 4 = 20$
- ④ making a purchase - $5 \times 5 = 25$
- ⑤ viewing order history - $3 \times 3 = 9$

Total use case

$$\text{Points} = 25 \times 5 + 10 \times 3 + 5 \times 4 + 5 \times 3$$

$$= 125 + 30 + 20 + 15 = 170$$

$$170 + 12 + 12 + 25 + 9 = 206$$

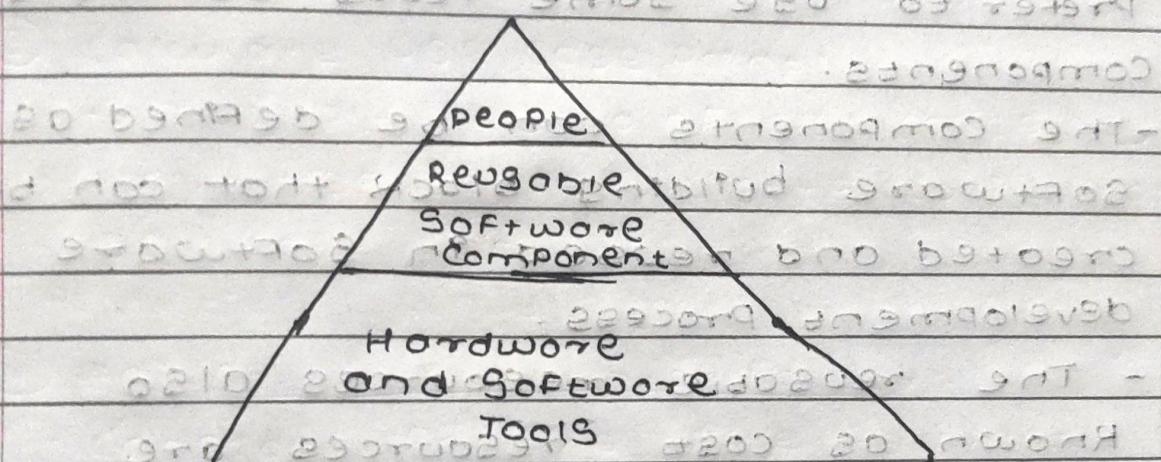
Assume that we have calculated effort for 5 hours per use case.

$$\text{Total Effort} = 206 \times 5 = 1030$$

~~Effort for 5 hours = 1030 hours~~

- 13) Discuss with suitable diagram three major categories of software project resources
- Project resources means resources that are required for successful development and completion of project.
 - These resources can be capital, people, materials that are helpful to carry out certain tasks in project.

- These resources can be denoted by Pyramid called Resource Pyramid.
- At base of pyramid i.e. last layer, hardware and software tools are present.
- Then at middle level Reusable Software component are present and at top of pyramid, people are present.



* Type of Resources:-

- i) Human Resource:-
- Humans play an important role in software development process.
 - No matter what size is and how much complexity is there in project.
 - In software industry, people are assigned some organizational position such as software developer, engineer, testing and so on.
 - For small project only, single individual can perform all these roles.

- For large projects, a team of people work on it. It is easier to manage projects if components are reusable.
- (2) Reusable Components are standard blocks used for bringing ease in software development process or to accelerate development process of software industry. Prefer to use some ready software components.
- The components can be defined as software building blocks that can be created and reused in software development process.
- The reusable resources also known as cost resources are very helpful as they help in reducing overall cost of development.

(3) Hardware and Software Tools (i)

- These are actual physical material resources that are part of project.
- This type of resources should be planned before starting development of project otherwise it may cause problem for project.