Unit: III
Lecture: 8
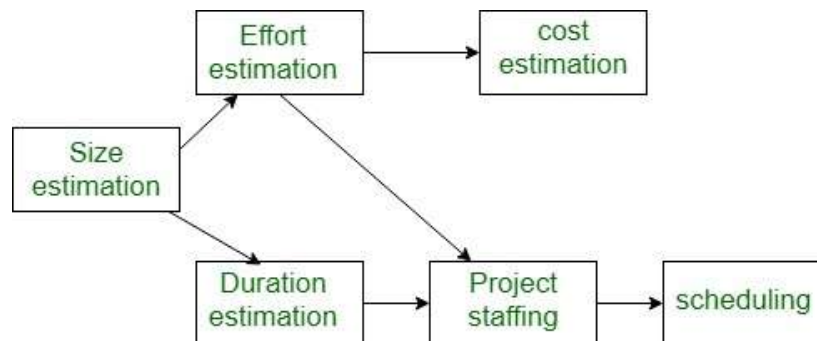**Estimation for Software Projects**

Software Project Estimation is the **process of estimating various resources required for the completion of a project.**

Estimation is the process of finding an estimate, or approximation, which is a value that can be used for some purpose even if input data may be incomplete, uncertain, or unstable.

Effective software project estimation is one of the most challenging and important activities in software development. Proper project planning and control is not possible without a reliable estimate. The software industry doesn't estimate projects well and doesn't use estimates appropriately.

The four basic steps in software project estimation are:

1) **Estimate the size of the development product**. The size can be estimated by using either Lines of Code (LOC) or Function Points (FP).

2) **Estimate the effort** in person-months or person-hours (man-month or man-hour). Man-month is an estimate of personal resources required for the project.

3) **Estimate the schedule** in calendar days /months/ years based on total man-month required and manpower allocated to the project.

4) **Estimate the project cost** in local currency.

Precedence ordering among planning activities

Fig: Project Estimation Process

Estimating the size:

Estimating the size of the software to be developed is the very first step to make an effective estimation of the project. Customer's requirements and system specification forms a baseline for estimating the size of a software. At a later stage of the project, system design document can provide additional details for estimating the overall size of a software.

- The ways to estimate project size can be through past data from an earlier developed system. This is called estimation by analogy.
- The other way of estimation is through product feature/ functionality. The system is divided into several subsystems depending on functionality and size of each subsystem is calculated.

Estimating effort:

Once the size of the software is estimated, the next step is to estimate the effort based on the size.

The estimation of effort can be made from the organizational specifics of software development life cycle. The development of any application software system is more than just coding of the system.

Depending on deliverable requirements, the estimation of effort for project will vary. Efforts are estimated in number of man-months.

- The best way to estimate effort is based on the organization's own historical data of development process. Organizations follow similar development life cycle for developing various applications.
- If the project of a different nature which requires the organization to adopt a different strategy for development then different models based on algorithmic approach can be devised to estimate effort.

Estimating Schedule:

The next step in estimation process is estimating the project schedule from the effort estimated. The schedule for project will generally depend on human resources involved in a process. Efforts in man-month are translated to calendar months.

Schedule estimation in calendar-month can be calculated using the following model [McConnell]:

$$\text{Schedule in calendar months} = 3.0 * (\text{man-months})^{1/3}$$

The parameter 3.0 is variable, used depending on the situation which works best for the organization.

Estimating Cost: Cost estimation is the next step for projects. The cost of a project is derived not only from the estimates of effort and size but from other parameters such as hardware, travel expenses, telecommunication costs, training cost etc. should also be taken into account

Fig: Cost Estimation Process

Now, once the estimation is complete, we may be interested to know how accurate the estimates are to reality.

The answer to this is "we do not know until the project is complete". There is always some uncertainty associated with all estimation techniques.

The accuracy of project estimation will depend on the following:

- Accuracy of historical data used to project the estimation.
- Accuracy of input data to various estimates
- Maturity of organization's software development process.

The following are some of the reasons which make the task of cost estimation difficult:

- Software cost estimation requires a significant amount of effort. Sufficient time is not allocated for planning.
- Software cost estimation is often done hurriedly, without an appreciation for the actual effort required and is far from real issues.
- Lack of experience for developing estimates, especially for large projects.
- An estimator used the extrapolation technique to estimate, ignoring the non-linear aspects of software development process.

The following are some of the reasons for poor and inaccurate estimation:

- Requirements are imprecise. Also, requirements change frequently.
- The project is new and is different from past projects handled.
- Non-availability of enough information about past projects.
- Estimates are forced to be based, on available resources.

Project Estimation Guidelines:

- Preserve and document data pertaining to organization's past projects.
- Allow sufficient time for project estimation especially for bigger projects.
- Prepare realistic developer-based estimate. Associate people who will work on the project to reach at a realistic and more accurate estimate.
- Use software estimation tools
- Re-estimate the project during the life cycle of development process.
- Analyze past mistakes in the estimation of projects.