Unit 3

ACTIVITY PLANNING

Syllabus:

Objectives of activity planning, Project schedules, Projects and activities, Sequencing and scheduling activities, Network Planning models -Formulating network models, Using dummy activities, Identifying critical path, identifying critical activities. Risk Analysis and Management: Nature of risk, Managing risk, Risk identification, Risk analysis, reducing the risks, evaluating the risks.

Objectives

Provides a detail view of the following aspects:

- Produce an activity plan for a project;
- Estimate the overall duration of a project;
- Create a critical path and a precedence network for a project.
- Identify the factor: putting a project at risk:
- Categorize and prioritize action for risk elimination or containment.
- Quantify the likely effects of risk on project time-scales.

Introduction

We looked at methods for forecasting the effort required for a project - both for the project as a whole and for individual activities. A detailed plan for the project. However, must also include a schedule indicating the start and completion times for each activity. This will enable us to:

- ensure that the appropriate resources will be available precisely when required;
- avoid different activities competing for the same resources at the same time:
- produce a detailed schedule showing which staff carry out each activity;
- produce a detailed plan against which actual achievement may be measured:
- produce a timed cash flow forecast:
- Replan the project during its life to correct drift from the target.

To be effective, a plan must be stated as a set of targets the achievement or non-achievement of which can be unambiguously measured. The starts and completions of activities must be clearly visible and this is one of the reasons why it is advisable to ensure that each and every project activity produces some tangible product or 'deliverable. Monitoring the project's progress is then, at least in part, a case of ensuring that the products of each activity are delivered on time.
As a project progresses it is unlikely that everything will go according to plan. Much of the job of project management concerns recognizing when something has gone wrong, identifying its causes and revising the plan to mitigate its effects. The activity plan should provide a means of evaluating the consequences of not meeting any of the activity target dates and guidance as to how the plan might most effectively be modified to bring the project back to target. We shall see that the activity plan may well also offer guidance as to which components of a project should be most closely monitored.

The objectives of activity planning

In addition to providing project and resource schedules, activity planning aims to achieve number of other objectives which may be summarized as follows.

- **Feasibility imminent** is the project possible within required timescales and resource constraints? It is not until we have constructed a detailed plan that we can forecast a completion date with any reasonable knowledge of its achievability.

- **Resource allocation** What are the most effective ways of allocating resources to the project and when should they be available? The project plan allows us to investigate the relationship between timescales and resource availability and the efficacy of additional spending on resource procurement.

- **Detailed costing** How much will the project cost and when is that expenditure likely to take place? After producing an activity plan and allocating specific resources, we can obtain more detailed estimates of costs and their timing.

- **Motivation** Providing targets and being seen to monitor achievement against targets is an effective way of motivating staff, particularly where they have been involved in setting those targets in the first place.

- **Co-ordination** When does the staff in different departments need to be available to work on a particular project and when do staffs need to be transferred between projects? The project plan, particularly with large projects involving more than a single project team, provides an effective vehicle for communication and co-ordination among teams.

When to plan

Planning is an ongoing process of refinement, each iteration becoming more detailed and more accurate than the last. Over successive iterations, the emphasis and purpose of planning will shift.

During the feasibility study and project start-up, the main purpose of planning will be to
estimate timescales and the risks of not achieving target completion dates or keeping within budget. As the project proceeds beyond the feasibility study, the emphasis will be placed upon the production of activity plans for ensuring resource availability and cash flow control.

Throughout the project, until the final deliverable has reached the customer, monitoring and replanning must continue to combat any drift that might present meeting time or Cost targets.

Project schedules

Before work commences on a project or, possibly, a stage of a larger project, the project plan must be developed to the level of showing dates when each activity should start and finish and when and how much of each resource will he required. Once the plan has been refined to this level of detail we call it a project schedule. Creating a project schedule comprises four main stages.

The first step in producing the plan is to decide what activities need to be carried out and in what order they are to be done. From this we can construct an ideal activity plan — that is, a plan of when each activity would ideally be undertaken were resources not a constraint.

The ideal activity plan will then be the subject of an activity risk analysis, aimed at identifying potential problems. This might suggest alterations to the ideal activity plan and will almost certainly have implications for resource allocation. The third step is resource allocation. The expected availability of resources might place constraints on when certain activities can be carried out, and our ideal plan might need to be adapted to take account of this. The final step is schedule production. Once resources have been allocated to each activity, we will be in a position to draw up and publish a project schedule, which indicates planned start and completion dates and a resource requirements statement for each activity.

Projects and activities

Defining activities

When we start to produce an activity plan.

- A project is composed of a number of inter-related activities:
- A project may clan v. hen at least one of its activities is ready to start:
- A project will he completed when all of the activities it encompasses have been completed:
- An activity must have a clearly defined start and a clearly defined end-point. normally marked by the production of a tangible deliverable:
- If an activity requires a resource (as most do) then that resource requirement must be forecastable and is assumed to be required at a constant level throughout the duration of the activity:
The duration of an activity must be forecastable - assuming normal circumstances, and the reasonable availability of resources:

- Some activities might require that others are completed before they can begin

**Identifying activities**

Essentially there are three approaches to identifying the activities or tasks that make up a project - we shall call them the *activity-based approach*, the *product-based approach* and the *hybrid approach*.

**The activity-based approach**

The activity-based approach consists of creating a list of all the activities that the project is thought to involve. This might involve a brainstorming session involving the whole project team or it might stem from an analysis of similar past projects. When listing activities, particularly for a large project, it might be helpful to subdivide the project into the main life style stages and consider each of these separately.

Rather than doing this in an ad hoc manner, with the obvious risks of omitting or double-counting tasks, a much favoured way of generating a task list is to create a Work Breakdown Structure (WBS). This involves identifying the main (or high-level) tasks required to complete a project and then breaking each of these down into a set of lower-level tasks.

Activities are added to a branch in the structure if they directly contribute to the task immediately above - if they do not contribute to the parent task, then they should not be added to that branch. The tasks at each level in any branch should include everything that is required to complete the task at the higher level - if they are not a comprehensive definition of the parent task, and then something is missing. When preparing a WHS, consideration must be given to the final loci of detail or depth of the structure. Too great a depth will result in a large number of small tasks that will be difficult to manage, whereas a too shallow structure will provide insufficient detail for project control.

Advantages claimed for the WBS approach include the belief that it is much more likely to result in a task catalogue that is complete and is composed of non-overlapping activities. Note that it is only the leaves of the structure that comprise the list of activities comprising the project - higher-level nodes merely represent collections of activities.

**The product-based approach**

It consists of producing a Product Breakdown Structure and a Product How Diagram. The PFD indicates, for each product, which other products are required as inputs. The PFD can therefore be easily transformed into an ordered list of activities by identifying the transformations that turn some products into others. Proponents of this approach claim that it is
less likely that a product will be left out of a PBS than that an activity might be omitted from an unstructured activity list.

This approach is particularly appropriate if using a methodology, such as SSADM, which clearly specifies, for each step or task, each of the products required and the activities required to produce it. The SSADM Reference Manual provides a set of generic PBSs for each stage in SSADM which can be used as a basis for generating a project-specific PBS.

The hybrid approach

The WBS is based entirely on a structuring of activities. Alternatively, and perhaps more commonly, a WBS may be based upon the project's products, which is in turn based on a simple list of final deliverables and, for each deliverable, a set of activities required to produce that product, framework dictating the number of levels and the nature of each level in the structure may be imposed on WBS.

Level 1: Project
Level 2: Deliverable such as software, manuals and training courses.
Level 3: Components which are the key work items needed to produce as the modules and tests required to produce the system software
Level 4: Work-Packages which are the major work items, or collections of related tasks, required to produce a component.
Level 5: Tasks which are tasks that will normally be the responsibility of a single person.

Sequencing and scheduling activities

Throughout a project, we will require a schedule that clearly indicates when each of the project's activities is planned to occur and what resources it will need. One way of presenting such a plan is to use a bar chart. In drawing up the chart, we have therefore done two things - we have sequenced the tasks (that is identified the dependencies among activities dictated by the development process) and scheduled them (that is, specified when they should take place). The scheduling has had to take account of the availability of staff and the ways in which the activities have been allocated to them. The schedule might look quite different were there a different number of staff or were we to allocate the activities differently. Approaches to scheduling that achieve this separation between the logical and the physical use networks to model the project.

Network planning models

These project scheduling techniques model the project's activities and their relationships as a network. In the network, time flows from left to right. The two best known
techniques being CPM (Critical Path Method) and PERT (Program Evaluation Review Techniques). Both of these approaches used an activity-on-arrow approach to visualize the project as a network where activity are drawn as arrows joining circles, or nodes which possibly represent the start and end of the activity.

Approaches to scheduling that achieve this separation between the logical and the physical use networks to model the project. A recently variation on these techniques, called precedence networks, has become popular and it is this method that is adopted in the majority of computer applications currently available. All three methods are very similar and it must be admitted that many people use the same name (particularly CPM) indiscriminately to refer to any or all of the methods.

Formulating a network model

The first stage in creating a network model is to represent the activities and their interrelationships as a graph. In CPM we do this by representing activities as links (arrowed lines) in the graph — the nodes (circles) representing the events of activities starting and finishing.

Constructing CPM networks

Before we look at how CPM networks are used, it is worth spending a few moments considering the rules for their construction.

- A project network may have only one start node
- A project network may have only one end node
- A node has duration
- Links normally have no duration
- Precedents are the immediate preceding activities.
- Times move from left to right.
- A network may not contain loops
- A network should not contain dangles

The forward pass

The forward pass is carried out to calculate the earliest dates on which each activity may be started and completed. Where an actual start date is known, the calculations may be carried out using actual dates.
The backward Pass

The second stage in the analysis of a critical path network is to carry out a backward pass to calculate the latest date at which each activity may be started and finished without delaying the end date of the project. In calculating the latest date, we assume that the latest finish date for the project is the same as the earliest finish date - that is we wish to complete the project as early as possible.

Identifying the critical path

There will be at least one path through the network that defines the duration of the project, this is known as the critical path. Any delay on the critical path will delay the project. The difference between the earliest date and the latest date for an event is known as the activity's float - it is a measure of how late an event may be without affecting the end date of the project. Any event with a float of zero is critical in the sense that any delay in achieving that event will delay the completion date of the project as a whole. There will always be at least one path through the network joining those critical events - this path is known as the critical path.

The significance of the critical path is two-fold.

- In managing the project, we must pay particular attention to monitoring activities on the critical path so that the effects of any delay or resource unavailability are detected and corrected at the earliest opportunity.
- In planning the project, it is the critical path that we must shorten if Y4C are to reduce the overall duration of the project.

Identifying critical activities

The critical path identifies those activities which are critical to the end date of the project: however, activities that are not on the critical path may become critical. As the project proceeds, activities will invariably use up some of their float and this will require a periodic recalculation of the network. As soon as the activities along a particular path use up their total float then that path will become a critical path and a number of hitherto non-critical activities will suddenly become critical.

It is therefore common practice to identify 'near-critical paths' - those whose lengths are within, say, 10-20% of the duration of the critical path or those with a total float of less than. Say, 10% of the project's uncompleted duration. The importance of identifying critical and near-critical activities is that it is they that are most likely to be the cause of delays in completing the project.
Risk Management

Introduction

We are concerned with the risk of the development project’s not proceeding according to plan. We are primarily concerned with the risks of the project's running late or looser budget and with the identification of the steps that can be taken to avoid or minimize those risks.

Some risks are more important than others. Whether or not a particular risk is important depends on the nature of the risk, its likely effects on a particular activity and the criticality of the activity. High risk activities on a project's critical path are a cause for concern.

Risk

Risk is defined as ‘an uncertain event or condition that, if it occurs, has a positive or negative effect on a project’s objectives. Risk is also referred as “the chance of exposure to the adverse consequence of future events”. The difference between the two definitions is that the first includes situation where a future uncertainty actually turns out to work in our favour and present us with an opportunity.

The key elements of a risk follow
- It relates to the future Risk planning in involves speculating about future events
- It involves the cause and effect For example a cost over-run might be identified as a risk, but the simple description of cost over-run gives the consequence of some adverse event.

The nature of risk

For the purpose of identifying and managing those risks that may cause a project to overrun its time-scale or budget, it is convenient to identify three types of risk:
- those caused by the inherent difficulties of estimation:
- those due to assumptions made during the planning process;
- those of unforeseen (or at least unplanned event) occurring.

Estimation errors

Some tasks are harder to estimate than others because of the lack of experience of similar tasks or because of the nature of a task. Producing a set of user manuals is reasonably straightforward and. given that we have carried out similar tasks previously, we should be able to estimate with some degree of accuracy how long it will take and how much it will cost. On the other hand, the time required for program testing and debugging, might be
difficult to predict with a similar degree of accuracy - even if we have written similar programs in the past.

Estimation can be improved by analyzing historic data for similar activities. Keeping records comparing our original estimates with the final methods to estimation outcome will reveal the type of tasks that are difficult to estimate correctly.

**Planning assumptions**

At every stage during planning, assumptions are made which, if not valid, may put the plan at risk. Our activity network, for example, is likely to be built on the assumption of a particular design methodology - which may be subsequently changed. We generally assume that, following coding, a module will be tested and then integrated with others - we might not plan for module testing showing up the need for changes in the original design but, in the event, it might happen. At each stage in the planning process, it is important to list explicitly all of the assumptions that have been made and identify what effects they might have on the plan if they are inappropriate.

**Eventualities**

Some eventualities might never be foreseen and we can resign ourselves to the fact that unimaginable things do, sometimes, happen. They are, however, very rare. The majority of unexpected events can, in fact, be identified - the requirements specification might be altered after some of the modules have been coded.

**Managing risk**

The objective of risk management is to avoid or minimize the adverse effects of unforeseen events by avoiding the risks or drawing up contingency plans for dealing with them. There are a number of models for risk management, but most are similar, in that they identify two main components -

1. **risk identification**
2. **risk management**.

- **Risk evaluation** consists of ranking the risks and determining risk aversion strategies.
- **Risk planning** consists of drawing up contingency plans and, where appropriate, adding these to the project's task structure. With small projects, risk planning is likely to be the responsibility of the project manager but medium or large projects will benefit from the appointment of a full-time risk manager.
- **Risk control** concerns the main functions of the risk manager in minimizing and
reacting to problems throughout the project. This function will include aspects of quality control in addition to dealing with problems as they occur.

- **Risk monitoring** must be an ongoing activity, as the importance and likelihood of particular risks can change as the project proceeds.
- **Risk directing and risk staling** are concerned with the day-to-day management of risk. Risk aversion and problem solving strategies frequently involve the use of additional staff and this must be planned for and directed.

**Risk identification**

The first stage in any risk assessment exercise is to identify the hazards that might affect the duration or resource costs of the project. A hazard is an event that might occur and will, if it does occur, create a problem for the successful completion of the project. In identifying and analyzing risks, we can usefully distinguish between the cause (or hazard), its immediate effect (the problem that it creates) and the risk that it will pose to the project.

For example, the illness of a team member is a hazard that might result in the problems of late delivery of a component. The late delivery of that component is likely have an effect on other activities and might, particularly if it is on the critical path, put the project completion date at risk.

A common way of identifying hazards is to use a checklist listing all the possible hazards and factors that influence them. Typical checklists list many, even hundreds, of factors and there are, today, a number of knowledge-based software products available to assist in this analysis.

Some hazards are generic risks - that is, they are relevant to all software projects and standard checklists can be used and augmented from an analysis of past projects to identify them. These will include risks such as misunderstanding the requirements or key personnel being ill. There will also be specific risks that are relevant to an individual project and these are likely to be more difficult to identify without an involvement of the members of the project team and a working environment that encourages risk assessment.

The categories of factors that will need to be considered include the following.

**Application factors** The nature of the application - whether it is a simple data processing application, a real-time system or a large distributed system with real-time elements is likely to be a critical factor. The expected size of the application is also important – the larger the system, the greater is the likelihood of errors and communication and management problems.

**Stuff factors** The experience and skills of the staff involved are clearly major factors - an experienced programmer is, one would hope, less likely to make errors than one with little experience. We must, however, also consider the appropriateness of the experience -
experience in coding small data processing modules in Cobol may be of little value if we are developing a complex real-time control system using C++.

**Project factors** It is important that the project and its objectives are well defined and that they are absolutely clear to all members of the project team and all key stakeholders. Any possibility that this is not the case will pose a risk to the success of the project. Similarly, an agreed and formal quality plan must be in place and adhered to by all participants and any possibility that the quality plan is inadequate or not adhered to will jeopardize the project.

**Project methods** Using well specified and structured methods for project management and system development will decrease the risk of delivering a system that is unsatisfactory or late. Using such methods for the first time, though, may cause problems and delays - it is only with experience that the benefits accrue.

**Hardware/software factors** A project that requires new hardware for development is likely to pose a higher risk than one where the software can be developed on existing (and familiar) hardware. Where a system is developed on one type of hardware or software platform to be used on another there might be additional (and high) risks at installation.

**Changeover factors** The need for an 'all-in-one' changeover to the new system poses particular risks. Incremental or gradual changeover minimizes the risks involved but is not always practical. Parallel running can provide a safety DO but might be impossible or too costly.

**Supplier factors** The extent to which a project relies on external organizations that cannot be directly controlled often influences the project's success. Delays in, for example, the installation of telephone lines or delivery of equipment may be difficult to avoid - particularly if the project is of little consequence to the external

**Environment factors** Changes in the environment can affect a project's success. A significant change in the taxation regulations could, for example, have serious consequences for the development of a payroll application.

**Health and safety factors** While not generally a major issue for software project, (compared, say, to civil engineering projects), the possible effects of project activities on the health and safety of the participants and the environment should be considered. RS 6079 states that 'every project should include an audit of these specific risks before work starts' and that 'audit updates should be scheduled as part of the overall project plan.'

**Risk analysis**

Having identified the risks that might affect our project we need some way of assessing their importance. Some risks will be relatively unimportant (for example, the risk that some of the documentation is delivered a day late), whereas some will be of major significance (such as the risk that the software is delivered late). Some are quite likely to occur (it is quite likely, for example, that one of the software developers in a team will take a few days sick leave during a
lengthy project), whereas others are relatively unlikely (hardware failure causing loss of completed code, perhaps).

The probability of a hazard's occurring is known as the risk likelihood; the effect that the resulting problem will have on the project, if it occurs, is known as the risk impact and the importance of the risk is known as the risk value or risk exposure.

The risk value is calculated as:

\[ \text{risk exposure} = \text{risk likelihood} \times \text{risk impact} \]

Ideally the risk impact is estimated in monetary terms and the likelihood assessed as a probability. In that case the risk exposure will represent an expected cost in the same sense that we calculated expected costs and benefits when discussing cost-benefit analysis. The risk exposures for various risks can then be compared with each other to assess the relative importance of each risk and they can be directly compared with the costs and likelihoods of success of various contingency plans.

However, estimation of these costs and probabilities is likely to be difficult, subjective, time-consuming and costly. In spite of this, it is valuable to obtain some quantitative measure of risk likelihood and impact because, without these, it is difficult to compare or rank risks in a meaningful way. Moreover, the effort put into obtaining a good quantitative estimate can provide a deeper and valuable understanding of the problem.

A better and popular approach is to score the likelihood and impact on a scale of, say, 1 to 10 where the Ward that is most likely to occur receives a score of 10 and the least likely a score of 1.

Ranking likelihoods and impacts on a scale of 1 to 10 is relatively easy, but most risk managers will attempt to assign scores in a more meaningful way such that, for example, a likelihood scoring 8 is considered twice as likely as one with a score of 4. Impact measures, scored on a similar scale, must take into account the total risk to the project. This must include the following potential costs:

- the cost of delays to scheduled dates for deliverables:
- cost overruns caused by using additional or more expensive resources:
- the costs incurred or implicit in any compromise to the system's quality or functionality.

Prioritizing the risk

Managing risk involves the use of two strategies

- reducing the risk exposure by reducing the likelihood or impact;
- drawing up contingency plans to deal with the risk should it occur.

Any attempt to reduce a risk exposure or put a contingency plan in place will have a cost associated with it. It is therefore important to ensure that this effort is applied in the most
effective way and we need a way of prioritizing the risks so that the more important ones can receive the greatest attention. Risk exposures based on scoring methods must be treated with some caution. In practice, there are generally other factors, in addition to the risk exposure value, that must also be taken into account when prioritizing risks.

- **Confidence of the risk assessment** Some of our risk exposure assessments will be relatively poor, where this is the case, there is a need for further investigation before action can be planned.
- **Compound risks** Some risks will be dependent on others. Where this is the case, they should be treated together as a single risk.
- **The number of risks** There is a limit to the number of risks that can be effectively considered and acted on by a project manager. We might therefore wish to limit the size of the prioritized list.
- **Cost of action** Some risks, once recognized, can be reduced or avoided immediately with very little cost or effort and it is sensible to take action on these regardless of their risk value. For other risks we need to compare the costs of taking action with the benefits of reducing the risk. One method for doing this is to calculate the risk reduction leverage (RRL) using the equation

\[
RRL = \frac{RE_{\text{before}} - RE_{\text{after}}}{\text{risk reduction cost}}
\]

Where \( RE_{\text{before}} \) is the original risk exposure value, \( RE_{\text{after}} \) is the expected risk exposure value after taking action and the risk reduction cost is the cost of implementing the risk reduction action. Risk reduction costs must be expressed in the same units as risk values - that is, expected monetary values or score values. If the value, are expected monetary values then an RRL greater than one indicates that we can expect to gain from implementing the risk reduction plan because the expected reduction in risk exposure is greater than the cost of the plan. In either case the higher the leverage value for a risk then the more worthwhile it will be to plan the risk reduction action.

**Reducing the risks**

Broadly, there are five strategies for risk reduction.

- **Hazard prevention** Some hazards can be prevented from occurring or their likelihood reduced to insignificant levels. The risk of key staff being unavailable for meetings can be minimized by early scheduling, for example.

- **Likelihood reduction** Some risks, while they cannot be prevented, can have their likelihoods reduced by prior planning. The risk of late changes to a requirements specification can, for example, be reduced by prototyping. Prototyping will not
eliminate the risk of late changes and will need to be supplemented by contingency planning.

- **Risk avoidance** A project can, for example, be protected from the risk of mentioning the schedule by increasing duration estimates or reducing functionality.
- **Risk transfer** The impact of sonic risks can be transferred away from the project by, for example, contracting out or taking out insurance.
- **Contingency planning** Some risks are not preventable and contingency plans will need to be drawn up to reduce the impact should the hazard occur. A project manager should draw up contingency plans for using agency programmers to minimize the impact of any unplanned absence of programming staff.

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<th>Risk</th>
<th>Risk Reduction</th>
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<td>Staffing with top talent; job matching; teambuilding; training and career development; early scheduling of key personnel</td>
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<tr>
<td>Unrealistic time and cost estimates</td>
<td>Multiple estimation techniques; design to cost; incremental development; recording and analysis of past projects; standardization of methods</td>
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<tr>
<td>Developing the wrong software functions</td>
<td>Improved software evaluation; formal specification methods; user surveys; prototyping; early user manuals</td>
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<td>Developing the wrong user interface</td>
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<td>Gold plating</td>
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<td>Late changes to requirements</td>
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<td>Shortfalls in externally supplied components</td>
<td>Benchmarking, inspections, formal specifications, contractual agreements, quality controls</td>
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<td>Shortfalls in externally performed tasks</td>
<td>Quality assurance procedures, competitive design etc</td>
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<td>Real time performance problems</td>
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<td>Development technically too difficult</td>
<td>Technical analysis, cost-benefit analysis, prototyping, training</td>
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**Evaluating Risks to schedule**

We have seen that not all risks can be eliminated - C1 en those that are classified as
avoidable or manageable can, in the event, still cause problems affecting activity durations. By identifying and categorizing those risks, and in particular, their likely effects on the duration of planned activities, we can assess what impact they are likely to have on our activity plan.

**Using PERT to evaluate the effects of uncertainty**

PERT was developed to take account of the uncertainty surrounding estimates of task durations. It was developed in an environment of expensive, high-risk and State-of-the-art projects - not that dissimilar to many of today's large software projects.

The method is very similar to the CPM technique (indeed many practitioners use the terms PERT and CPM interchangeably) but, instead of using a single estimate for the duration of each task, PERT requires three estimates.

- **Most likely time** - the time we would expect the task to take under normal circumstances. We shall denote this by the letter \( m \)
- **Optimistic time** the shortest time in which we could expect to complete the activity, barring outright miracles. We shall use the letter \( a \) to denote this.
- **Pessimistic time** the worst possible time allowing for all reasonable eventualities but excluding acts of God and warfare (as they say in most insurance exclusion clauses). We shall denote this by \( b \).

PERT then combines these three estimates to form a single expected duration. c. using the formula

The expected durations are used to carry out a forward pass through a tietyork: using the same method as the CPM technique. In this case, however, the calculated event dates are not the earliest possible dates but are the dates by which we expect to achieve those events.

**Summary**

- This Chapter discuss the use of critical path method and precedence network to obtain an ideal activity plan, which helps us identify which activities are critical to meeting a target completion date
- Provides an inside view of details about risk and risk management framework and its various tasks.

**Key Terms:**

Risk - cause and effect- PERT- CPM -checklist-brain storming-RRL-Risk Exposure - Forward-pass backward-pass Work break down structure (WBS)
Key Term Quiz:
1. The two main approaches to the identification of risk are the use __________ and __________
2. __________ is defined as ‘an uncertain event or condition that, if it occurs, has a positive or negative effect on a project’s objectives
3. __________ is carried out to calculate the earliest dates on which each activity may be started and completed
4. __________ consists of ranking the risks and determining risk aversion strategies
5. The activity based approach carried out the task list by much favoured way of generating a task list is to create a __________

Review Questions
1. Define Risk?
2. Explain activity based approach?
3. Explain the method to calculate the cost of action?
4. What are the two different strategies of managing risks?
5. What are the different factors that constitute the risk factors?
6. Explain the task of managing Risks?
7. Explain the network planning models?
8. What is PERT and CPM analysis?