**Critical Path Method**

**Introduction**

Once you have the network diagrams for the activities, as well as the activity duration estimates, you can begin scheduling the project. The critical path method (CPM) is one of the key techniques for developing a project schedule.

In a schedule network diagram, the critical path is the longest full path linking activities that must be performed in sequence. It's important to identify this path, because if one of its activities is delayed, the end date of your project is delayed too.

CPM provides a way to calculate four time boundaries:

* the early start date, which is the earliest possible start date for each activity to begin
* the early finish date, which is the earliest date each activity can end
* the latest start date, which is the latest possible time for each activity to begin
* the latest finish date, which is the latest date each activity can end

CPM involves completing three steps:

1. performing a forward pass through the network diagram
2. performing a backward pass to check your initial results
3. calculating the float for each activity to determine the critical path

**The forward pass**

The first step in CPM is performing a forward pass through the schedule network diagram so you can establish the early start and finish dates for each activity. This is done so that resources, such as project team members and equipment, can be allocated as soon as possible. Allocating resources assists in determining project expenditure and therefore establishing the project budget.

When performing a forward pass, you begin with the first activity in the network diagram and move forward. You

1. record the earliest date the first activity can start
2. add the duration of this activity to the early start date
3. subtract one day from the result

Some project managers find it useful to record activities' start and finish times in the network diagram. The early start is usually filled in on the top left corner of each activity block, with the early finish date shown in the right corner.

**The backward pass**

The second step in determining the critical path for a project is to perform a backward pass through the schedule network diagram.

You perform the backward pass to establish the latest start and finish dates for the project to remain on schedule.

In a backward pass, you start at the end of the project and work back, subtracting the estimated duration of each preceding activity.

To begin the backward pass, the late finish date will either be a hard date that's been set or the early finish date of the last activity in the project. An example of a hard date may be a deadline that determines the project's end date.

To calculate the late start date, you

1. subtract the duration of the last activity from its late finish date
2. add one day because the last day of the project is included as a working day

As you work backward through the schedule network diagram, the late finish date will fall on the working day preceding the late start date of the last activity.

When activities occur in parallel, the smaller of the late start values of the activities is used to calculate the late finish date for the preceding activity.

The late start date should usually be the same as the early start date for the first activity in a schedule network diagram. Any other result may indicate that you've made an error, unless there is a hard end date and you're starting the project in advance to give yourself an extra buffer.

**Calculating the float**

When there's a difference between the early finish date of an activity and the early start date of an activity that immediately follows it, the difference is called slack time, or float. It's the amount of time that an earlier activity can be delayed without affecting the completion time of the project.

The final step in the CPM is to find the activities that lie on the project's critical path by calculating their float. The critical path is sometimes defined as the longest path through the network diagram and contains no float.

The easiest way to find the critical path is to find the activities where the early start date is the same as the late start date. If the two dates are the same, there's no float available for that activity, and it must lie on the critical path.

You can also calculate the float for each activity by subtracting the early start date from the late start date, or by subtracting the early finish date from the late finish date.

If any of the activities on the critical path aren't completed on time, all of the activities that follow it will run late too. So it's important to prevent this, for example by ensuring enough resources are allocated for completing critical activities.

The critical path is one of the techniques for developing a project schedule. It identifies the shortest period of time in which the project can be completed. The critical path method involves completing three steps. You perform a forward pass through the network diagram, perform a backward pass to check your initial results, and then calculate the float for each activity to determine the critical path.

**Course:** Developing and Controlling the Project Schedule
**Topic:** Critical Path Method