ACTIVITY SCHEDULES

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AGENDA

Activity networks

Critical Path Method (CPM)

ACTIVITY NETWORKS

- An activity network is an acyclic directed graph by which the tasks identified by WBS along with their interdependencies is represented.
- An activity network shows the different activities making up a project, their durations and interdependencies.
- Each activity is represented by a rectangular node and the duration of the activity is shown alongside each task.
- The edges (arrows) between nodes show where the start of one activity depends on the completion of some other activity.
- The 'start' and 'finish' activities represent milestones.

Note: milestones can also be located in the middle of a project.

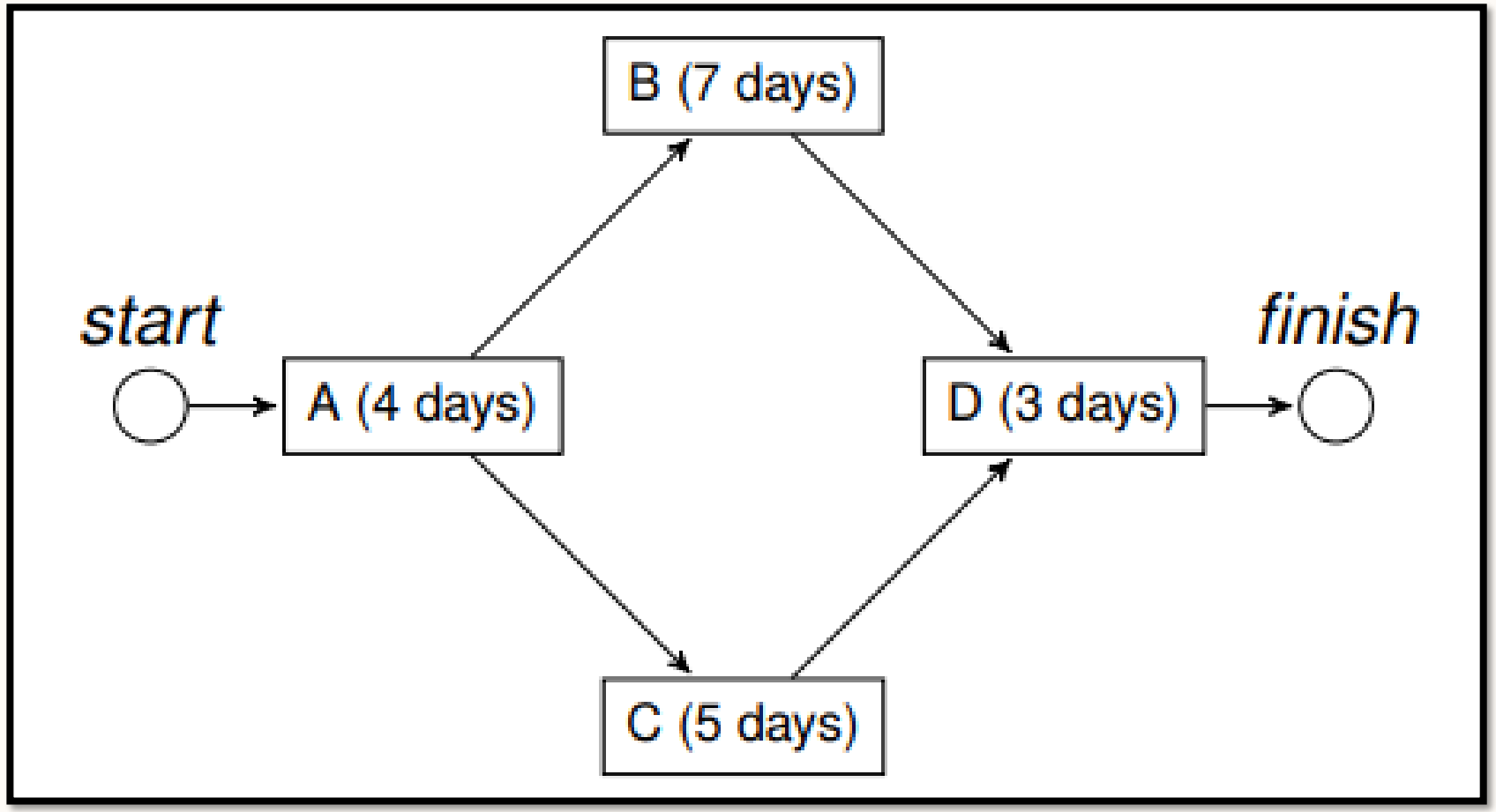

Figure 1: Activity network example

AN EXAMPLE

Assume we have a WBS for Management Information System MIS) software as shown in Figure 2.

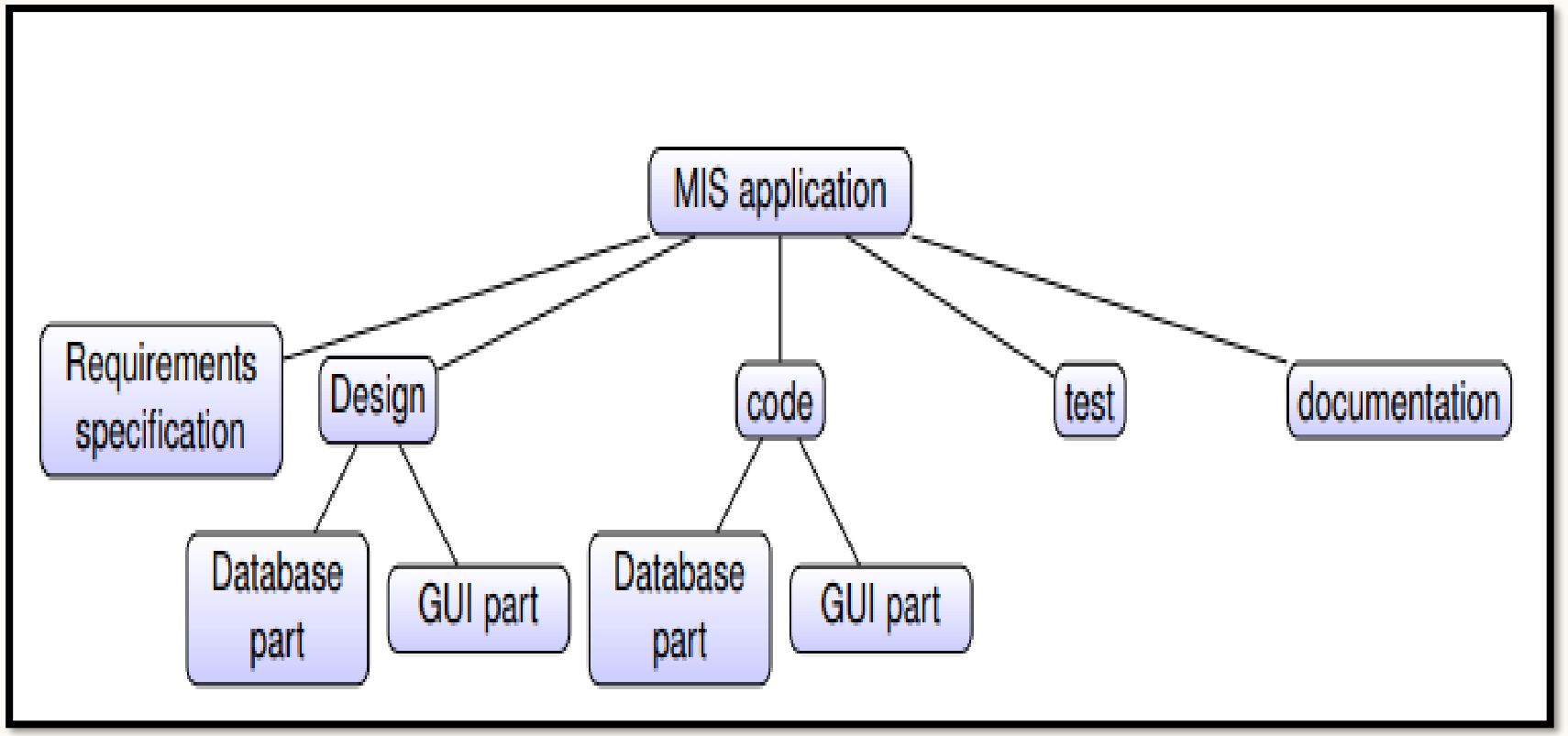

Figure 2: Work breakdown structure of an MIS problem

AN EXAMPLE

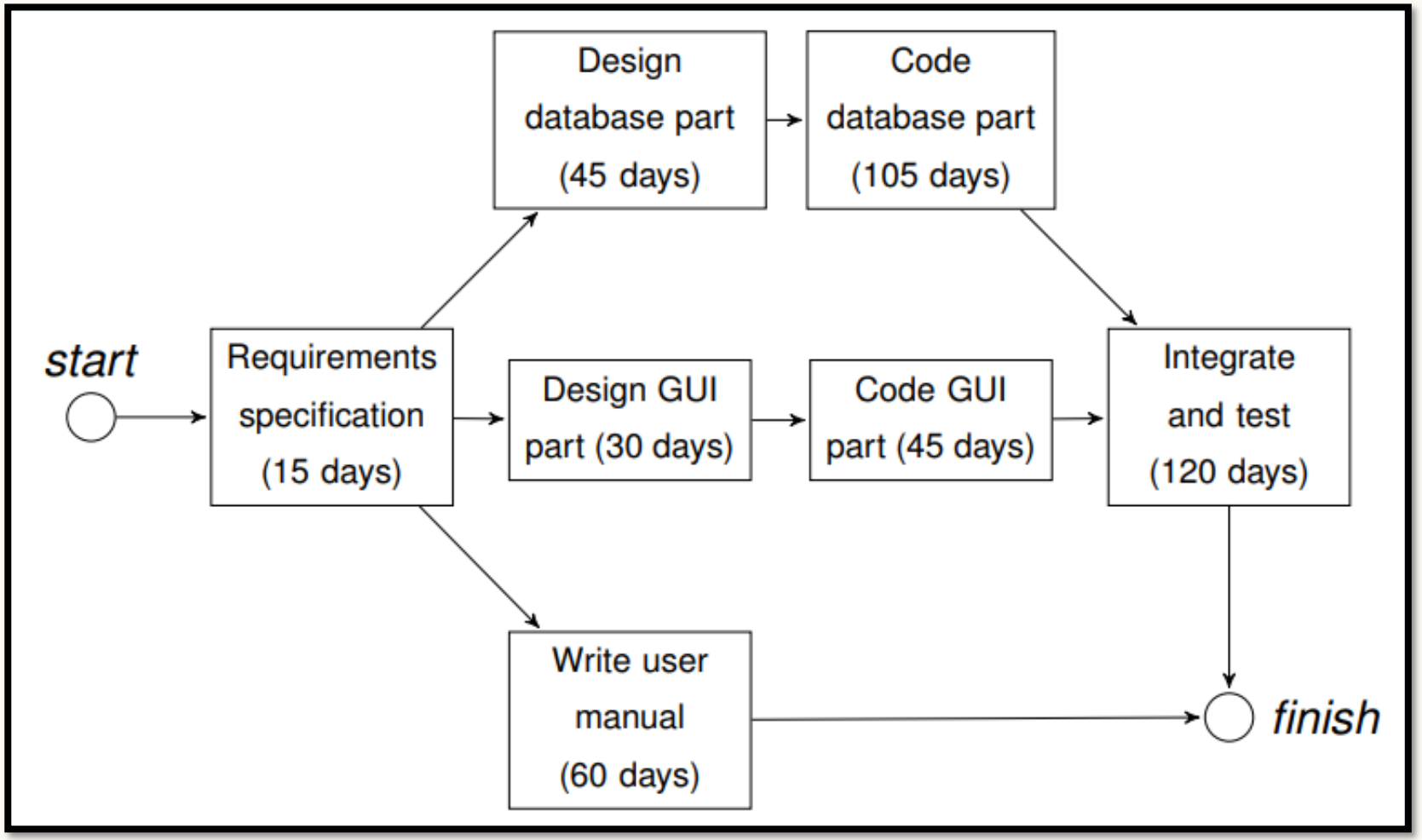

Figure 3: Activity networks of the MIS problem

AN EXAMPLE

Activities	description	Duration in day	Depend on
A	Requirements Analysis	3 days	—
B	Database Design	2 days	A
C	Graphical interface design	2 days	A
D	Database Development	3 days	B
E	Interface Development	3 days	C
F	Connecting the interface with the base	2 days	D, E
G	System Testing	2 days	F
H	Project delivery	1 day	G

CRITICAL PATH METHOD (CPM)

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Analysis of activity networks helps to obtain some information regarding the time from the start of an activity to the finish.

DETERMINING THE EARLIEST START DATE (ES) IN ACTIVITY NETWORKS

When constructing an activity network, the **Earliest Start Date** (ES) of an activity represents the **earliest possible time** that the activity can begin, assuming all preceding activities are completed on schedule.

DETERMINING THE EARLIEST START DATE (ES) IN ACTIVITY NETWORKS

The calculation of the ES depends on the number of immediate predecessor activities:

- **The earliest start date is equal to 0, because it is the first activity in the network**

$$ES = 0$$

- **If the activity has only one immediate predecessor:**

$$ES = EF_{\ preceding\ activity}$$

DETERMINING THE EARLIEST START DATE (ES) IN ACTIVITY NETWORKS

- **If the activity has multiple immediate predecessors:** The earliest start date is determined by the **latest** of the earliest finish dates among all the preceding activities. This ensures that the activity does not start until **all dependencies are fulfilled.**

$$ES = max\left(EF_{all\ preceding\ activities}\right)$$

DETERMINING THE EARLIEST FINISH DATE (EF) IN ACTIVITY NETWORKS

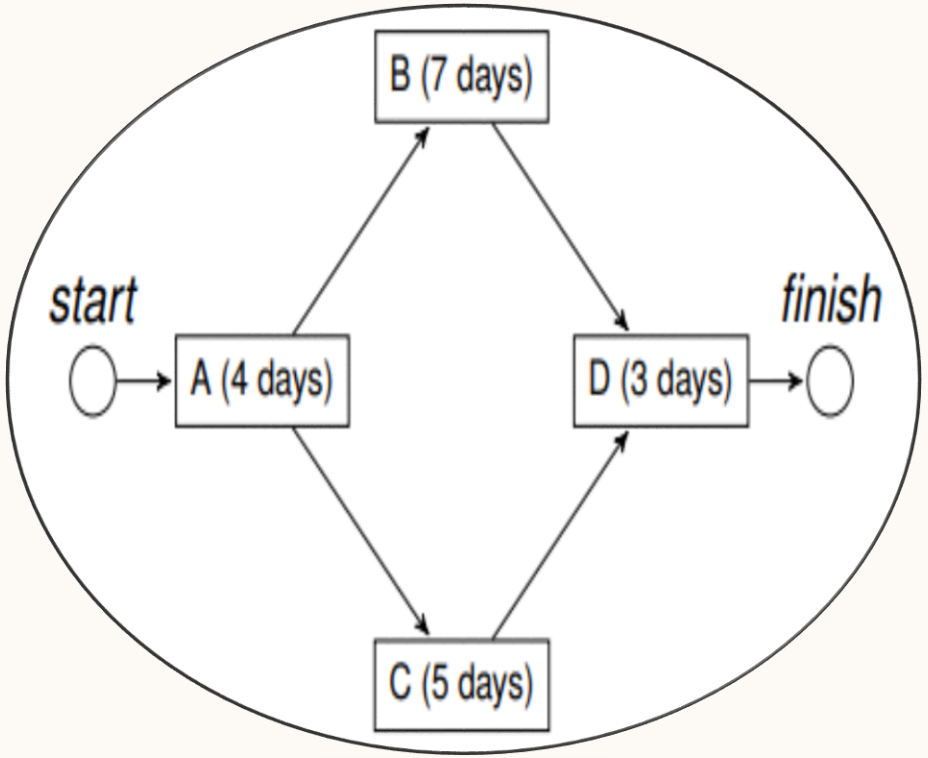
- The **Earliest Finish Date** (**EF**) of an activity represents the **soonest possible time** by which the activity can be completed, assuming it begins at its **Earliest Start Date** (**ES**) and proceeds without delay.

The EF is calculated using the following formula:

$$EF = ES + Activity\ Duration$$

CALCULATE THE (ES) AND (EF) IN ACTIVITY NETWORKS

(A) activity:
ES = 0
EF = 0 + 4 = 4
(B) activity:
ES = 4
EF = 4 + 7 = 11
(C) activity:
ES = 4
ES = 4 + 5 = 9
(D) activity:
ES = 11
EF = 11 + 3 = 14



CALCULATE THE (ES) AND (EF) IN ACTIVITY NETWORKS

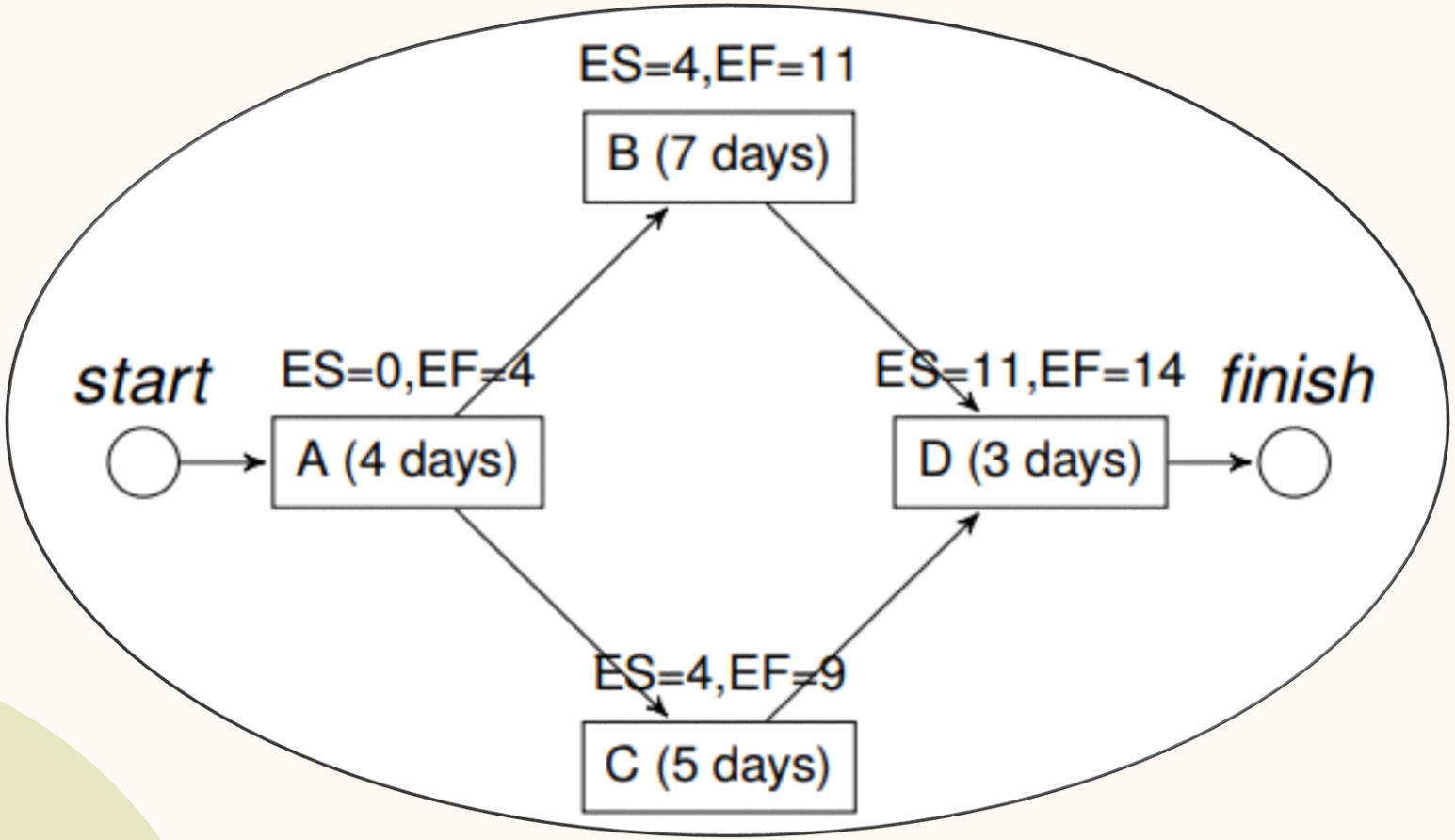


Figure 4: Earliest start and finish dates

DETERMINING THE LATEST START AND FINISH DATES IN ACTIVITY NETWORKS

In project management, It is possible for some activities to start or finish late without the project as a whole being delayed. To see where this is the case, we calculate the latest finish and latest start dates.

Latest Finish Date (LF)	Latest Start Date (LS)
The latest time an activity can finish without delaying the project.	The latest time an activity can start without delaying the project.

ASSUMPTION OF MINIMUM PROJECT DURATION

We assume that the project is to be completed in the shortest possible time.

For example, if the minimum total project duration is 14 days, then Day 14 becomes the Latest Finish Date (LF) for the final activity in the project (e.g., activity D).

CALCULATING LATEST START DATE (LS)

Once the LF is known, the **Latest Start Date** is calculated using:

$$LS = LF - Activity\ Duration$$

To find the LS and LF for all other activities, we perform a backward pass through the activity network. That is, we move from the project's end date back toward the beginning.

WORKING BACKWARD THROUGH THE NETWORK

- If **Activity D** has an LF of **Day 14** and a duration of **3 days**, then:

  LS (D) = 14 – 3 = 11 day

- If **Activities B and C** are immediate predecessors of D, then: The latest start day for 'D' LS(D) becomes the latest finish day for 'B' and 'C'

  LS(D) = LF(B) = LF(C)

LS(B)=11–7= Day 4,
LS(C)=11–5= Day 6

CALCULATING LATEST FINISH FOR EARLIER ACTIVITIES

If an activity has **multiple successors**, its Latest Finish Date is the **earliest** of the Latest Start Dates of its immediate dependent activities:

$$LF = min\left(LS_{all\ preceding\ activities}\right)$$

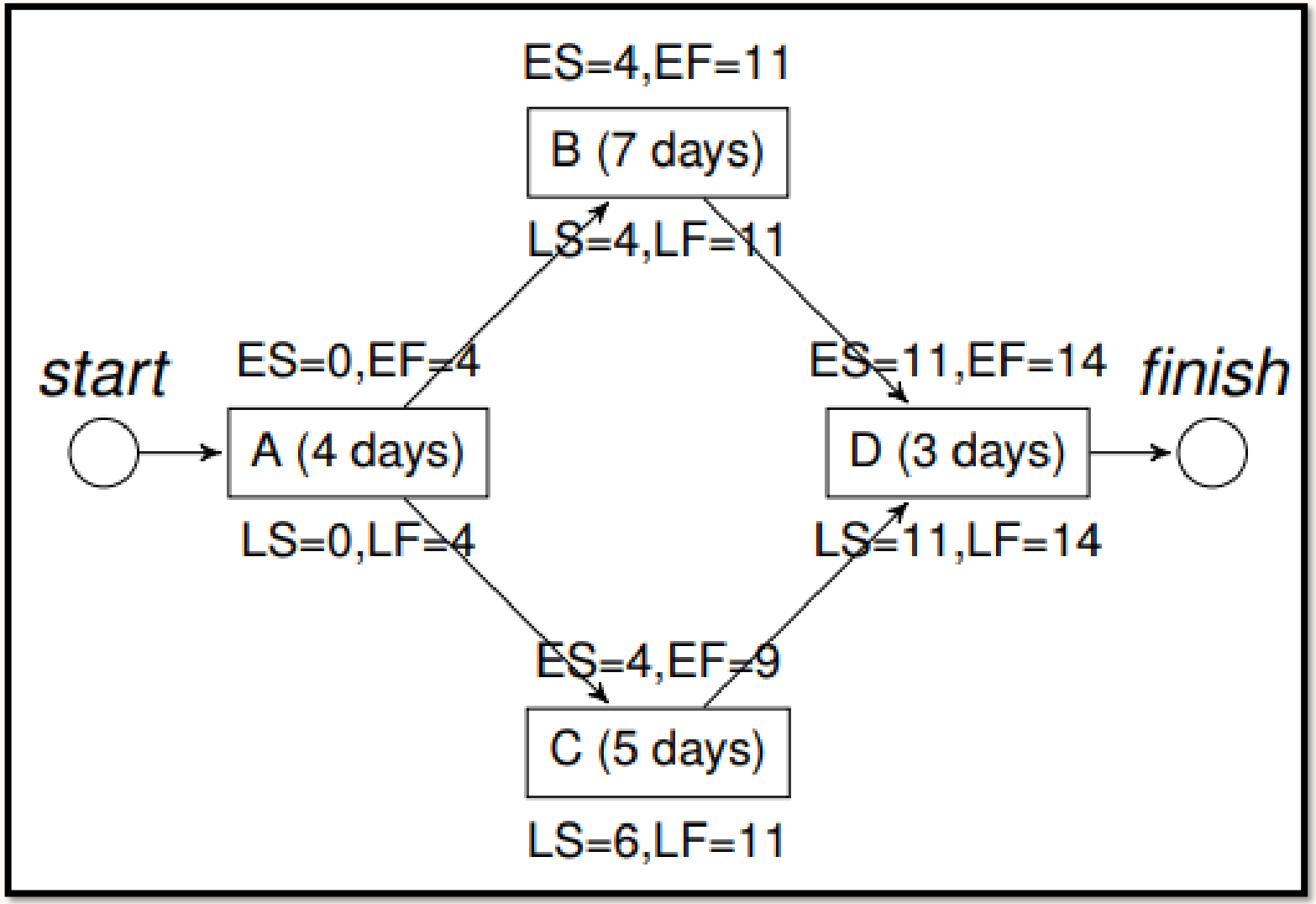


Figure 5: Latest start and finish dates

CRITICAL ACTIVITY

It can be seen that some activities have the same earliest and latest finish and start dates. Any delay of these activities will cause a delay in the project as whole.

$$EF = LF \text{ and } ES = LS$$

NON CRITICAL ACTIVITY

On the other hand, there is some activities having different earliest and latest dates, for example the activity (C).
The delay of one or two days in this activity will not cause any delay to the project

$$EF \mathrel{!}= LF \text{ and } ES \mathrel{!}= LS$$

This delay time having no effect on the project duration called (Float) and can be defined as:

$$Float = LF - ES - Duration$$

CRITICAL PATH

The activities (A), (B) and (D) all have zero float.

They form a critical path, which starts from the beginning of the activity network to the end.

If any activity on this path is delayed, the whole project will be delayed.

This path is longest path in activity network

ADVANTAGES OF CRITICAL PATH METHOD

- Offers a visual representation of the project activities.
- Presents the time to complete the tasks and the overall project.
- Tracking critical activities in order to avoid the effect of any delay.
- In order to shorten the overall duration of the project, we reduce the activities on critical path(s).

THANK YOU

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