Business Management Toolkit
13. CRITICAL PATH ANALYSIS (HL)

Critical Path Analysis - Introduction

Businesses get involved in projects that are complex and involve significant investment and risk.

As the complexity and risk increases it becomes even more necessary to identify the relationships between the activities involved and to work out the most efficient way of completing the project.

Critical path analysis ("CPA") is a project management tool that requires mapping out every key task that is necessary to complete a project. It includes identifying the amount of time necessary to finish each activity and the dependencies of each activity on any others.

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Critical Path Analysis - Introduction

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Critical Path determines the activities that must be completed to achieve the minimum time.

For **Critical Path Analysis network diagram** the following information is needed:

- A **list of all activities** needed for the completion of the project
- **The time (duration)** that each activity needs to be completed
- **The dependencies** between the activities

Critical Path Analysis

The CPA network diagram calculates:

- **The longest path of planned activities to the end of the project. The Critical Path** determines the activities that must be completed to achieve the minimum possible time.
- **The earliest start time (EST) and the latest finish time (LFT)** that each activity can start and finish **without prolonging the duration** of the project.
- The **critical** activities (i.e. the activities that cannot be delayed to start) and the **float** activities (i.e. that can be delayed without making the project longer)

Tip! Any delay of an activity on the critical path directly impacts the planned project completion date (i.e. there is no float activity on the critical path).

Critical Path Analysis

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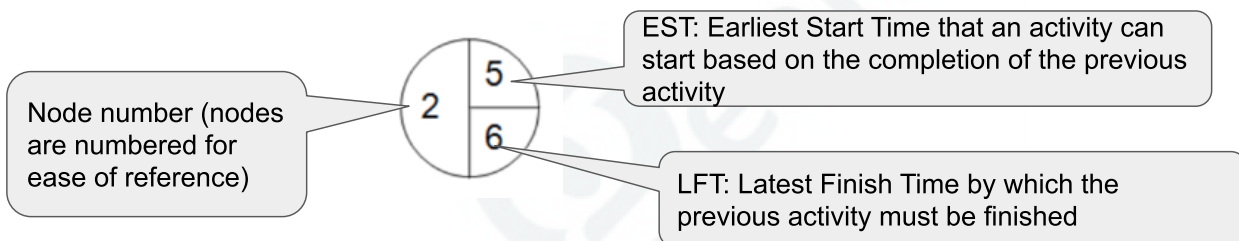
Tip! Any delay of an activity on the critical path directly impacts the planned project completion date (i.e. there is no float activity on the critical path).

Critical Path Analysis

The main parts of a Critical Path Analysis are the following:

Node: a circle that represents the end of an activity. It has three sections

EST: Earliest Start Time that an activity can start based on the completion of the previous activity

Node number (nodes are numbered for ease of reference)

LFT: Latest Finish Time by which the previous activity must be finished

Activity: an activity is shown on the network as a line with an arrow linking the circles. The description or the letter corresponding to the activity is shown above the line.

Duration: The time it takes to complete an activity. It is shown under the activity line.

Critical Path Analysis

5 RULES YOU MUST FOLLOW FOR THE CPA NETWORK DIAGRAM

RULE #1: Calculate EST first and always work from left to right

RULE #2: Where two or more activities meet, you select to write in the node the highest EST you calculated

RULE #3: Calculate LFT after EST and you always work from right to left.

RULE #4: Where two or more activities meet, you select to write in the node the lowest LFT you calculated

RULE #5: The critical activities have 0 float. Total Float = LFT-Activity Duration-EST. It is the time an activity can be delayed without delaying the whole project.

RULE #6: Free Float= EST (next activity)-duration-EST (this activity). It is the length of time an activity can be delayed without delaying the start of the next activities.

Critical Path Analysis

| Activity	Preceding Activities	Duration (days)
A	-	8
B	-	6
C	A	9
D	B and C	6
E	A	14
F	E	10
G	F,D	3

Exam style question:

1. Draw the network for the Project A.
   [6 marks]
2. Use the duration times to calculate the EST (earliest start time) and LFT (latest finish time) of each activity.
   [6 marks]
3. Identify the critical path.
   [2 marks]

Critical Path Analysis

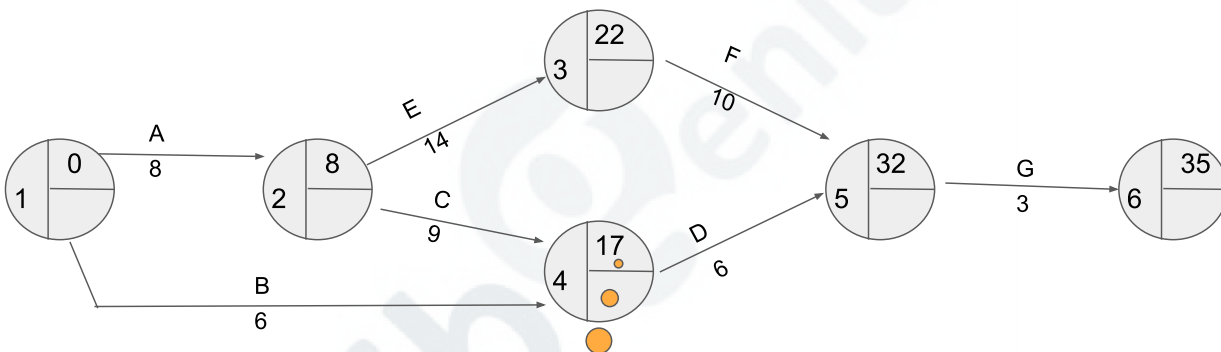**STEP 1:** Draw the nodes, number the nodes, draw the lines of the activities, label them and write their duration
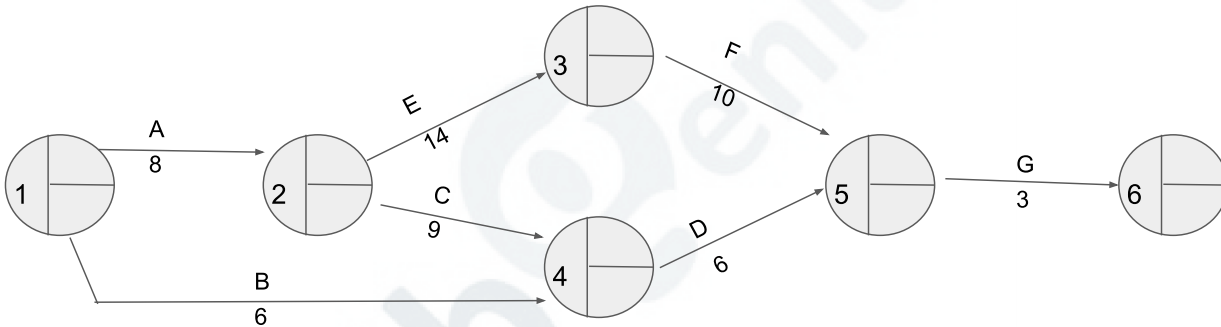
Critical Path Analysis

STEP 2: Calculate and write at the top right of each node the EST. Start from the left! Remember the 2 first rules!!!
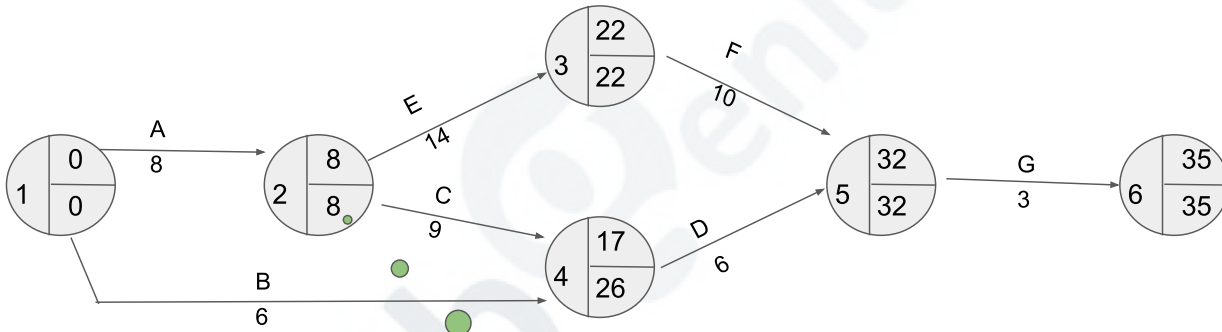

What do you observe? There are two activities ending in this node. The EST of C is 8+9 and the EST of B is 6. You need to choose the longest one. Rule No 2!

Critical Path Analysis

STEP 3: Calculate and write at the bottom right of each node the LFT. Start from the end! Remember the 2 last rules!!!

What do you observe? There are two activities ending in this node. The LFT of C is 26-9 and the LFT of E is 22-14. You need to choose the shortest one. Rule No 4!

Critical Path Analysis - Calculated Float

STEP 4: Calculate the float of each activity in order to identify the critical path. Remember Rule #5!

Activity	LFT	Duration	EST	Total Float (LFT-Duration-EST)
A	8	8	0	0
B	26	6	0	20
C	26	9	8	9
D	32	6	17	9
E	22	14	8	0
F	32	10	22	0
G	35	3	32	0

What does it mean? It means that Activity B can be delayed by 20 days without the whole project to be delayed.

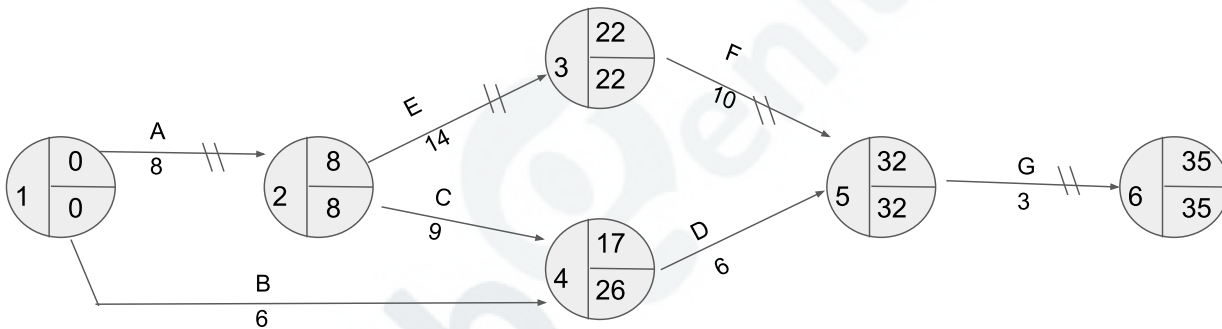Critical Activities have Total Float = 0. Can you identify them?

Float is the duration an activity might be delayed/ extended, without the whole project delaying

Critical Path Analysis

STEP 5: Show on the network diagram the critical path with the use of

Critical Path Analysis - Evaluation

Advantages	Disadvantages
● Helps reduce the risk and costs of complex projects ● Helps spot which activities have some slack ("float") and could therefore transfer some resources, better allocation of resources ● Provides overview of a complex project ● Links well with other aspects of business planning, including cash flow forecasting and budgeting	● Its reliability is largely based on accurate estimates and assumptions made ● It does not guarantee the success of a project ● Too many activities may create a too complicated network diagram ● Needs to be reviewed during the project

Are you ready for the quizz?

- **Do the quiz in the ibGenius platform**
- **You need 70% to pass!**
- **Then you are ready to move on to the next Business Management Tool!**

Critical Path Analysis

- https://www.projectmanager.com/guides/critical-path-method
- https://www.tutor2u.net/business/reference/critical-path-analysis
- https://pmstudycircle.com/critical-path-method-cpm-in-project-management/
- https://www.investopedia.com/terms/c/critical-path-analysis.asp