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# Critical path analysis

2017-18

# NATURE AND PURPOSES OF CRITICAL PATH ANALYSIS

Complete tasks more quickly

→ improve *efficiency* and *profitability*

**Tool:** *critical path analysis* which uses *network diagrams*

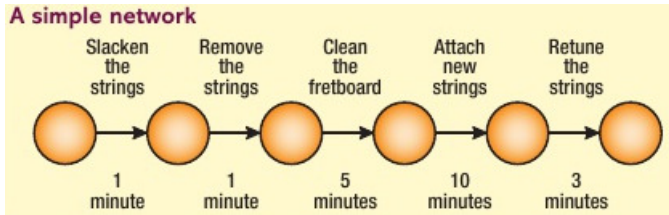
- ▶ Tool is used to
  - ▶ plan
  - ▶ organise
  - ▶ manage resources optimally
- ▶ Used in the following *industries*
  - ▶ construction
  - ▶ defence
  - ▶ engineering
  - ▶ software design
  - ▶ plant maintenance
  - ▶ aerospace

# NATURE AND PURPOSES OF CRITICAL PATH ANALYSIS

- ▶ *Efficiency:*
  - ▶ saving *production/installation time*
  - ▶ helps meeting the *deadline*
- ▶ *Decision making:*
  - ▶ *scientific/objective* method for decision making
  - ▶ *length of time* of project estimated (on past data)
- ▶ *Time-based management:*
  - ▶ techniques to minimize time spend on processes
  - ▶ identify order of tasks that have to be done
- ▶ *Working capital control:*
  - ▶ identify when *materials/equipment* will be used
  - ▶ purchase materials when needed (e.g., *just-in-time*)

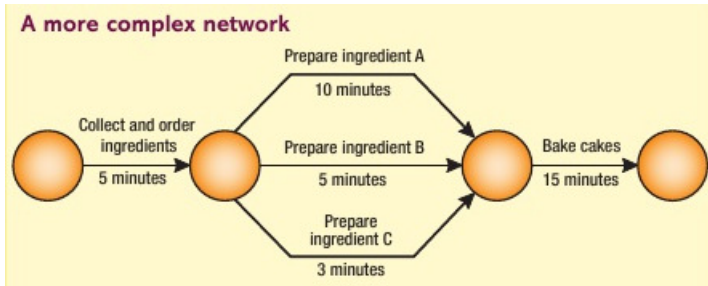
# NETWORKS

## EXAMPLE: TASKS OF AN INSTRUMENT REPAIRER



# NETWORKS

## EXAMPLE: TASKS OF A CAKE MANUFACTURER

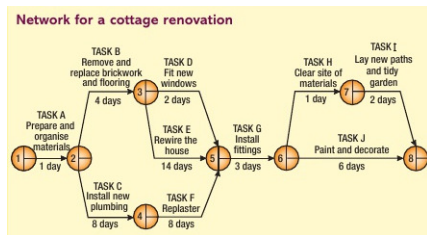


# NETWORK ANALYSIS

- ▶ businesses involve a *series of complicated tasks and orders*  
→ have to be carried out in a *certain order*
- ▶ *estimate the time* required to complete a project
- ▶ identify the *sequence* or *path* of tasks  
→ importance of planning networks ahead

# NETWORK ANALYSIS

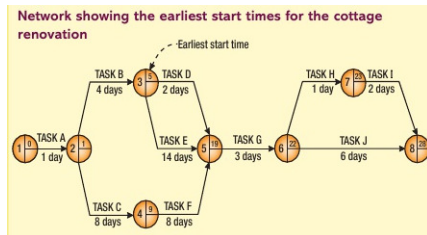
## EXAMPLE: RENOVATING A COTTAGE



- ▶ *arrows and lines*:
- ▶ *order* of carrying out tasks (e.g., simultaneous, in sequence)
- ▶ arrows and lines *cannot cross*
- ▶ *time* required to complete task
- ▶ circles in diagram are called *nodes*: start & finish of tasks
- ▶ nodes contain information about *timing*

# NETWORK ANALYSIS

## EARLIEST START TIME (EST)

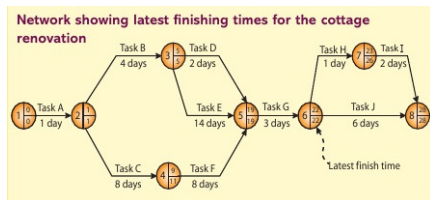


- ▶ Located at the top right of the node
- ▶ Node 5: *maximum* of the different paths that lead to it
- ▶ same for node 8!



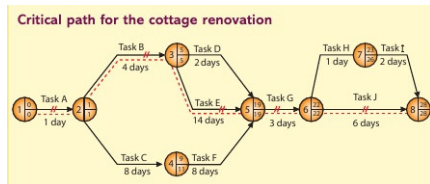
# NETWORK ANALYSIS

## LATEST FINISHING TIME (LFT)



- ▶ Located at the bottom right of the node
- ▶ LFT of earlier nodes  
= LFT at node - time taken to complete previous tasks

# IDENTIFYING THE CRITICAL PATH



- ▶ *critical path*: where the earliest start time and the latest start finish times in the nodes are the same
- ▶ indication: broken line, crossed line, highlighted line, colored line

## CALCULATING THE FLOAT

*Float time*: amount of time by which a task can be delayed without causing the project to be delayed

► *Total float*:

$$\begin{aligned} \text{Total float} &= \text{LFT of activity} \\ &\quad - \text{EST of activity} \\ &\quad - \text{duration} \end{aligned}$$

► *Free float*:

$$\begin{aligned} \text{Free float} &= \text{EST start of next task} \\ &\quad - \text{EST start of this task} \\ &\quad - \text{duration} \end{aligned}$$

# CALCULATING THE FLOAT

**Table 1 Float**

Task/activity	LFT	EST	Duration	Total float	EST next	EST this	Duration	Free float
A	1	0	1	0	1	0	1	0
B	5	1	4	0	5	1	4	0
C	11	1	8	2	9	1	8	0
D	19	5	2	12	19	5	2	12
E	19	5	14	0	19	5	14	0
F	19	9	8	2	19	9	8	2
G	22	19	3	0	22	19	3	0
H	26	22	1	3	23	22	1	0
I	28	23	2	3	28	23	2	3
J	28	22	6	0	28	22	6	0

## LIMITATIONS OF CRITICAL PATH ANALYSIS

- ▶ incorrect estimation of time
- ▶ changes that occur during life of project
- ▶ difficulty to assign material elsewhere (e.g., crane)
- ▶ complexity increases with size of project (e.g., skyscraper)  
→ use computer software

## KEY TERMS

- ▶ **Earliest start time:** how soon a task in a project can begin. It is influenced by the length of time taken by tasks which must be completed before it can begin
- ▶ **Critical path:** the tasks involved in a project which, if delayed, could delay the project
- ▶ **Critical path analysis (CPA)/network analysis:** a method of calculating the minimum time required to complete a project, identifying delays which could be critical to its completion
- ▶ **Free float:** the time by which a task can be delayed without affecting the following task

## KEY TERMS

- ▶ **Latest finish time:** the latest time that a task in a project can finish
- ▶ **Network diagram:** a chart showing the order of the tasks involved in completing a project, containing information about the times taken to complete the tasks
- ▶ **Nodes:** positions in a network diagram which indicate the start and finish of a task
- ▶ **Total float:** the time by which a task can be delayed without affecting the project

# KEY TERMS

## REVISION OF CHAPTER 21

- ▶ **Aims:** What a business tries to achieve in the long term
- ▶ **Objectives:** The goals or targets set by a business to help achieve its long-term purpose
- ▶ **Sales maximisation:** An attempt to sell as much as possible in a given time period (or an attempt to generate as much sales revenue as possible in a given time period)



# KEY TERMS

## REVISION OF CHAPTER 22

- ▶ **Articles of Association:** A document that provides details of the internal running of a limited company
- ▶ **Certificate of Incorporation:** A document that declares a business is allowed to trade as a limited company
- ▶ **Co-operative:** A business organisation owned by its members, who have equal voting rights
- ▶ **Deed of Partnership:** A binding legal document that states the formal rights of partners
- ▶ **Franchise:** A business model in which a business (the franchisor) allows another operator (the franchisee) to trade under their name

# KEY TERMS

## REVISION OF CHAPTER 22

- ▶ **Lifestyle business:** A business that aims to make enough money and provide the flexibility needed to support a particular lifestyle for the owner
- ▶ **Limited company:** A business organisation that has a separate legal entity from that of its owners
- ▶ **Limited liability:** A legal status which means that a business owner is only liable for the original amount of money invested in the business
- ▶ **Limited partnership:** A partnership where some members contribute capital and enjoy a share of profit, but do not participate in the running of the business. At least one partner must have unlimited liability.
- ▶ **Memorandum of Association:** A document that sets out the constitution and states key external details about a limited company

# KEY TERMS

## REVISION OF CHAPTER 22

- ▶ **Mutual organisation:** A business owned by its members who are customers not shareholders
- ▶ **Online business:** A business that uses the global communications infrastructure of the internet as a trading base
- ▶ **Partnership:** A business organisation that is usually owned by between 2 20 people
- ▶ **Primary sector:** Production involving the extraction of raw materials from the earth
- ▶ **Secondary sector:** Production involving the concersion of raw materials into finished and semi-finished goods

# KEY TERMS

## REVISION OF CHAPTER 22

- ▶ **Sleeping partner:** A partner that contributes capital and enjoys a share of the profit but takes no active role in running the business
- ▶ **Social enterprise:** A business that trades with the objective of improving human or environmental well-being charities and workers' co-operatives, for example
- ▶ **Sole trader or sole proprietor:** A business organisation which has a single owner
- ▶ **Tertiary sector:** The production of services in the economy
- ▶ **Unlimited liability:** A legal status which means that the owner of a business is personally liable for all business debts