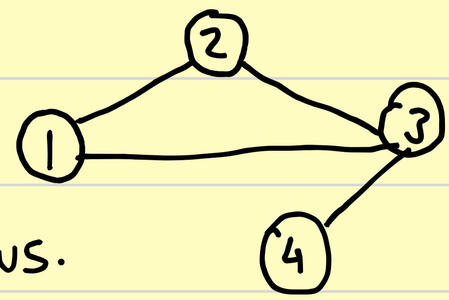
20211004_Project_Management_VH7

We continue our Project & Process Management approach by considering Projects & Processes as NETWORKS.

A network can be mathematically described as a GRAPH: a set of NODES and EDGES. $G = \{N, E\}$

Graphs can be described visually:

- Direct graph: Edges are arrows.
- Undirect graph: " are not arrows.

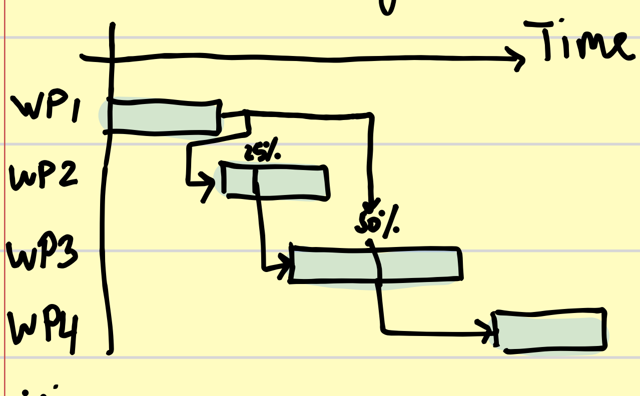


Nodes = {1, 2, 3, 4}

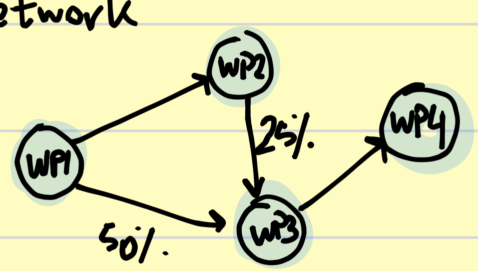
Edges = {(1,2), (2,3), (1,3), (3,4)}

Project - Management (DCP)nA	Process Management (CPD)nA

Do - Gantt Diagramm



Network

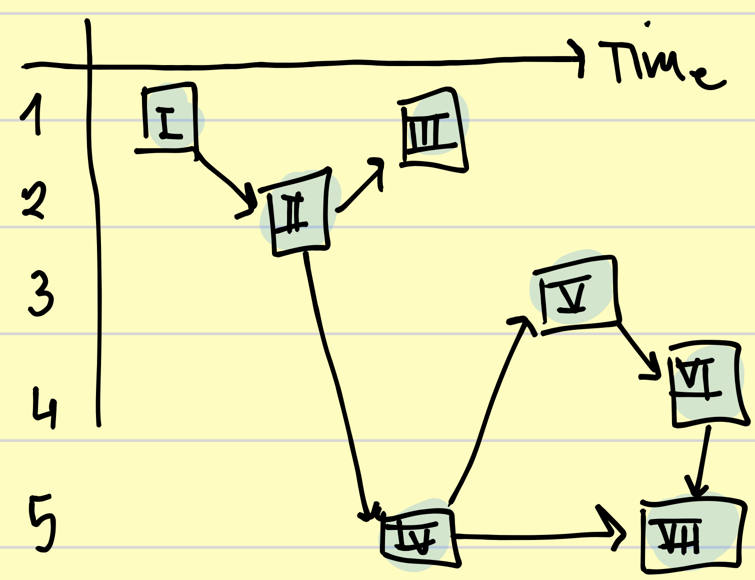


Graph PROJECT

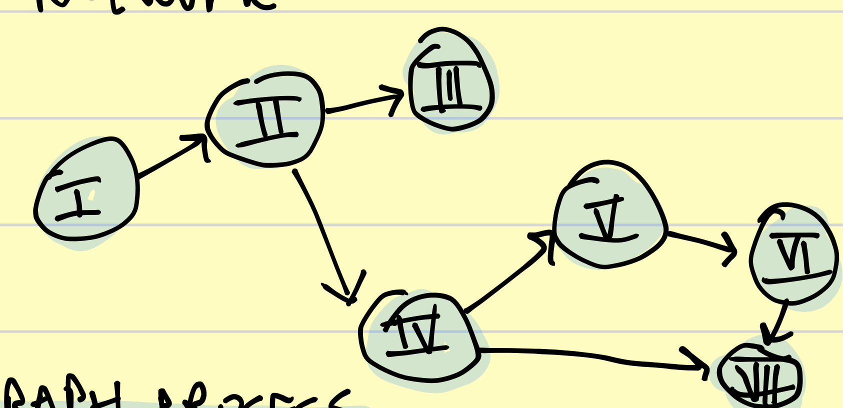
$N = \{WP1, WP2, WP3, WP4\}$

$E = \{(WP1, WP2), (WP1, WP3), (WP2, WP3), (WP3, WP4)\}$

Plan - Current State Process



Network



GRAPH PROCESS

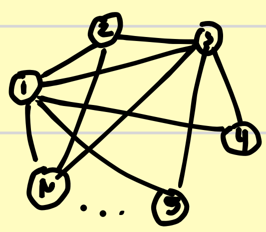
$N = \{I, II, III, IV, V, VI, VII\}$

$E = \{(I, II), (II, III), (II, IV), (IV, V), (V, VI), (VI, VII), (IV, VII)\}$

Metrics to measure Network Performance

AVERAGE PATH LENGTH (APL): Average distance btw. two nodes of the network.
We want our APL to be as small as possible. The smaller the APL, the faster value will flow through the network.

$$APL = \underbrace{\frac{1}{N\cdot(N-1)}}\cdot\underbrace{\sum_i\sum_j d_{ij}} \longrightarrow \boxed{APL = \frac{1}{N(N-1)}\sum_i\sum_j d_{ij}}$$



- Maximum Number of Edges in the network
- I have a maximum of (N-1) relationship for each one of the N nodes.

distance between all nodes

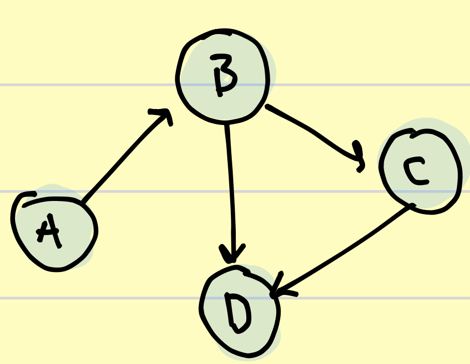
CLUSTERING COEFFICIENT (CC): Measure of how clusters (groups) form the network.
We want the CC to be as big as possible so that information is effectively shared in the network.

$$CC = \frac{1}{N}\underbrace{\sum_i cc_i} = \underbrace{\frac{1}{N}\sum_i\frac{2L_i}{k_i(k_i-1)}} \longrightarrow \boxed{CC = \frac{1}{N}\sum_i\frac{2L_i}{k_i(k_i-1)}}$$

CC_i is the CC of each node

L_i: number of connections btw the neighbours of node „i"
k_i: number of neighbours of node „i" (degree of the node).

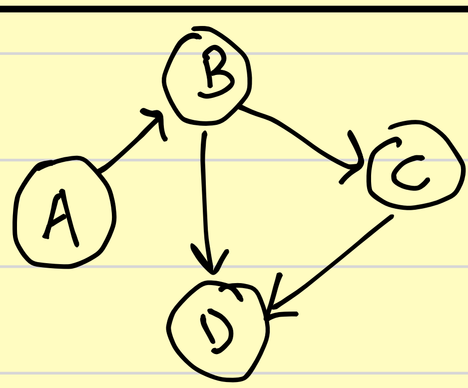
Example 1.



APL & CC ?

$$APL = \frac{1}{N(N-1)} \cdot \sum_i \sum_j d_{ij} \underset{\substack{\uparrow \\ N=4}}{=} \frac{1}{4\cdot(4-1)} \cdot \left[\frac{1}{d_{AB}} + \frac{2}{d_{AC}} + \frac{2}{d_{AD}} + \frac{1}{d_{BC}} + \frac{1}{d_{BD}} + \frac{1}{d_{CD}} \right] =$$

$$= \frac{1}{12}[8] = \frac{2}{3} = 0'\hat{6}$$



$$CC = \frac{1}{N} \sum_i \frac{2L_i}{k_i(k_i-1)} =$$

L_B = There is only one connection C → D btw the neighbours of B.

$$= \frac{1}{4} \cdot \left[CC_A\left(\frac{2 \cdot 0}{\text{—}} \right) + CC_B\left(\frac{2 \cdot 1}{3 \cdot (3-1)} \right) + CC_C\left(\frac{2 \cdot 1}{2 \cdot (2-1)} \right) + CC_D\left(\frac{2 \cdot 1}{2 \cdot (2-1)} \right) \right]$$

L_C = There is only one connection B → C btw the neighbours of C.

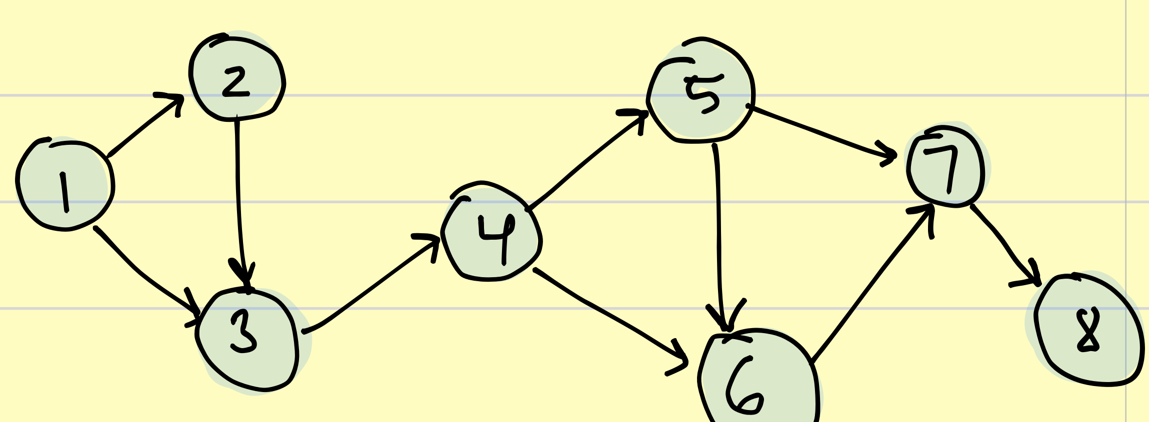
k_B = B has 3 neighbours

k_C = C has 2 neighbours

$$= \frac{1}{4}\left[\frac{1}{3} + 1 + 1 \right] = \frac{7}{12}$$

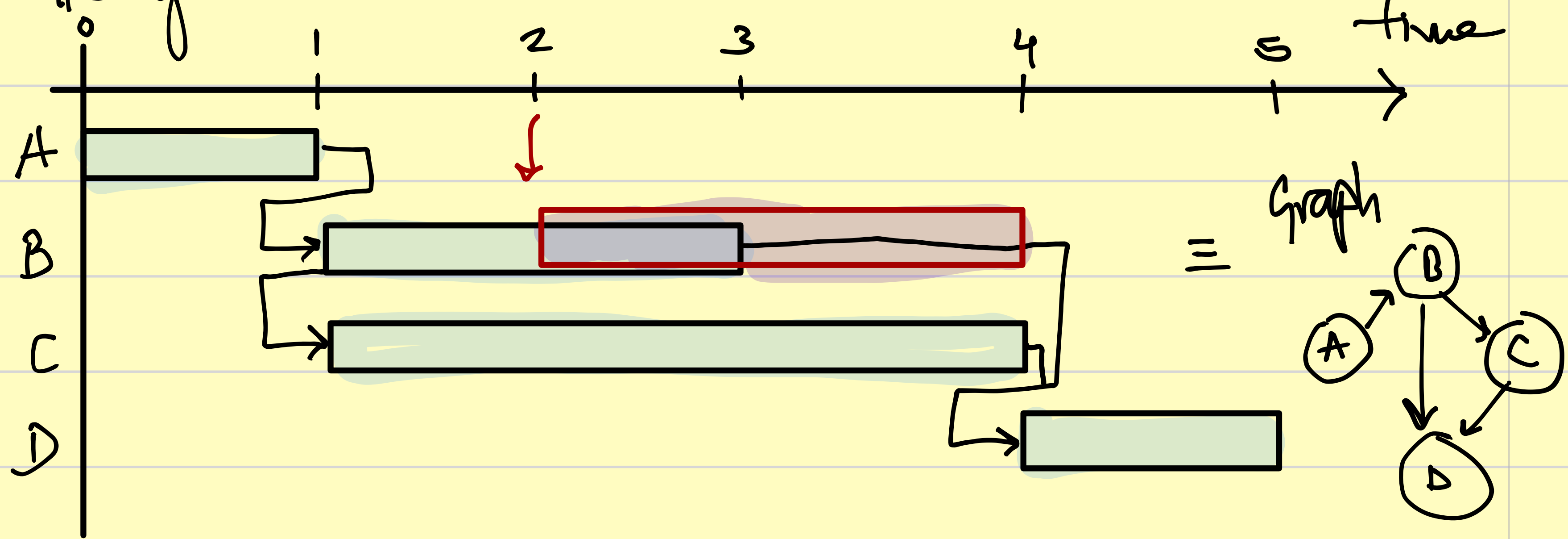
Example 2.

APL & CC



"SLACK". Amount of time we can delay an activity and not influence the overall duration of a project.

Gantt Diagramm:



SLACK? Can we delay an activity without delaying the overall project?

	Slack	Early Start	Early Finish	Late Start	Late Finish
A	0	0	1	0	1
B	1	1	3	2	4
C	0	1	4	1	4
D	0	4	5	4	5

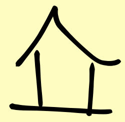
ES = earliest possible start EF = ES + duration

LS = latest possible start LF = LS + duration

SLACK = LS − ES = LF − EF

CRITICAL PATH = group of work packages which slack = 0

$\{A, C, D\}$

Example. 

Workpackage	Description	Predecessors	Duration
1	lease site	—	1
2	Hiring	1	5
3	Arranging	1	1
4	Installing	3	2
5	Phones	4	1
6	Install IT	5,3	1
7	Move into	2,6,4	3

ES, EF, LS, LF, Slack of each workpage + critical Path

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