

Weekly Notebook

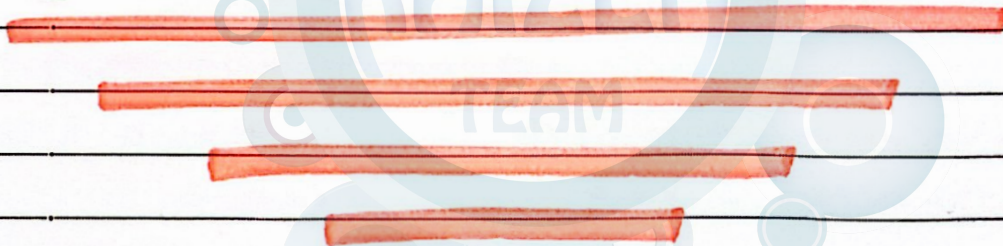
PM

Second
Semester
2024



Done By: Leen Hani.

PMM



Project Management 1

27/2

* **Management**: (3 basic components) the ability to design, implement, and control.

* **Project**: a complex, one-time non-routine effort that is limited by time, budget (cost), and specifications.

⇒ **main objective**: to satisfy customer needs

∴ **PM**: a field of a project that is managed by main tools, techniques, etc., to design, implement, and control.

ex: grad. project, develop a business idea, car design.

* **Difference btw operation & project**:

- operation → effort needed to sustain an organization. (not one time).

- Project → has a limited life span with a start and end, needs to deliver an end result. (if not, failure).

* **End Result has 4 categories**:

① Physical product (tangible, artifact) ② Development on an existing (or new) product or service.

③ Capability to perform service or produce product ④ Study result (report).

→ Types of organizations in terms of being functional (operational) or projectized. It could be a mixture of both. (matrix).

Organizations

Functional

- mostly operations (projects used when needed)
- needs operations management since most staff works in operations.
- ex: airports, banks.
- no life span

Matrix

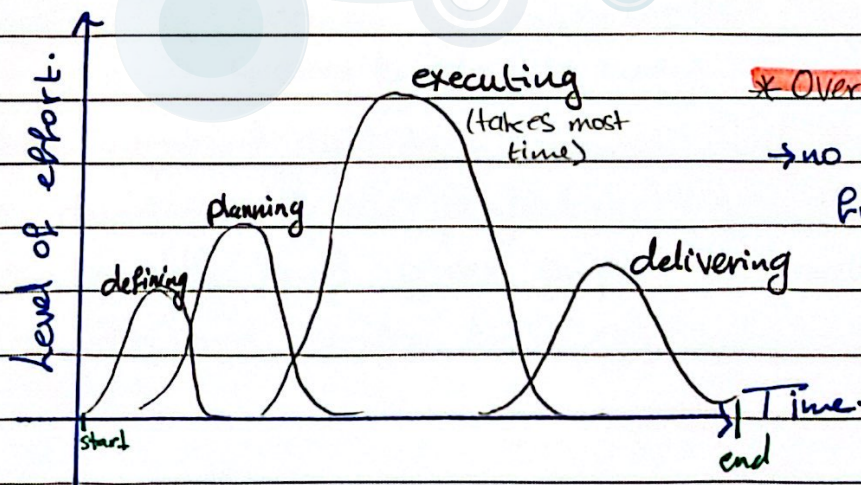
- large part of organizations uses operations and projects at the same time.

Projected

- mostly projects (operations used when needed).
- most staff works on projects
- ex: law firms startups, consulting marketing.
- has life span

* 4 levels of Project management :-

1. **Defining**: define scope, objective, responsibilities, time, tasks.
2. **Planning**: to plan the project itself.
3. **Executing**: where actual work is done, monitoring & controlling.
4. **Delivering**: to reallocate resources, transfer end results.



* Overlapping in graph?

→ no necessity to finish one phase to start the other

* Graph shows limited life span.

Chapter 4.

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⇒ In the previous graph, it's iterative and overlapping (not sequential) which mean we can go back in levels and modify, BUT, each step is essential to start the next step.

1- Defining Level: First level that defines:-

A- Project scope

B- Project Priorities

C- Project Tasks

D- Project Responsibilities

E- Coding System.

A- Project Scope: → an actual document that defines the end result of a project in a tangible, measurable, specific way. (one of the most imp. things for success of proj.).

* Project scope checklist (Project Charter): (size depends on complexity of project).

1- Project objective: define (what, when, how) the end result is and answers 3 questions ↑, needs a rough ~~micro~~ macro estimation. (ex.: customer tells contractor that they want a 4-story building to own).

2- Deliverables: expected outputs & outcomes that happen through the duration of the project, (end result so outputs & v) → eases the process and gives proper estimation of cost & time (ex: plans and blueprint of the building).

3- Milestones: a significant event (with a date and day) of the starting or completion of deliverables, or ~~any~~ other output. (expected start or completion).

→ not necessarily for deliverables

→ helps organize the sequence of a task.

→ needs date & day.

ex: On Thursday

29/12/2024, the

designer finished the blueprint

4- Technical Requirements & Specifications: laws and special requirements that ensure the proper functioning of the proj. (ex: application of FIDIC contract laws).

5- Limits & Exclusions: this specifies the boundaries of proj. so that it's clear for both the customer & manager what is expected.

→ Limits: (what's included)

→ Exclusion: (what isn't included) sometimes more imp. than limits

6- Customer Review: Here we assign the project manager and the rest of the team. (الرجوع إلى العميل).

* Notes:-

→ Project scope is usually a rough definition, not detailed.

→ it's ^{not} done by *project manager: *person who is given authority to use resources needed to conduct a project.

→ Rather, it is done by ① customer & ② sponsor (difference btw roles)

external internal

→ accountable to provide resources to conduct Proj.

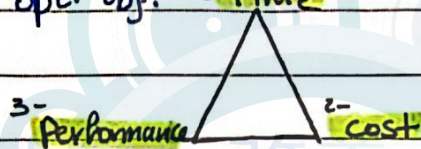
* Improper project scope definition & scope creeps are both factors that contribute in the failure of the proj.

→ Why limits & exclusions important?

For 2 reasons, ① as for the company, (not to spend resources on something that is not needed), ② as for the customer (not to have false expectations and to not have any conflicts btw customer and project manager later on).

B- Defining Project Priorities:-

any project's effort depend on 3 basic elements & pillars to reach opt. obj: 1- Time



→ why drawn in a triangle?

* We try our best to get minimum time, cost, and best performance.

* because any change on one element will at least affect the other two.

→ Project manager should know each element's priority, so that the project manager could manage the trade off btw these elements and balance it based on priority.

↳ (time, cost, Perfor.)

decided upon the desire of the customer sponsor & project team -

* **Base line Plans**:- plans that are conducted as a base & foundation, based on normal conditions, constraints, estimated time & cost, and relationship & interdependency. It specifies cost, time, and performance and acts as a reference.

⇒ if we have to update the project plan & modify its steps, the decision should be based on priority, reserving the fixed parameters & base line plan.

ex: Software development: project,

activity: coding & programming

cost & time: 3 weeks, 10K

needed: Skilled programmer

↳ the programmer i already had quit,

⇒ new decision to modify plan & hire new programmer taking into consideration all mentioned aspects.

⇒ Constraints, Accept, enhance are used with the 3 basic elements (cost, time, pref.) using a tool.

Tool: Priority Matrix:-

* Constraint: need to keep fixed to plan -

* Enhance: try to keep fixed to plan -

* Accept: not needed to meet plan -

	Time	Cost	Pref.
Constraint			
enhance			
Accept			

* example needs details & explanation to take proper decision -

WBS using

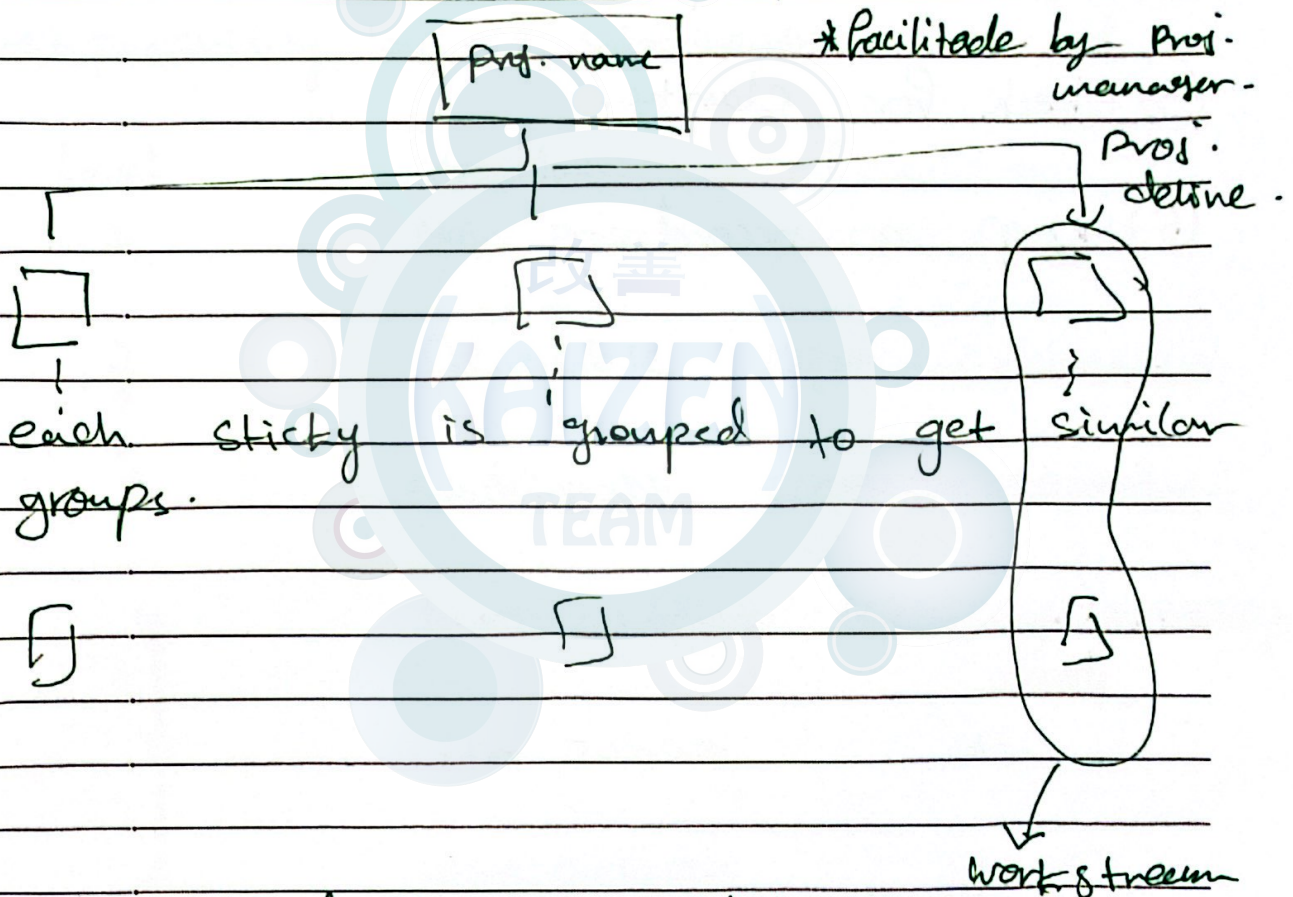
Assignment ①

deliverables & 3 levels of details.

Moving From your current house to a new house.

Advantages of sticky notes: (For WBS)

quick to use, can be moved around, anyone can contribute, visible results, help build commitment from the team



- keep record to keep data safe -

Completeness checked by 100% rule -

When to stop → assigned workstream to each dep.

Summary:-

- ① Plan Proj. with team
- ② Brainstorm work package using sticky note
- ③ Group work packages into workstreams
- ④ Check for completeness
- ⑤ Check for clarity.
- ⑥ keep a record

* **Defining Tasks**: to define what is needed to be done to get end result.

Task: action & work that have a duration & consume resources & budget, it is define by WBS tool.

→ **Work break-down Structure (WBS)** :- (most efficient & imp. tool.)
a Hierarchical structure that divides the complete project into main deliverables till the lowest management responsibility level of subdeliverables is reached.

Level	Breakdown	Description.
1	Main project	<u>complete project</u>
2	Deliverable	<u>Major (main) deliverables</u>
↕		
3	Subdeliverable	<u>Supporting deliverable</u>
↕		
4	lowest subdeliverable	<u>lowest mang. responsibility level</u>
↕		
5	Cost account	*
↕		
6	work packages	*

* Cost account: a control point created by accounting dep. to assess and control the project's process. Each group (or one) of workpackages ~~are~~ ~~that~~ monitors the progress and responsibility of the project, in terms of cost and cashflow, percent of task completion, and the linkage to deliverables; to get the ~~en~~ immediate upper deliverable (group of workpackage under ^{one} subdeliverable controlled by one person or department).

* Work packages: short duration task (used when we have a tangible product) that has a start and an end; that consumes resources and has a budget. (has the cost & isn't a deliverable). ^{nouns}
Workpackage - are verbs, they are actions.
→ For PMI, workpackages are the lowest level & are called "activities".

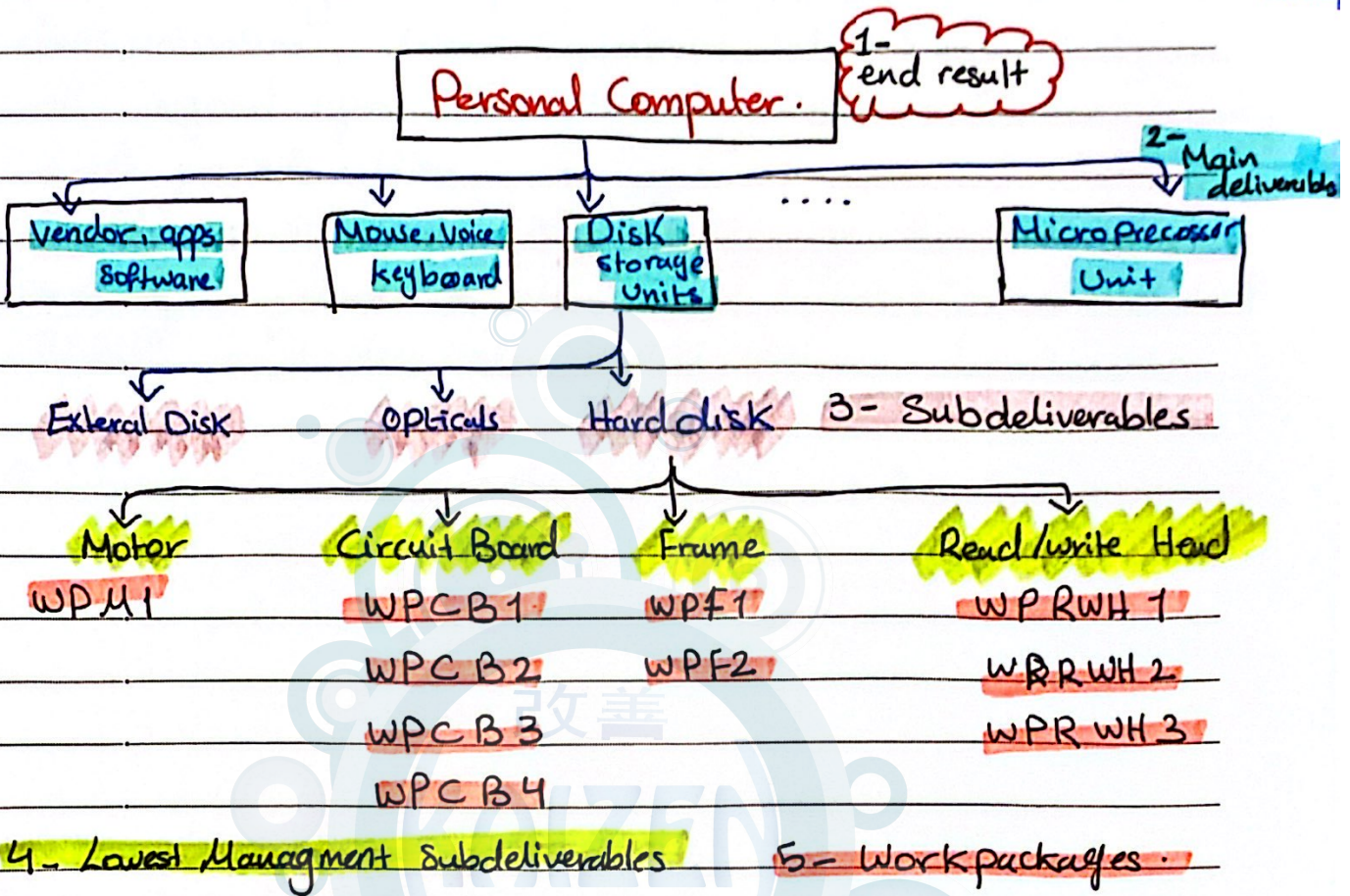
* Defining Project Responsibilities:

→ to assign each task done by a person or a department using tools ~~and~~ ~~to~~ to integrate the WBS with the breakdown structure of the organization.

* explained more in the example.

→ it's not necessary that all main deliverables have the same * of subdeliverables.

* Example: Developing a personal pc.



* Next, we develop Organizational Breakdown Structure.

⇒ Organization → departments → workpackages

"this can be done as a matrix or a chart or a list

		Motor	CB	Frame	RWH
Organization	Manu.			WPF1	
					WPRWH3
	Testing	WPM1		WPF2	
	Purchasing				
	Software		WPCB1 WPCB2		

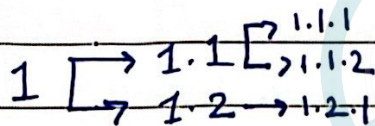
* Each WP needs cost accounting.

* Defining Coding System:-

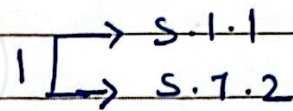
→ eases management process in terms of information dissemination, letters, numbers, identifications; that are all agreed upon from the organization for consistency and definition.

→ PMT usually uses WBS Dictionary for standard coding systems & other risk identification related fields and this also applies between departments.

* Numerical Identification:-



* Numbers + letters.



* Other Ways to Define Responsibilities *

PMS

A- Small tasks with different roles (only role specification)

ex task	Ahmad	Amal	Bisan
1		✓	
2	✓		
3			✓

B- Small tasks with Responsibility definition (could be called responsibility matrix)

ex task	Ahmad	Amal	Bisan
1		R	S
2	R		
3		S	R

R → Responsible

S → Support.

C- RSCNA Responsibility matrix:-

R: Responsible S: support C: Consult N: notification A: Approval

ex/

WP	Design	Production	Testing	Purchasing	Quality
WPM1	S			R	
WPCB2		R	A		
WPCB3					A

→ (PBs)
We Use Process Breakdown Structure to: define tasks of a project that doesn't give a tangible product.

→ not very commonly used, process oriented

dependency $\Leftarrow$ (it's not a low level option)

& Phases are not parallel (phase oriented).

→ at the end of each phase, we will have a list of deliverables (the output of the task).

→ lowest level management → task, work package.

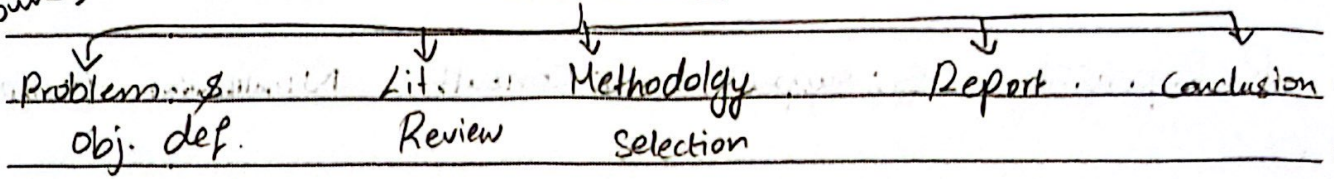
→ tools help in systematic order & consistency in defining the task.

ex.: Graduation Project could work on both PBs & WBS

ex.

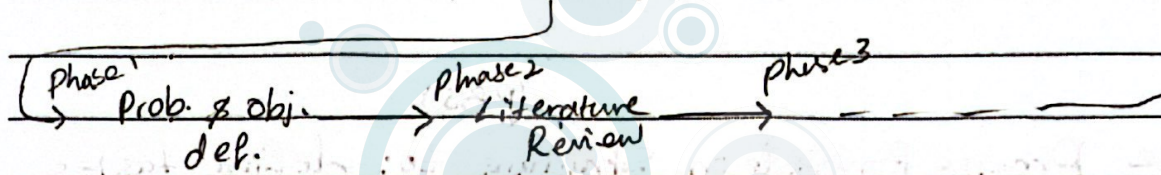
WBS $\Rightarrow$ GIP Proj

(knows)



- Visit Place
- Select Problem

PBS $\Rightarrow$ GIP



Predicting

* Estimating time & cost of the project is done in both the planning & Defining phase, why?

because this step in specific is done on diff. levels, including planning, defining, & execution; all need estimation for time & cost.

* 2 Stages of estimation:

Macro estimation

- in defining phase (look where).
- without many details
- usually on main deliverables
- Decide to take proj. or not
- a rough estimate for whole proj. (less accurate).

Micro estimation

- in planning phase

- 1- develop proj. resource + schedule
 - 2- develop proj. network dependency.
 - 3- develop proj. budget schedule
- find time & cost for each WP

* Importance of predicting time & cost:-

⇒ Factors that affect the accuracy of estimation: (error)

1] Duration & Horizon: the longer the duration, less quality & more error.

2] Complexity: ① depends on the skills of whom is doing the project; ② the more the experience, the higher the quality; ③ ~~the~~ more complex projects needs more skillful people; ④ if the team worked together or not before hand.

- dedicated proj or Matrix environment



- team works on one project at a time.

- When one project is done, next project is started.

- team works on multiple projects at a time; needs

Startup time when working on other projects.

- more time consuming.

③ **Padding**:- an increase in time & cost to reduce the risk of being late or overbudget in a certain Proj.

* Organizational cultures contribute highly in padding:-
(could encourage or discourage).

→ Encourage padding → Prevents ~~late~~^{being late} & overbudget.

→ Does cut off: → estimates are exact

→ Discourage padding

LL) if an organization is willing to not have padding, then the right environment should be provided without any punishments on the employee for doing wrong estimates.

→ should have a risk management system.

④ **External Factors**: governmental regulations; weather.

* Guidelines of Estimation:-

[1] Responsibility:- people who are responsible for conducting the activity are better to give estimates ?

→ ① more knowledgeable of the activity itself.

→ ② hold them to their estimates. (هو المسؤول عن التقدير الزايف)

[2] Ask several persons with knowledge & experience.

[3] Normal Conditions:- (الظروف العادية). (padding لا يضاف)

→ estimate done on efficient usual methods used & what the normal resources level used.

→ uncertain events & risks should be studied & managed by risk management to know the impact of these events; this is then added to what is estimated under normal conditions (الظروف العادية).
⇒ avoid surprises-

[4] Time units: activity & WP (الوقت للأنشطة و الحزم)

[5] Independency: each activity has its own estimation; same goes for Work packages (WP).

* Techniques for estimation:-

III Macro estimation Approach:-

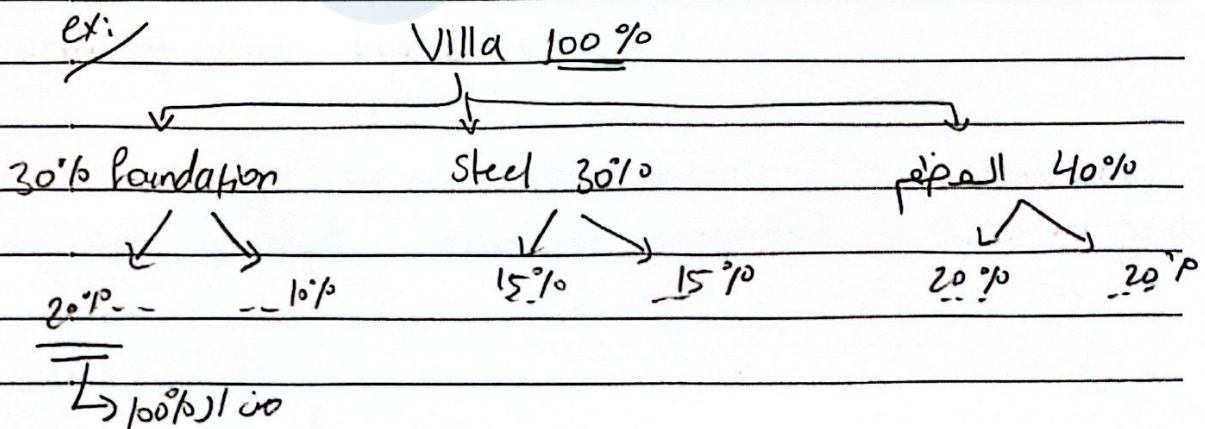
A- Consensus Method ^{توافق}:- has relation with executives that conduct meetings, arguments, & discussions till they reach consensus in relation to estimation of cost & time.

⇒ **Delphi Method**: Used on experience of others (experts).

B- Ratio Method:- a parametric method that uses ratios & surrogates in estimations.

ex: customer willing to build a home, went to consultation; he wanted to use superdeluxe → usually 2000 JD/m^2 (Ratio from previous proj.)
(has 100 m^2 → so consultation $2000 \text{ JD} \times 100 \text{ m}^2 = 200000 \text{ JD/m}^2$)

C- Apportion Method: a continuous method of ratio method. used to estimate the cost & time of the whole project; this time & cost is then divided as percentages (apportion) on Main & subdeliverables. (not on WP).
→ percentages are rough estimates-



E-Learning Curves: a tool to improve the estimation in terms of accuracy when there is repetition of the work in project.

→ * helps to estimate the reduction in time due to repeating the same activity.

→ **Improvement ratio:** rate of effectiveness increase over time, often measured by the rate of reduction in time & cost.

$$\text{Improvement Ratio} = \frac{\text{New time}}{\text{Old time}} \times 100\% \quad \begin{array}{l} \text{as ratio decreases} \\ \text{more improvement} \end{array}$$
$$= 100\% \text{ (no improvement)}$$

* how learning curves help in better estimation?

What activities have improvement capability?

→ manual labor work that is complex. (as complexity ↑ improvement ↑)

D-Function Point Method:

→ Used for software and system projects.

Function point: variable that represents time or anything or activity that represents time.

→ system analyst agrees with customer to define elements that are needed, later on converted to function points

Assignment 2

* Complexity ~~like~~ Weighing *

(** for example)

Element	low	Avg.	high	Total
* of input	$n \times 2$	$n \times 4$	$n \times 1$	A
* of output	$n \times 3$	$n \times 5$	$n \times 2$	B
* of inquiries	$n \times 4$	$n \times 2$	$n \times 4$	C
* of files	$n \times 5$	$n \times 3$	$n \times 6$	D
* of interfaces	$n \times 6$	$n \times 2$	$n \times 5$	E
				=

ex: (3) Project X T

element	n	low	Avg	high	Total
input	10				
output	20				
inquiries	10				
files	30				
interfaces	50				
= 120 function points.					

5 function points = 1 person/month, 6 people on proj.

A - estimate for 1 proj. (time): $1 \times \frac{\text{total function points}}{\text{total * of people}}$

$$1 \times \frac{120}{6 \times 5} = 4 \text{ months}$$

B. 20 people? $1 \times \frac{120}{20 \times 5} = 1.2 \text{ months}$

D. 6 month = $\frac{120}{5 \times x}$ $x = 4 \text{ people.}$

2] Micro estimation Approach:-

→ a detailed estimation of all workpackages in the work breakdown structure. (more accurate than macro).

⇒ How is it done?

1] ask people responsible for conducting the workpackages

① → most knowledgeable of workpackages and its value.

so judgement is based on experience.

↳ tied to their estimation (تقديرهم)، held accountable.

② → judgement using parametric methods. (not for all activities).

2] ask more than one person to do the estimate (under normal conditions)

3] ask team to asses risk based on low/Avg./high estimate.

low: optimistic

Average: Normal

high: pessimistic

(الأفضل الأحوال) estimate -

Conditions (most likely)

estimate. (الأسوأ الأحوال)

→ taken from several estimators -

1 → Take consultations from different estimators (L / Avg / H)

2 → Take the average value of all 3 parameters.

Average Low, Average of Averages, Average high

3 → Calculate Range = Average high - Average Low

4 → Calculate Average = Average of Averages.

Ratio = $\frac{\text{Range (3)}}{\text{Average (4)}}$

as the value of the range increases, the more variability between estimators there is, so:

→ more factors affecting the workpackage (more risks).

Types of Cost:-

PM 8

[1] Directed Cost: Directly related to a specific workpackage.
① material ② Labor ③ Equipment

[2] Direct Overhead Cost: Directly related to a specific project
"a percentage" of the direct cost.

[3] General & Administrative Overhead Cost (G & A):
Costs that are related to the company that works
on the projects.
→ Percentage of (Direct overhead cost + Direct Cost).

→ Project managers usually use direct cost for estimation.

ex./ Direct = 80,000 \$

Direct overhead = 25% of DC = 20,000 \$

Total Direct Cost = 80,000 + 20,000 = 100,000 \$

Cost A Cost = 20% of total cost = 20,000 \$

Total cost = 120,000

Add profit ↗

then give to customer Total Bid.

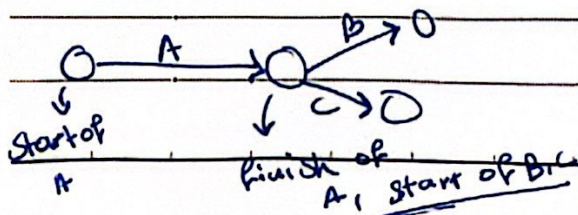
CH6: Developing Project Network.

→ Work packages don't show interrelationships / interdependency.
↳ Activity here and on.

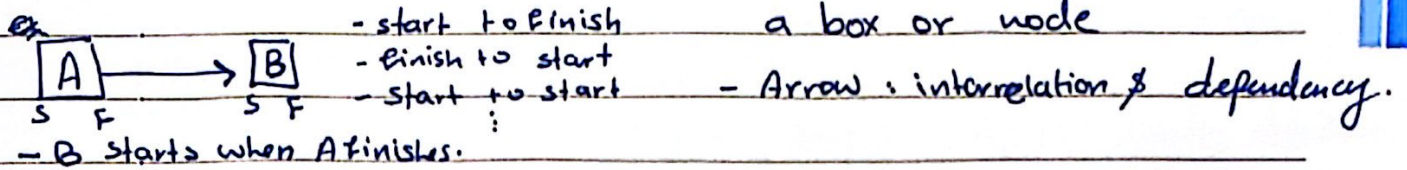
Project Networks:- a visual flow diagram that shows the sequence & interdependency between activities of a project.

* 2 Techniques to develop Project Network:-

[1] Activity on Arrow: (AOA) - activity represented by an arrow
- node represent a point in time and event



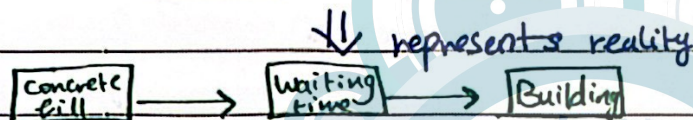
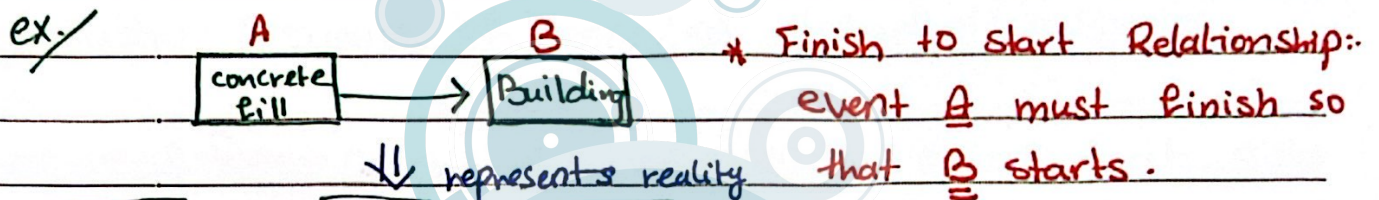
[2] Activity-on-Arrow (AOA) activity is represented by



PM 9

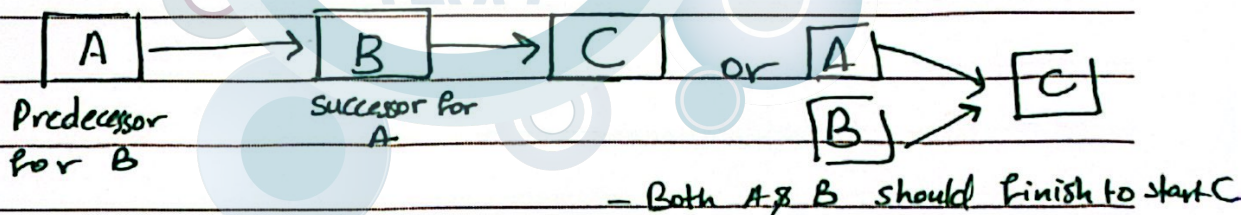
→ **Activity**: element that represent actual time or work.

* activity represent workpackage (short time task that consumes resource).

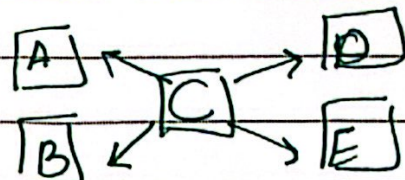
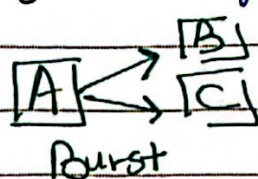


↳ separation by waiting time?! to avoid wrong estimations in time & cost (increase).

→ **Merge Activity**: an activity that has more than 1 predecessor

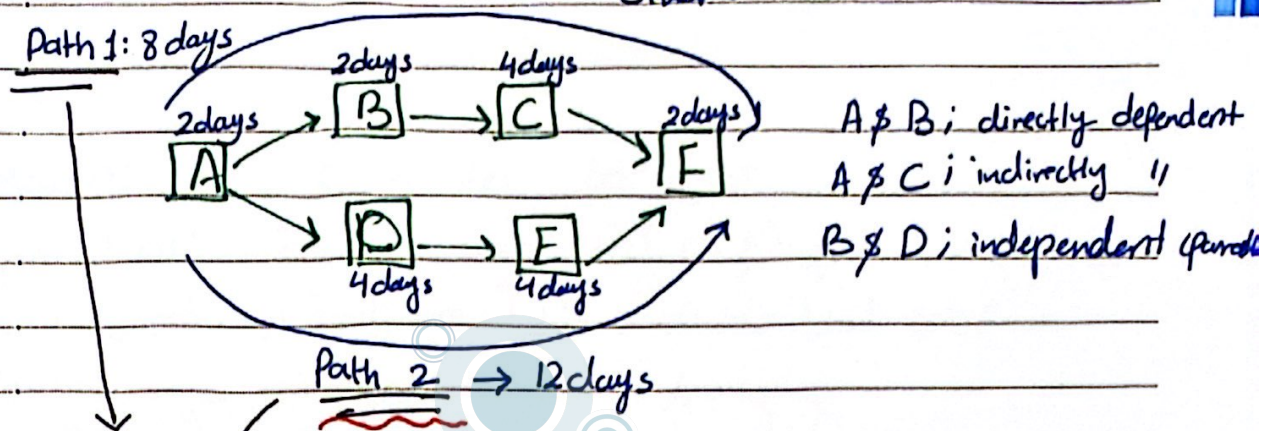


→ **Burst Activity**: activity with more than one successor.



Burst & Merge.

→ **Parallel Activity:** activities that are independent of each other.



→ **Path:** sequence of connected dependent activities.

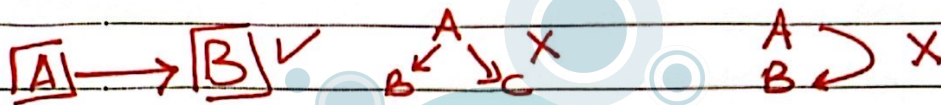
→ **Critical Path:** longest duration path in a project that gives the minimum duration of the project. (Path 2)
(we should have at least 1 critical path.)

→ **Event:** a specific point in time (start or finish).

Basic Rules of Developing Project Network:-

[1] Network Flows from left to right

بالمصالحان لديم اشرح حجم الرصة عشان الهم مصنف
يرجع لورا والدتجاه دايماً من السخال للمين

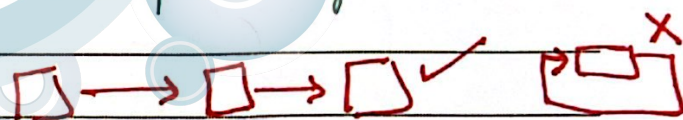


[2] An activity cannot begin until all preceding connected activities have been completed.

[3] Arrows or network indicates precedence & flow; arrows can cross each other «doesn't mean anything»

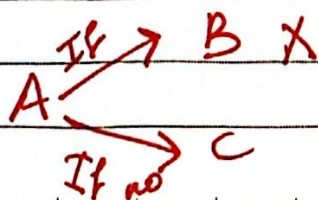
[4] Each activity must have a unique identification number that is larger than all preceding activities.

[5] Looping isn't allowed



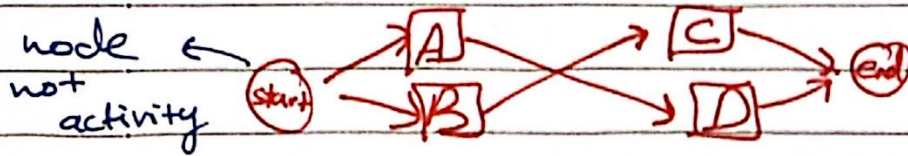
[6] Conditional statements are not allowed ??

→ because we assume normal conditions or what will be done in the project (normal → successful).



- You can come up with an alternative network "conditioning plan" (used in Risk management).

[8] IF there are multiple starting nodes, (same goes for end), use a common starting node



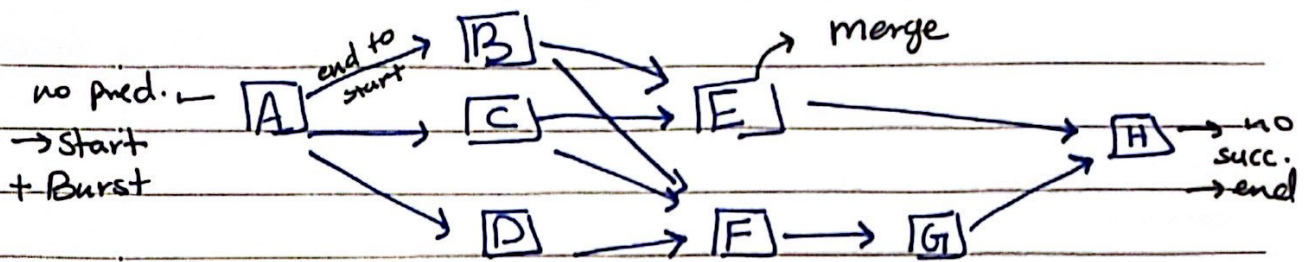
Precedence Table: a table that organizes activities & relationships in order of sequence in (preceding activities).

* The work package in WBS is the activity in the precedence table usually 1 wp = 1 activity.

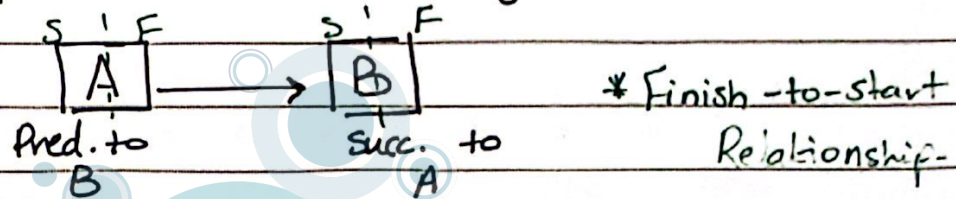
→ the project team discusses which activities that have no starting constraints and choose them as start.
Then specify preceding activities.

ex.

Activity	Description	Preceding Activity	Time
A	Approval	none	5
B	Constructing Plans	A	15
C	Traffic Study	A	10
D	Availability	A	5
E	Report	B, C	15
F	Commission Approval	B, C, D	10
G	construction	F	170
H	Occupancy	E, G	135



⇒ usually precedence table is given

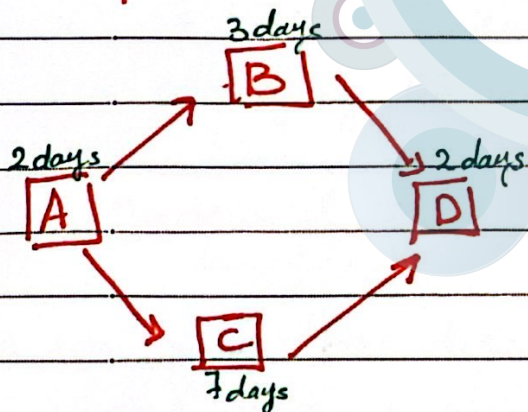


→ Sometimes defining starting activities is easy due to previous activities & experience; or hard if the project is done for the first time.

→ In most cases, each activity is made up of one work package.

Example (2):

PM 10



* Two Passes:

- Pass-1 (A-B-D) = 7 days

- Pass-2 (A-C-D) = 11 days

main duration. ←



longest * of days

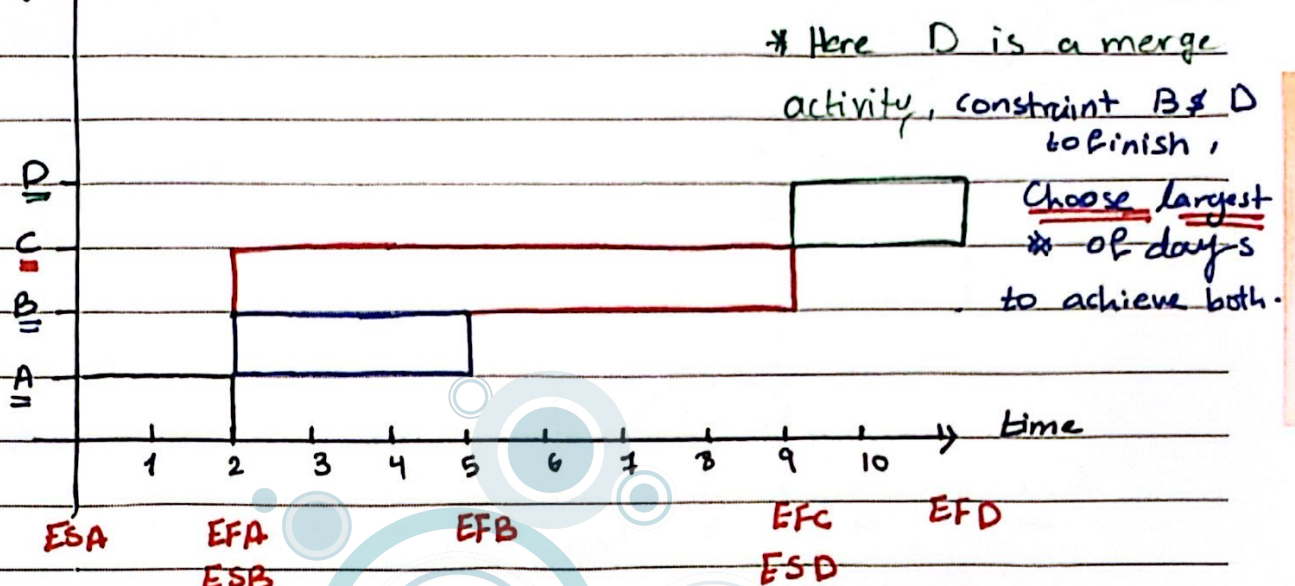
→ min. * of days

for proj. to be close

critical path method.
(CPM): ①

* **Forward Pass Calculations:-** (early start, early finish, duration)

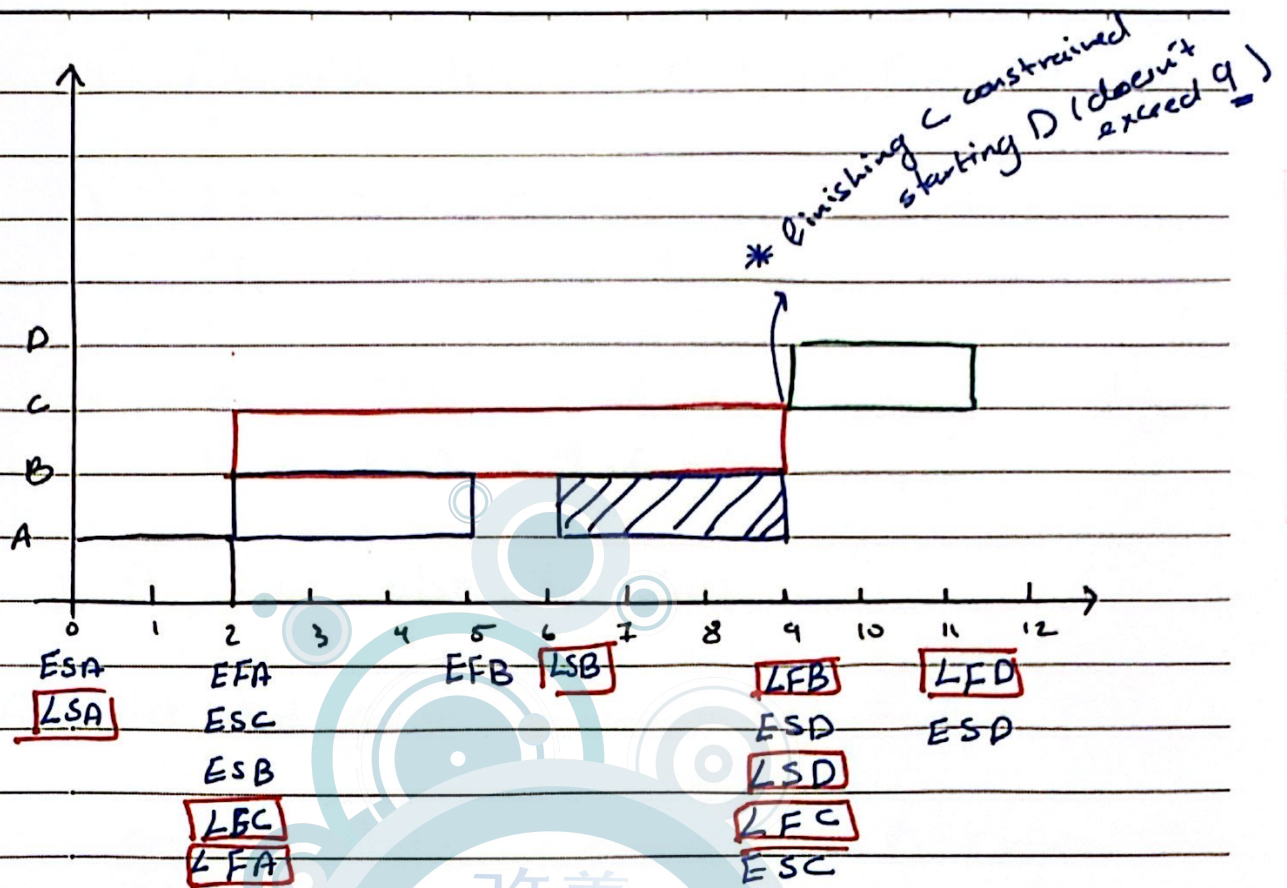
Activity ↑ Grant's Chart.



- Time constraint:
- ① Earliest time to start A? At time zero, (has no constraints)
 - ② Earliest time to finish A? 5, (ES_A + duration 5 days)
 - ③ " " start B, C? 2, (EFA)
 - ④ " " finish B? 5, (EFA + duration 3 days + ESB)
 - ⑤ " " finish C? 9, (ESC + duration 7 days).
 - ⑥ " " start D? 9, (EFC) * look note.
 - ⑦ " " finish D? 11, (ESD + duration 2 days).
- * when specifying ES and EF, constraints should be considered.

② * **Backward pass calculations:** (Latest finish, latest start, duration)

⇒ we need to define the latest time an activity can start without exceed min. time of project.



- ① Latest time to finish D? At time 11, not exceed Proj. duration.
- ② " " " start D? At time 9, $LSD = LFD - \text{duration} (2)$.
- ③ " " " finish C? " " 9, * look note.
- ④ " " " start C? " " 2, $9 - 7 = 2$ ($LFC - \text{duration}$)
- ⑤ " " " finish B? " " 9, it constrained start of D
- ⑥ " " " start B? " " 6, $9 - 3 = 6$ ($LFB - \text{duration}$)
- ⑦ " " " finish A? " " 2, $LSB = 6$, $LSC = 2$ choose smallest
- ⑧ " " " start A? " " 0, $2 - 2 = 0$ ($LFA - \text{duration}$)

* **Slack**: Allowable delay to start or finish the project.

on (A) $LSA - ESA = 0 - 0 = 0$ no allowable
 $LFA - EFA = 2 - 2 = 0$ slack

on (B) $LSB - ESB = 6 - 2 = 4$ slack = 4 days.
 $LFA - EFA = 9 - 5 = 4$

C & D have also zero slack.

→ Activities that cause unallowable delay? A, C, D.

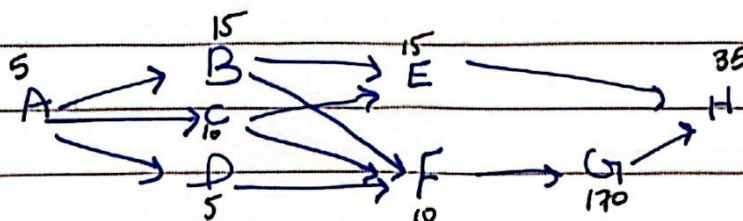
so → Path A → C → D Critical Path
path A → B → D not critical.

* **Critical Path**: includes the start & finish activities with a slack of zero (~~zero~~)

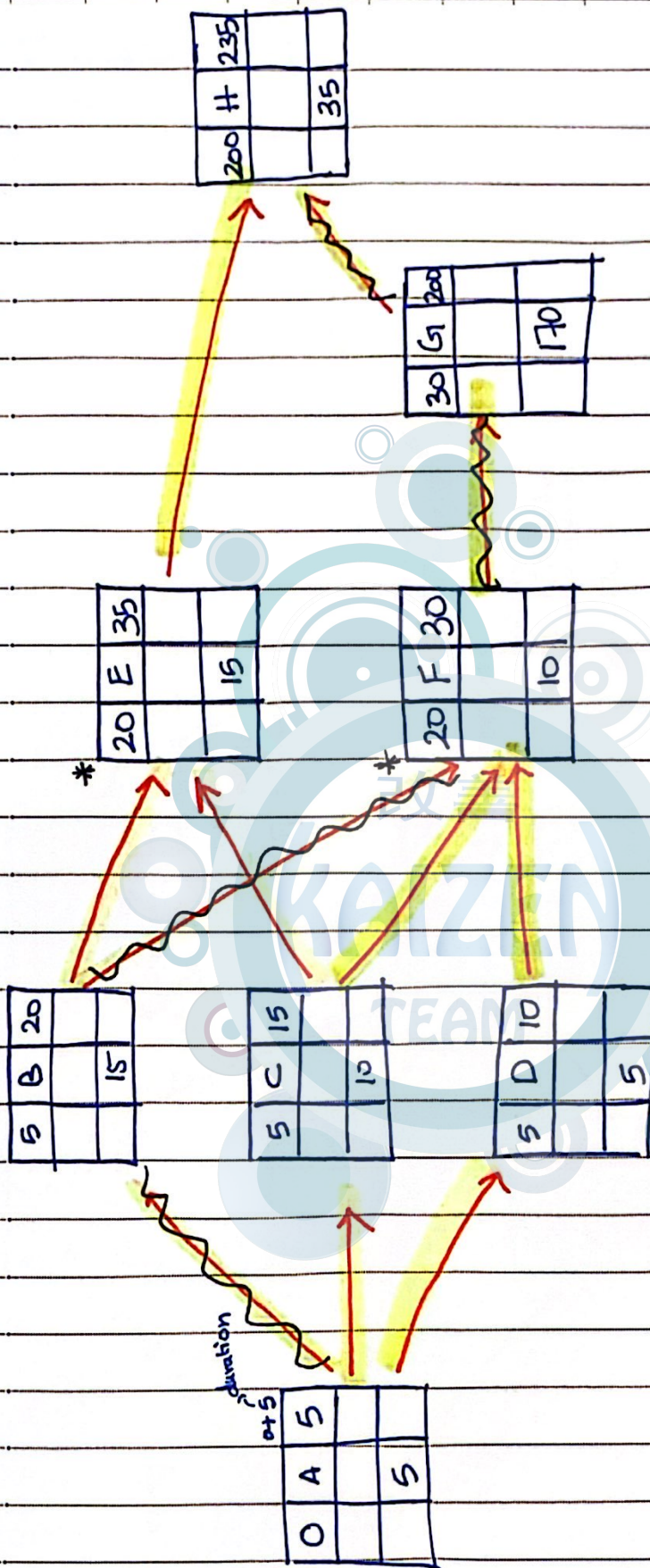
Look Example 1 Precedence table :-

PM II

ES	ID	EF
slack		slack
LS	Duration	LF



* Forward Calculation: (ES, EF, duration)



* ES & F are merge activities, we take the target of days preceding it.

* Project Duration = 235 days

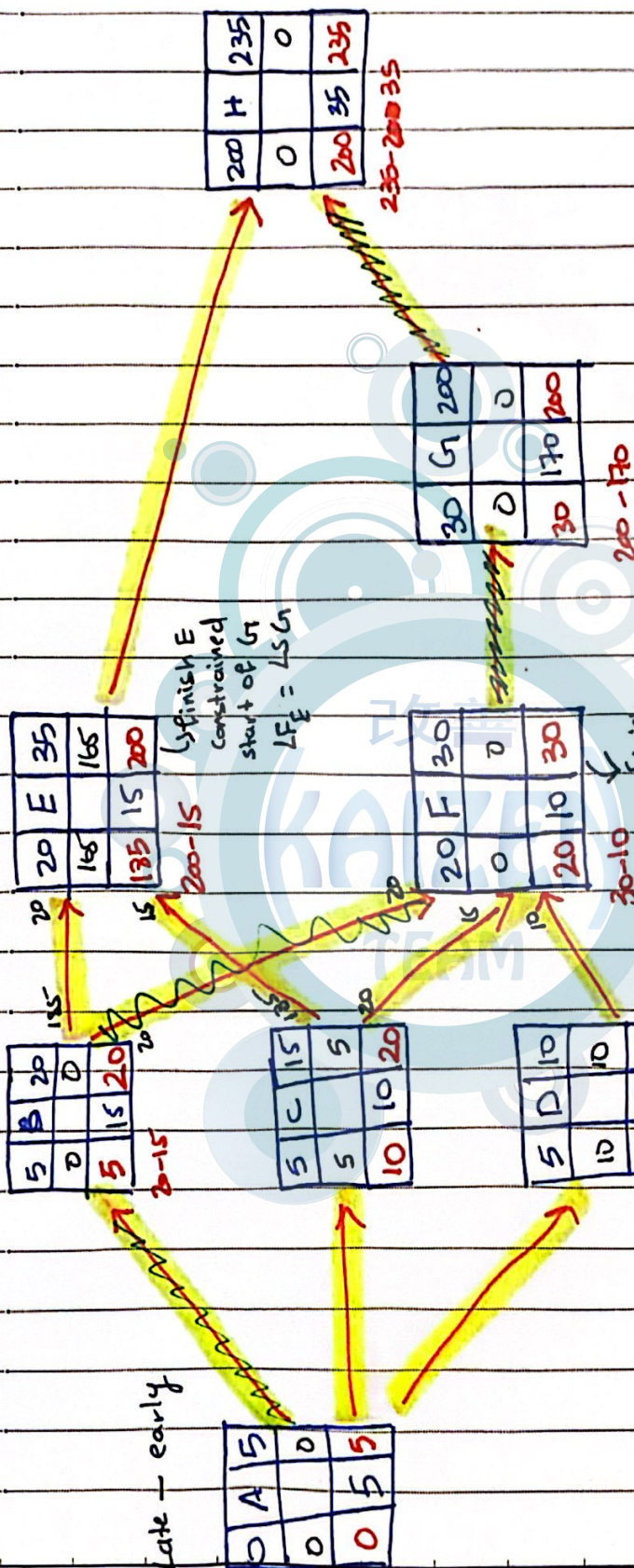
* Each Project at least has one Critical Path.

(A-B-E-H)
min. Proj. Duration

* Backward Pass Calculation: (LS, LF, duration) not exceed

PM 12

each Finishing activity has it's Late Finish = it's duration.



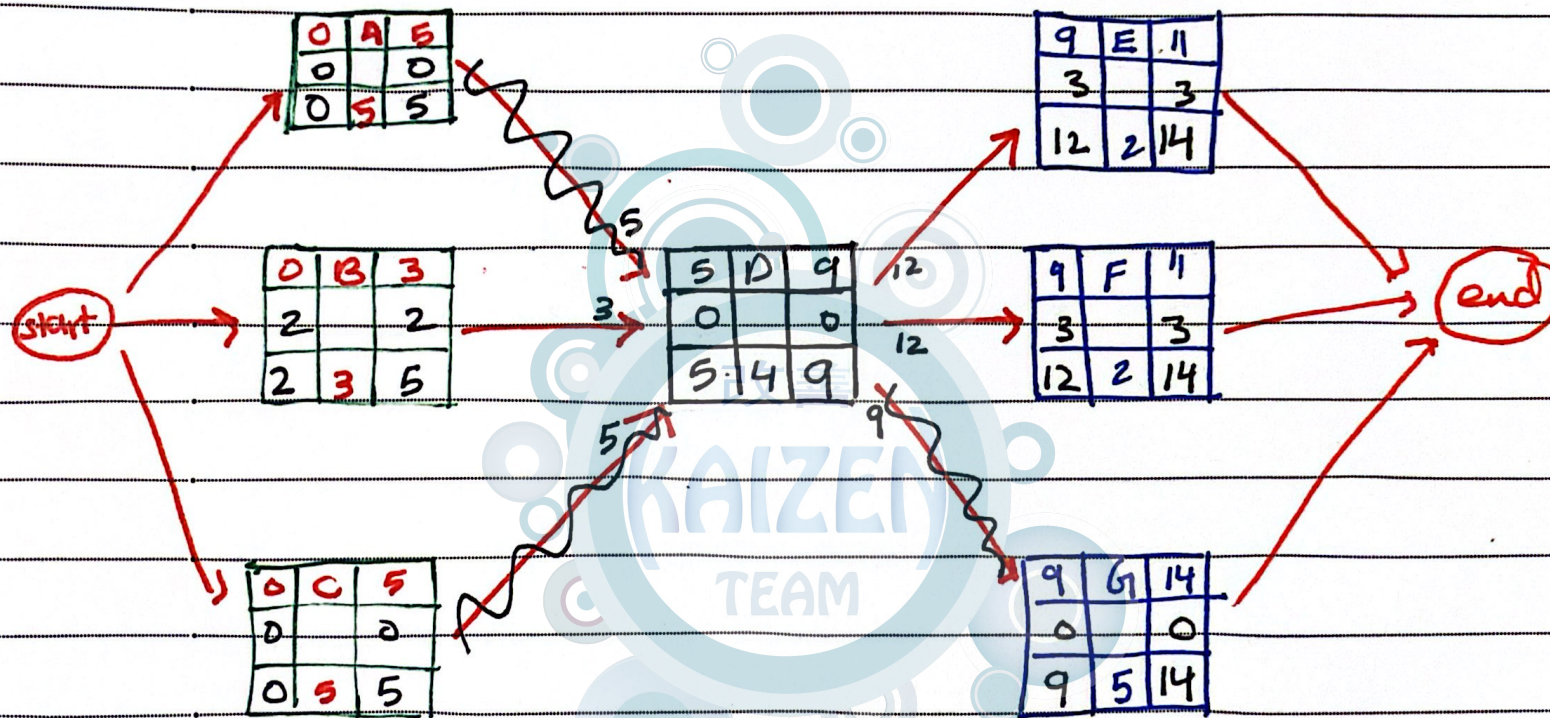
* on merge activity, Choose smallest * of days.

* Critical path → sequence of critical events (A-B-E-H)

arrows → relationships → technical & logical constraints

start till Finish (Jointed: joining to start)
 critical path

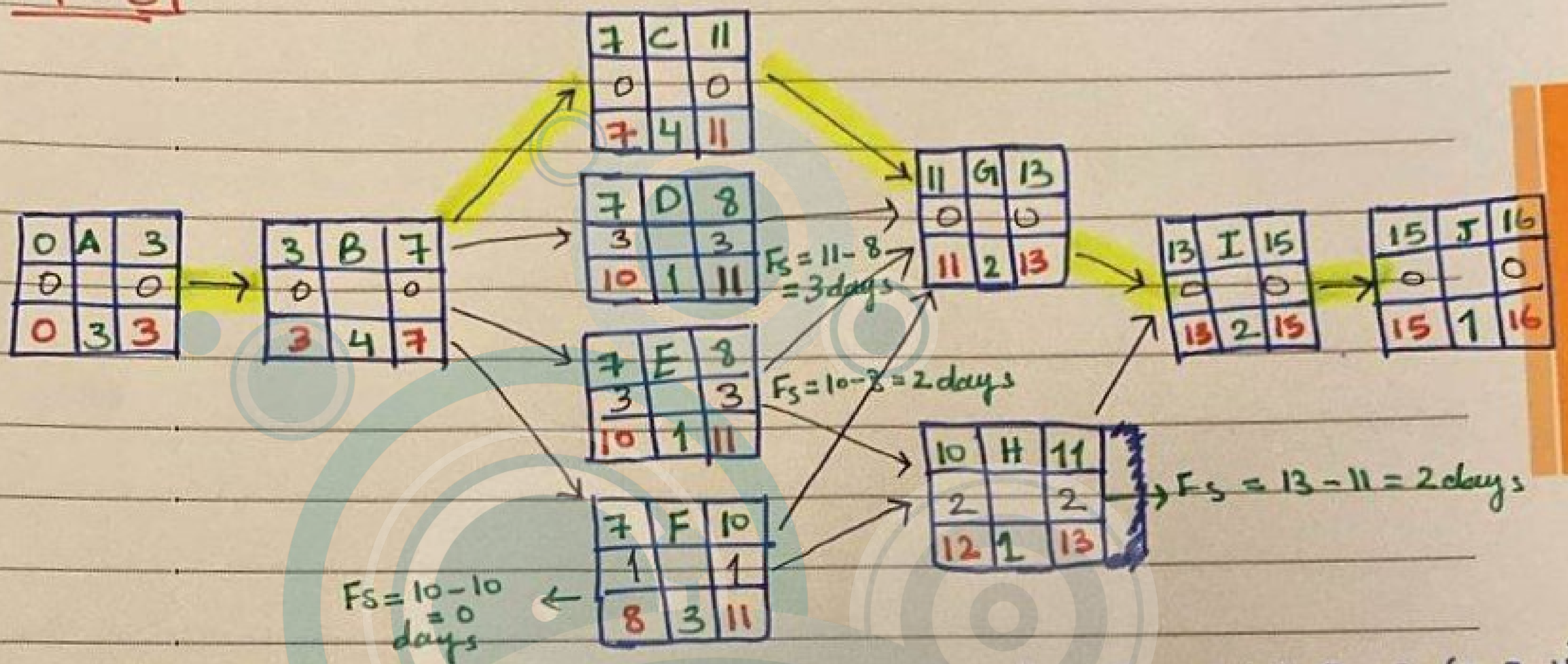
ex: (3)



* of Paths = 9

* of Critical Path = 2 → $\frac{10}{14} = 14$

Q-8



* of paths = 6 paths * of CP = 1 (A-B-C-G-I-H)

FS = free slack
 FS = total slack

* 2 types of Slack:-

1- **Total slack**: allowable delay to start or finish an activity without exceeding the min. duration of proj.

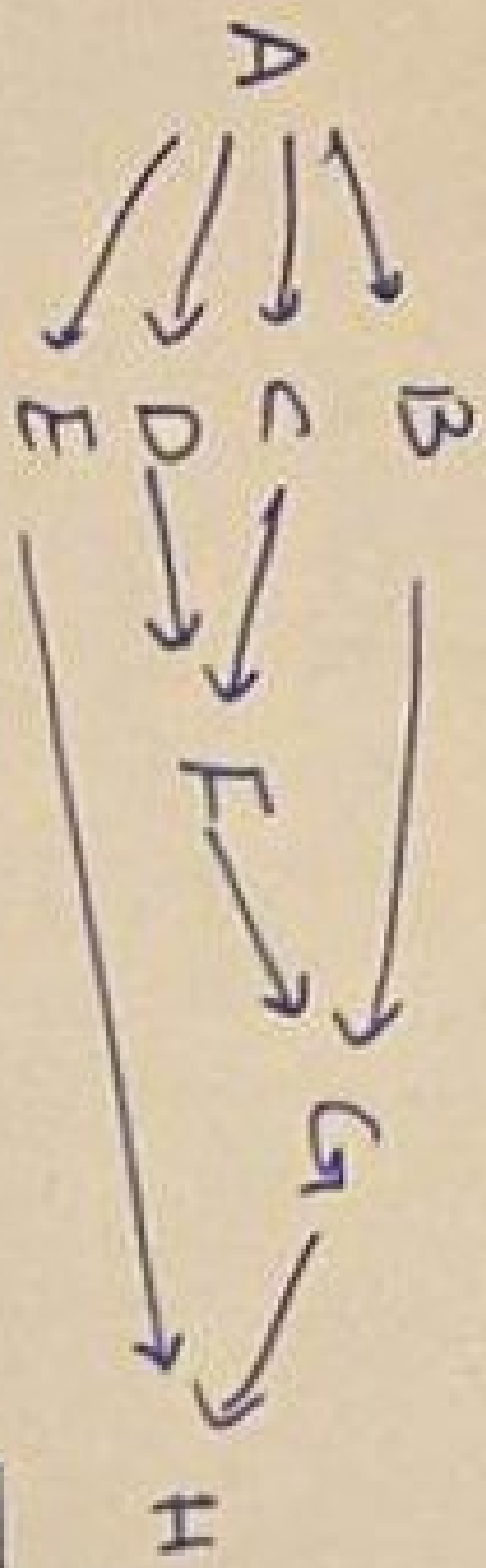
2- **Free slack**: allowable delay to start or finish an activity without affecting the successor's activity.

* If we have an activity with zero total slack, then Free slack will also be zero. $[F_s \leq T_s, F_s = 0, \text{never } F_s > T_s]$

* if only one successor: $F_s \text{ activity} = ES_{\text{successor}} - EF_{\text{activity}}$

* multiple: calculate for both & choose min.

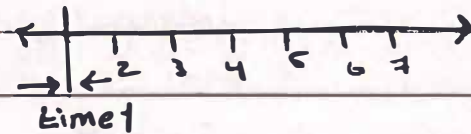
Q1 Assignment 3 *Learn How to* 0206111



* of Paths: 4

* of Critical paths: 1 (A-D-F-G-H)

* Calendar Dates:- E_s & E_f are points in time & are needed to be set into calendar dates.

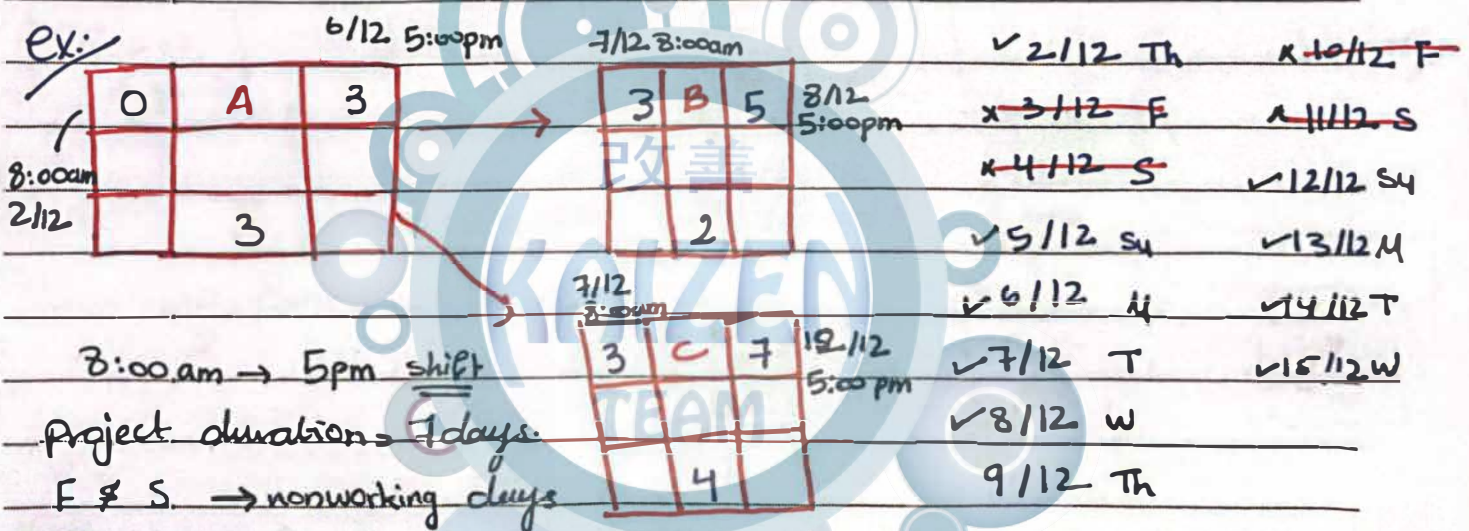


* Time 1 $\rightarrow$ end of 1 & start of 2

$\rightarrow$ Usually When the duration of the project is determined, we remove the ~~xx~~ of non working days when setting the calendar dates.

$\rightarrow$ Work shift is also taken into consideration.

ex:



* Techniques used to make proj. networks closer to reality.

- 1 Laddering
- 2 Use of lags on different relations
- 3 Hammocks activity.

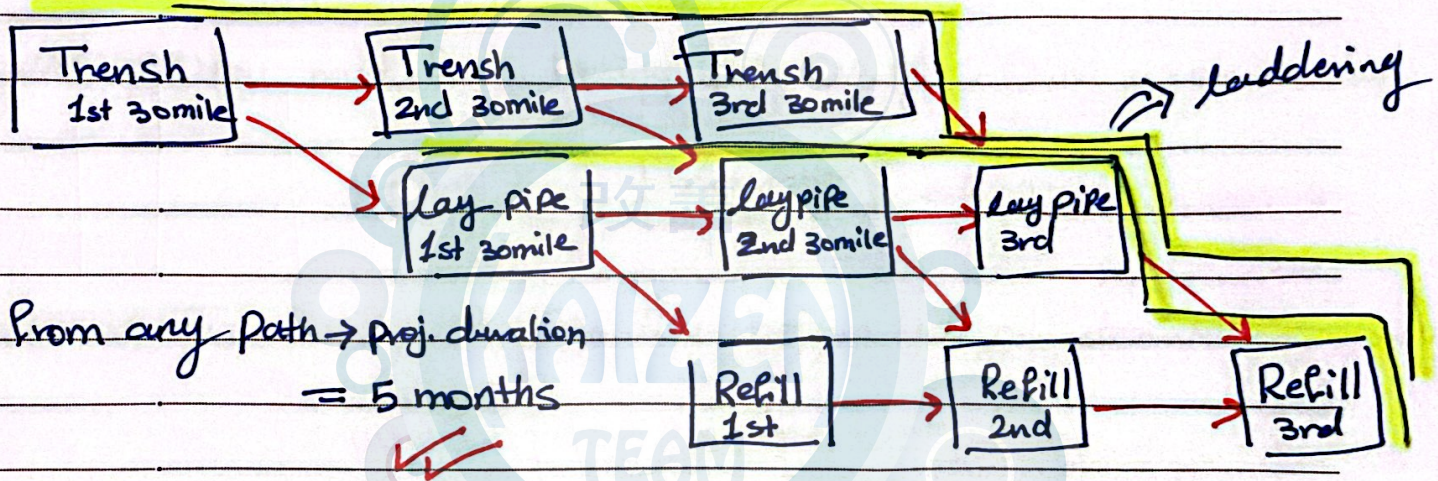
$\Rightarrow$ In reality, finish-to-start relations aren't always useful since not all works need to be done when the preceding activity is done.

1 Laddering:- to divide long duration projects into sections of shorter durations in a ladder like way.

ex: Pumping waterline for 90 miles needs 3 activities. ① Trench ② lay pipe ③ Refill
90 mile, 3 months 90 mile, 3 months 90 mile, 3 months

XX Trench → lay pipe → Refill Proj. duration = 9 months.
(Finish-to-start)

⇒ Divide each activity into subactivities of 30 miles, 1 month.

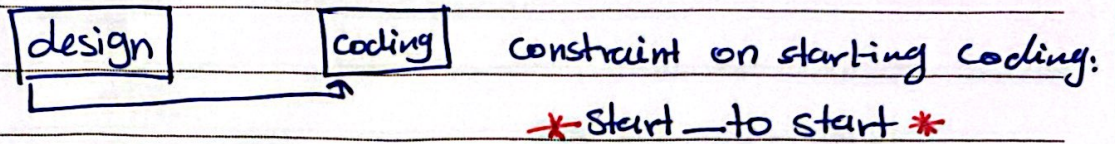


2 Use of Lags in Different Relationships:-

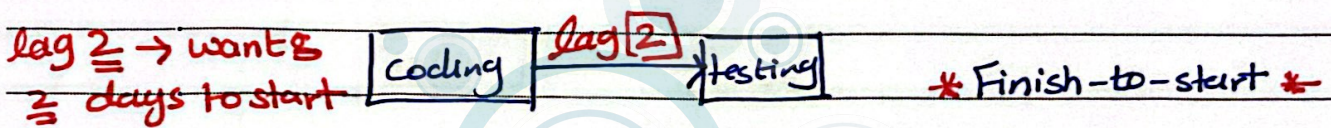
→ we need to understand that the process of building a project network with more closeness to reality depends on understanding the reality itself & choosing the relationship that represents it, then drawing the project network.

* types of relationships depending on dependency btw 2 activities:

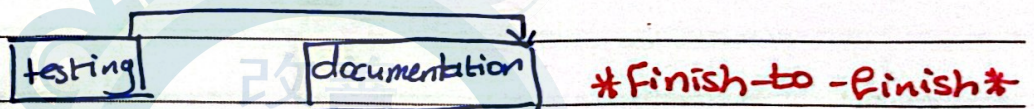
Case 1: You must start design stage before coding stage.



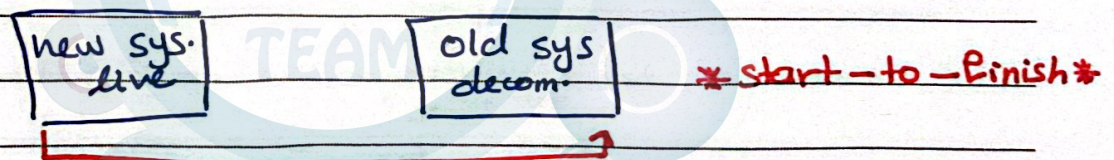
Case 2: You must Finish coding before you start testing.



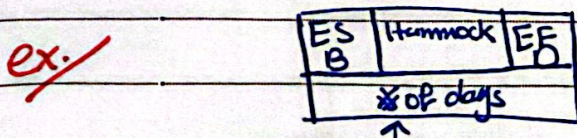
Case 3: You must Finish testing before you can Finish documentation



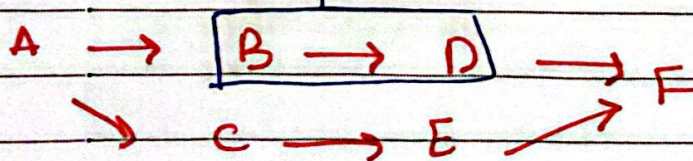
Case 4: The new sys. must go live before you can decommission old one.



3 Hammock Activity: sometimes resources need cost & have no estimated & rather depends on the segment of the Proj. network.



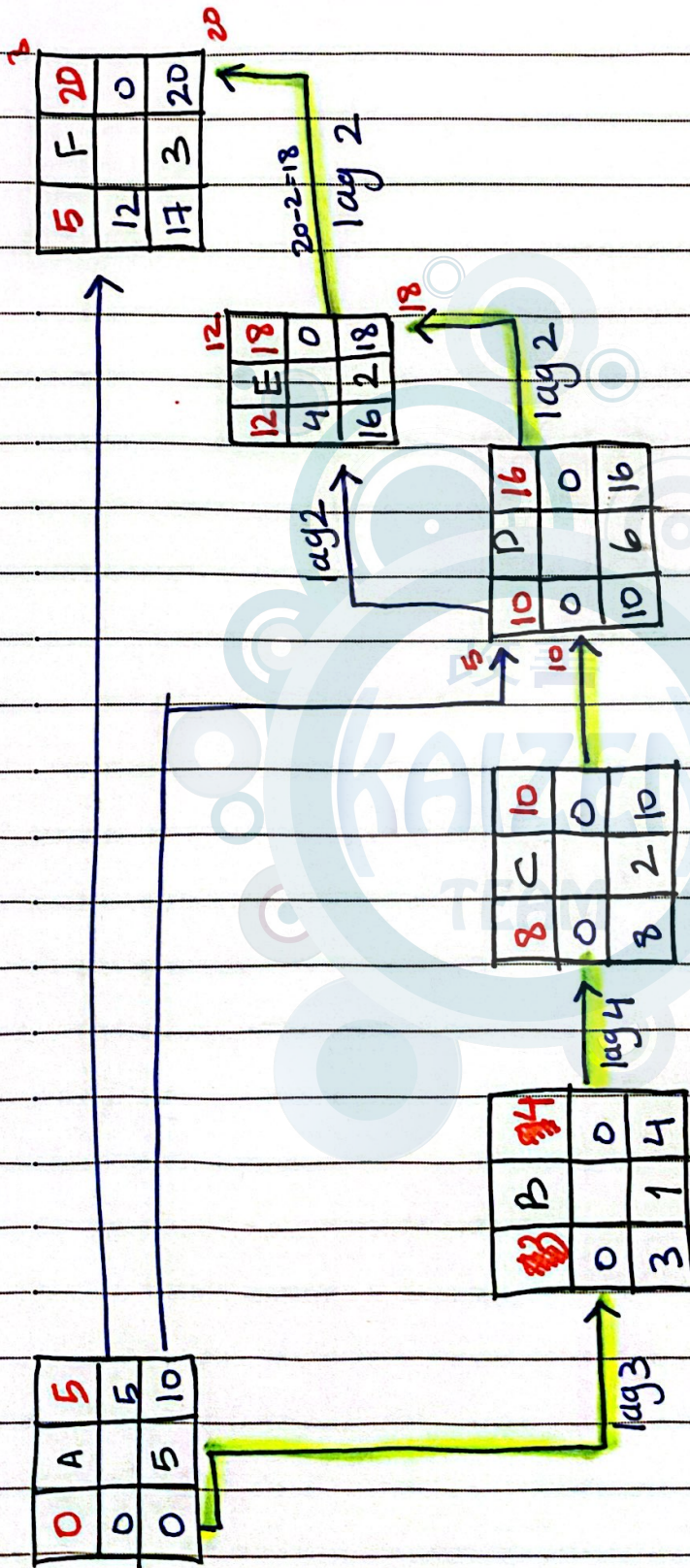
→ consultant advises as long as B & D are on.



∴ to represent his work, hammock activity is used with Es & Ef after FPC.

segment نهاية

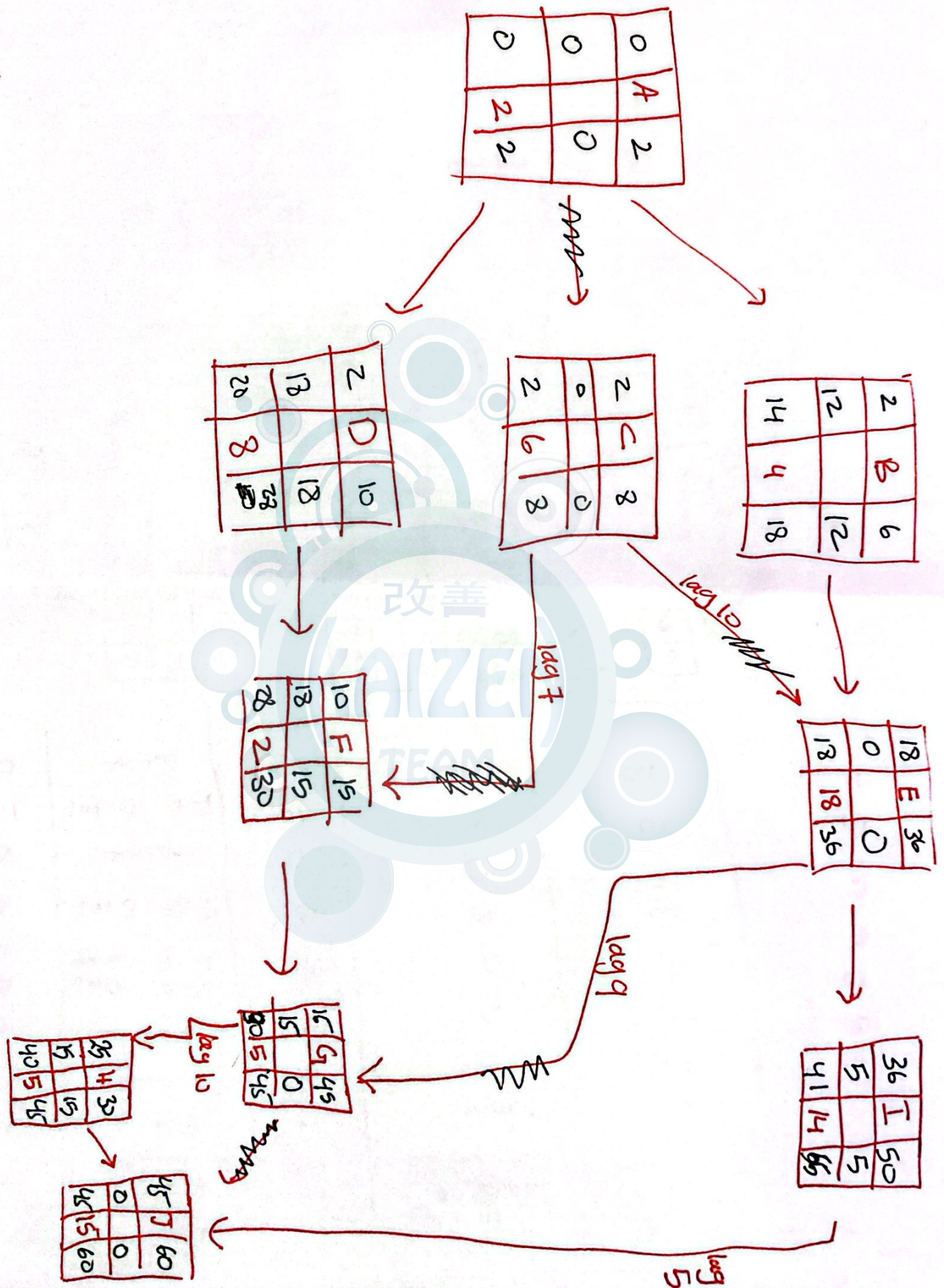
* Forward & backward pass calculations on Different relations.



1 Critical path

* of paths = 5

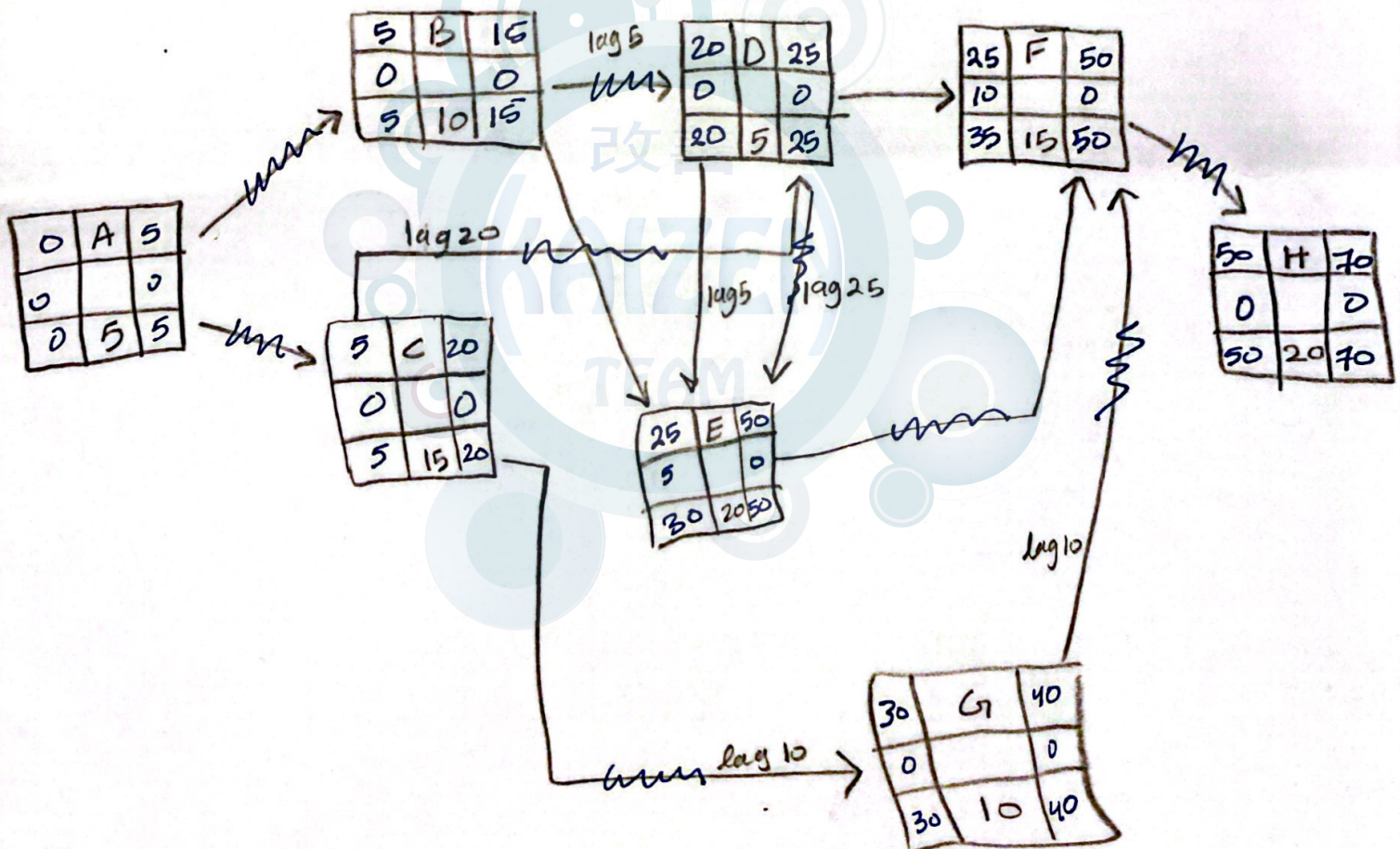
Assignment Pm:-



example

18/4/2024
Thursday.

Activity	Duration	Finish to start Predecessor	F-S lag	Lag relations	lag
A	5	None	0	None	0
B	10	A	0	None	0
C	15	A	0	S-F → C to D	20
D	5	D	5	S-S D → E F-F D → E	5 25
E	20	B	0	F-F E to F	0
F	15	D	0	None	0
G	10	C	10	F-F G to F	10
H	20	F	0	None	0



Risk management:-

23/4

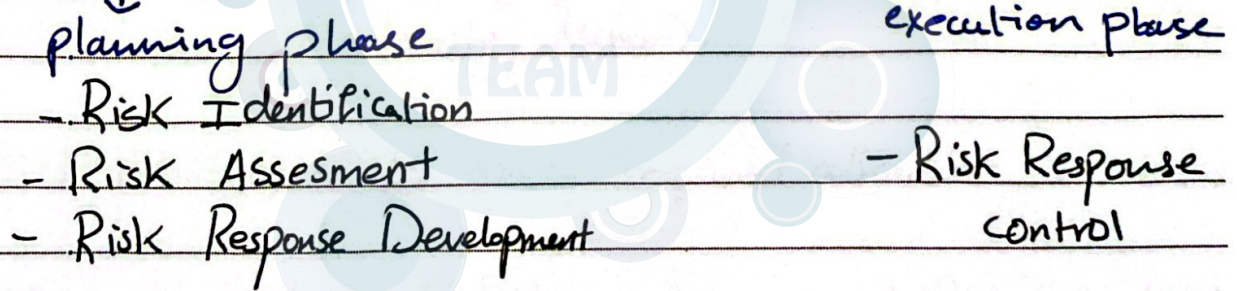
Risk management is done in the planning phase for uncertain conditions; Risks are on events not on consequences

* Uncertainty causes risks, these risks might be positive (opportunity) risks or negative (Threats)
take eliminate

→ consequences are on time, cost, performance.

* Risks could be → External: not controlled: (weather, regulation, employees, planning) ← Internal: controlled by team & proj. manager

* Risk management is done on
2 Phases:



* **Risk Identification:** to identify all possible risks that might happen to the project "on event".

→ **Micro risks:** on a specific activity **Macro risk:** on whole proj.

* **Tools Used:** ① Brainstorming ② Delphi method ③ WBS
④ Risk Profile ⑤ Risk Breakdown Structure ⑥ Experience

→ **Risk Profile:** Set of questions tailored depending on the type of the project, whose answers give an indication of risk occurrence. [For main categories].

→ **Risk Breakdown Structure:** hierarchical representation of risks organized by categories; helps prioritize and identify risks for an organization or a project.

⇒ **Output of Risk Identification:** List of known Risks. as (Major, Moderate, Minor).

* **Risk Assessment:** to assess required attention to risks.

1.1 **Scenario Analysis:** ① Risk Form Assessment ② Risk Severity Matrix
③ FMEA

to ask several questions that gives a "scenario Analysis" of the happening of the risk.

25/4

EX: assessment of 4 potential risks when updating windows sys.

- 1 answer questions:-
- ① what is the impact of this risk? ^{severity}
 - Probability of occurrence ← ② " " " " likelihood " "
 - Magnitude of severity ← ③ " " " " difficulty of detection
 - detecting before happening ← for this risk?
 - what time or activity ← ④ when may this risk happen?
 - ⑤ what happens when this risk is materialized?

- Risk assessment Form

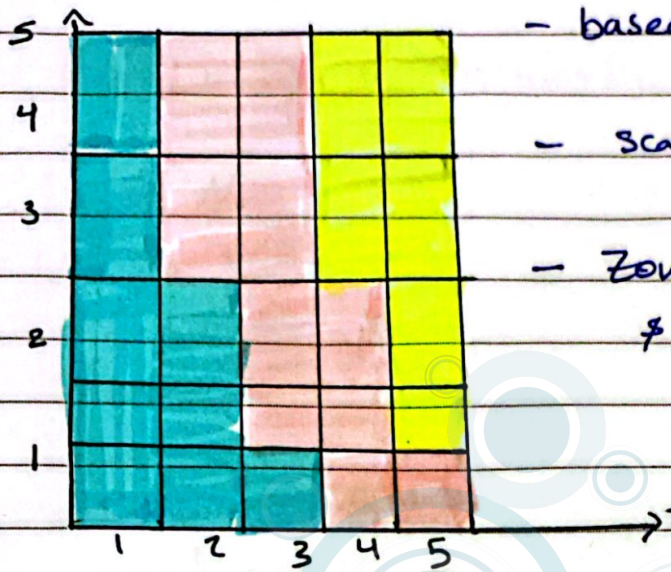
Risk	likely hood	impact	Difficulty detection	when	Risk Value
Interface Prob.	4	4	4	conversion	64
Sys. Freezing	2	5	5	startup	50
User backlash	4	3	3	Post install	36
Hardware Prob.	1	5	5	instaktion	25

- this also needs severity matrix (this scale is 1-5)

- Risk Value Zoning For FMEA

1-40	minor
41-80	moderate
81-120	Major.

- Risk severity Matrix



- based on likely hood & impact

- scale also (1-5)

- Zones of Major, Moderate & Minor Risks

detection for FMEA

- FMEA : Failure mode & effect Analysis.

risk value = likelihood x impact x Difficulty of detection

→ the higher risk value, the more major of a risk it is

$$\text{min} = 1 \times 1 \times 1 = 1$$

$$\text{max} = 5 \times 5 \times 5 = 125$$

(1-5 scale)

[2] Semi quantitative Scenario analysis.

assigning numerical values in percentages to Impacts by → increase cost 15% (ex.)

[3] Probability Analysis:

⇒ **PERT Technique:** "Program Evaluations & Review Technique"

CPM

- depends on knowing estimated duration - time & dependencies

- constant duration based on normal conditions

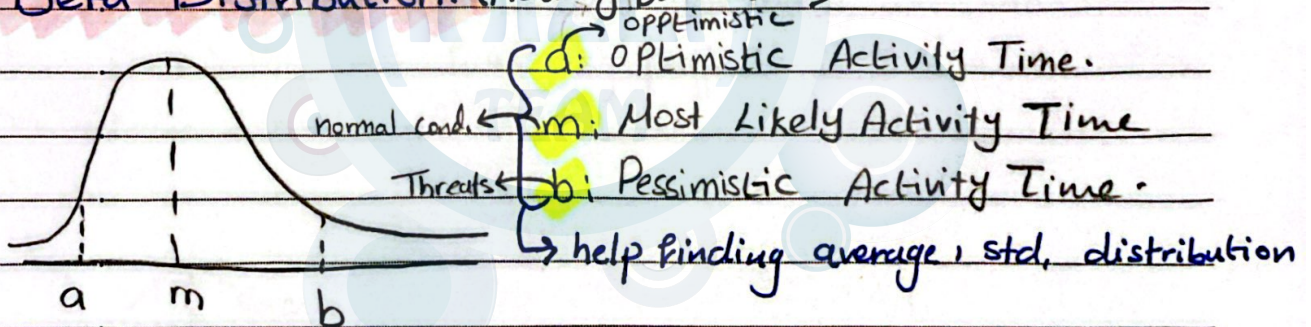
- Plans depend on CPM & is built on fixed values

PERT

- duration of activity not constant, follows **Beta Distribution**.

- Plans don't depend on PERT, gives an indication of the risk & helps define different probabilities of Project's duration.

* **Beta Distribution: (Activity duration)**



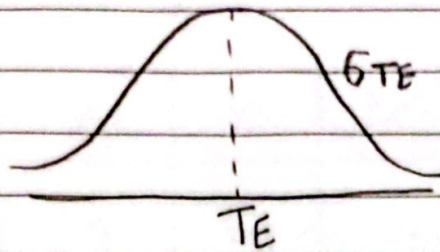
$$t_e = \frac{a + 4m + b}{6}$$

↙ weighted average activity time

$$\sigma t_e = \frac{b - a}{6}$$

↙ std of activity time

* Normal Distribution: - (Project Duration).



- T_E : average project duration - σ_{TE} = std of proj. duration

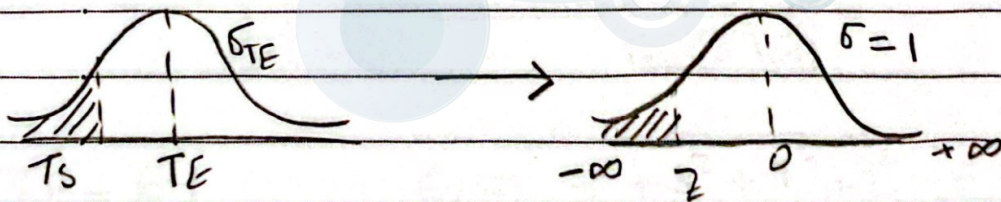
$$T_E = \sum t_e \quad (\text{activities on one of the critical paths})$$

$$\sigma_{TE} = \sqrt{\sum \sigma_{te}^2} \quad \text{on all activities on all critical paths}$$

↳ this is the activity

$$Z = \frac{T_s - T_E}{\sigma_{TE}}$$

⇒ follows normal distribution so that we can study the probability of finishing project before, at, or after a certain time.

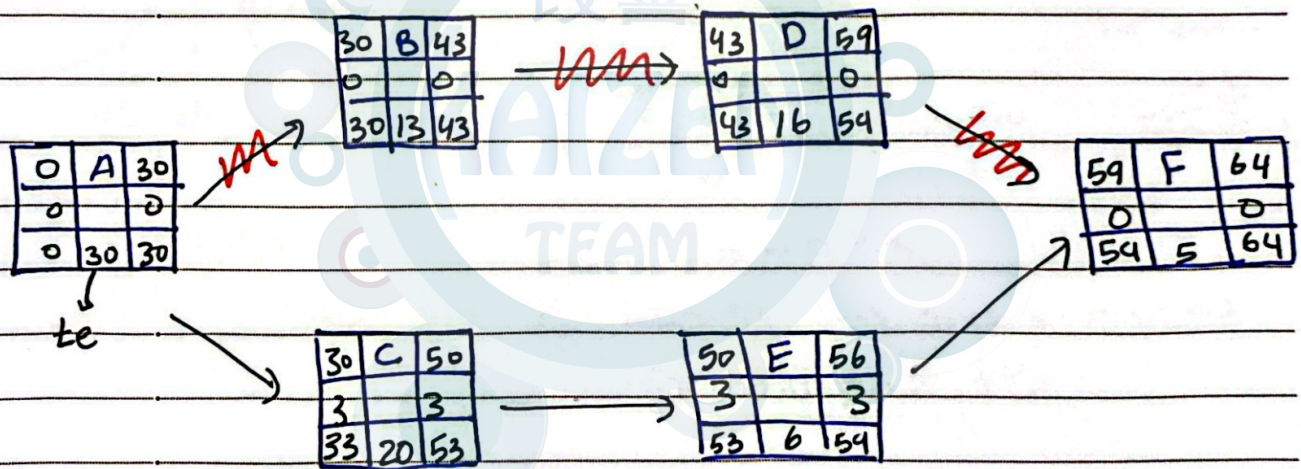


Example:-

ID	a	m	b	$t_e = \frac{a+4m+b}{6}$	σ_{t_e}
A	17	29	47	30	5 ✓
B	6	12	24	13	3 ✓
C	16	19	28	20	2
D	13	16	19	16	1 ✓
E	2	5	14	6	2
F	2	5	8	5	1 ✓

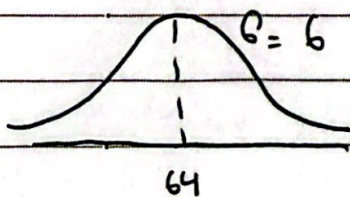
$\bar{T}$ used as duration of activity

$TE, \sigma_{TE} = ? \Rightarrow$ should know Critical Path



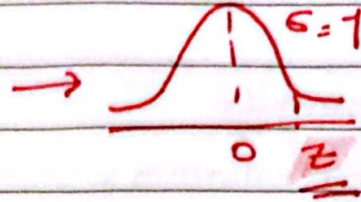
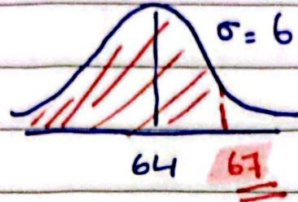
$$TE = 64$$

$$\sigma_{TE} = \sqrt{5^2 + 3^2 + 1^2 + 1^2} = 6$$



* What is the probability that the project before a scheduled time (T_s) of 67

$$z = \frac{67 - 64}{6} = 0.5$$



area = 0.69 $\Rightarrow$ Probability 69%

* What is the probability that the project will be finished after (T_s) of 62 days?

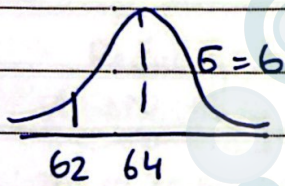
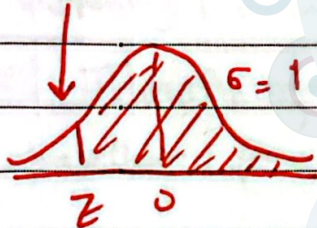


table given in exams the

$$z_1 = \frac{T_s - T_E}{\sigma} = \frac{62 - 64}{6}$$

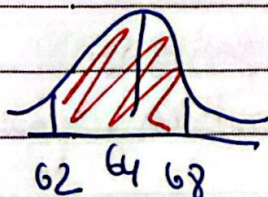
$$= -0.33$$



$$z_2 = +0.33 \rightarrow \text{area} = 0.6293$$

Probability 62.9%

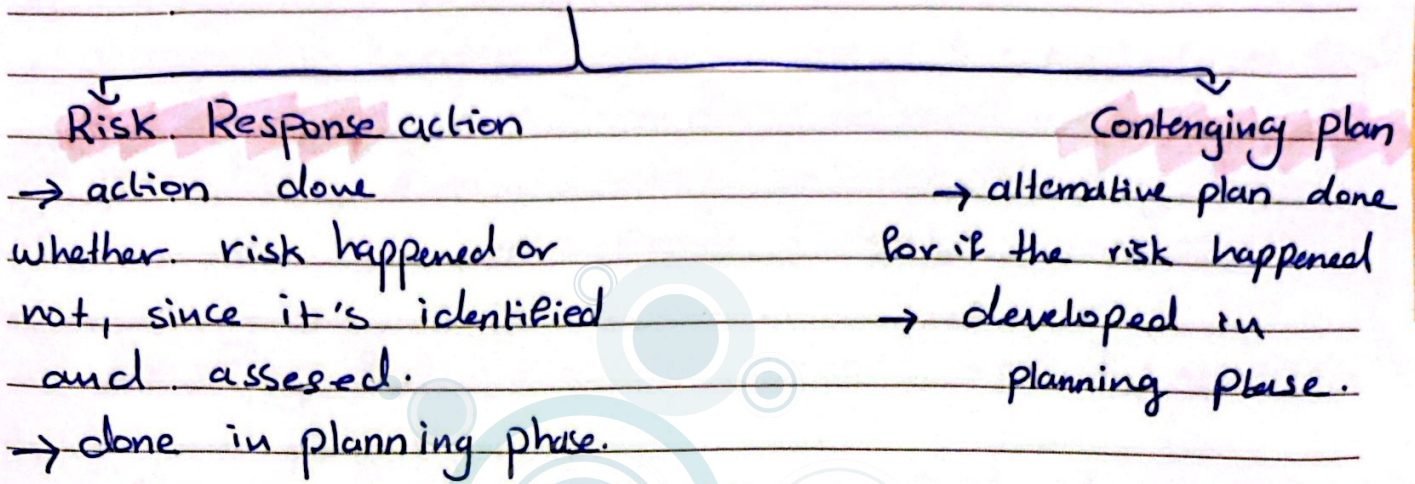
* What is the probability that the project will be completed after 62 & before 68 days?



$$z_1 = \frac{62 - 64}{6} = -0.33$$

$$z_2 = \frac{68 - 64}{6} = +0.666$$

* Risk Response Development:-



* 1: Risk Response Types:-

- A- Mitigating Risk** ^{Reducing} → mitigating impact
action to lower prob. of happening (or impact). → mitigating likelihood
- B- Transferring Risk**: action that transfers risks to another party to deal with it (warranty...)
- C- Avoiding Risk**: Changing the plan itself to avoid.
- D- Sharing Risk**: an action shared between different parties
- E- Retaining Risk**: to take a conscious ^{decision} ~~deciding~~ to do nothing, and to accept to deal with risk when occurring.

ex: Construction project with machine malfunction Risk.
جاذبة

Ⓐ Mitigating risk (Likelihood): continuous maintenance.
→ (Impact): contract with company if it malfunctioned, fix).
"Planned in advance".

Ⓑ Transferring Risk: → warranty package (company deals).
→ insurance package, outsource.

Ⓒ Avoiding Risk: choose another method (استبدال الطريقة)

Ⓓ Sharing Risk: all parties → pool of equipment

* 2: Contingency Plan: - executed if the risk occurs.
and same as normal project plan (Activities / scheduling / budget / ...)
contingency budget ←

* Contingency budget: (to deal with known & unknown risks)

* Management reserve

- allocated to deal with unknown risk that might happen to the whole project.
- used by sponsor + customer not by project team.
- لا يتم توزيعه على فريق المشروع
- لا يتم توزيعه على فريق المشروع
- depends on complexity of project.

* Budget reserve

- allocated ~~specific~~ to deal with specific Risk for specific activity
- estimated time & cost for alternative plan
- Used by whom monitors the risk & its triggering events
- unused budget is used in management reserve

Risk Response Matrix: Summarizes Response & plan

↳ list all risk & decide each response & cont. plan
(3) triggering event & who is responsible

look book for example.

- Budget reserve decreases with time & Management Reserve ↑
- " " estimation depends on the estimated cost of the activity in the contingency plan

* Risk Response Control:-

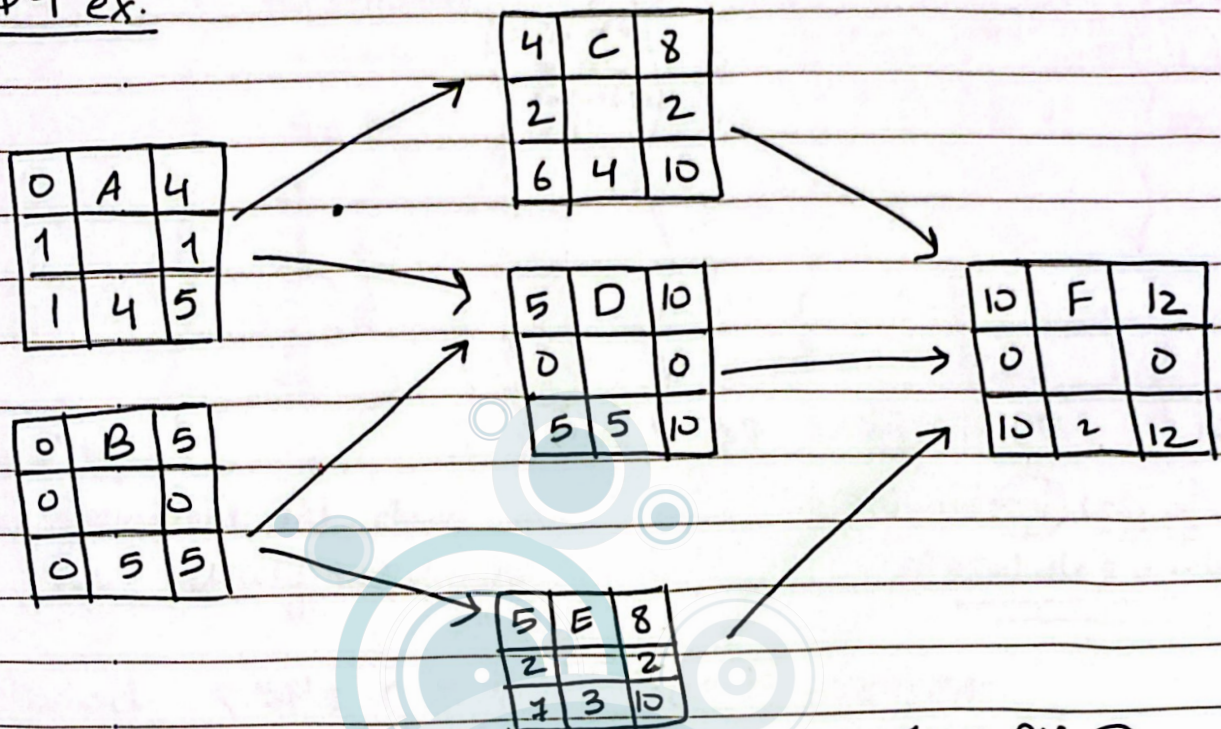
- Done in execution phase.

- [1] To execute (the actions) of the Risk Response Strategy
- [2] Monitoring of triggering event.
- [3] Execution of the contingency plan (in case risk happen).
- [4] Watching for new risks.

She solved only on Period 2 & 6

Tuesday 21/5

Q4 ex.



- Base line Budget: (\$000) من الميزانية

EV & PV →

		0	1	2	3	4	5	6	7	8	9	10	11	12
A	40	10	10	10	10									
B	32	8	4	8	4	8								
C	48					12	12	12	12					
D	18						6	2	2	2	6			
E	28						8	8	12					
F	40											20	20	
Total	206	18	14	18	14	20	26	22	26	2	6	20	20	
Cumulative		18	32	50	64	84	110	132	158	160	166	186	206	

→ Percent complete & actual cost [from person responsible of conducting the project] should be collected by whom is doing the status report.

- CV, SV, SPI, CPI → من القوائم

Status Report : Ending Period 2 (\$000)

Task	% complete	EV	AC	PV	CV	SV
A	75%	$75\% \text{ of } 40 = 30$	25	$10 + 10 = 20$	$EV - AC = 5$	10
B	50%	$50\% \text{ of } 32 = 16$	12	$8 + 4 = 12$	$= 4$	12 4
C	Activity didn't start					
D						
E						
F						
Cumm Total:		46	37	32	9	14

* Assessment not done on each activity individually * Answers (tve) (ahead of schedule & under budget).

Period	SP1	CPI	PCIB = EV/BAC	
2	1.44	1.24	22%	$CPI = \frac{EV}{AC}$
4	1.13	1.22	35%	
6	1.11	1.31	59%	$SPI = \frac{EV}{PV}$
8	0.97	1.18	75%	$CV = EV - AC$ $SV = EV - PV$

Status Report : Ending Period 4

Task	% complete	EV	AC	PV	CV	SV
A	100%	40	35	40	5	0
B	100%	32	24	24	8	8
Cumm. Totals		72	59	64	13	8

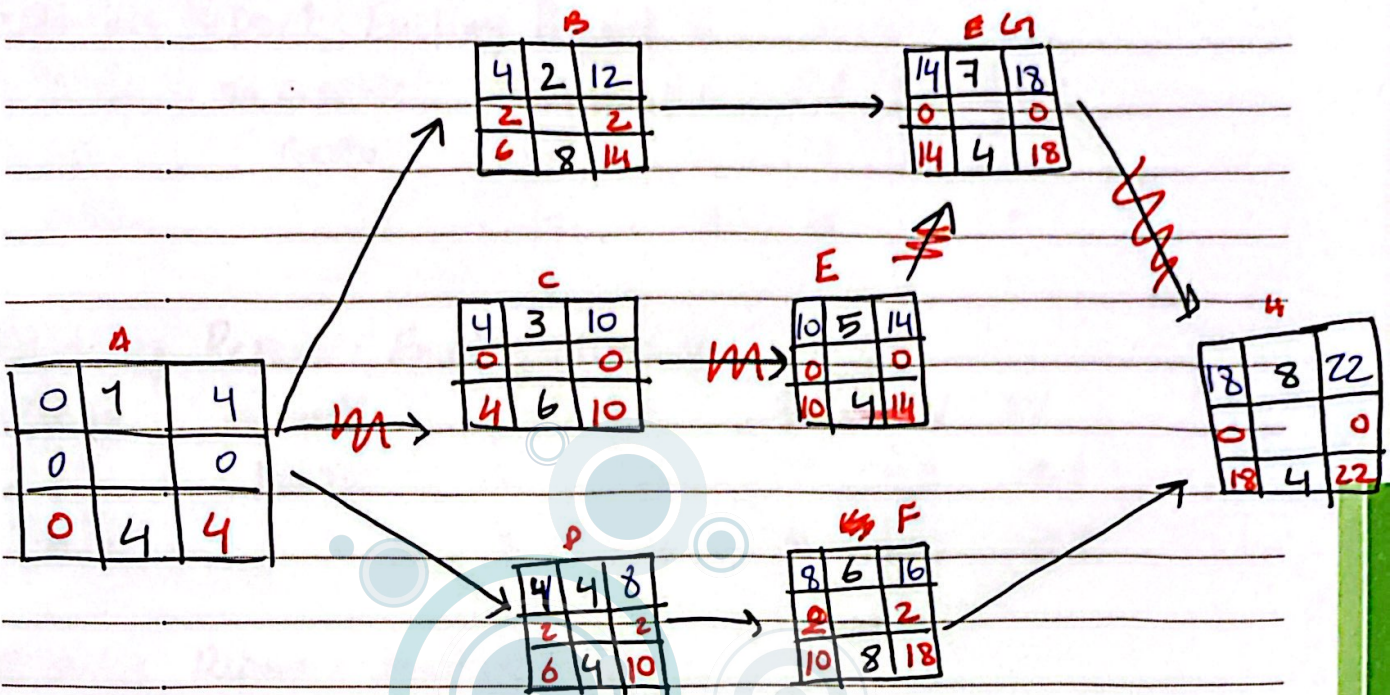
Status Report : Ending Period = 6

		EV	AC	PV	CV	SV
A	100%	40	35	40	5	0
B	100%	32	24	32	8	0
C	75%	36	24	24	12	12
E	50%	16	10	8	4	6
D	0%	0	0	6	0	-6
Total		124	93	110	29	17

behind schedule

Assignment : Last one

2315



Task	Dur	ES	LF	SI	PV	0	2	4	6	8	10	12	14	16	18	20	22
A	4	0	4	0	8	4	4										
B	8	4	14	2	40			10	10	10	10						
C	6	4	10	0	30			10	15	5							
D	4	4	10	2	20			10	10								
E	4	10	14	0	40						20	20					
F	8	8	18	2	60					20	20	10	10				
G	4	14	18	0	20								10	10			
H	4	18	22	0	30										20	20	10
Total 248						4	4	30	35	35	50	30	20	10	20	10	
Cumulative						4	8	38	73	108	158	188	208	218	238	243	

BAC = 248

$$CV = EV - AC$$

$$SV = EV - PV$$

① Status Report: Ending Period 2

Task	% complete	EV	AC	PV	CV	SV
A	50%	4	4	4	0	0
Totals		4	4	4	0	0

② Status Report: Ending Period 4

Task	% complete	EV	AC	PV	CV	SV
A	100%	8	10	8	-2	0
Totals		8	10	8	-2	0

③ Status Report: Ending Period 6

Task	% complete	EV	AC	PV	CV	SV
A	100%	8	10	8	-2	0
B	25%	10	15	10	-5	0
C	33%	10	12	10	-2	0
D	0%	0	0	10	0	0
Totals	-	28	37	38	-9	0

④ Status Report: Ending Period 8

Task	% complete	EV	AC	PV	CV	SV
A	100%	8	10	8	-2	0
B	30%	12	20	20	-8	-8
C	60%	18	25	25	-7	-7
D	0%	0	0	20	0	-20
Totals	-	38	55	73	-17	-35

⑤ Status Report: Ending Period 10

Task	% complete	EV	AC	PV	CV	SV
A ²	100%	8	10	8	-2	0
B ⁴⁰	60%	24	30	30	-6	-6
C ³⁰	100%	30	40	30	-10	0
D ²⁰	50%	10	20	20	-10	-10
E ⁴⁰	0%	0	0	0	0	0
F ⁶⁰	30%	18	24	20	-6	-2
Total		90	124	108	-34	-18

⑥ Status Report: Ending Period 12

Task	% complete	EV	AC	PV	CV	SV
A	100%	8	10	8	-2	0
B	40%	40	50	40	-10	0
C	30%	30	40	30	-10	0
D	20%	20	40	20	-20	0
E	50%	20	30	20	-10	0
F	50%	30	40	40	-10	-10
Total		148	210	158	-62	-10

Period	SPI	CPI	PCIB
2	1	1	1.61
4	1	0.8	3.22
6	0.73	0.75	11.29
8	0.52	0.69	15.3
10	0.83	0.72	36.2
12	0.93	0.70	59.6

$\Rightarrow$ At the end of Period 12, the project is behind schedule by (0.93) & is over budget (0.70)
& 59.6% of project is completed.

Graphs: (مخططات)

