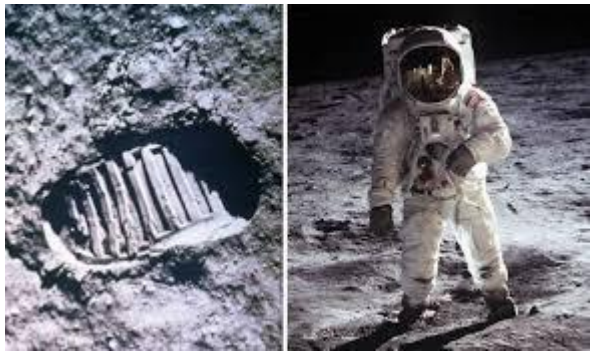
PROJECT MANAGEMENT

PROJECT MANAGEMENT

- **Project management is not new. It has been in use for hundreds of years**



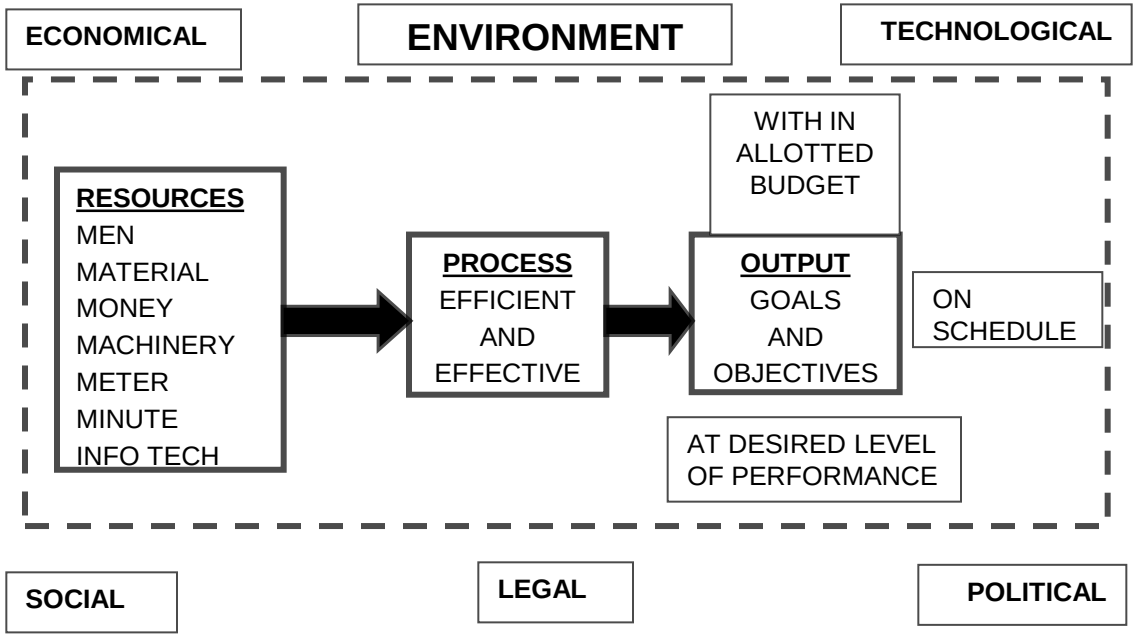
WHAT IS **PROJECT** MANAGEMENT

- A project is a temporary endeavor undertaken to create a unique product, service, or result --- PMBOK
- **"Any task which has a definable beginning and definable end, and requires the expenditure of one or more resources, in each of the separate but inter-related and inter dependent activities which must be completed to achieve the objectives for which the task or project was instituted".** Dr RL Martino
- Management can be defined as: -

"**The process of planning, organising, directing, co-ordinating and controlling the activities to achieve the laid down targets**".

WHAT IS **PROJECT MANAGEMENT**

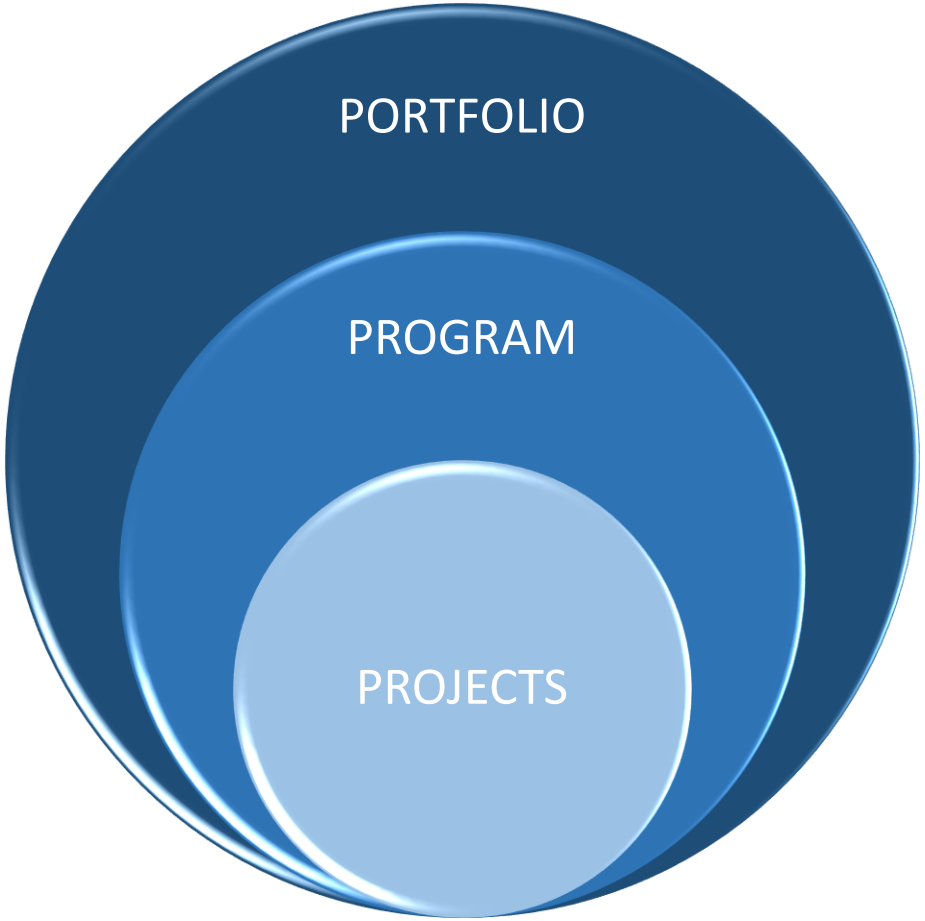
- "**The most effective and efficient use of resources (of manpower, materials, money, machinery, facilities, information and technology) so that organisational goals and objectives can be achieved within the allotted budget, on schedule and at the desired performance level while adhering to the ever changing environmental factors like political, economical, social, technological and legal**".



Lack of Project Management

- **Poorly managed projects or the absence of project management may result in:**
  - Missed deadlines
  - Cost overruns
  - Poor quality
  - Rework
  - Uncontrolled expansion of the project
  - Loss of reputation for the organization
  - Unsatisfied stakeholders
  - Failure in achieving the objectives for which the project was undertaken

RELATIONSHIP OF PROJECT, PROGRAM & PORTFOLIO

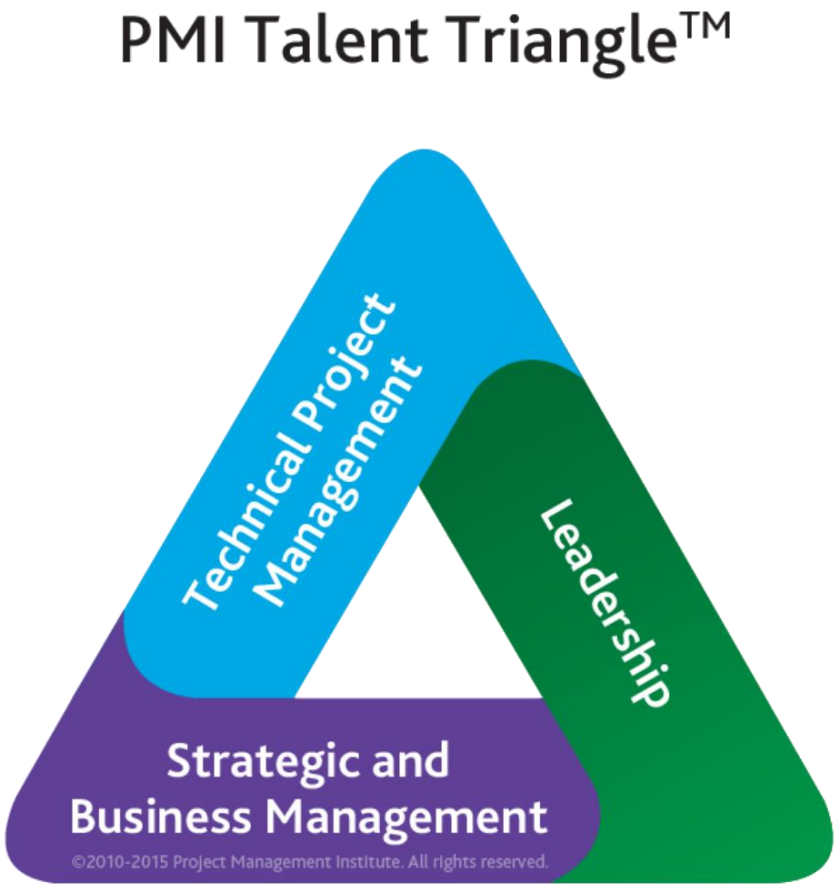


Importance of Project Manager

- Distinct from that of a Functional manager or Operations manager - Leads the team that is **responsible for achieving the project objectives.**

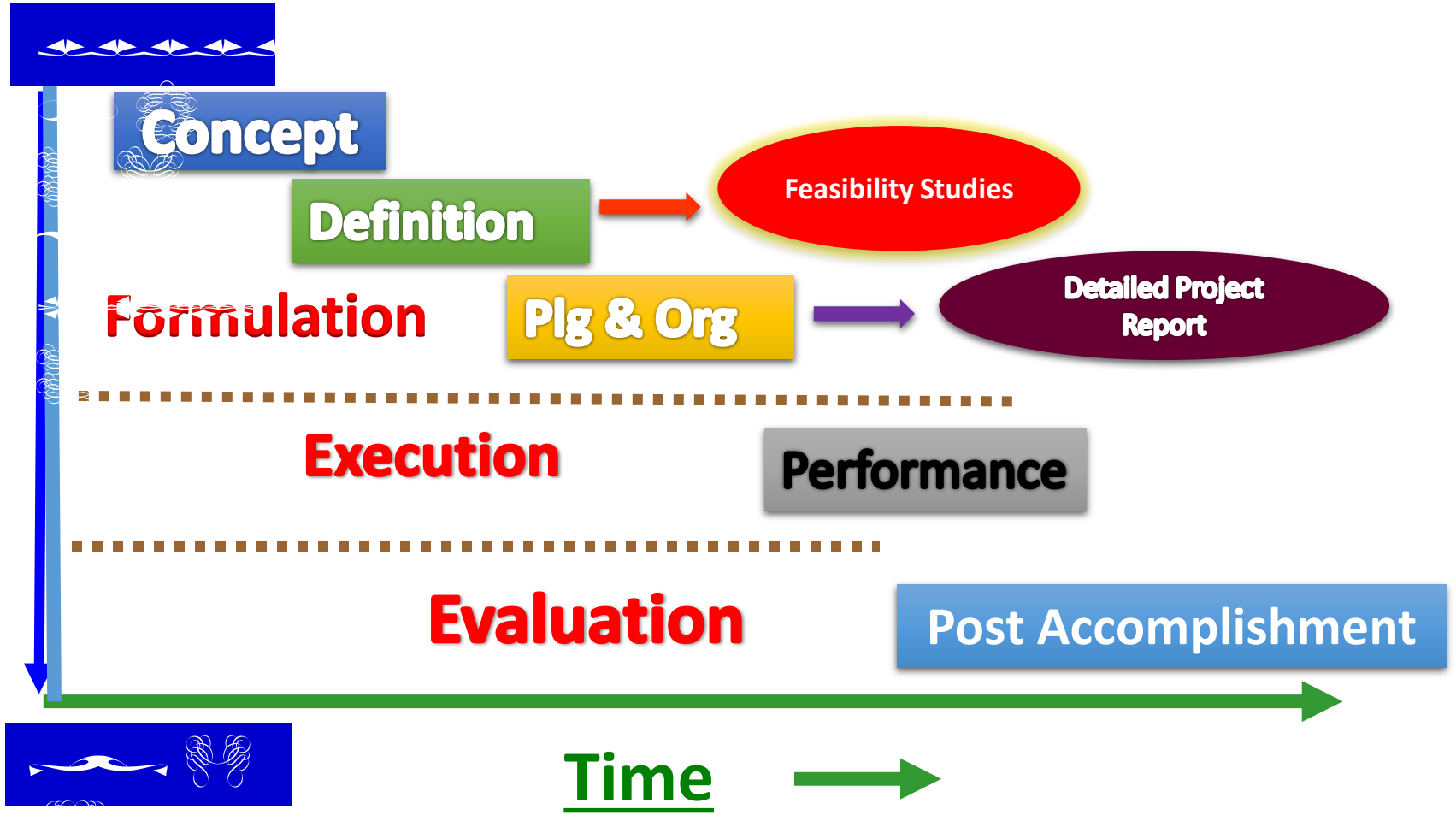
- Project Manager/Conductor of Orchestra
  - **Membership and roles**
  - **Responsibility for team.**
  - **Knowledge and skills**

Project Managers Competencies

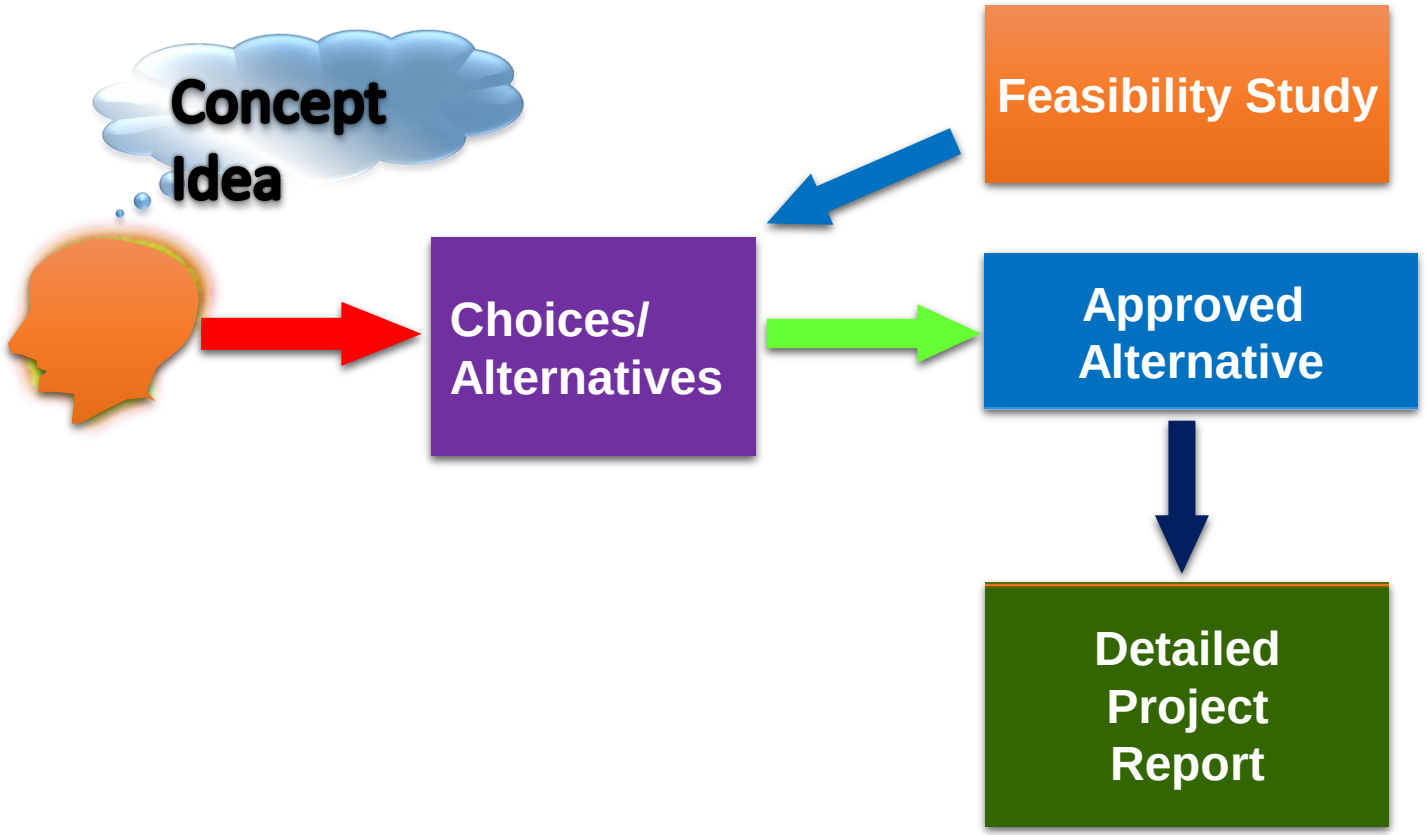


Project Life Cycle

Project Life Cycle



PROJECT FORMULATION



Feasibility Study & Report

- Technical Feasibility Study
- Economic Feasibility study
- Organisational Feasibility Study
- Environmental Feasibility Study

Project Planning

The process of defining the necessary tasks to reach the objectives, making cost estimates and preparing schedules & budgets. It also involves assigning overall segments of the plan to individuals, with a minimum of overlap problems.

Development of Project Plan

What is to be accomplished ?	WBS
Who is responsible for what ?	TRM
What resources are required ?	PCE
What must be done when ?	PS
How will the resources be allocated?	TPB

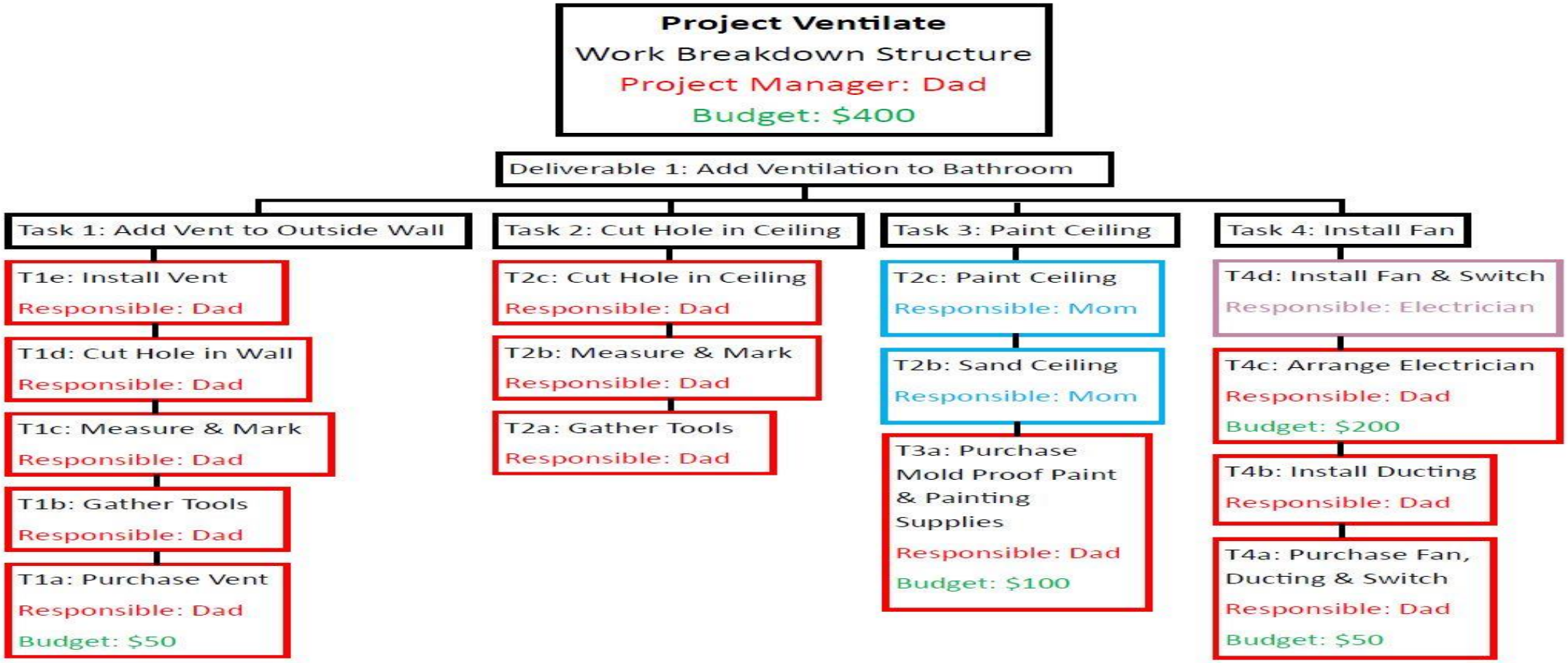
Work Breakdown Structure

- Hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables.
- Work Breakdown Structure (WBS) is the process of subdividing project deliverables and project work into smaller, more manageable components. The key benefit of this process is that it provides a framework of what has to be delivered. This process is performed once or at predefined points in the project.
- The WBS provides the relationships among all the project deliverables and their various components.

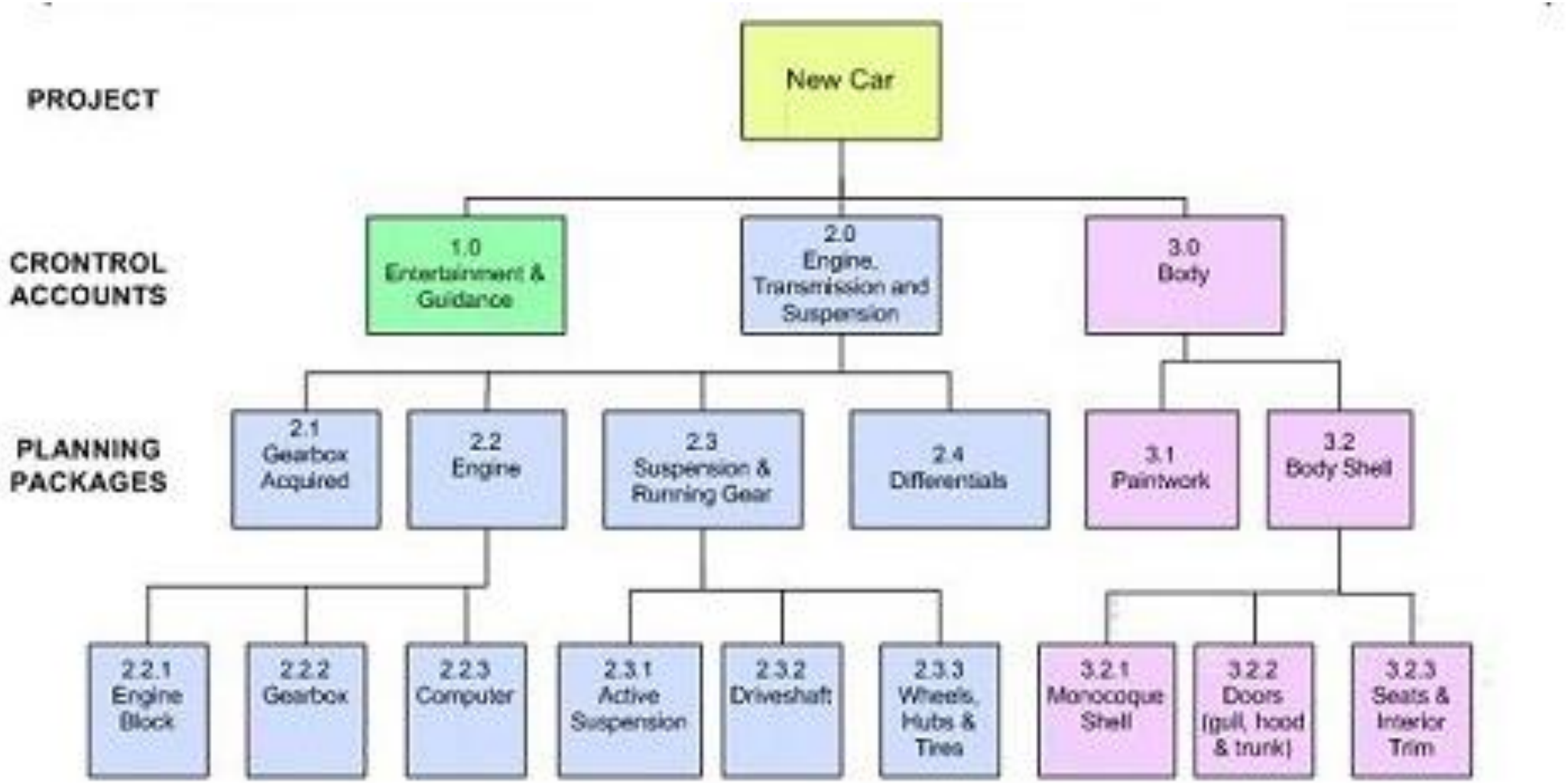
Diagram

WORK BREAKDOWN STRUCTURE

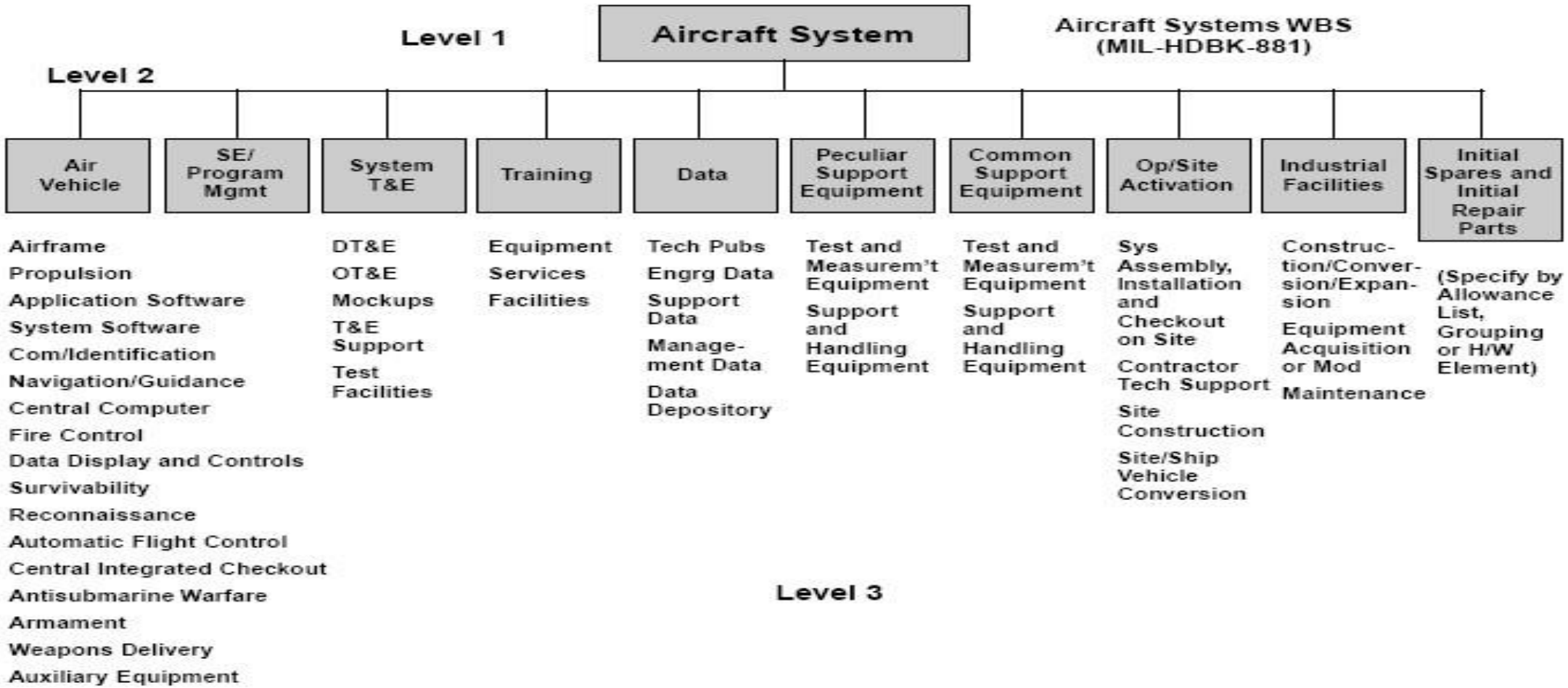
Work Breakdown Structure



Work Breakdown Structure



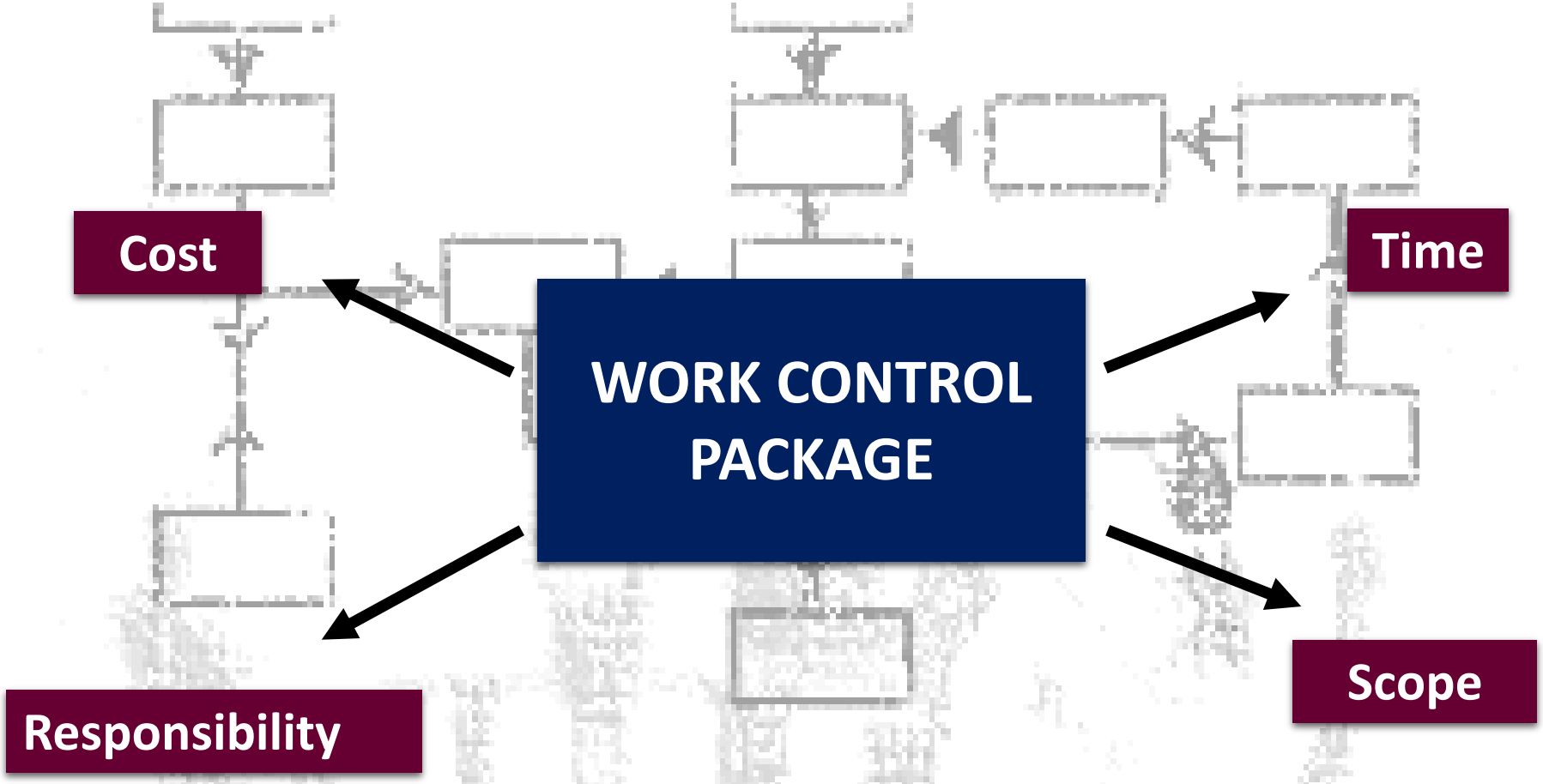
Work Breakdown Structure



Work Breakdown Structure

- **Systematic & logical breakdown**
- **Neither too many or too few levels.**
- **Breakdown to Work Control Package(WCP).**
- **WCP - Responsibility can be assigned.**
- **WCP - Can be costed and time assigned.**
- **Unique number for identification.**
- **Sum total of cost of all WCPs is cost of project.**

Work Breakdown Structure



Task Responsibility Matrix (TRM)

	Jeff	Michael	Reto	YOU	Alex	Anna	Bill	Cindy	Felix	Fred	Hans	John	Livio	Luc	Marco	Paul	Peter	Sue	Ted	Tim
Planning / Schedule	R	A	I	C					C											Q
Risk Management		I	I	Q						A								R		
Quality Management			R	C						R										A
Procurement				R		Q				R								R		A
1. Specifications Listing								A		R								R		R
2. Site Requirements		C	A	R	Q						R									
3. Call for Tenders				Q	A	R	C				R							R		
4. Budget Approval				A	Q					R							R			R
5. Contract Negotiations			A		Q	R	R											R		

* R – Responsible (works on), A – Accountable, C – Consulted, I – Informed, Q – Quality Reviewer

Merits of TRM

- Each row of TRM shows persons involved and nature of responsibility for WCP
- Each column shows the Work Packages for which a single individual is responsible and the responsibility
- Project personnel can easily identify their responsibility
- Mutual Agreement
- Enables monitoring of how effectively responsibility is being executed

Project Cost Estimates (PCE)

- Forecasted
- Worked out from WCP/WBS
- Historical data/ estimation methods used
- A detailed cost estimate is the basis of a project budget
- Standard for Comparison with Baseline

Project Cost Estimates

- Direct Labour – staff expenses.
- Direct non-labour – material expenses.
- Overheads – direct overheads (electricity, transport).
- General Administration – indirect overheads(office).
- Contingency Reserve.
- Profits (only for commercial organisation).
- Total Cost [sum of all above].

Project Schedule (PS)

Project Master schedule is prepared by integrating the WCP and TRM with the Project Schedule

Two levels of schedule planning

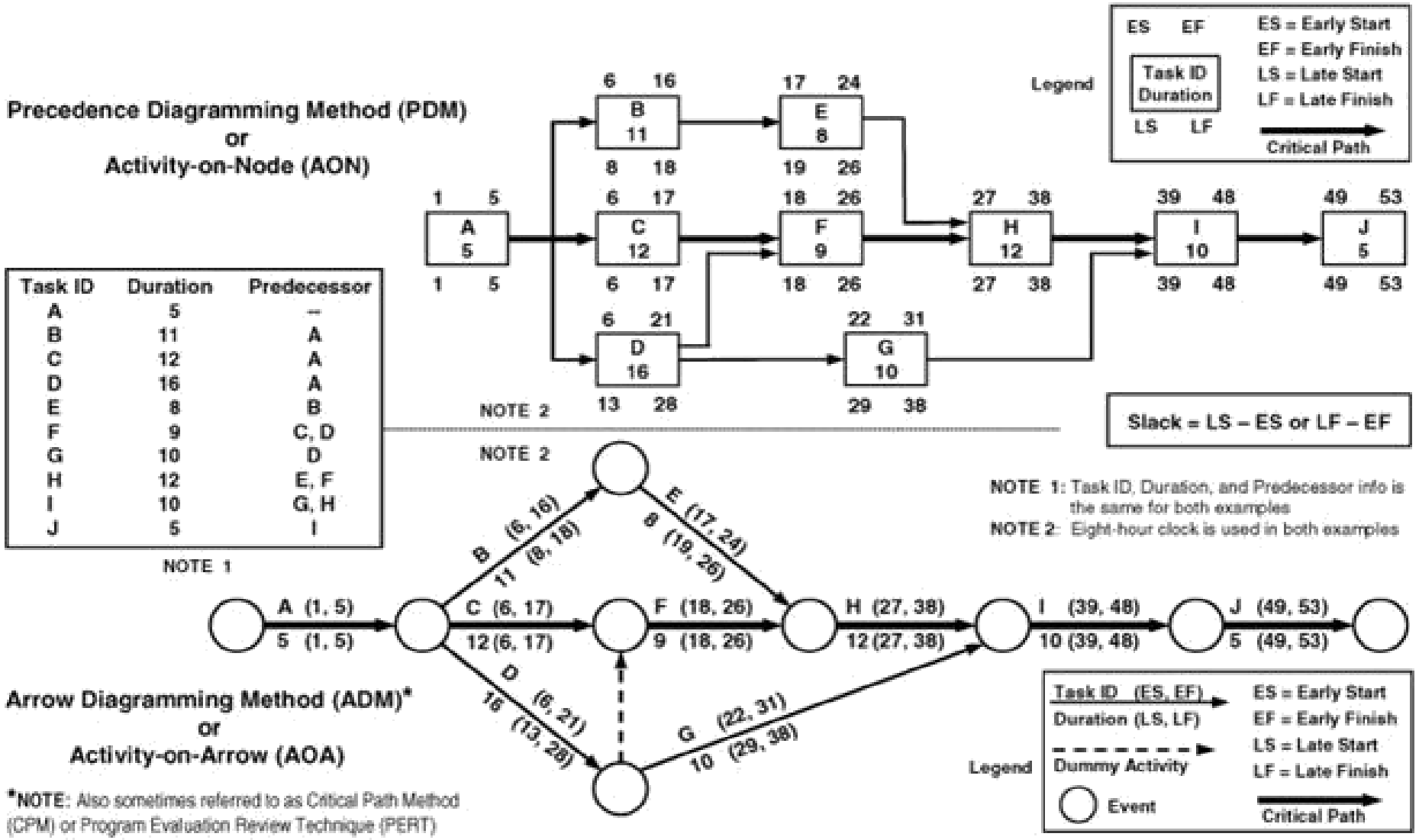
- **Project level**
- **Task Level**

Complete and comprehensive in scope

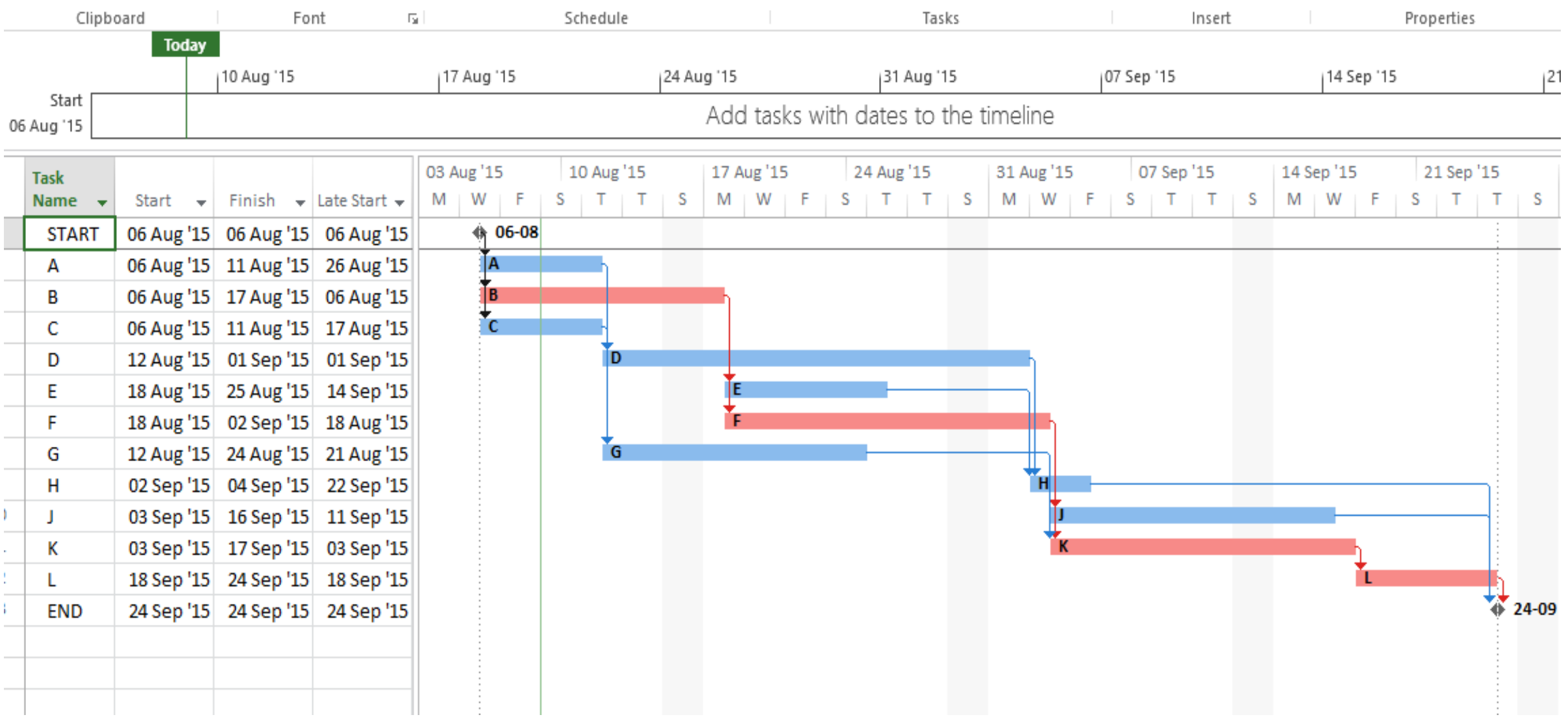
Include key milestones / Interface events linking all tasks

Useful in Progress evaluation & Management reporting

Project Schedule – Networks



Project Schedule – Gantt Chart



Task Name	Start	Finish	Late Start
START	06 Aug '15	06 Aug '15	06 Aug '15
A	06 Aug '15	11 Aug '15	26 Aug '15
B	06 Aug '15	17 Aug '15	06 Aug '15
C	06 Aug '15	11 Aug '15	17 Aug '15
D	12 Aug '15	01 Sep '15	01 Sep '15
E	18 Aug '15	25 Aug '15	14 Sep '15
F	18 Aug '15	02 Sep '15	18 Aug '15
G	12 Aug '15	24 Aug '15	21 Aug '15
H	02 Sep '15	04 Sep '15	22 Sep '15
J	03 Sep '15	16 Sep '15	11 Sep '15
K	03 Sep '15	17 Sep '15	03 Sep '15
L	18 Sep '15	24 Sep '15	18 Sep '15
END	24 Sep '15	24 Sep '15	24 Sep '15

Time Phased Budget (TPB)

Schedule Information							Baseline Budget Needs							
ACT/WP	Buildings/ Units	Building/ Units Complete	Percent Complete	DUR	ES	LF	July	August	September	October	November	December	January	February
Demolition	1	1	100%	5	24-Jul	29-Jul	42400							
Site Maintenance	1	1	60%	140	10-Aug	22-Feb		800	800	800	533	533	534	
Concrete Repairs	10	10	20%	5	10-Aug	17-Aug					1400		3600	
Framing/ Dry-in	10	10	95%	30	12-Aug	23-Sep		155520	29160			9720		
Metal Works	10	10	100%	10	10-Sep	24-Sep				34500				
Roofing	10	10	100%	5	18-Sep	25-Sep			32400					
Electrical - rough in	14	14	100%	20	25-Sep	23-Oct		6182	3091	27820				
Plumbing - rough in	14	14	103%	20	25-Sep	23-Oct		12710	43290					
HVAC - rough in	14	14	100%	20	25-Sep	23-Oct			21300	21300				
Sprinkler System	10	10	95%	3	15-Sep	19-Sep			20400			3600		
Insulation	14	14	0%	5	23-Oct	30-Oct					23000			
Drywall	14	14	0%	20	10-Nov	8-Dec					38000	38000		
Poured Floors	10	10	0%	5	1-Nov	8-Nov					12000			
Cabinets	14	14	0%	5	18-Jan	25-Jan					34000			
Trim	14	14	0%	15	8-Dec	29-Dec						12000		
Electrical - Fixtures	14	14	0%	10	25-Jan	8-Feb						24729		
Plumbing - Fixtures	14	14	0%	10	25-Jan	8-Feb						40200		
Painting - exterior	2	2	100%	5	25-Sep	2-Oct				3150				
Painting - interior	21	21	0%	15	21-Dec	11-Jan							24850	
HVAC Equipment	14	14	0%	5	25-Jan	1-Feb							28400	
Flooring	14	14	0%	10	1-Feb	15-Feb							26000	22000
Appliances	14	14	0%	5	15-Feb	22-Feb							21600	
Hardware & Blinds	14	14	0%	5	15-Feb	22-Feb							18000	
Final Cleaning	14	14	0%	5	22-Feb	1-Mar								5000
Permits	14	14	100%	10	5-Jul	6-Aug		10000						
Profit & Overhead	14	14	51%		5-Jul	6-Aug		18590	24787	20747	16340	19317	16404	7749
Change Order			100%					6750						
						Total PV	0	210552	175228	108317	125273	148099	139388	34749
							0	210552	385780	494097	619370	767469	906857	941606
								737804	555826	447509	322236	174137	34749	0


Detailed Project Report

DETAILED PROJECT REPORT

- Project Plan in Executable Format
- Elaborate and Systemic adoption of Feasibility report
- A tool for implementation
- Involves in-depth planning and detailed examination of all aspects
- Preparation invariably the task of competent and professional consultants

SUGGESTED PARTS OF DPR

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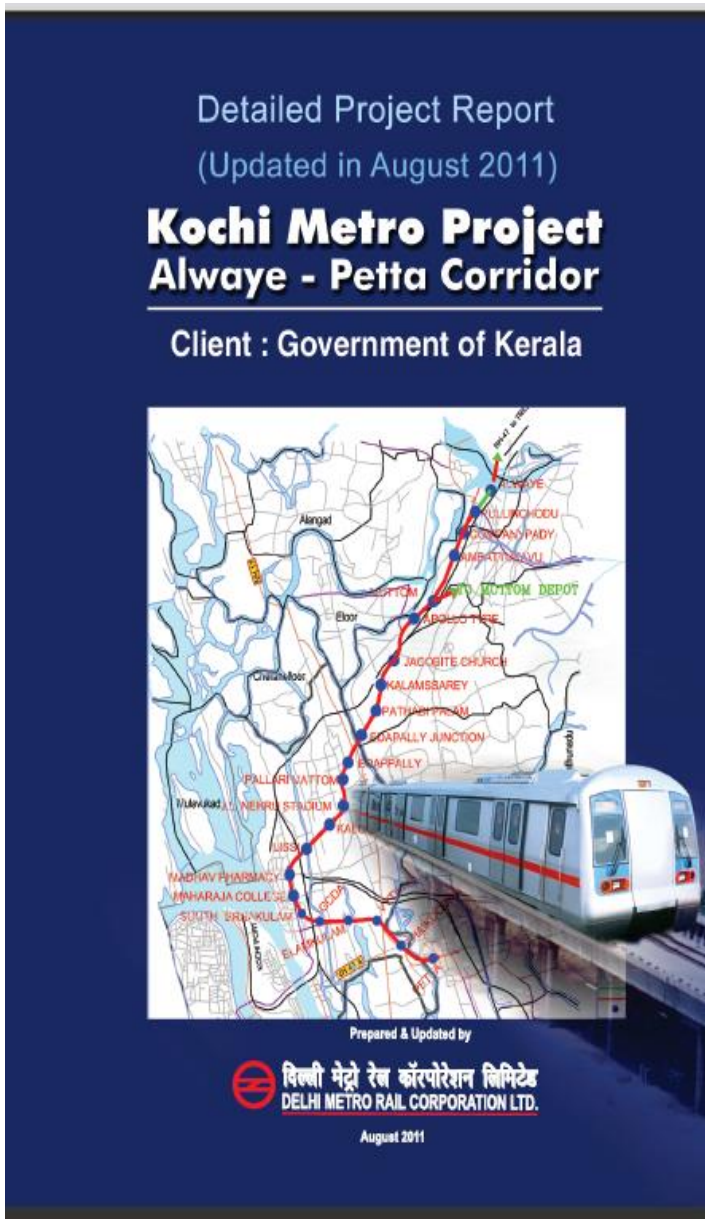
DPR Kochi Metro



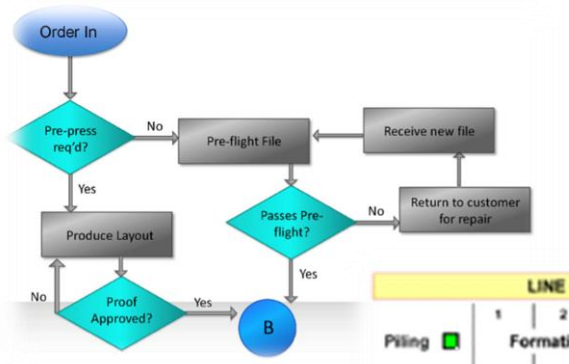
PROJECT SCHEDULING USING NETWORKS

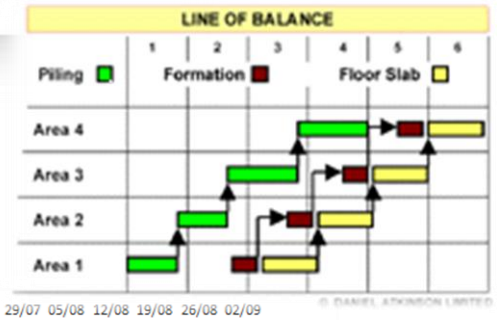
Project Scheduling

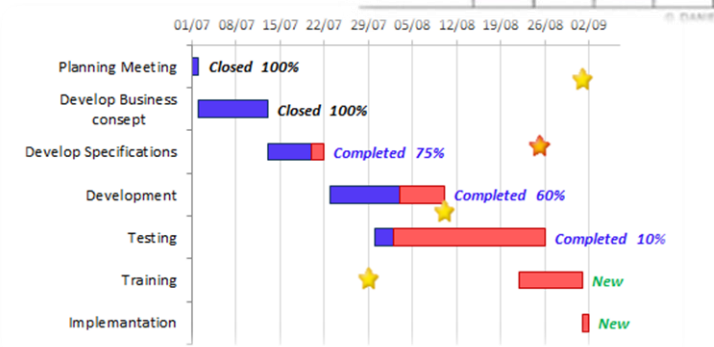
- Project scheduling is part of project management, which relates to the use of schedules to plan and subsequently report progress and apply control within the project environment.

  - Activities are finished in correct order and on time.
  - Project is within budget.
  - Project meets quality goals.
  - People receive info and direction.

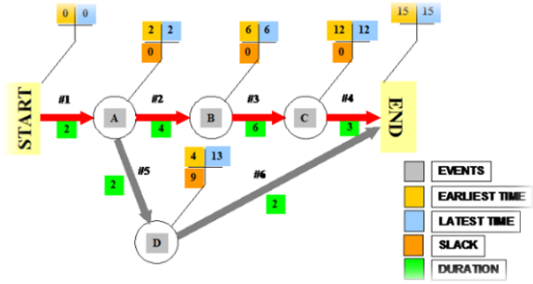
Scheduling Tools and Techniques







- ☑ ***The Flow Chart***
- ☑ ***Gantt Chart***
- ☑ ***The Milestone Chart***
- ☑ ***Networks***
  - ☑ ***AOA***
  - ☑ ***AON***



Evolution of Network Concept

Network techniques developed in 1950's

For planning and control of projects

CPM by DuPont & Remington Rand Univac for chemical plants (1957)

PERT by US Navy Special Office with Lockheed Martin and Booz, Allen & Hamilton - Polaris missile pgme (1958)

Consider activity relationships and inter-dependencies

Each uses a different estimate of activity times

Critical Path Method (CPM)

Used for jobs that have some past experience

Like plant maint /overhaul, building constr

Tasks with precedence - where activity time estimates can be predicted with considerable certainty

Focus is on arriving at an optimum project schedule that minimises the cost

Tasks where time estimates are certain
DETERMINISTIC

Program Evaluation Review Technique (PERT)

*One-time **unique tasks** –*
construction of dams, refineries, bridges etc.

Focus is on minimizing time required at optimum cost

*Tasks of **huge proportion** –*
construction / devp of ships / tanks / aircrafts

Tasks where time estimates tend to be quite uncertain
PROBABILISTIC

***R&D projects** –*

development of radars / missiles/spl software

*Organizing **large events** –*
conferences / rallies

Stages in Application of PERT/CPM

Drawing the network	• *Identify all essential events / activities.* • *Establish interrelationships to satisfy sequencing.*
Network Analysis	• *Time required for completing each activity.* • *Determine project duration and critical activity.* • *Compute the probability of completing the Project or part project in a given specified time.*
Resource Allocation and Scheduling	• *Translate plan into a time schedule based on resources required.* • *Examine economics (expedite the activities by incurring additional cost) before finalizing the schedule.*
Project control	• *Periodic updating to monitor Project progress.* • *Amending schedules to ensure timely completion.*

Networks

A simple concept to map and understand work flows of the project

Gives a clearer picture of the required sequence of events and activities

Activities are linked together in the logical sequence they need to be carried out

Steps in making networks

Define the project and prepare the WBS...WCP

Develop relationships among the activities

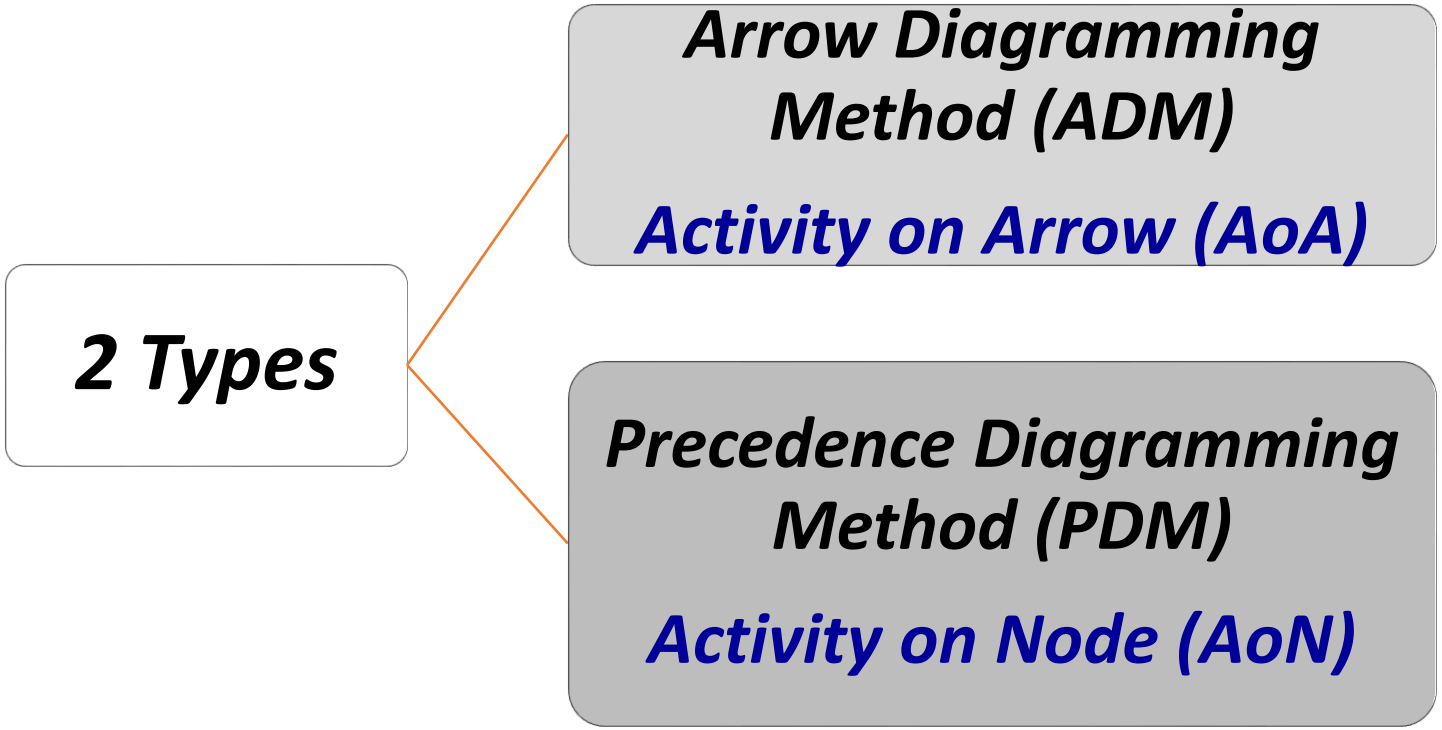
Draw the network connecting all activities

Assign time & cost estimates to each activity

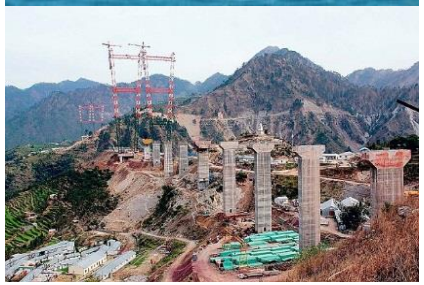
Compute the longest time path through the network – 'CRITICAL PATH'

Use the network to help plan, schedule, monitor, and control the project

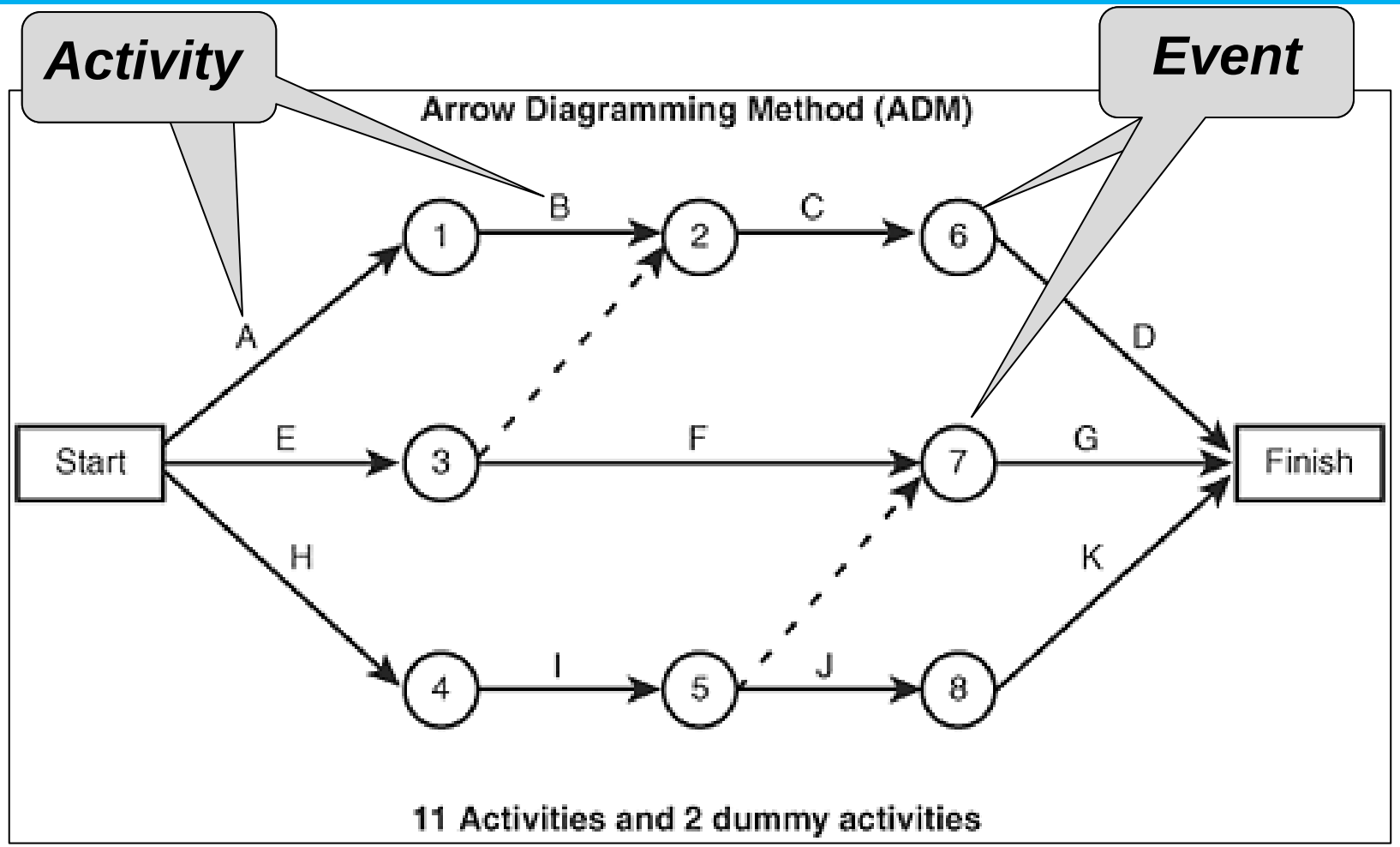
Network Diagrams



AOA NETWORKS



ADM (AOA) Network Diagram



Shows how tasks will flow from beginning to end

Depicts correct sequence of tasks & their relationships

ADM (AOA) Network Diagram

- Representation
  - Activities – Arrows
  - Events – Circles (one activity to another)
  - Duration – along the Arrow
- Also called **Activity On Arrow**
- Can Show only Finish to Start relationships

General Rules of Drawing Network

- Only one Start & one End Node.
- List Activities.
- Decide precedence relationships.
- Logic flow from left to right.
- No crossing of arrows/ loops, No danglers
- If Start of an activity is hanging, connect to ‘Start’ of the project.
- Finish of all the activities should be controlling some activity.
- If not, then connect to ‘Finish’ of the project.

Lets Draw

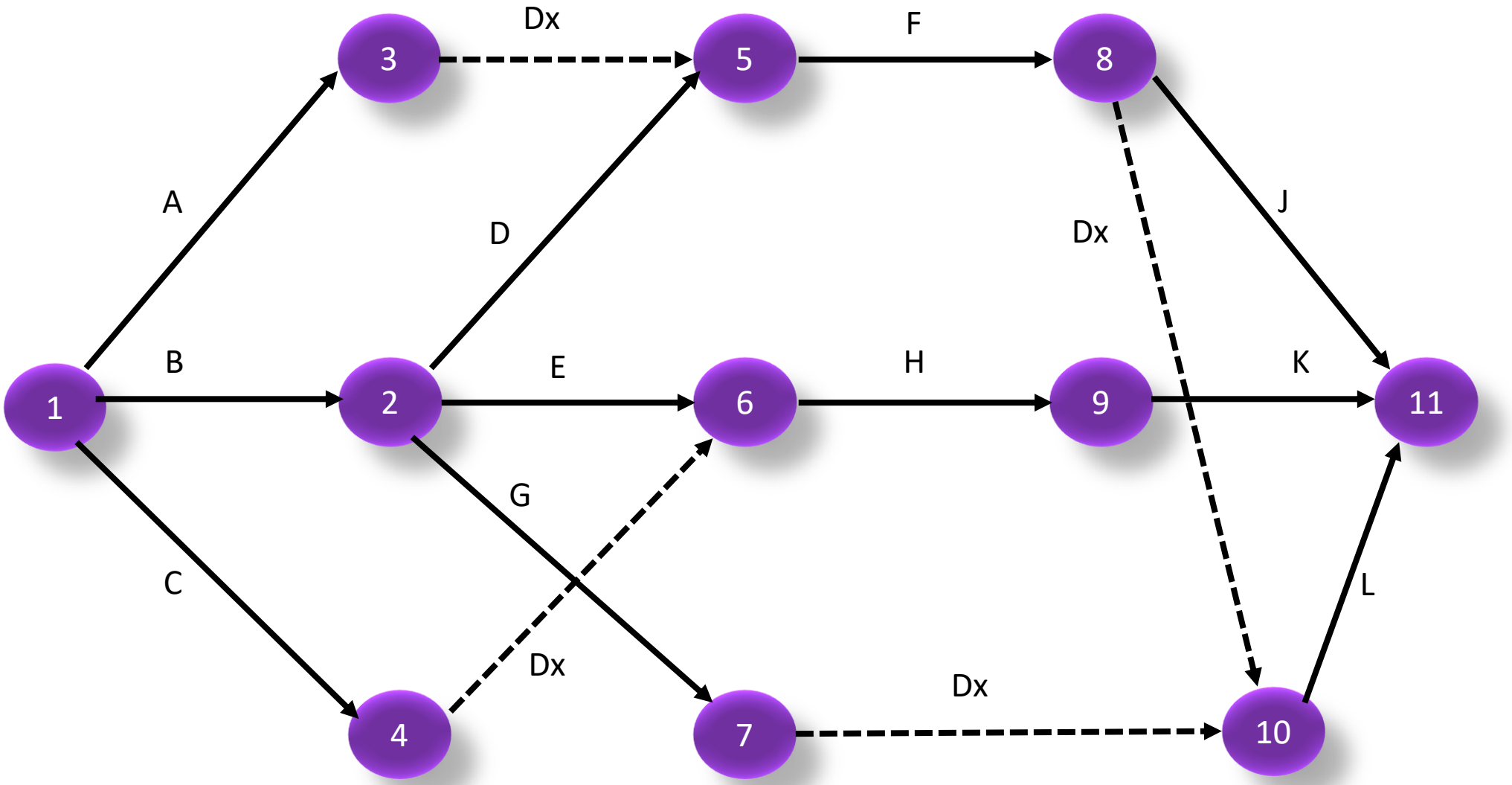
- Project Data ….
  - **A, B, C start the project**
  - **D, G, E follow B**
  - **F follows A, D**
  - **H follows C, E**
  - **J follows F**
  - **K follows H**
  - **L follows F, G**
  - **J, L, K end the project**

Draw an AoA Network for the Project

Tabulating Network Data

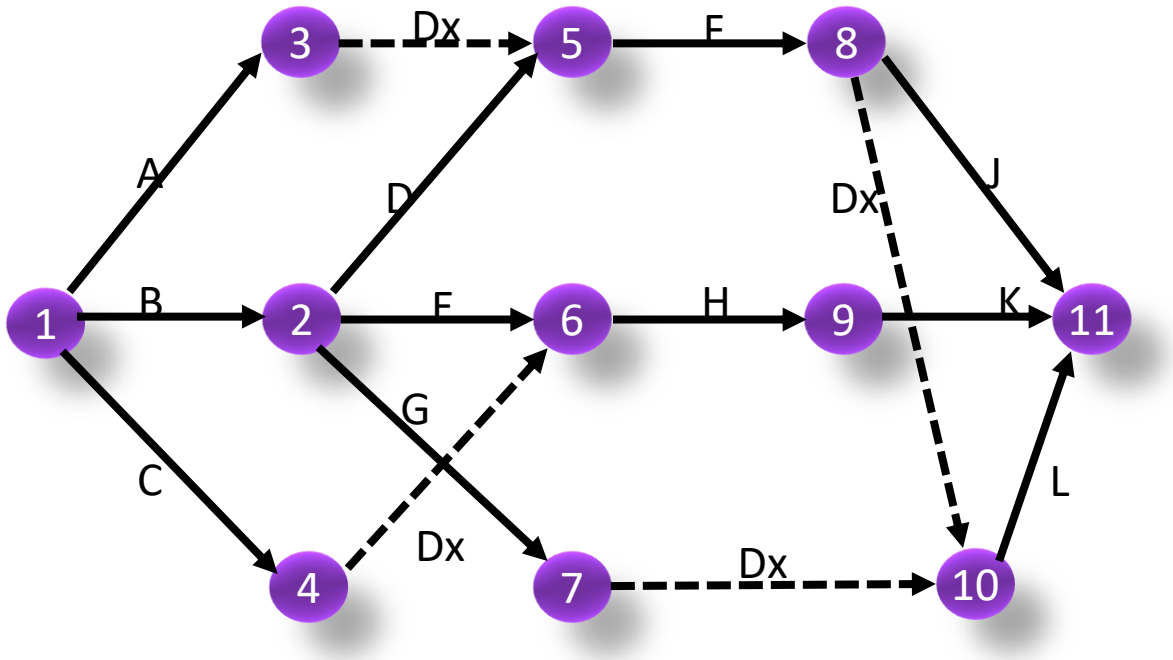
Activity	Dependency	Remarks	Duration
A	-	Starts Project	6
B	-	Starts Project	4
C	-	Starts Project	8
D	Follows B	-	8
E	Follows B	-	6
F	Follows A & D	-	2
G	FollowsB	-	10
H	Follows C and E	-	12
J	After F	Ends Project	8
K	Follows H	Ends Project	6
L	>F and >G	Ends Project	4

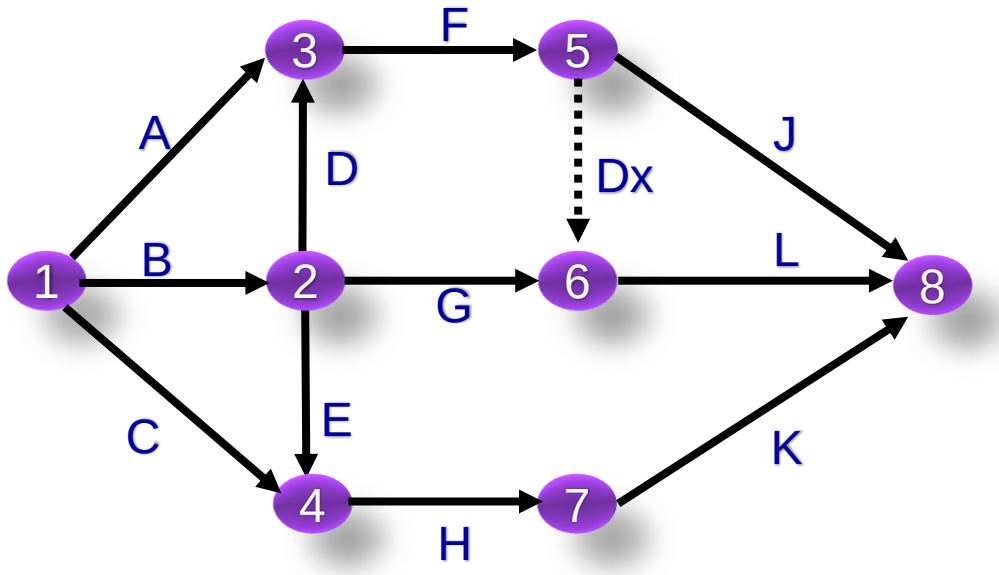
Possible AoA Network ……



Too many cross overs … complex!

Lets Draw
Simpler AoA Network .....

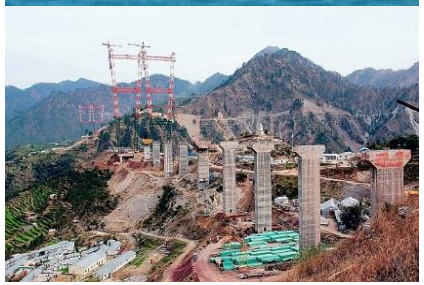




Paths?

1. A-F-J
2. A-F-L
3. B-D-F-J
4. B-D-F-L
5. B-G-L
6. B-E-H-K
7. C-H-K

NETWORK ANALYSIS



Analysis of Networks

- **Earliest possible time an event can take place (EOT)**
- **Latest allowable time by which an event must take place (LOT)**
- **Project Duration**
- **Critical Path and critical activities**
- **Time cushion (slack / float) available for other activities**

Assist mgt in :-

- Scheduling
- Monitoring
- Controlling

The Project

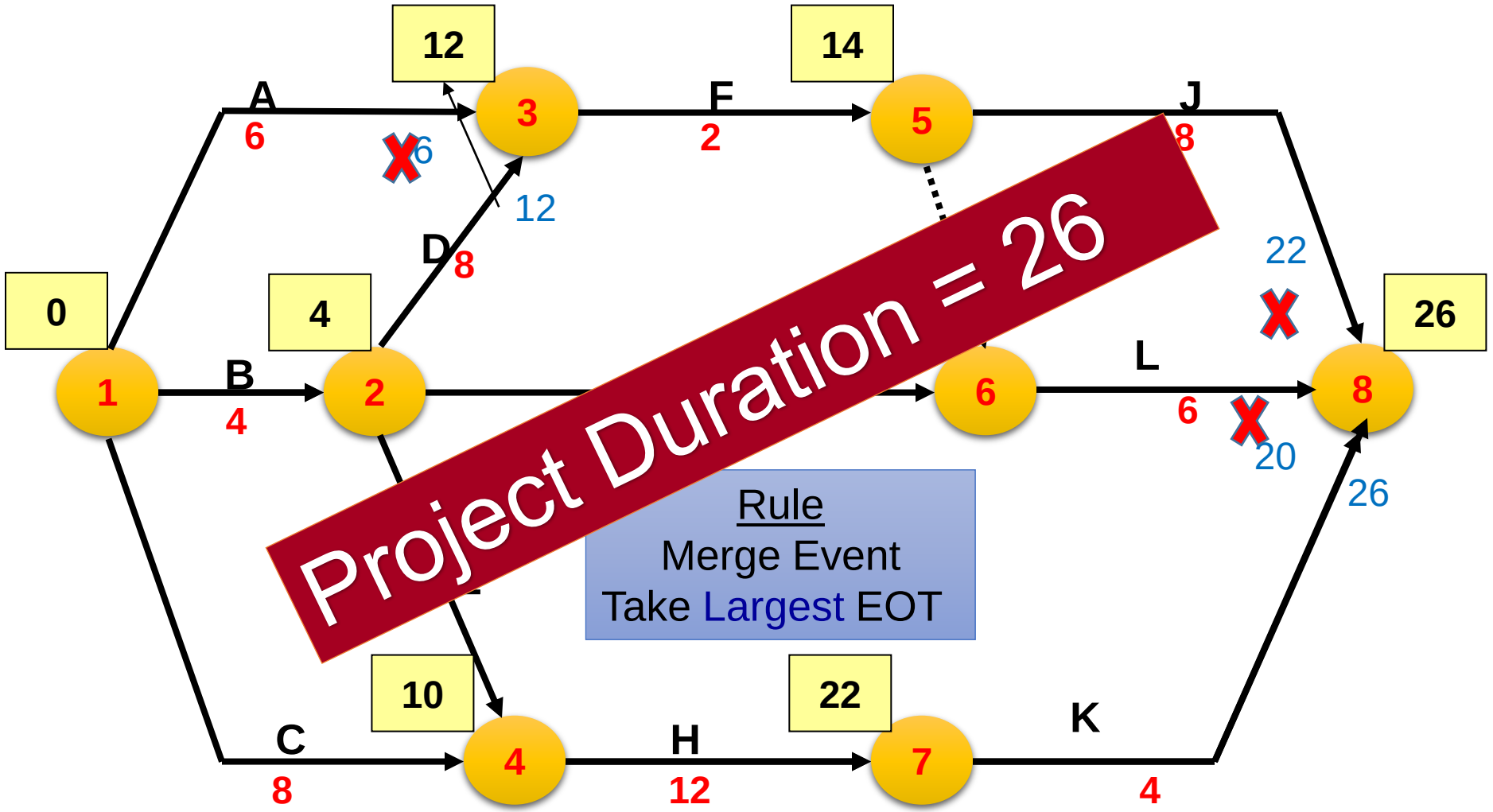
Forward & Backward Pass Computation

- Forward Pass
  - **Project Duration**
- Backward Pass
  - **Critical Path**

Tabulating Network Data

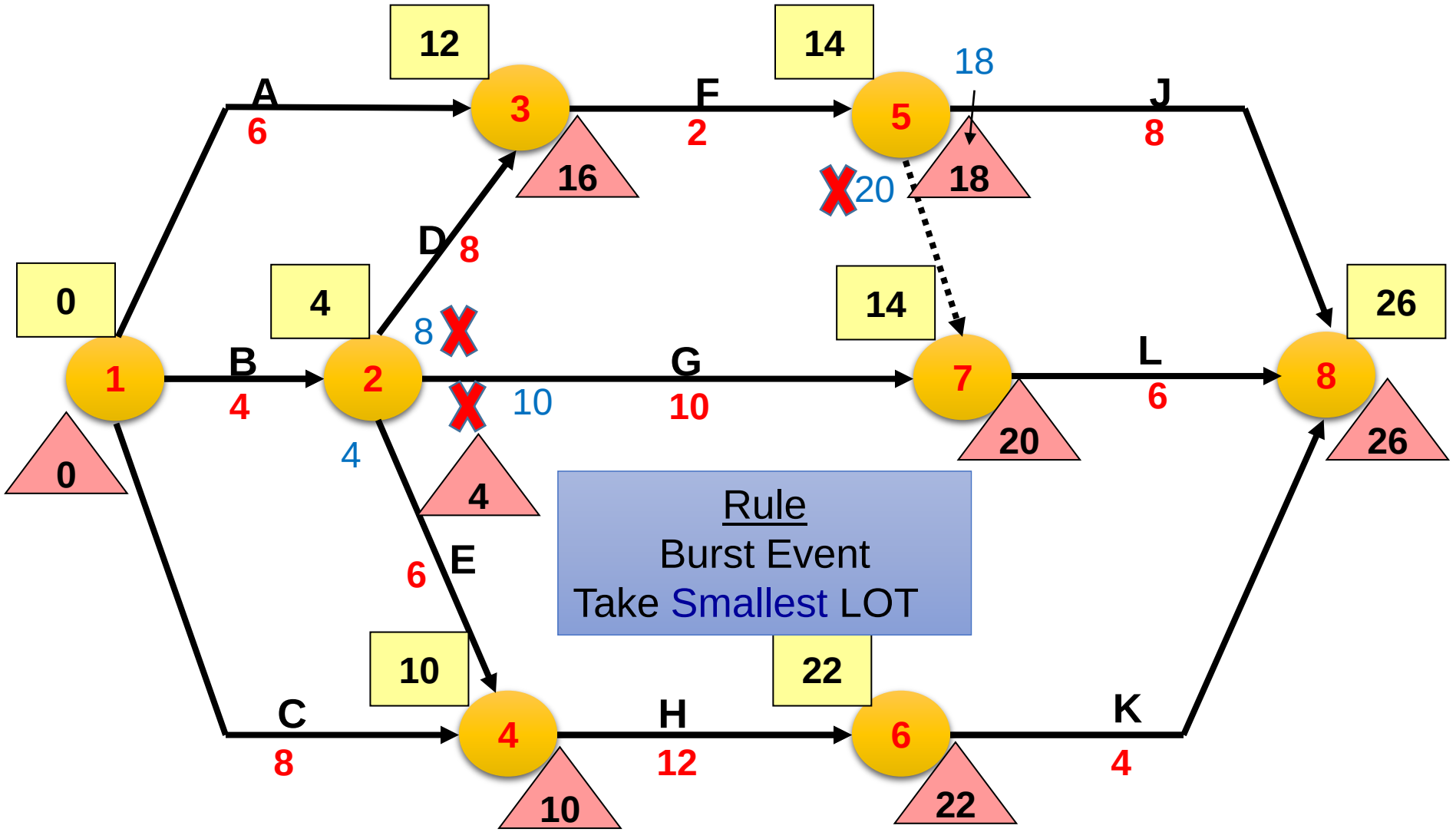
Activity	Dependency	Remarks	Duration
A	-	Starts Project	6
B	-	Starts Project	4
C	-	Starts Project	8
D	Follows B	-	8
E	Follows B	-	6
F	Starts after A & D	-	2
G	Controlled by B	-	10
H	After C and E	-	12
J	After F	Ends Project	8
K	Follows H	Ends Project	6
L	>F and >G	Ends Project	4

Forward Pass



EOT of Head Event= EOT of Tail Event + Duration

Backward Pass

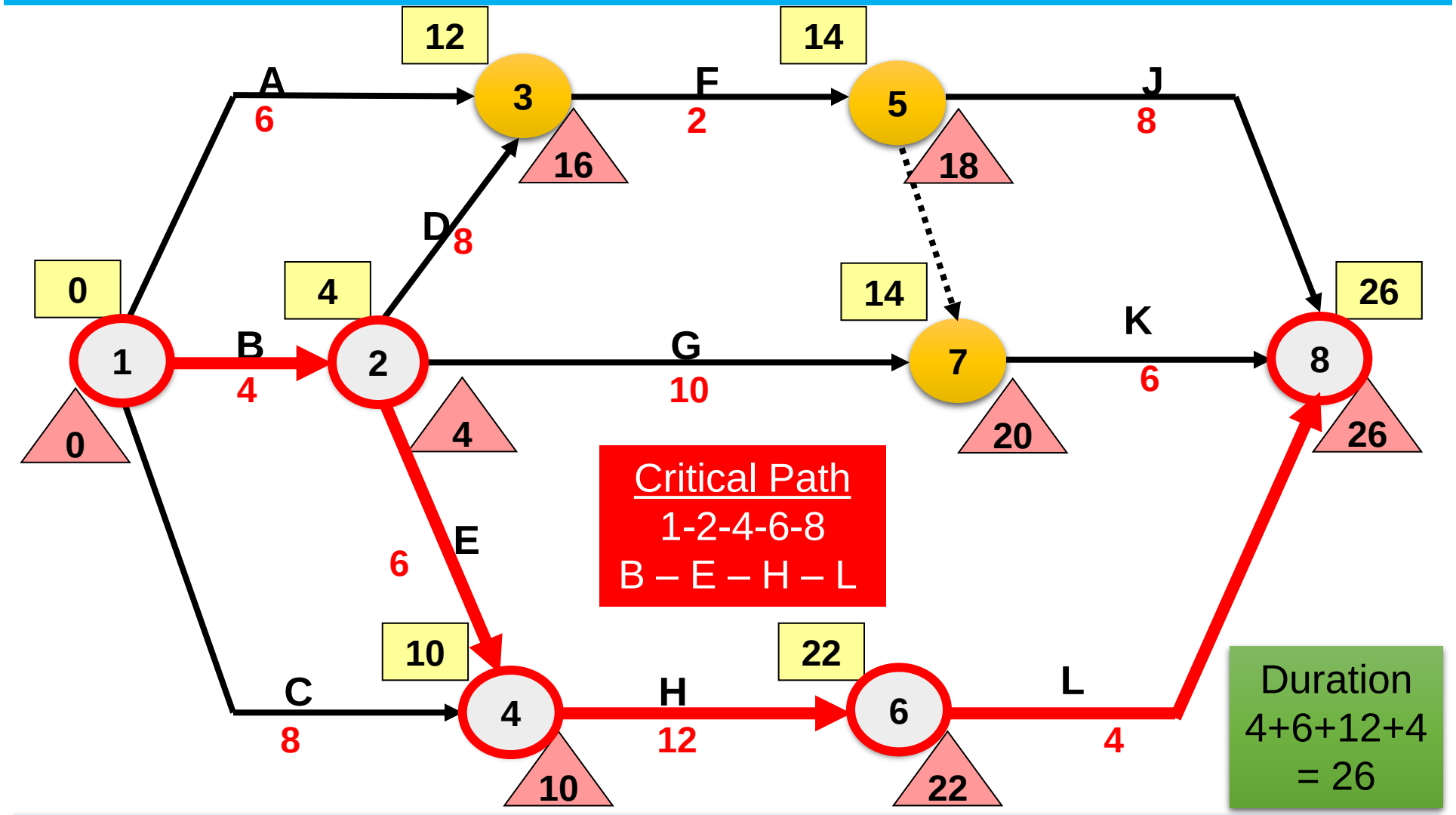


LOT of Tail Event= LOT of Head Event - Duration

Critical Events, Path, Activities

Critical Event	• ***Event with same Earliest & Latest Occurrence Time (EOT = LOT)***
Critical Path	• ***Path connecting critical events from start to end - Longest path.***
Critical Activities	• ***All activities on the critical path.***

Critical Events, Path, Activities



Project Duration = sum of durations of all activities on the Critical Path

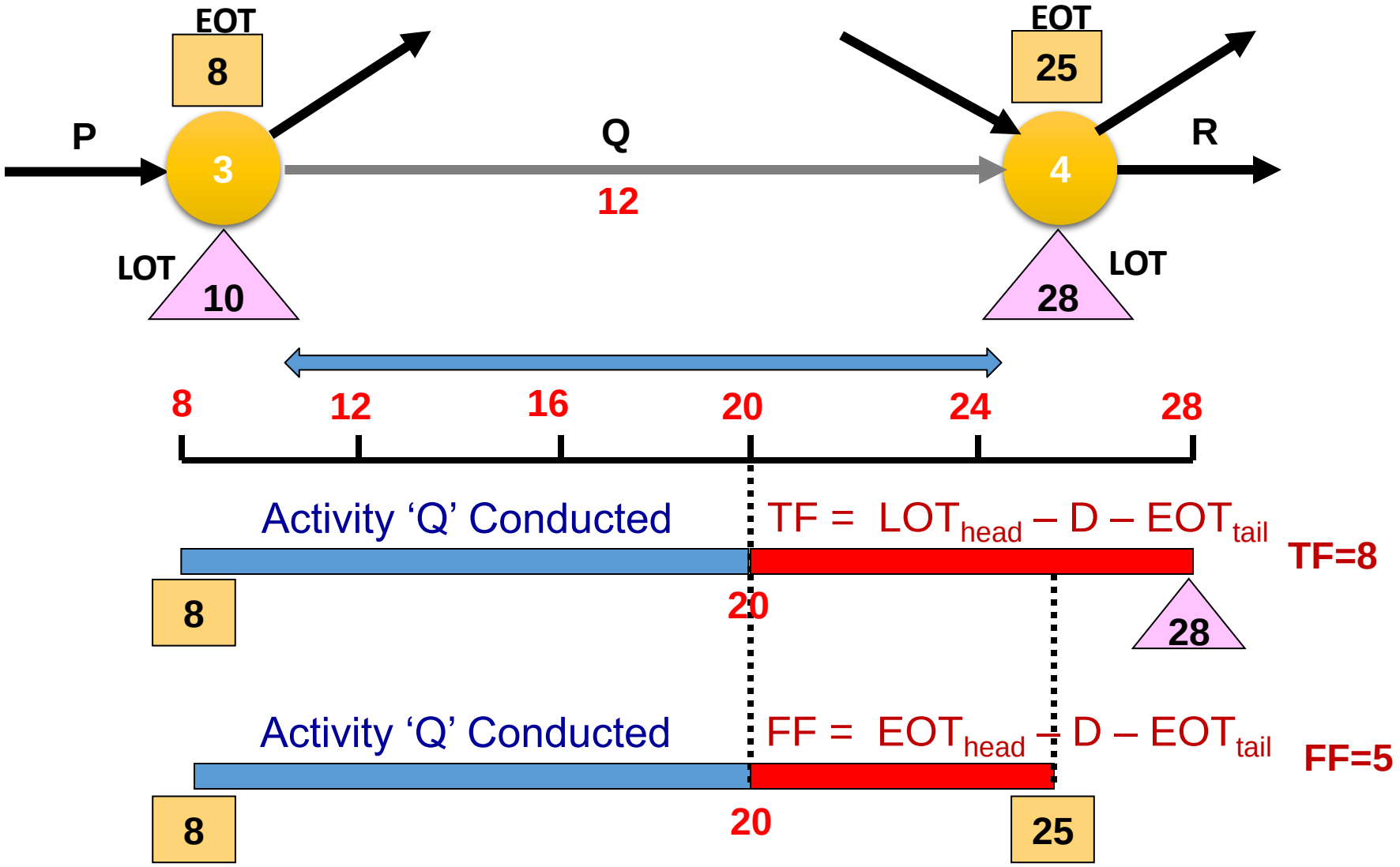
Any delay in Critical Activity causes a delay in proj completion

Floats

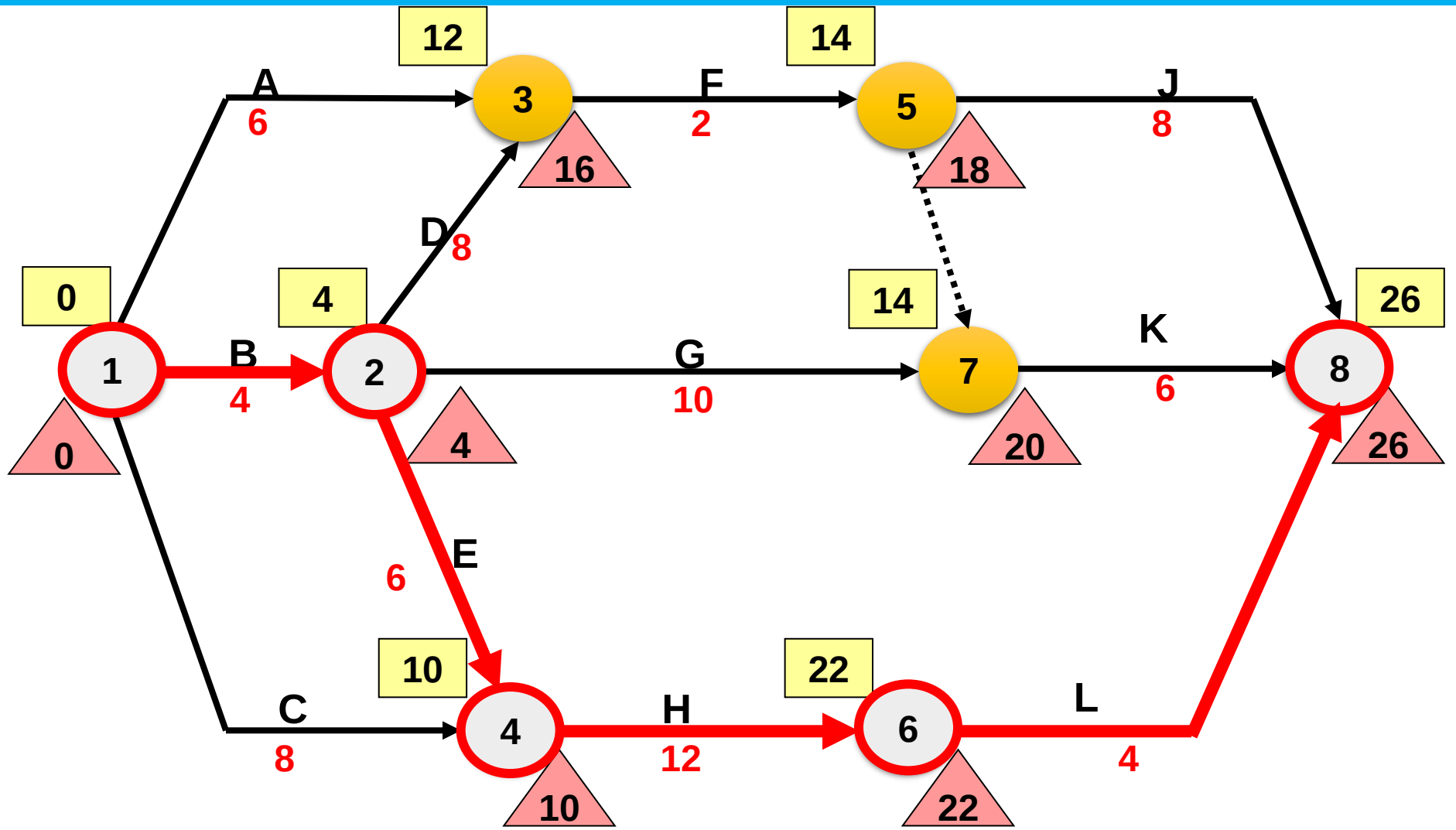
- Refer to the amount of time cushion, or scheduling flexibility, that is associated with activities on the project schedule.
- Float may occur when there are two or more activities happening concurrently.
- Utilisation
  - To economize & consume resources efficiently.
  - Appraise the effect of slippages.

Types of Float

1. *Total Float*
2. *Free Float*

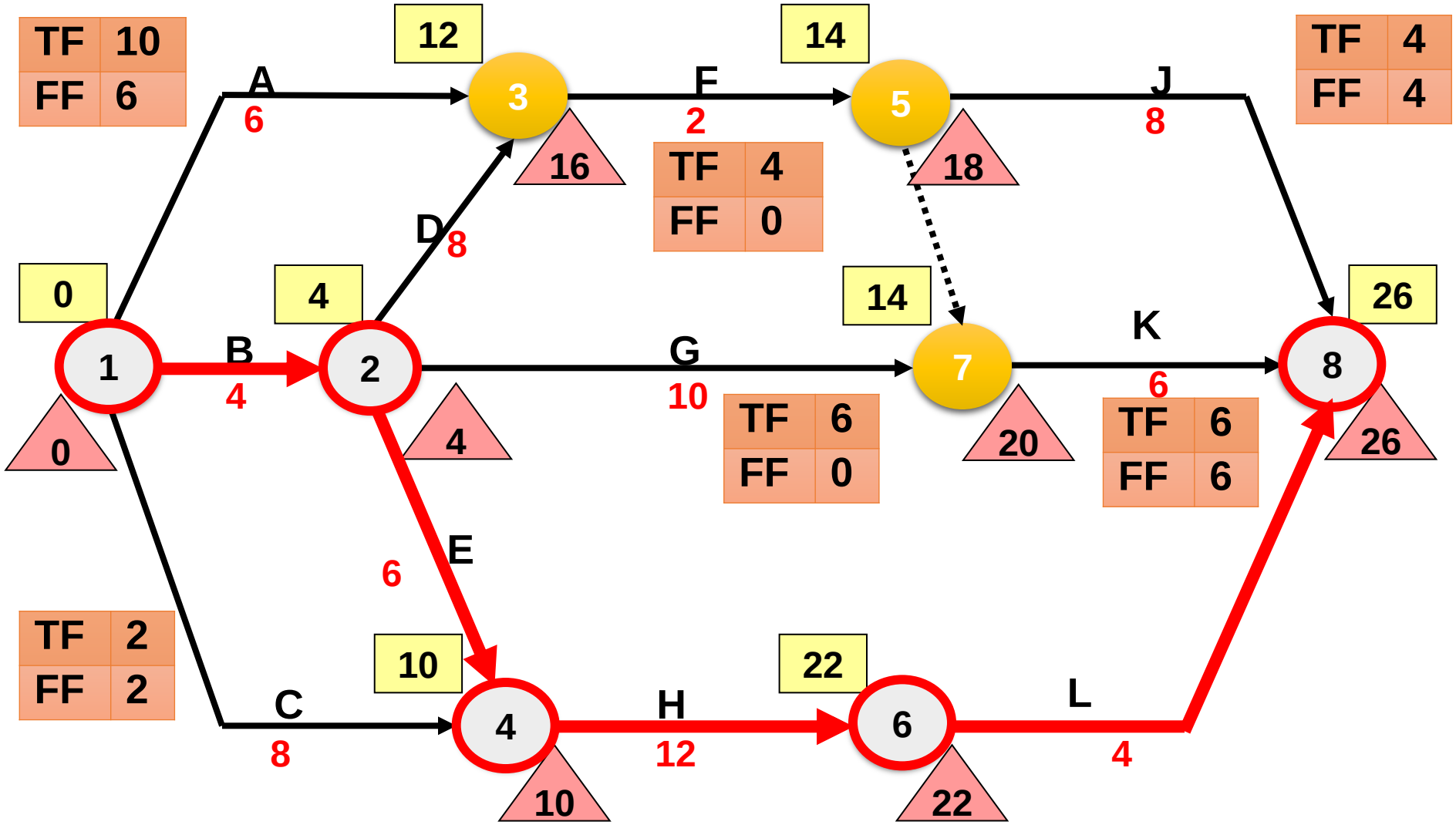

EOT
8
EOT
25
P
3
Q
12
4
R
LOT
10
LOT
28
8
12
16
20
24
28
Activity ‘Q’ Conducted
TF = LOT head – D – EOT tail
TF=8
8
20
28
Activity ‘Q’ Conducted
FF = EOT head – D – EOT tail
FF=5
8
20
25

Floats – Lets Draw



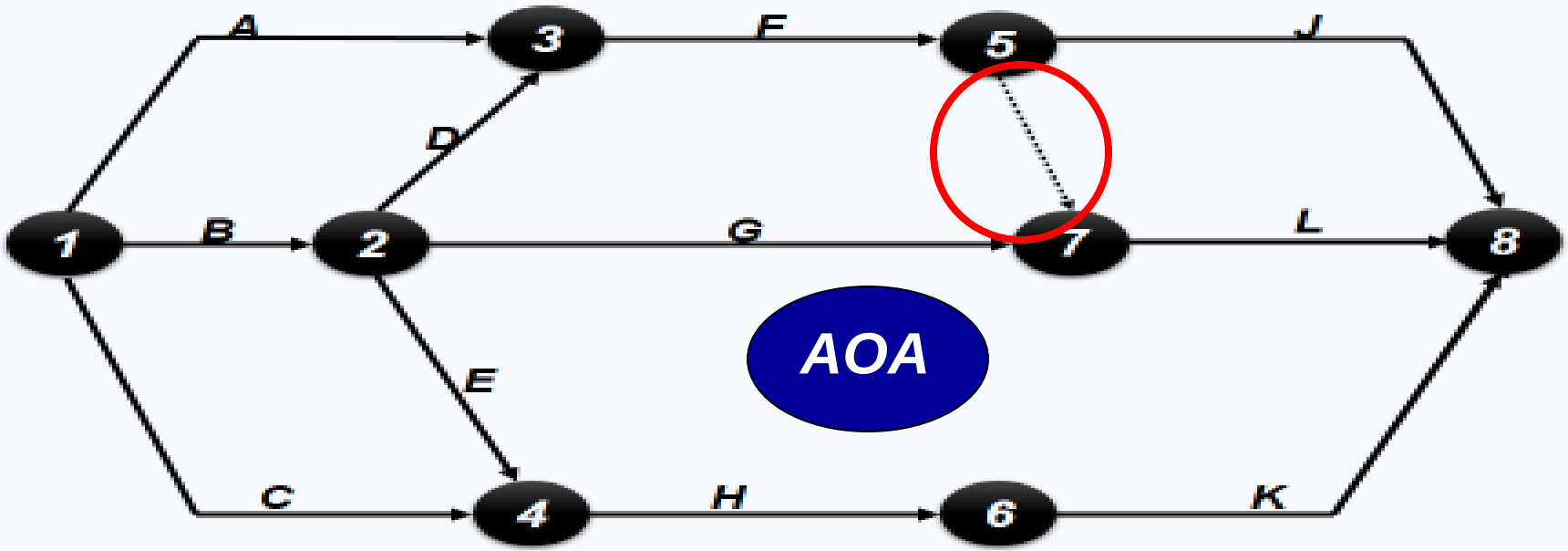
Determine the Total, Free & Independent Floats in the Project Schedule

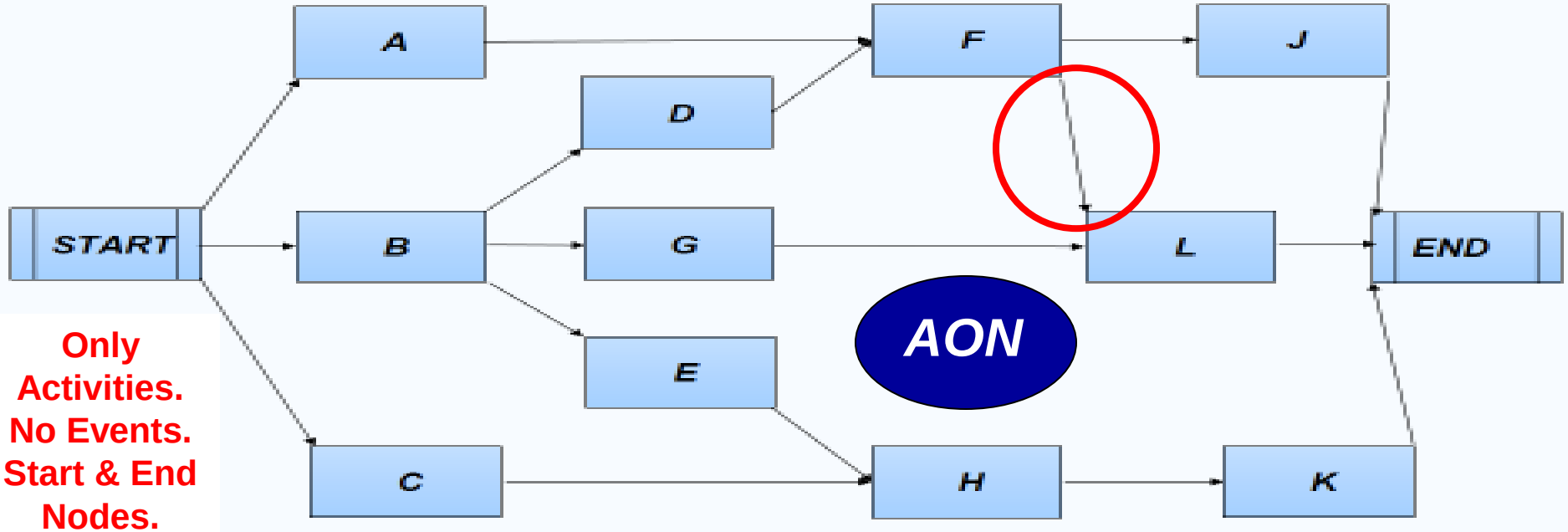
Analyse Schedule Flexibility:Lets Draw



Float utilization – appraise the impact of slippages along a Path

ACTIVITY ON NODE / PRECEDENCE DIAGRAMMING METHOD

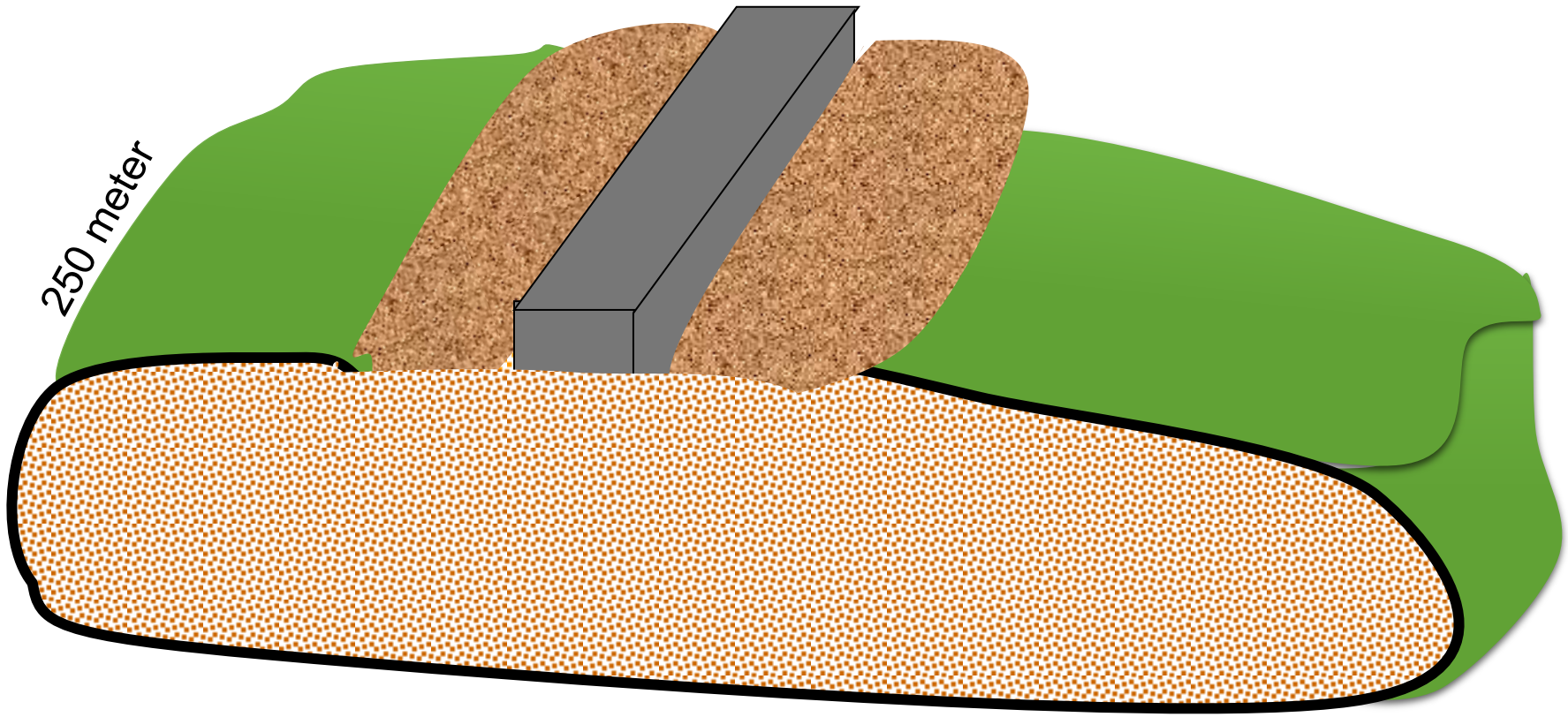




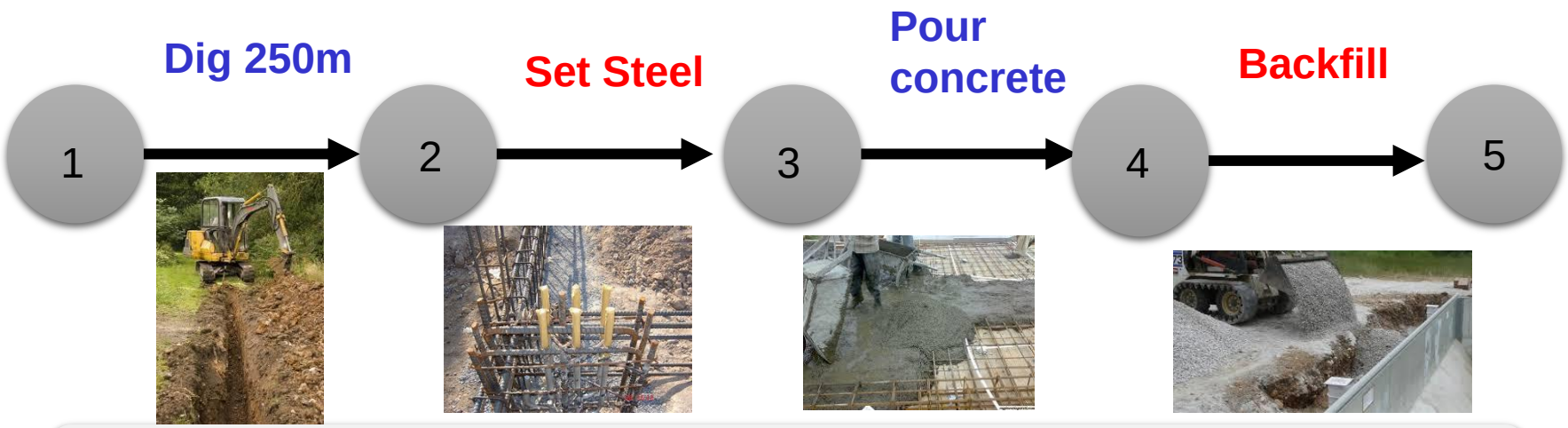
Only Activities. No Events. Start & End Nodes.

CASTING A FOUNDATION

A 250 M long foundation needs to be build



DIRECT SEQUENTIAL APPROACH



If each activity takes 5 days time &

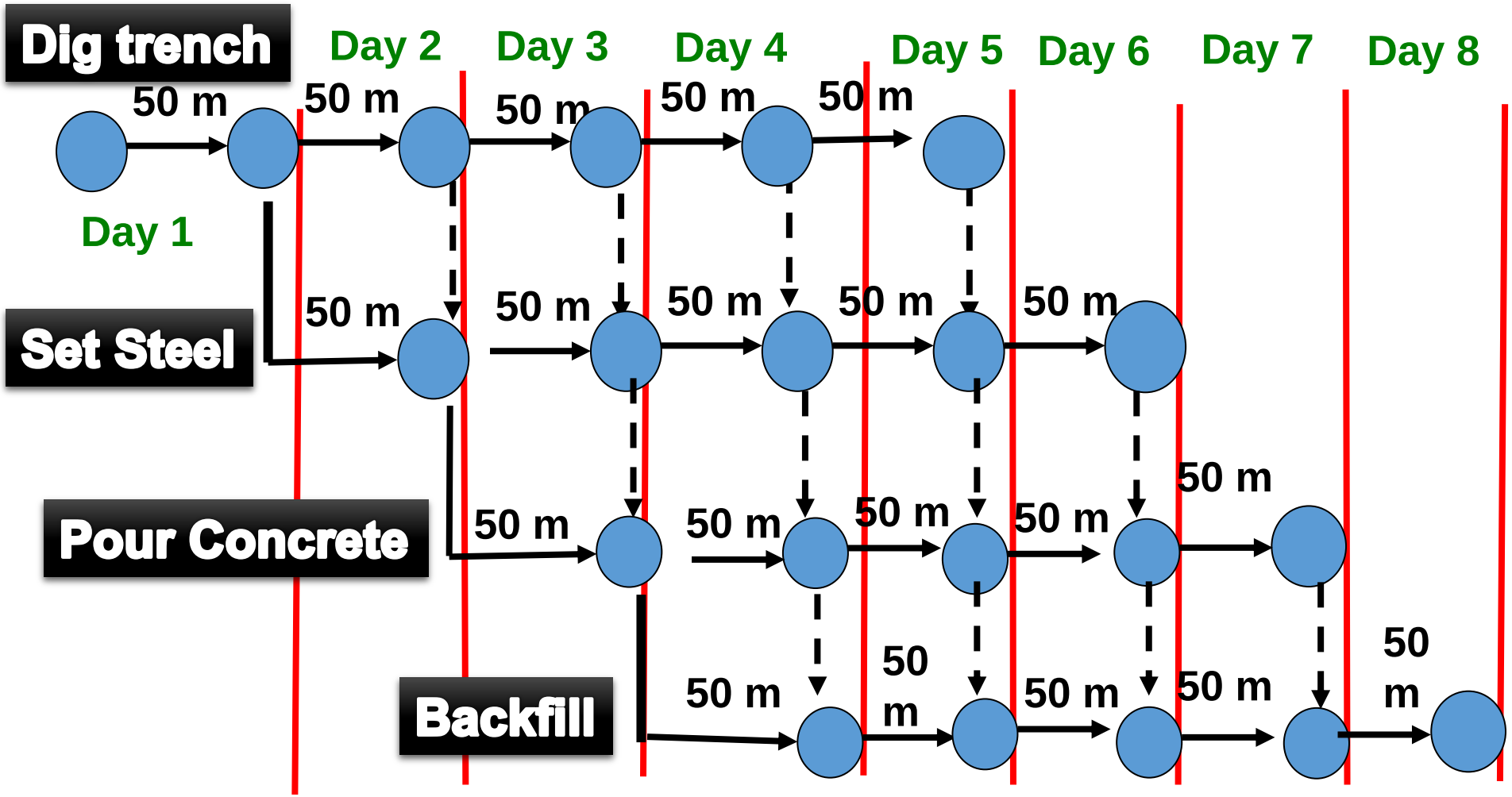
If all activities in serial sequence then,

5+5+5+5=20 days.

STAGGERED SEQUENTIAL APPROACH

- 1st day dig 50m only.
- 2nd day set steel for this 50m dug patch and continue digging further for 2nd 50m patch only.
- 3rd day: -
  - Pour concrete on the 1st 50m patch where steel has been set.
  - Set steel on the 2nd day's dug patch.
  - Continue digging 3rd 50m patch.
- 4th day: -
  - Backfill 1st 50m of completed patch.
  - Pour concrete on the 2nd 50m patch where steel has been set.
  - Set steel on 3rd days digging.
  - Dig next 4th patch of 50m.
- Continue till job gets completed.

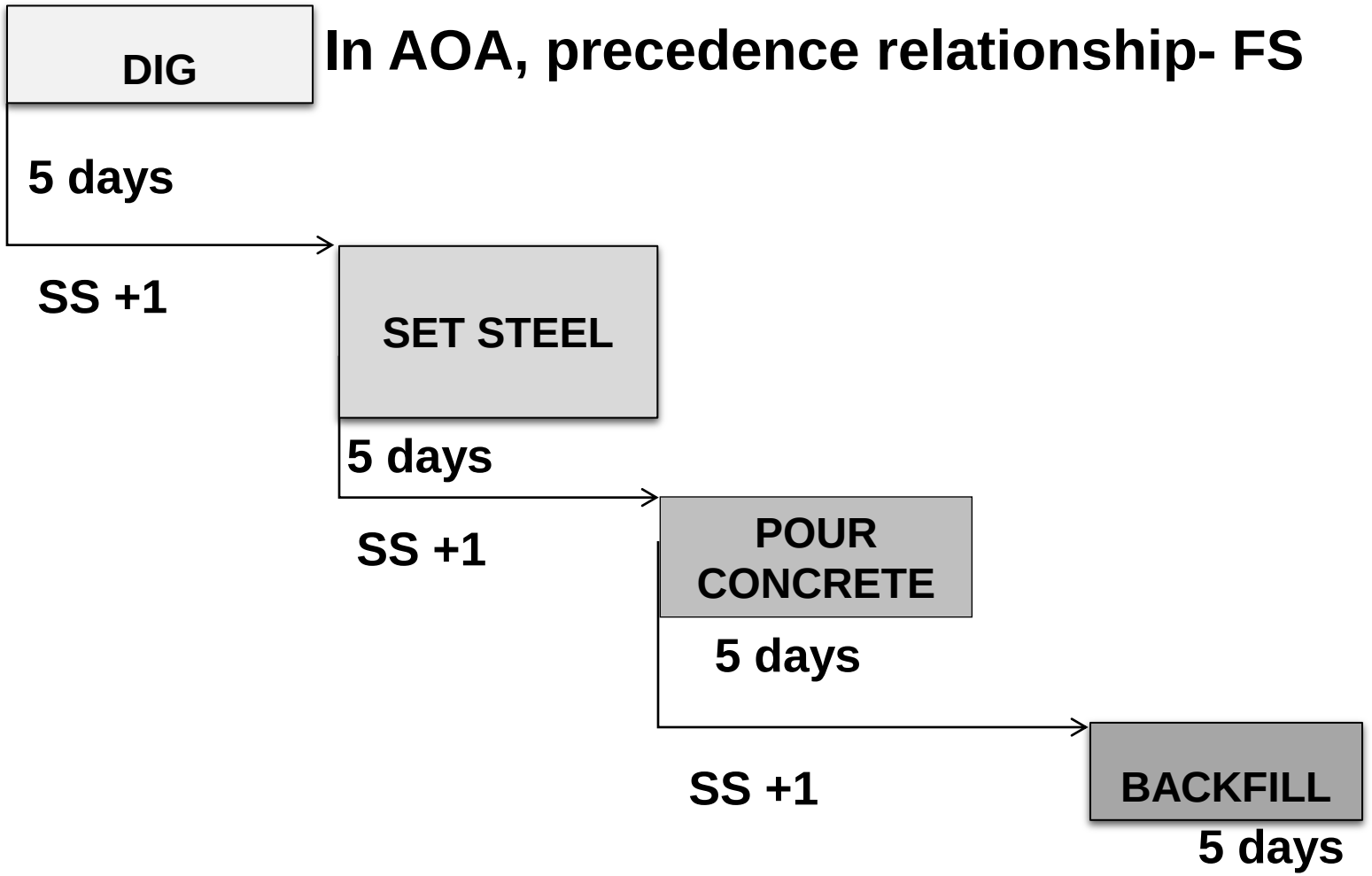
AOA NETWORK



20 ACTIVITIES, 21 EVENTS, 12 DUMMIES

NEW RELATION

In AOA, precedence relationship- FS



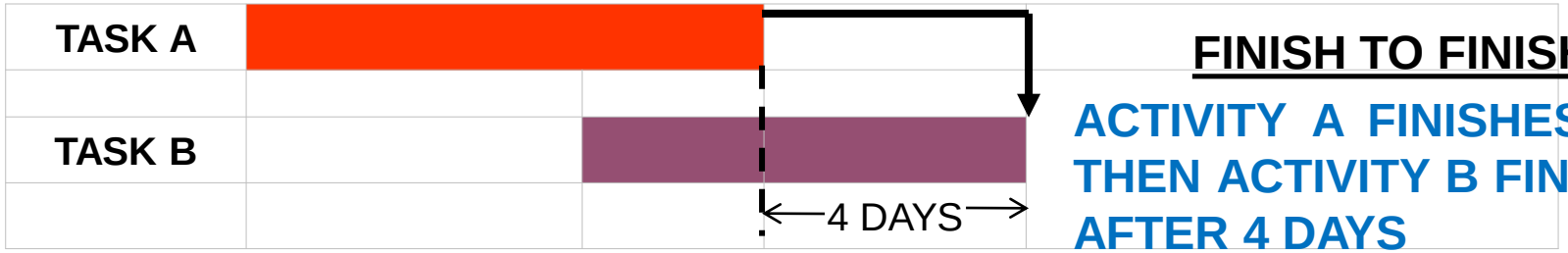
PRECEDENCE RELATIONSHIPS

PRECEDENCE RELATIONSHIP WITH LAG

START TO START

ACTIVITY A STARTS AND THEN ACTIVITY B STARTS AFTER 2 DAYS

$S_A S_B = 2$

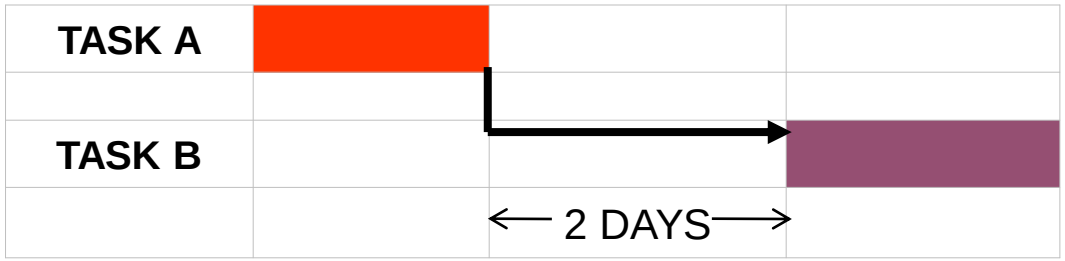


FINISH TO FINISH

ACTIVITY A FINISHES AND THEN ACTIVITY B FINISHES AFTER 4 DAYS

$F_A F_B = 4$

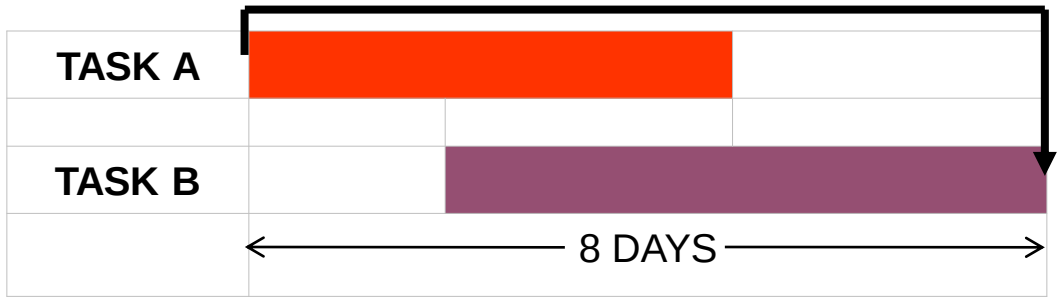
PRECEDENCE RELATIONSHIP WITH LAG



FINISH TO START

ACTIVITY A FINISHES AND THEN ACTIVITY B STARTS AFTER 2 DAYS

$F_AS_B = 2$

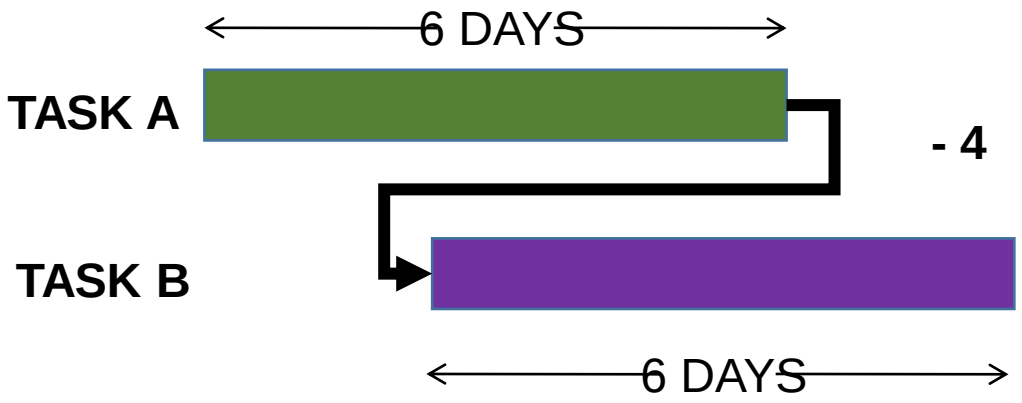


START TO FINISH

ACTIVITY A STARTS AND THEN ACTIVITY B FINISHES AFTER 8 DAYS

$S_AF_B = 8$

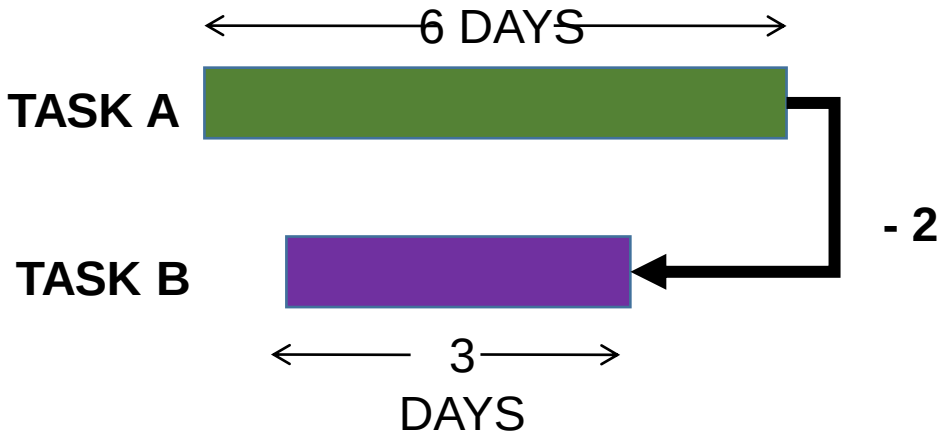
PRECEDENCE RELATIONSHIP WITH LEAD



FINISH TO START

ACTIVITY B STARTS 4 DAYS BEFORE FINISH OF A

$F_AS_B = -4$



FINISH TO FINISH

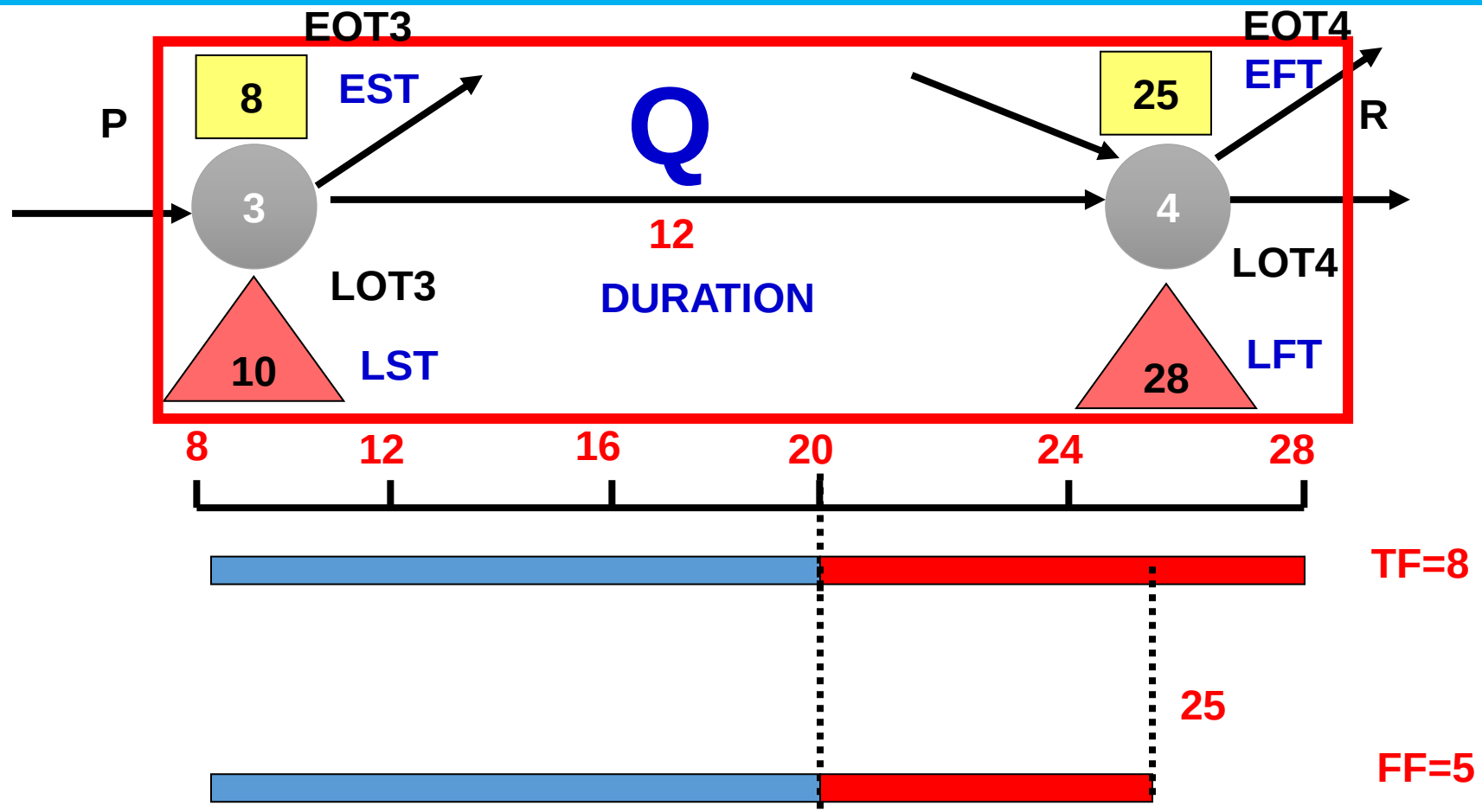
ACTIVITY B FINISHES 2 DAYS BEFORE FINISH OF A

$F_AF_B = -2$

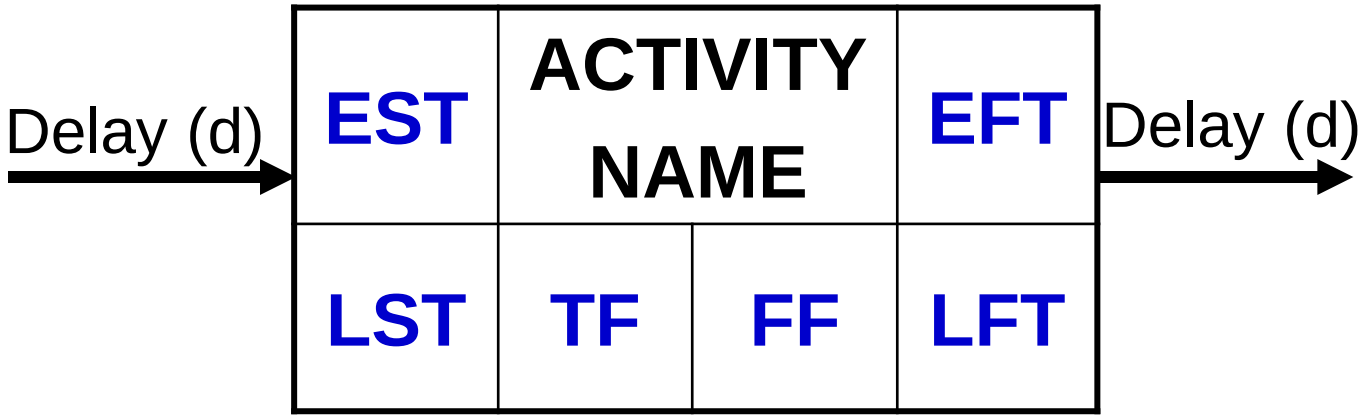
TIME FEATURES OF ACTIVITIES IN AON

Total Float (TF)	• Represents the amount of time an activity can be delayed without delaying the overall project duration
Free Float (FF)	• Represents the amount of time that an activity can be delayed without delaying the Early Start Time of any immediate successor activity within the network path

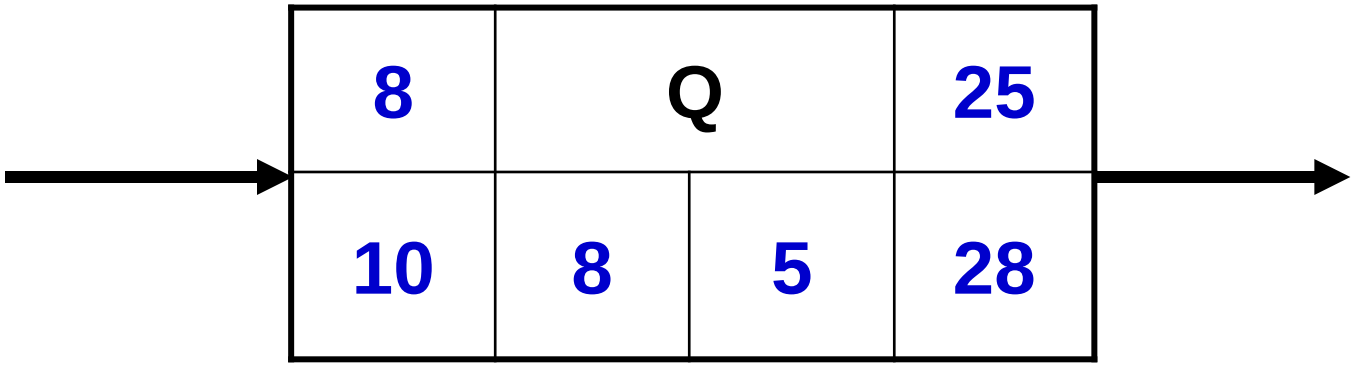
AON


EOT3
EOT4
8
EST
25
EFT
P
Q
R
3
4
12
LOT3
DURATION
LOT4
10
LST
28
LFT
8
12
16
20
24
28
TF=8
25
FF=5

AON


Delay (d)
EST
ACTIVITY NAME
EFT
Delay (d)
LST
TF
FF
LFT
DURATION (Du)

AON



12

RULES – AON NETWORKS

- Only one Start & one End Node.
- Logic flow from left to right.
- Avoid crossing of arrows.
- No danglers, No loops.
- If Start of an activity is hanging, connect to ‘Start’ of the project.
- Finish of all the activities should be controlling some activity. If not, then connect to the ‘Finish’ of the project.
- Forward and Backward Pass

EX - NEW ACCOMMODATION

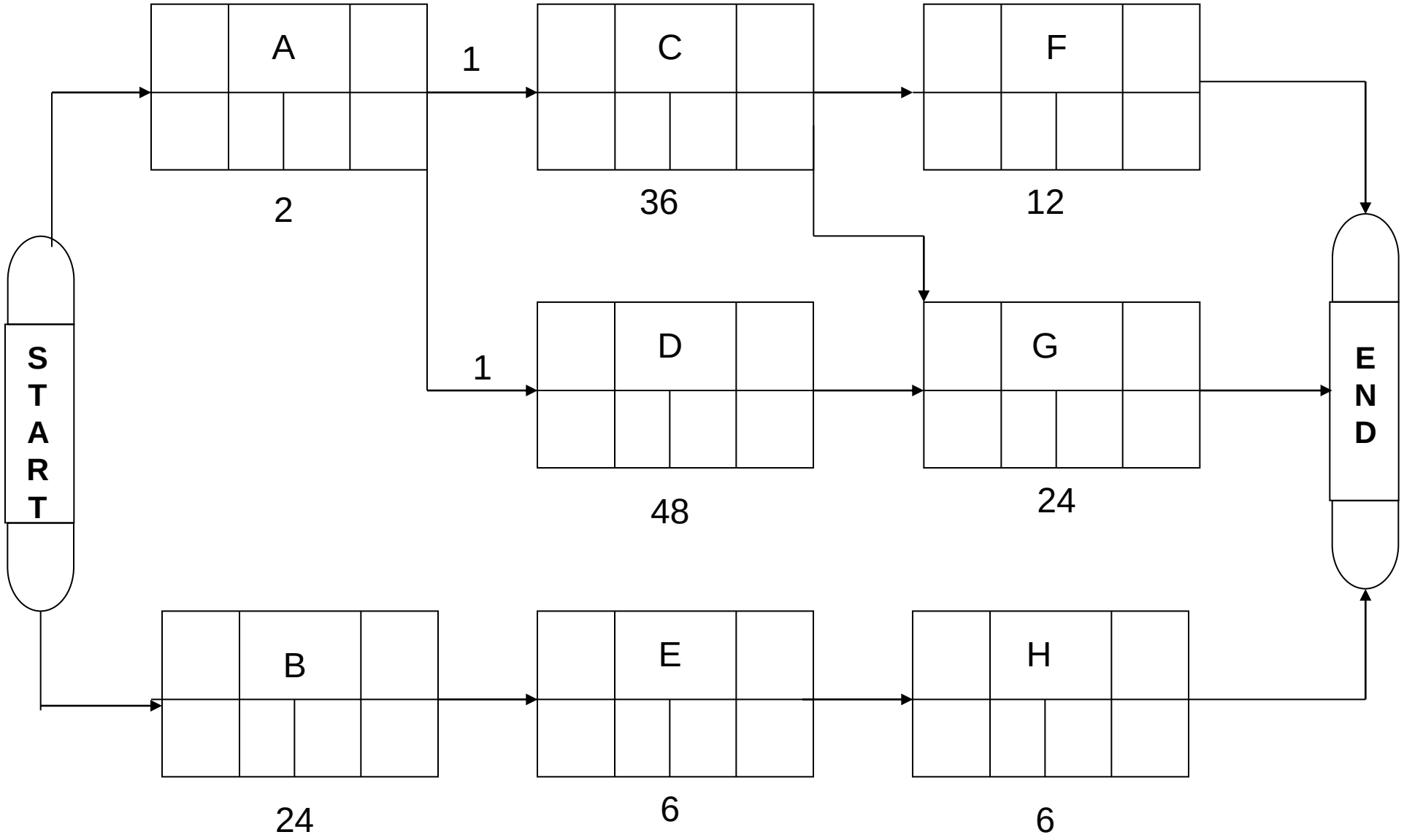
- List of imp activities are: -

(A) Leveling of Area	Starts Project	02 wks.
(B) Constr of B Wall & Gate	---do---	24 wks.
(C) Constr of R/W, Tarmac	Starts 1wk after A	36 wks.
(D) Constr of Hangar, ATC	---do---	48 wks.
(E) Fence and Watch Tower	Follow B	06 wks.
(F) Storm Water Drains	Follow C	12 wks.
(G) Runway Lights & Beacon	Follow C & D Finishes project	24 wks.
(H) Security Lights & Alarm	Contrl by E	06 wks.

TABLE

Sl No	Activity	Duration (Wks)	Precedence	Remarks
1	A	02	-	Starts the project
2	B	24	-	Starts the project
3	C	36	Start 1wk after A	F_AS_C =1
4	D	48	Start 1wk after A	F_AS_D =1
5	E	06	B	F_BS_E =0
6	F	12	C	F_CS_F =0
7	G	24	C & D	F_CS_G=0, F_DS_G=0
8	H	06	E	F_ES_H=0

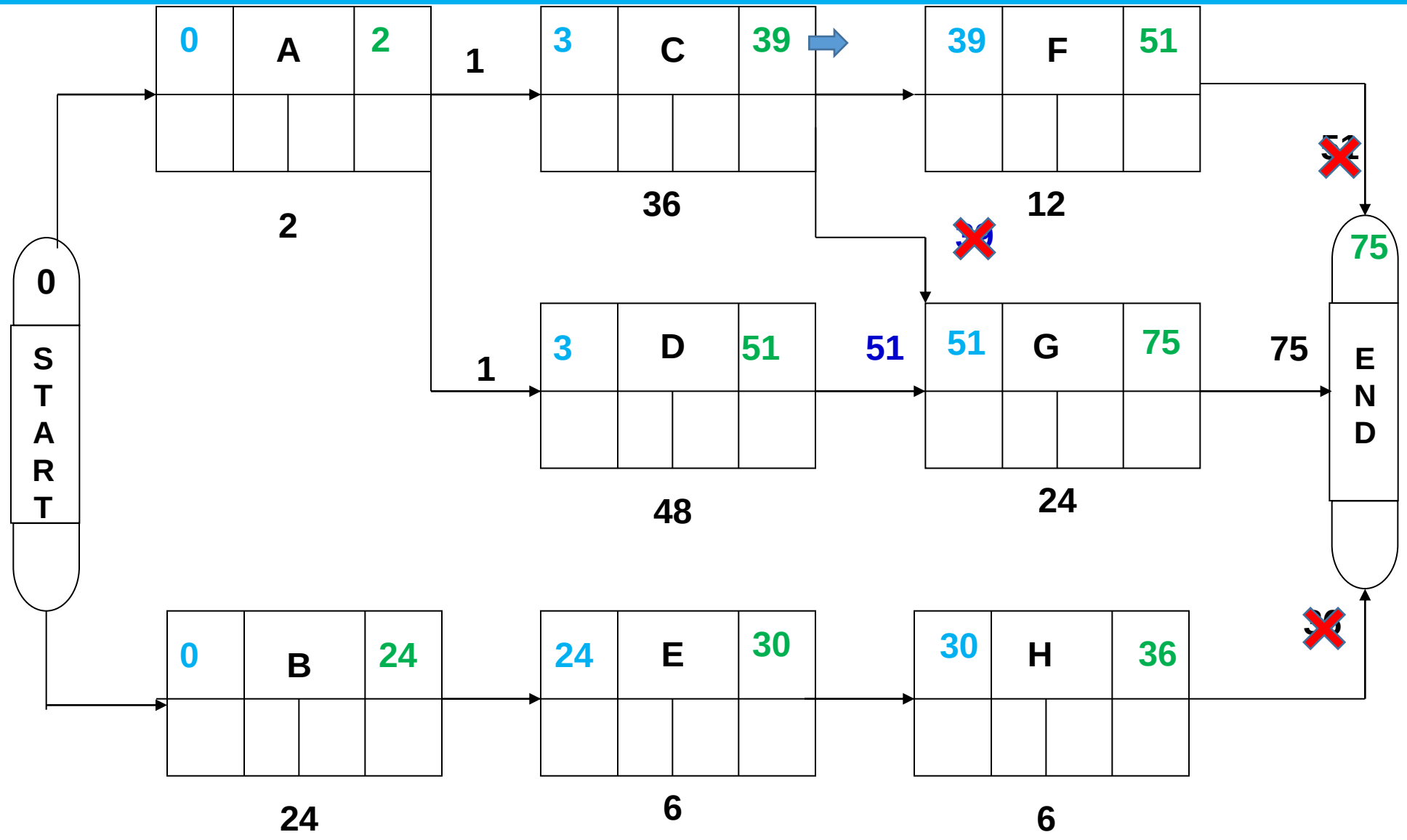
NEW ACCOMMODATION



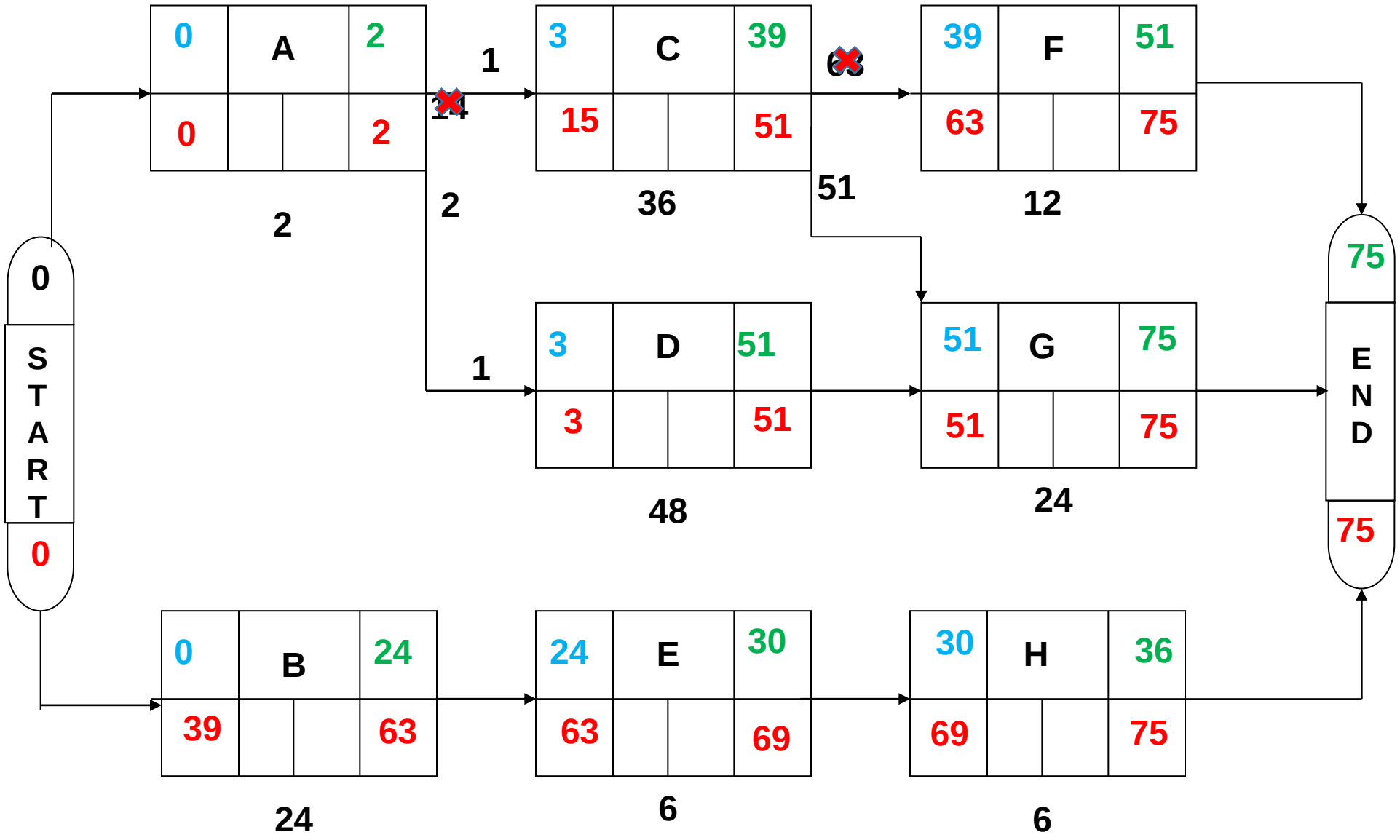
NETWORK ANALYSIS

- Two parts to the analysis
- Forward Pass
  - Calculates the DURATION of the Project
- Backward Pass
  - Calculates the SLACK / FLOAT for each task
  - Shows the CRITICAL PATH

NEW ACCOMMODATION

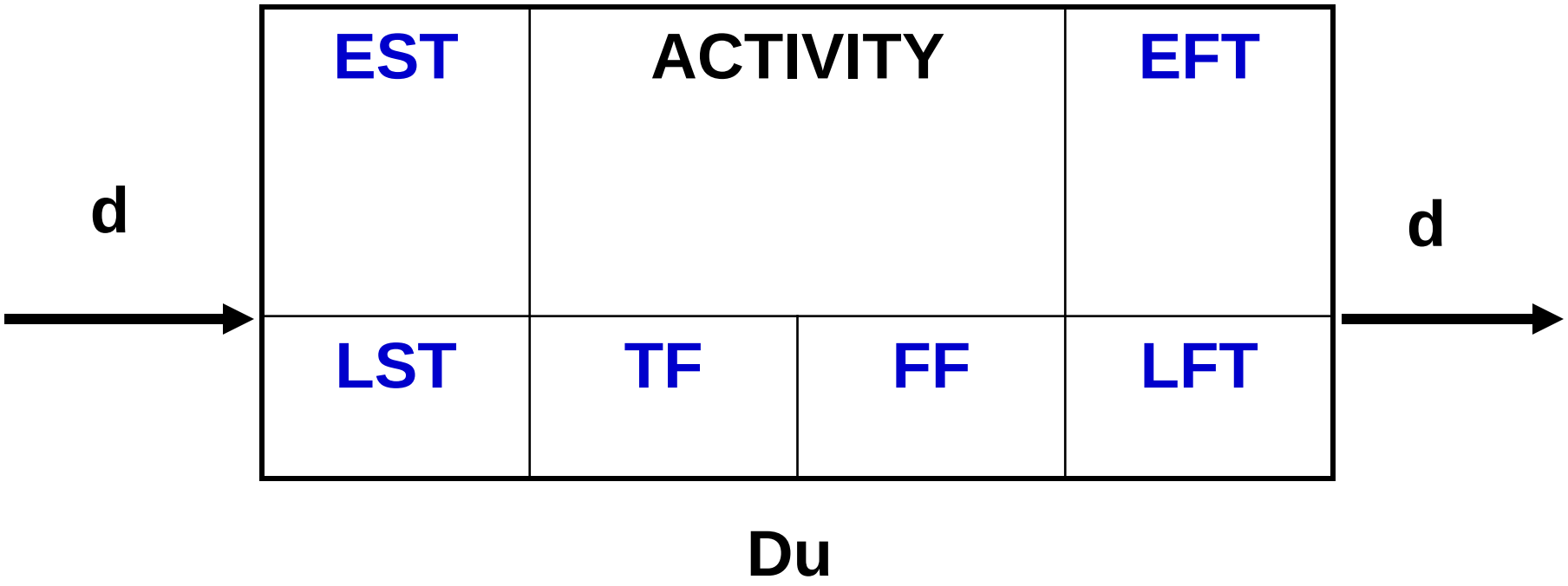


NEW ACCOMMODATION

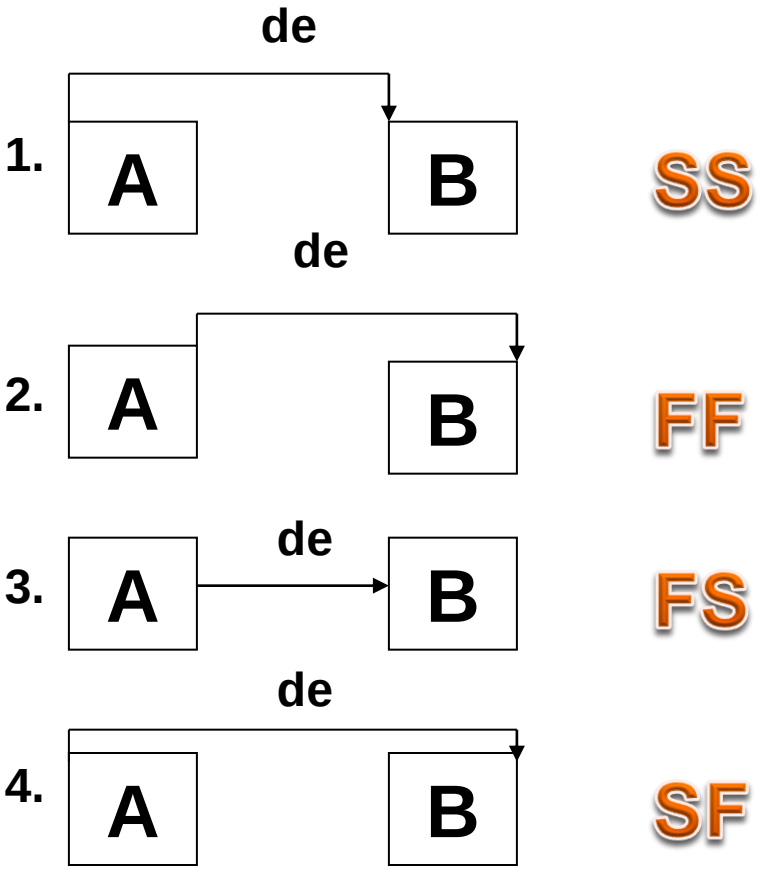


CALCULATION OF TOTAL FLOATS

STARTING TOTAL FLOAT = LST-EST
FINISHING TOTAL FLOAT = LFT-EFT

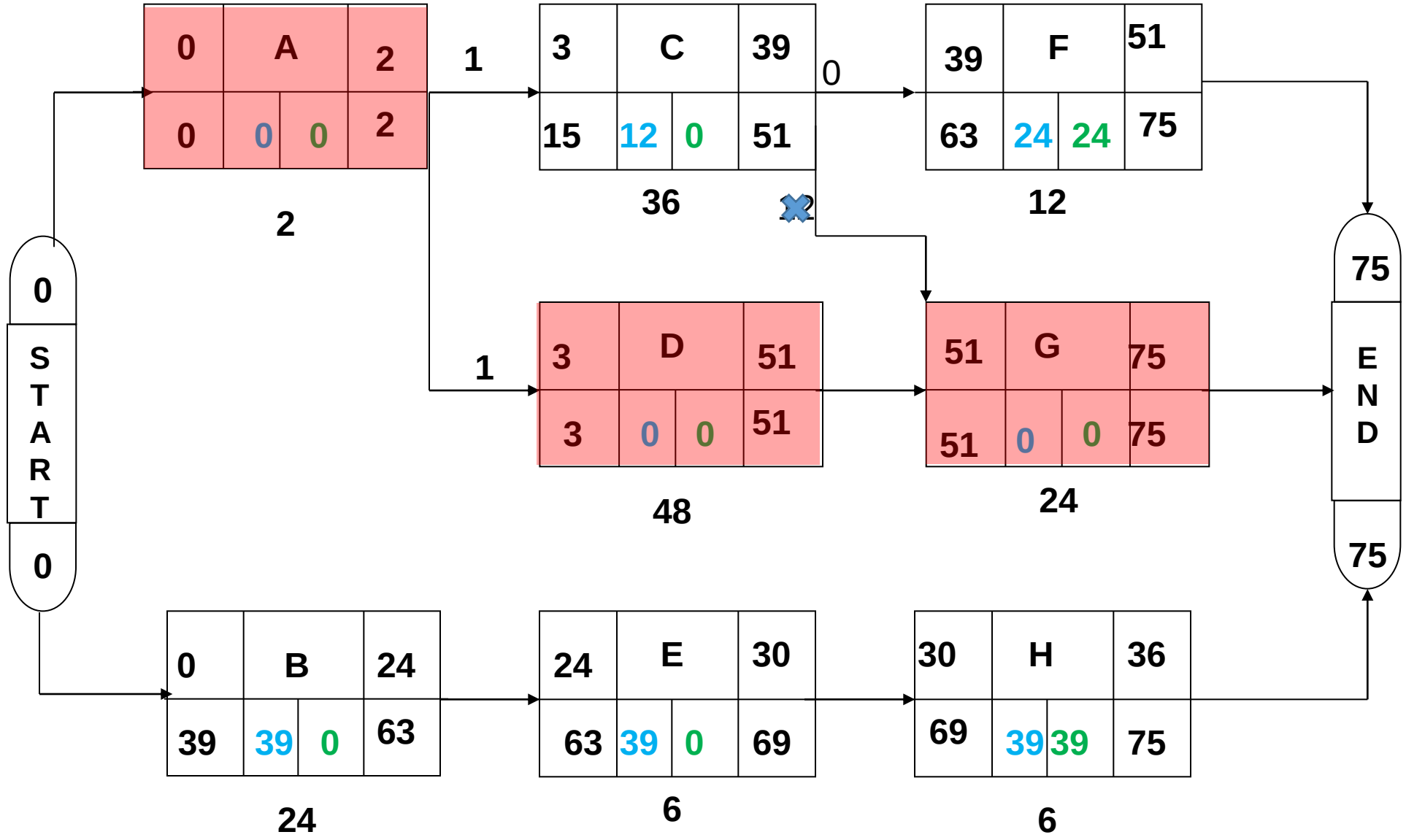


CALCULATION OF FREE FLOATS



EST_B – de – EST_A
EFT_B –de – EFT_A
EST_B – de – EFT_A
EFT_B –de – EST_A

NEW ACCOMMODATION



ADVANTAGES OF AON OVER AOA

- Less complex; more compact.
- Complex precedence relationships.
- No dummies.
- Lag without splitting activities.
- Amenable to digitisation / computerisation.