PROJECT MANAGEMENT FUNDAMENTALS BOOTCAMP

Session 2

Class will begin at 11am EDT

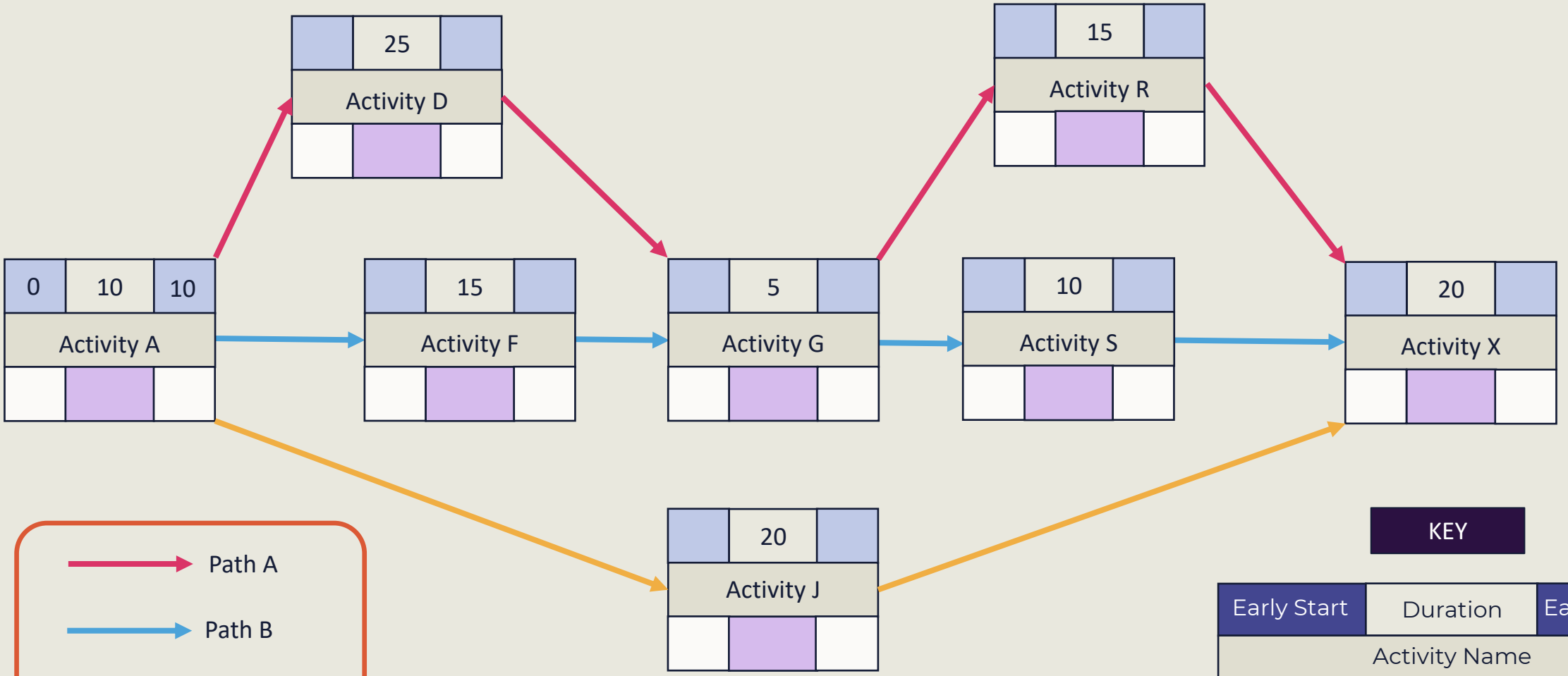
Instructor: Barb Waters, MBA, PMP

CRITICAL PATH METHOD (CPM)

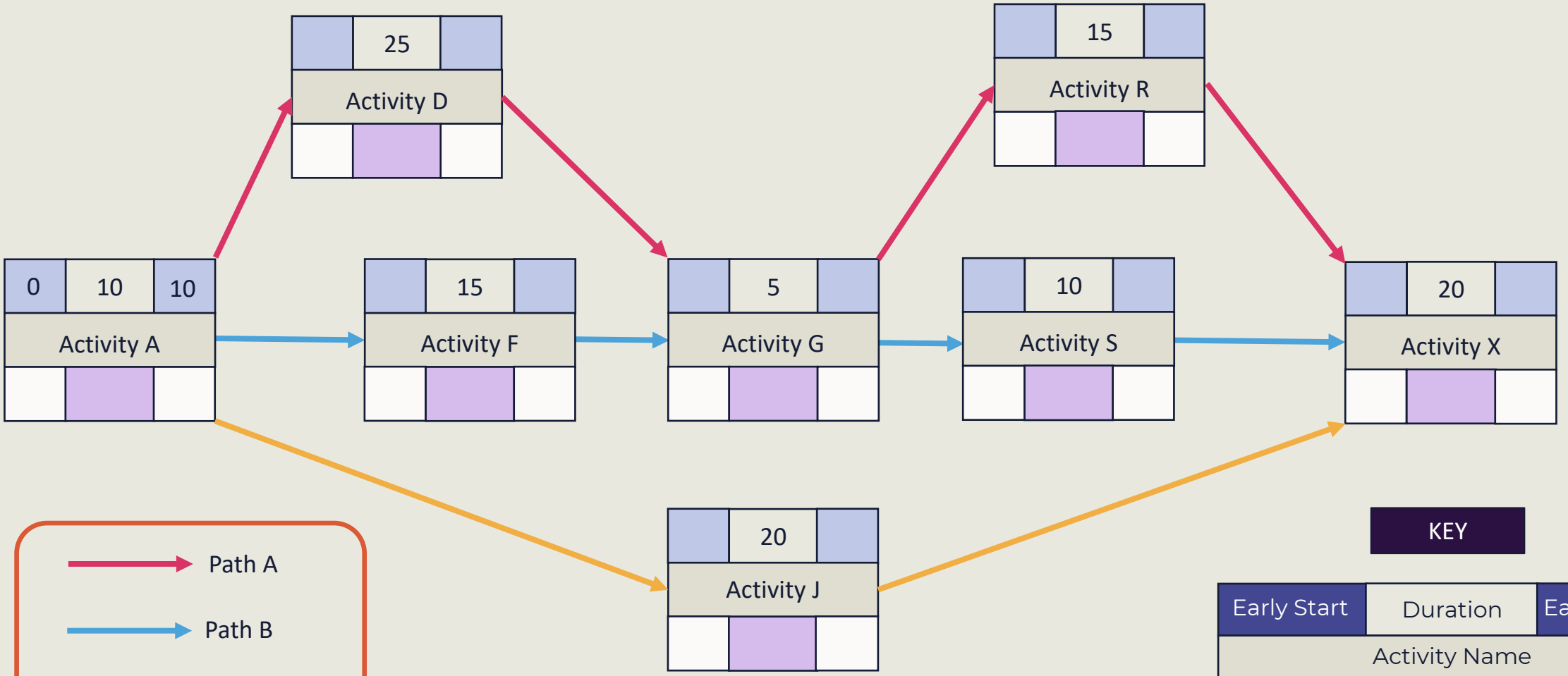
The **Critical Path Method**, or **CPM**, is used to calculate the minimum total project duration, based on estimates of how long critical activities will take to complete. The critical path is the path with no float, in which the activities have no flexibility with their scheduled dates.

Forward Pass. A critical path method technique for calculating the early start and early finish dates by working forward through the schedule model from the project start date or a given point in time.

THE FORWARD PASS



THE FORWARD PASS



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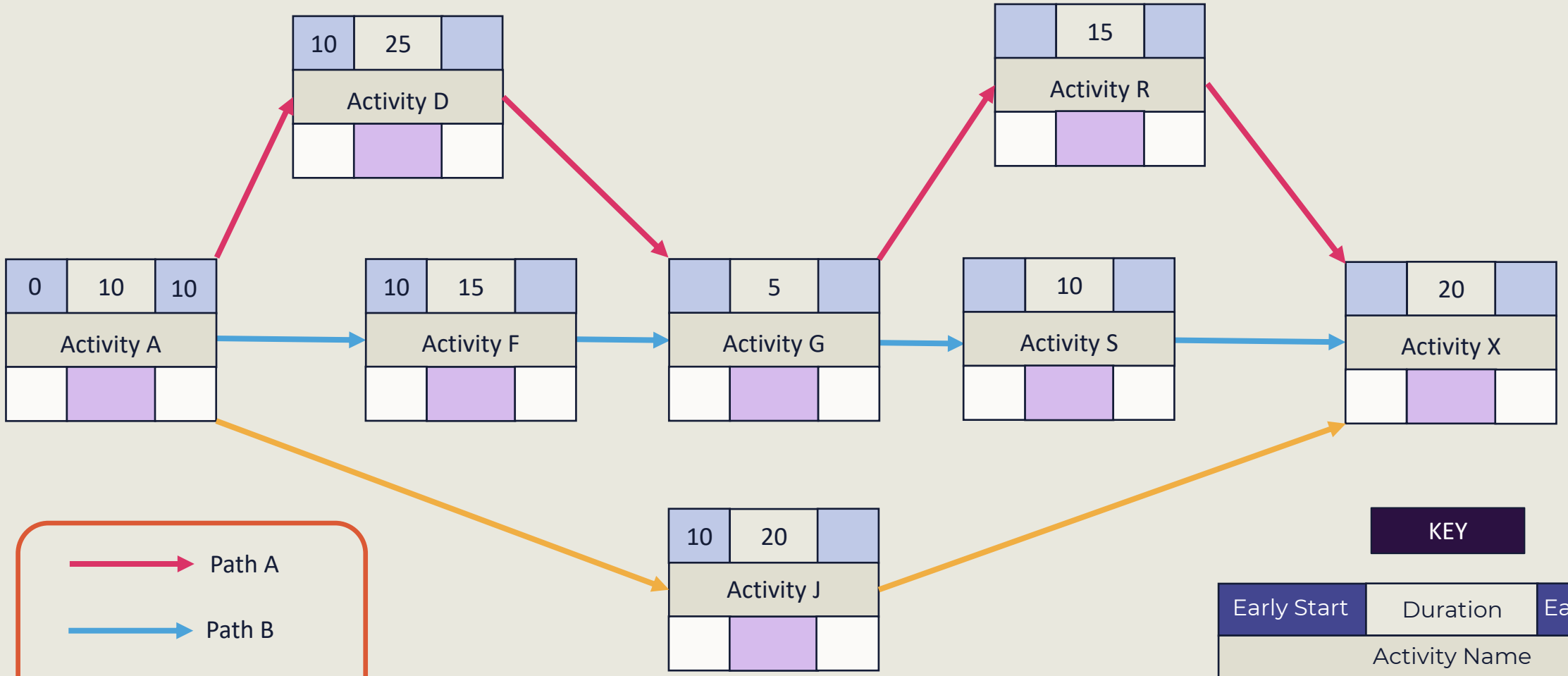

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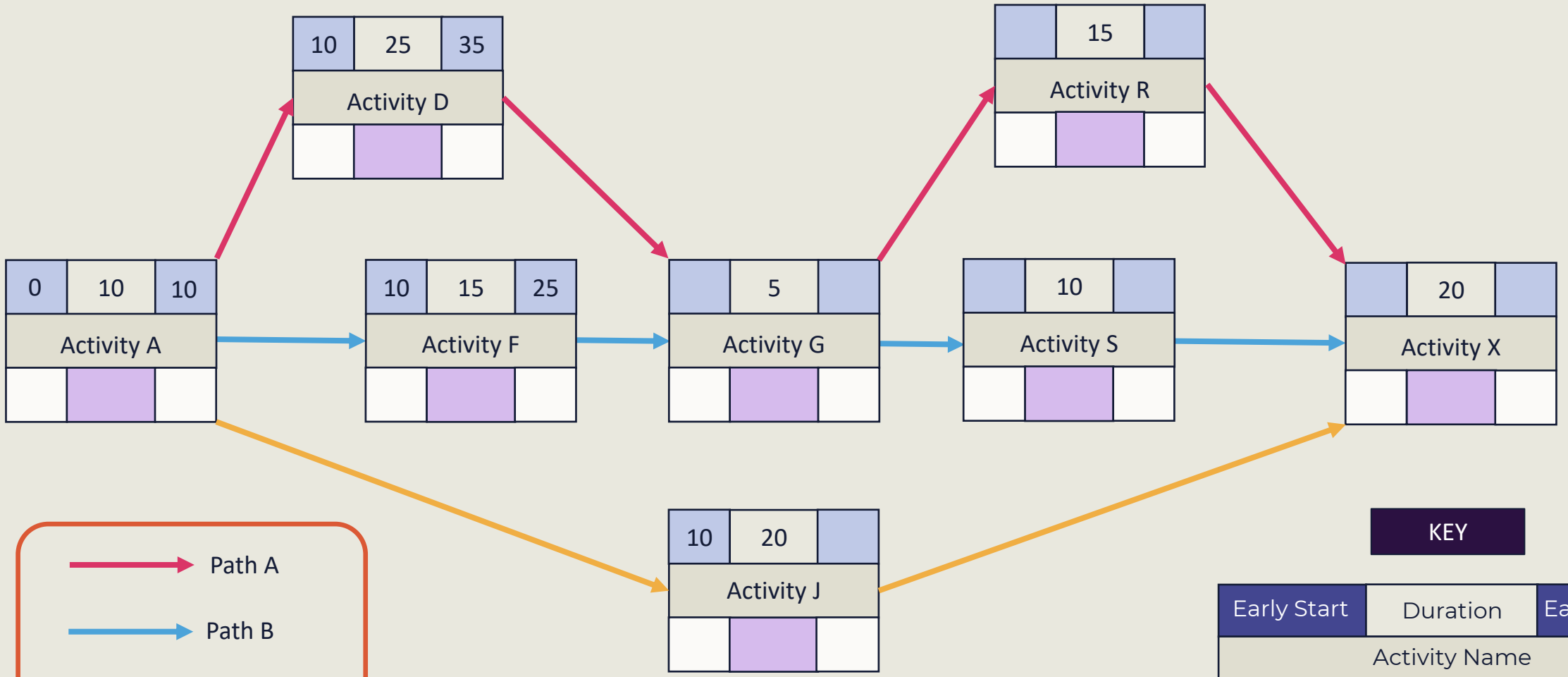

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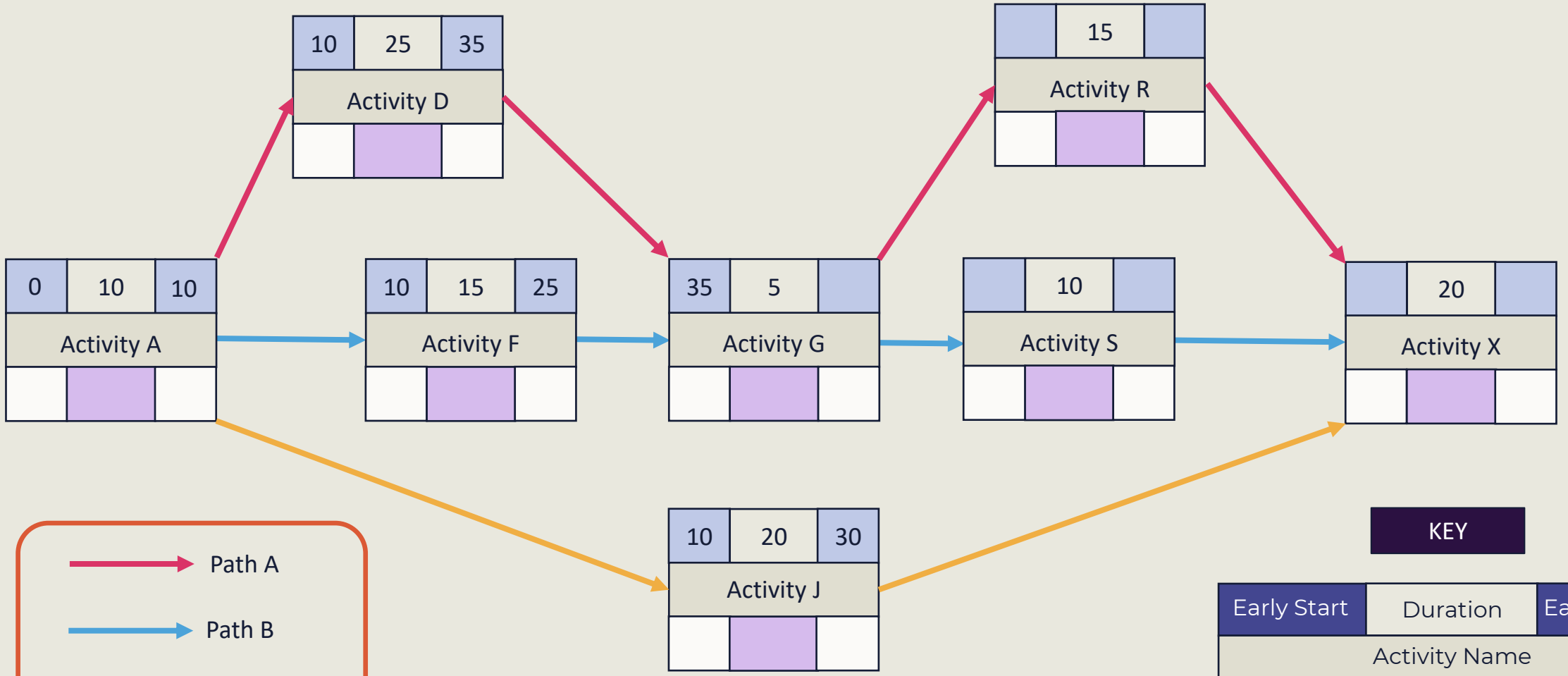

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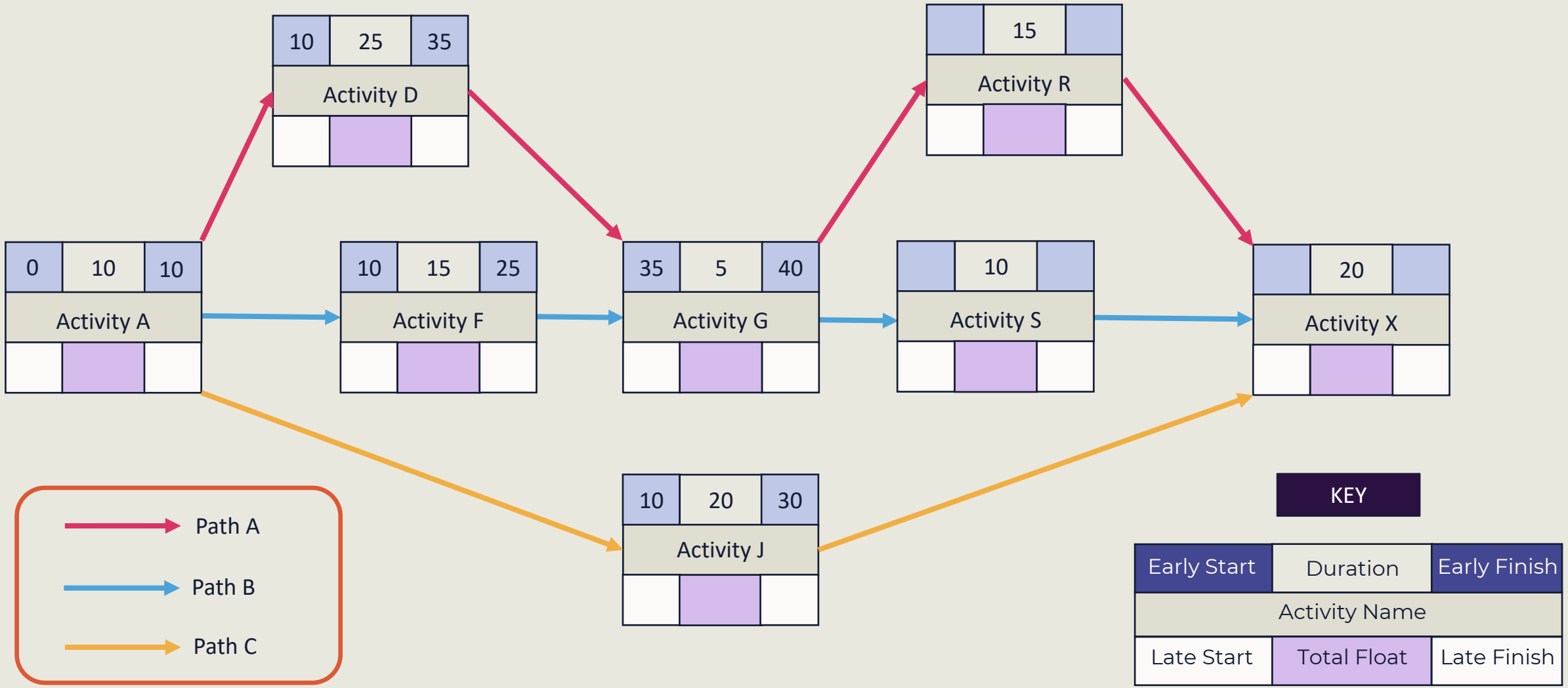

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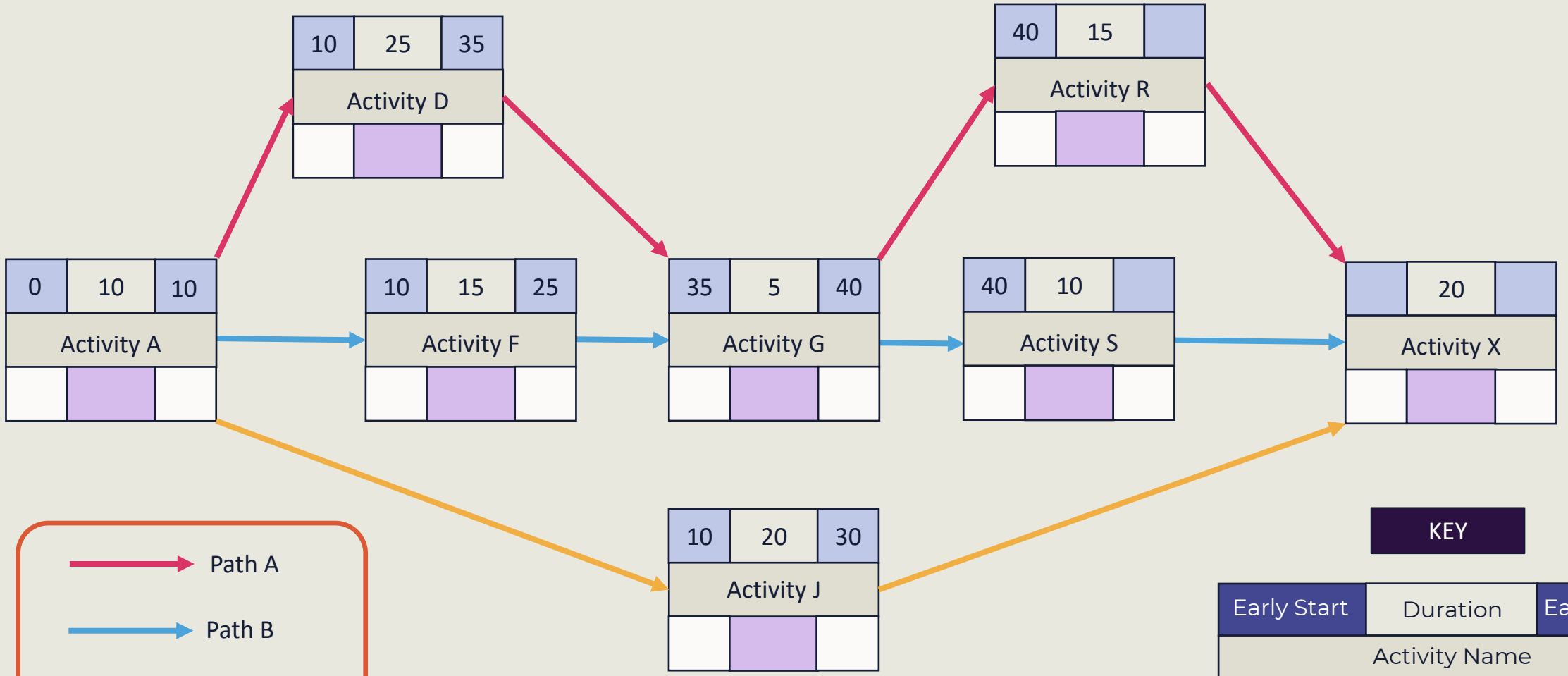

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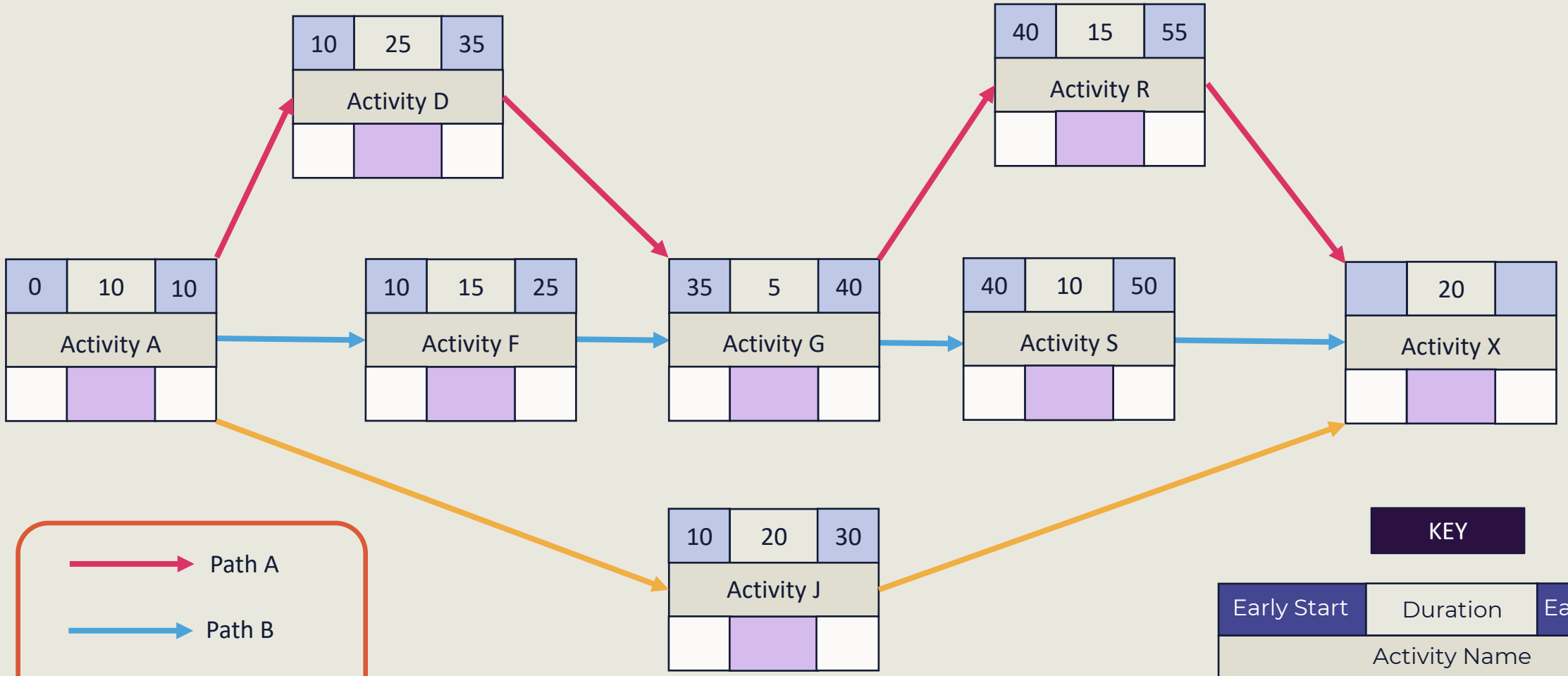

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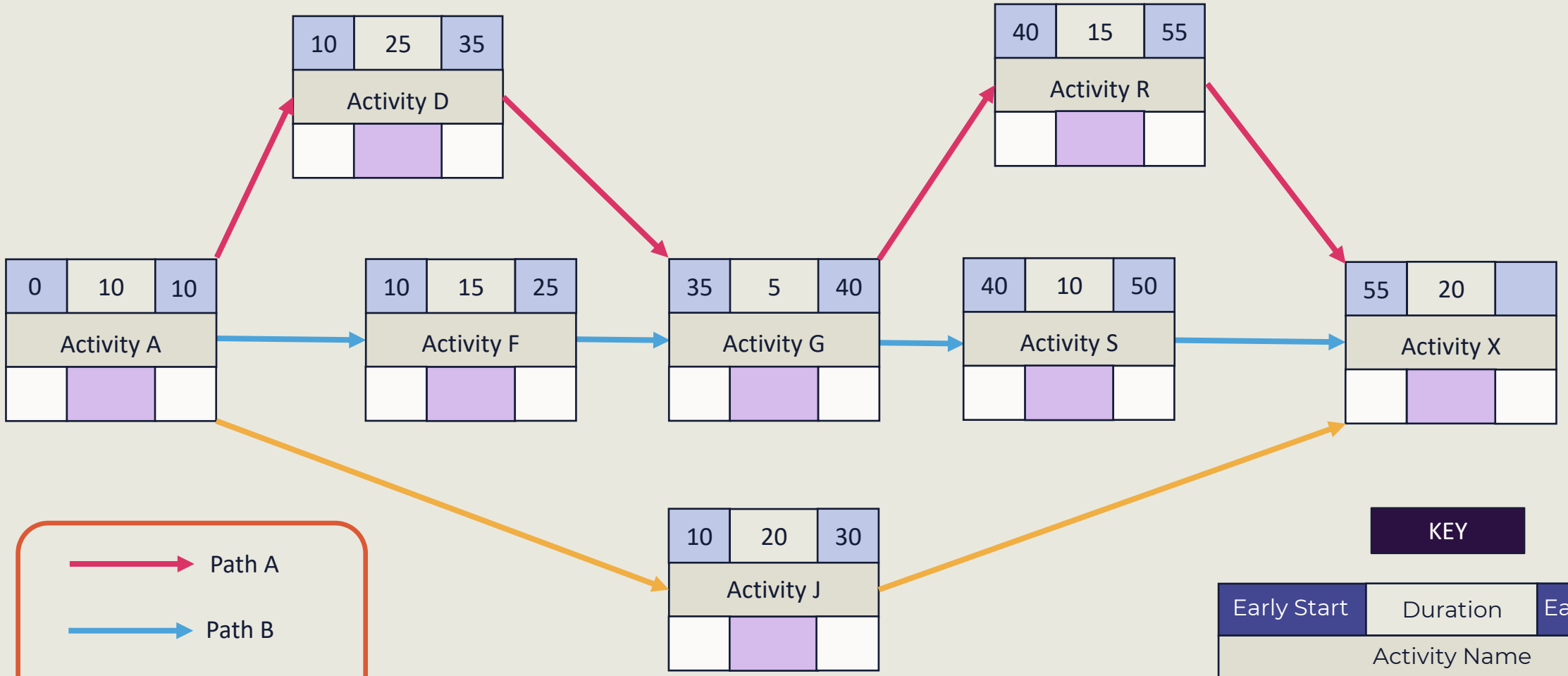

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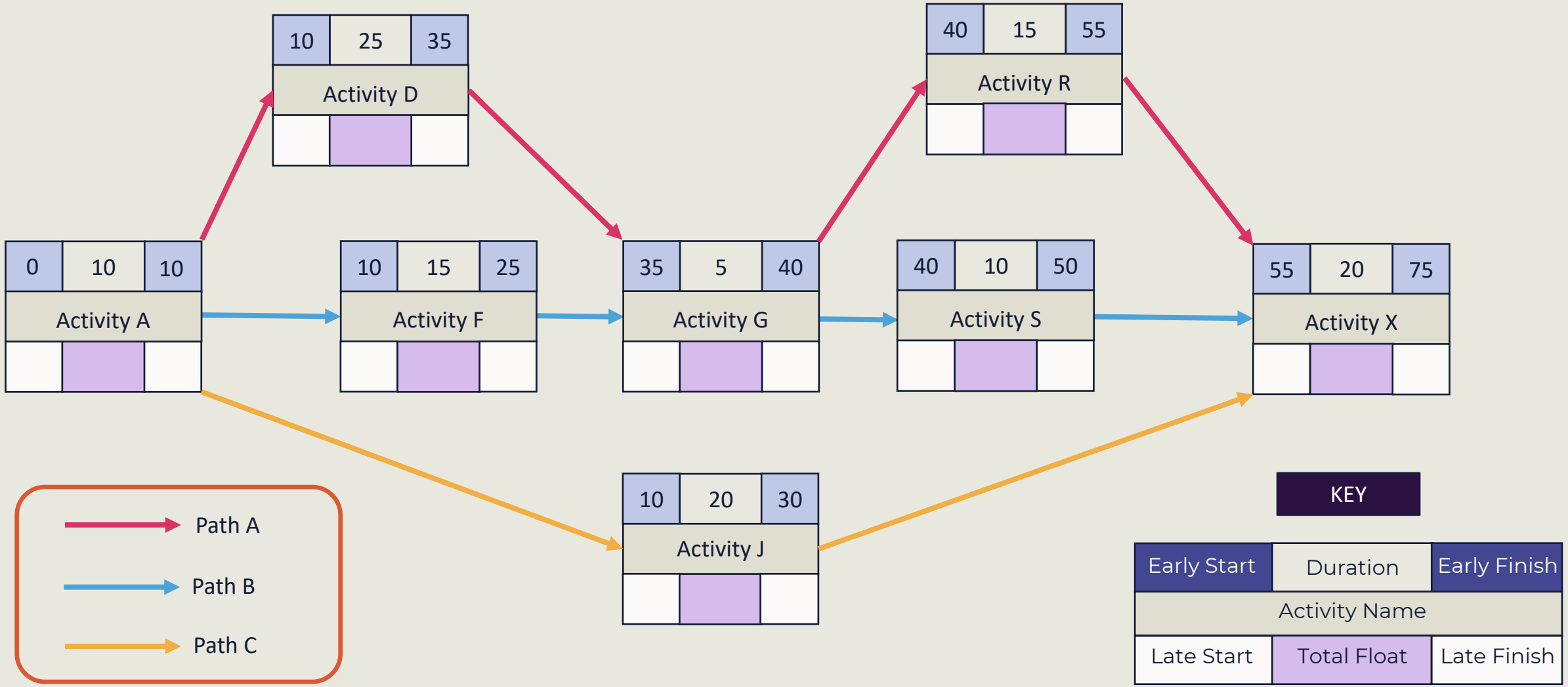

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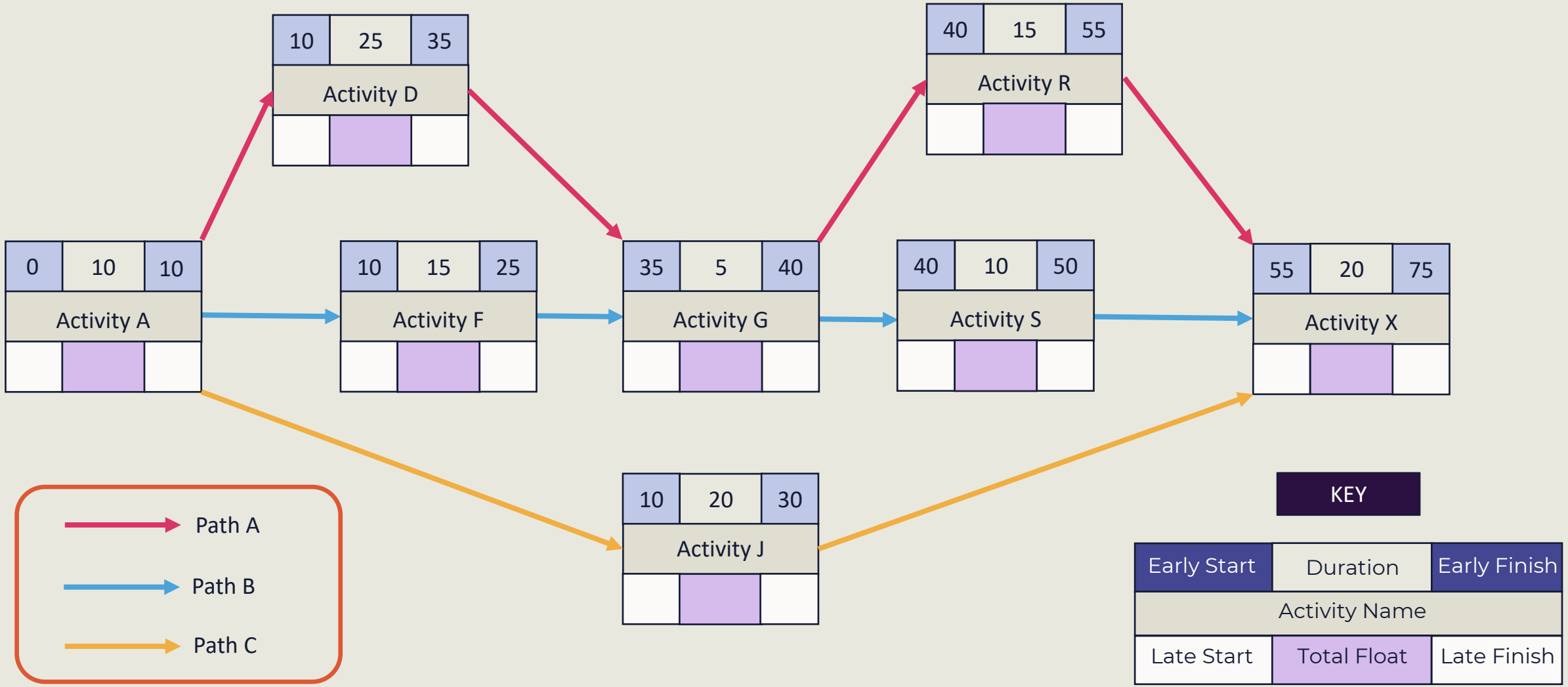

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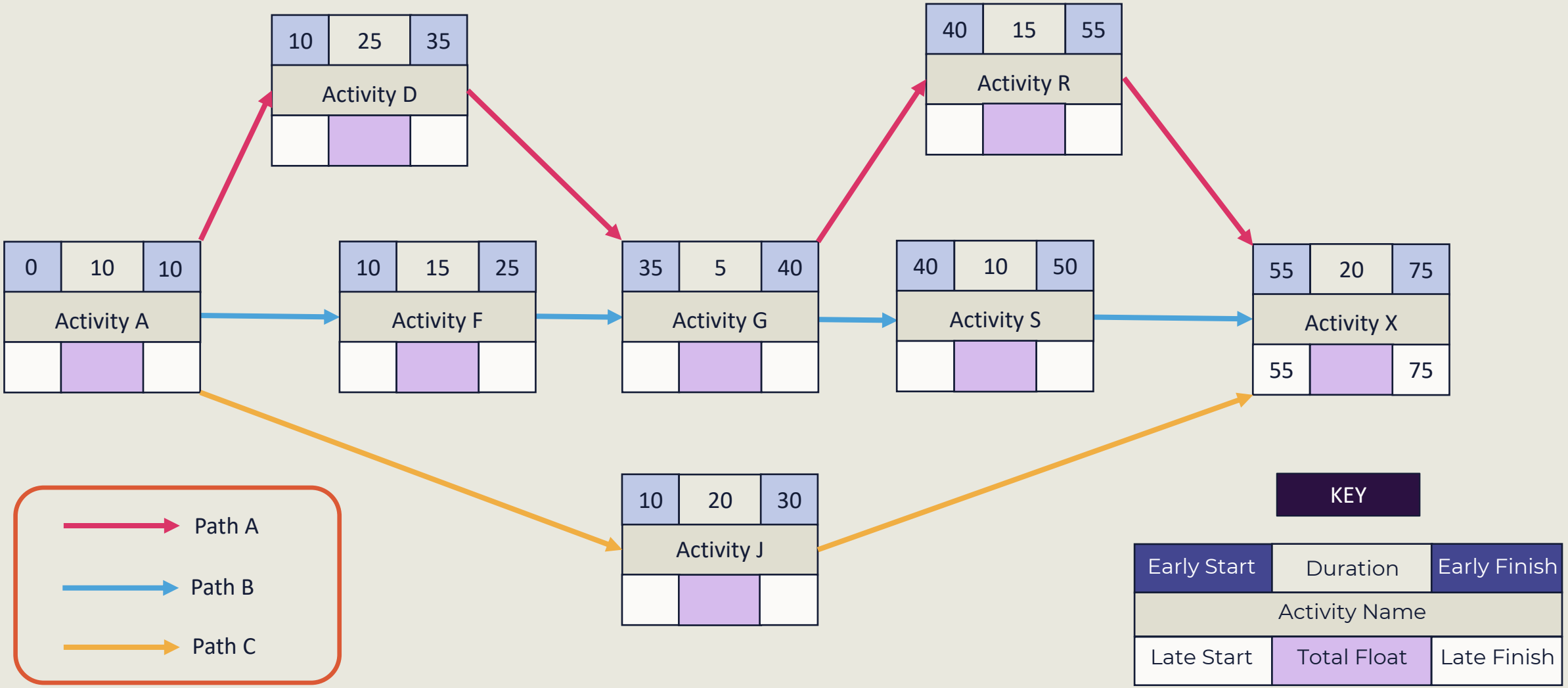

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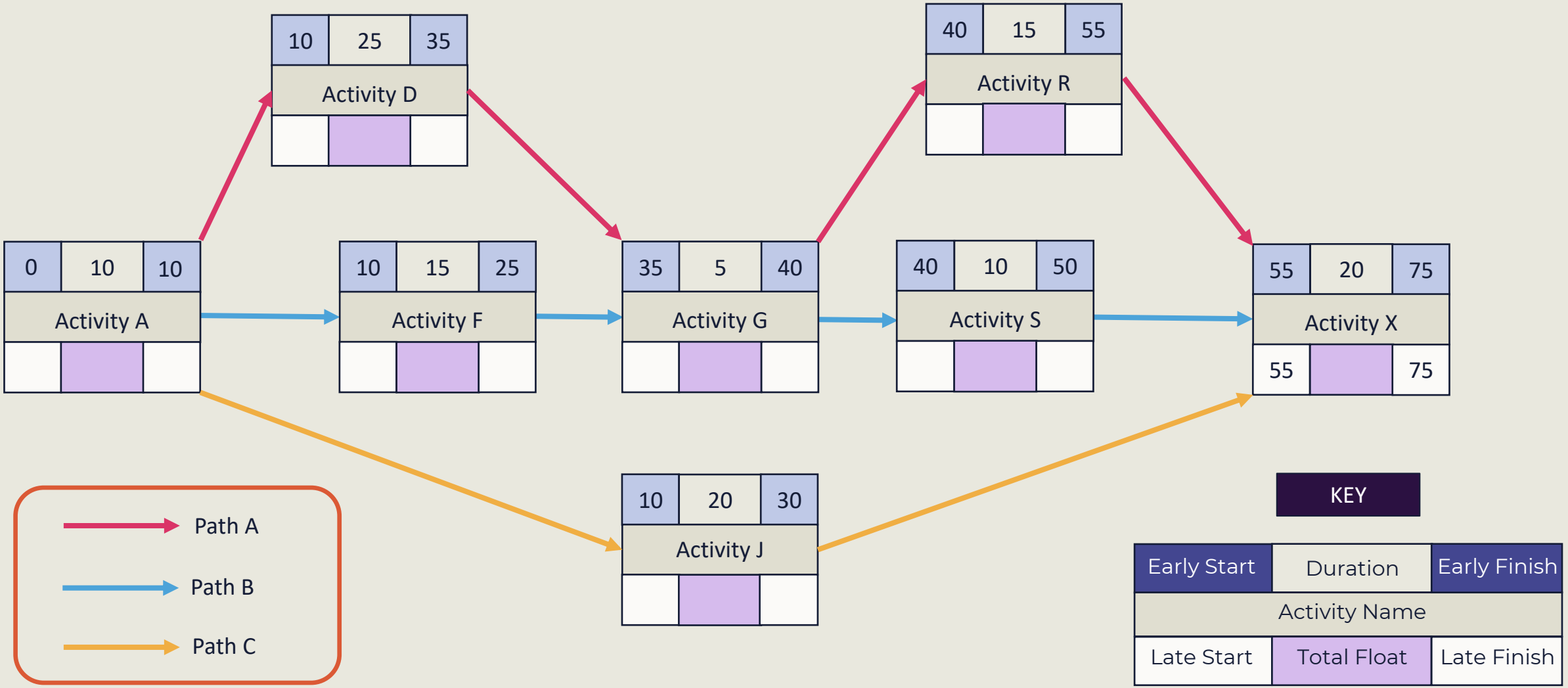

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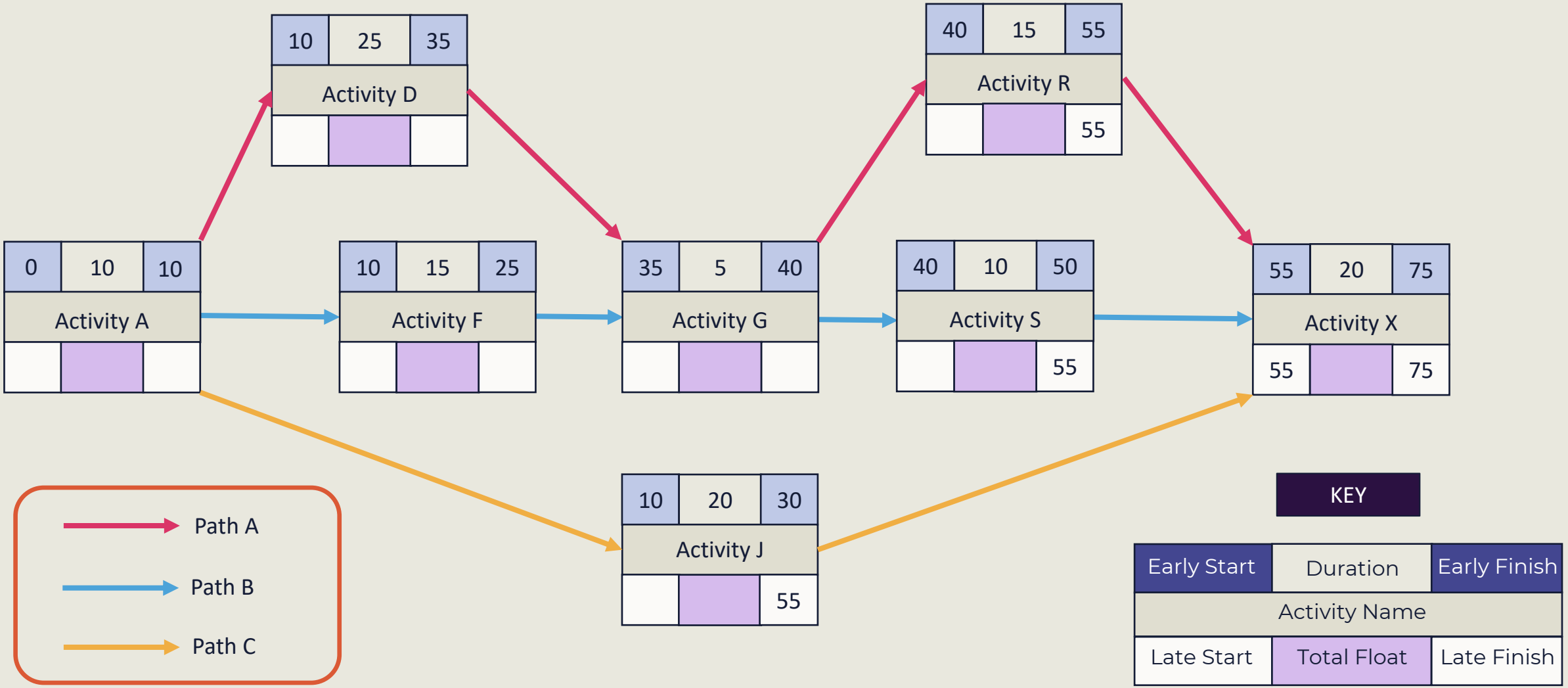

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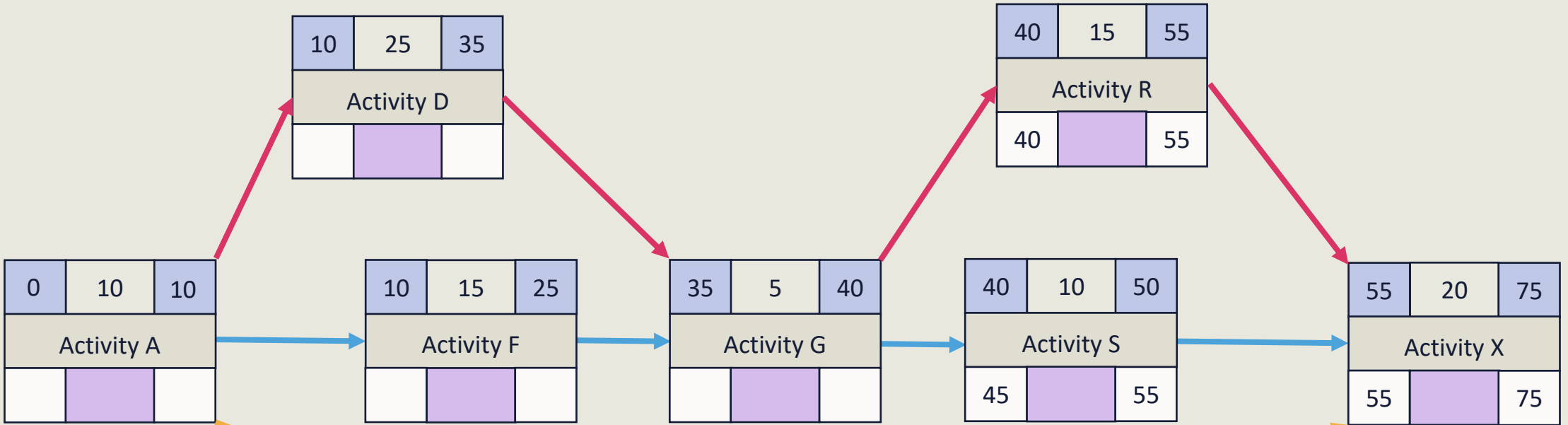
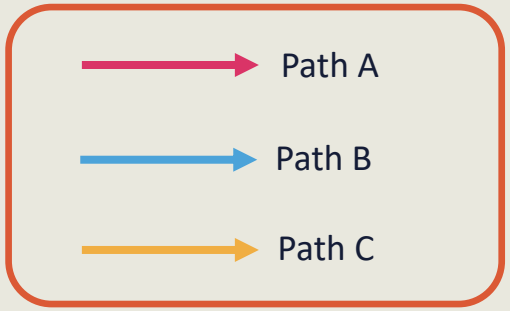
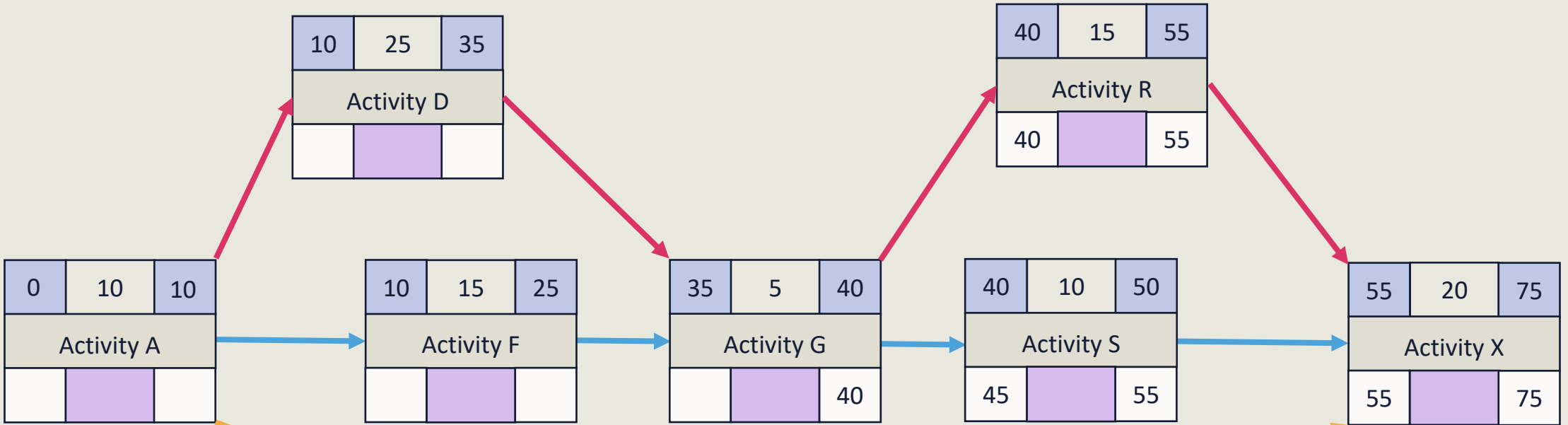


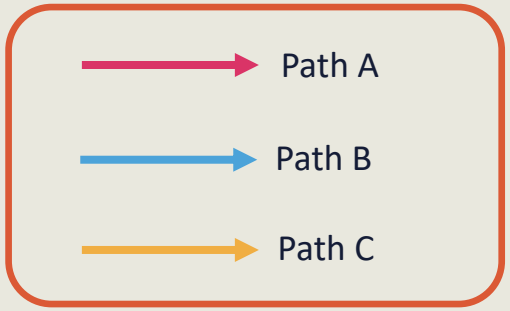


KEY

Early Start	Duration	Early Finish
Activity Name		
Late Start	Total Float	Late Finish

THE BACKWARD PASS





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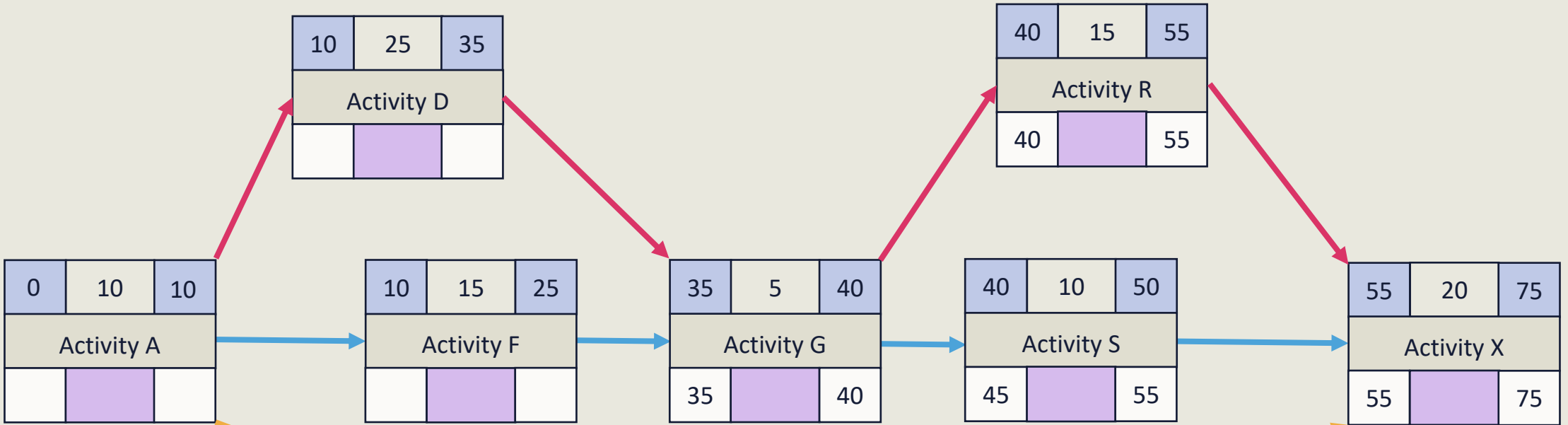

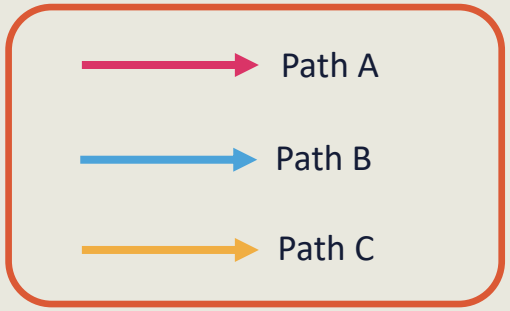

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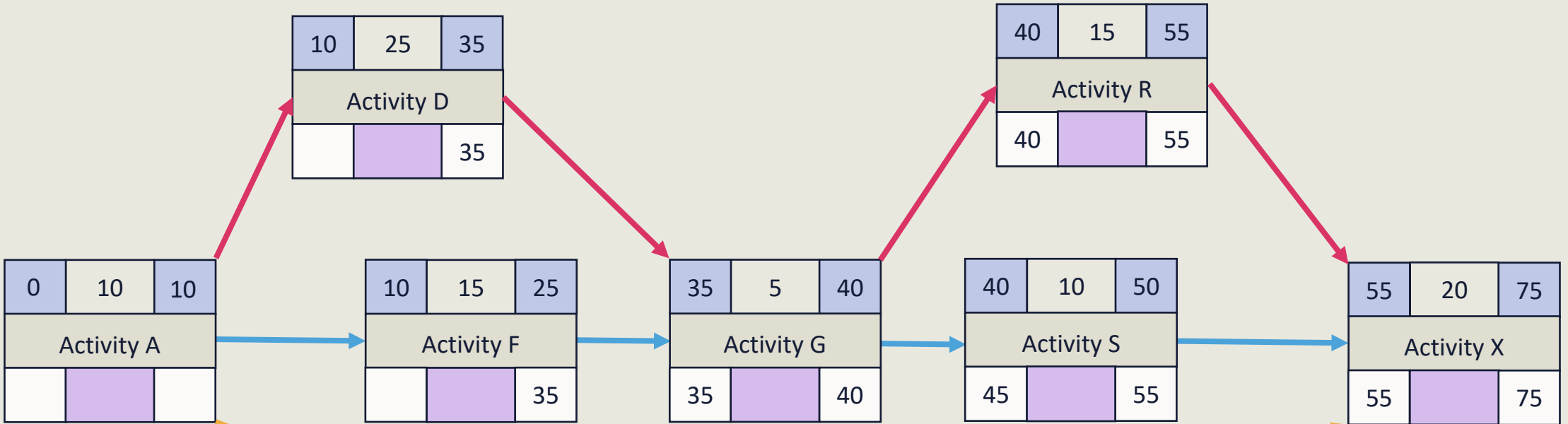

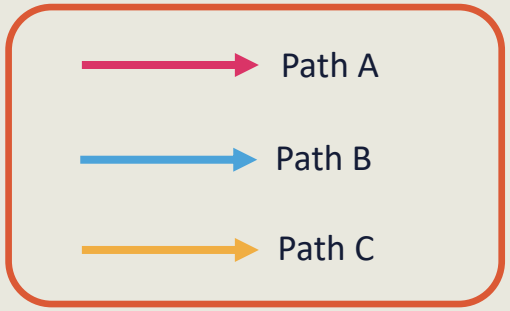

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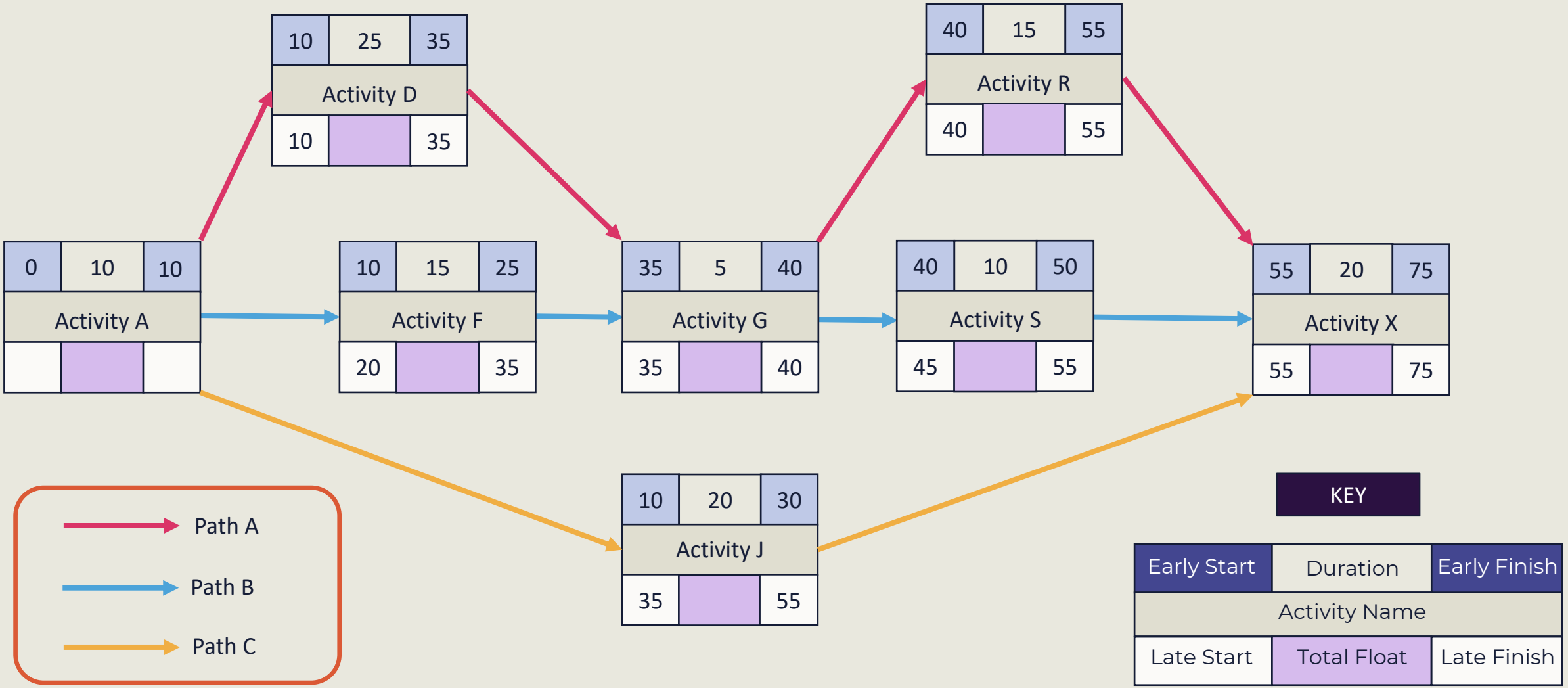

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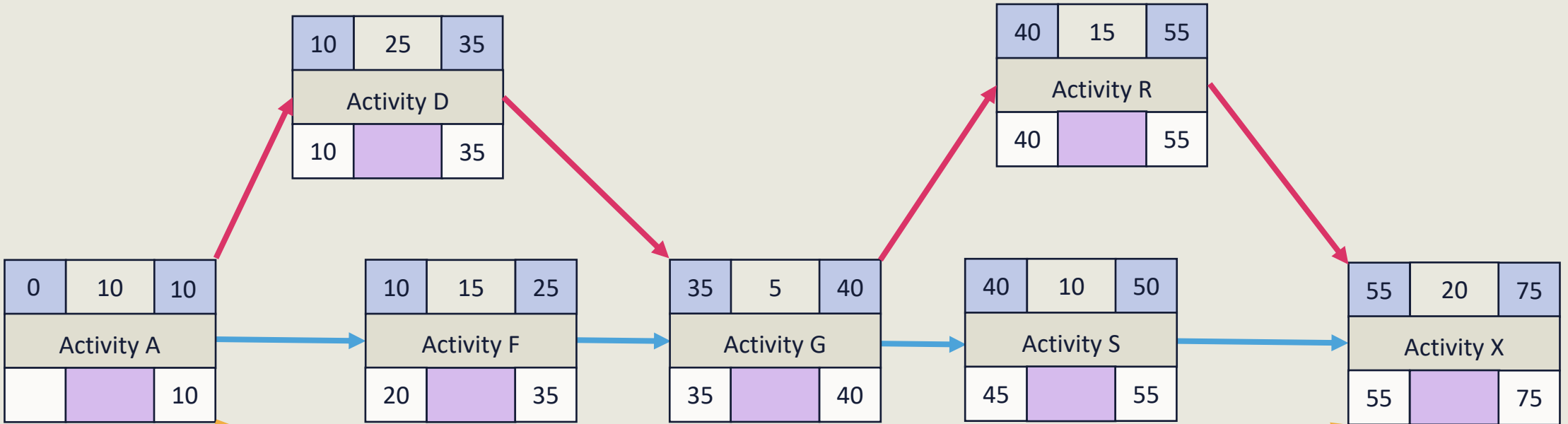

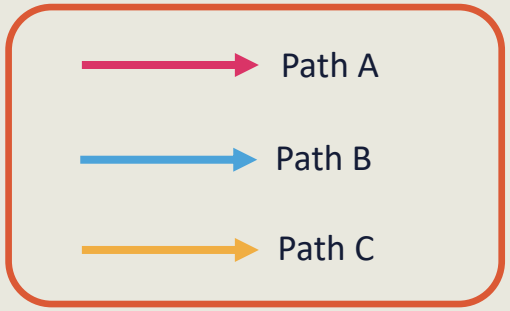

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Late Start	Total Float	Late Finish

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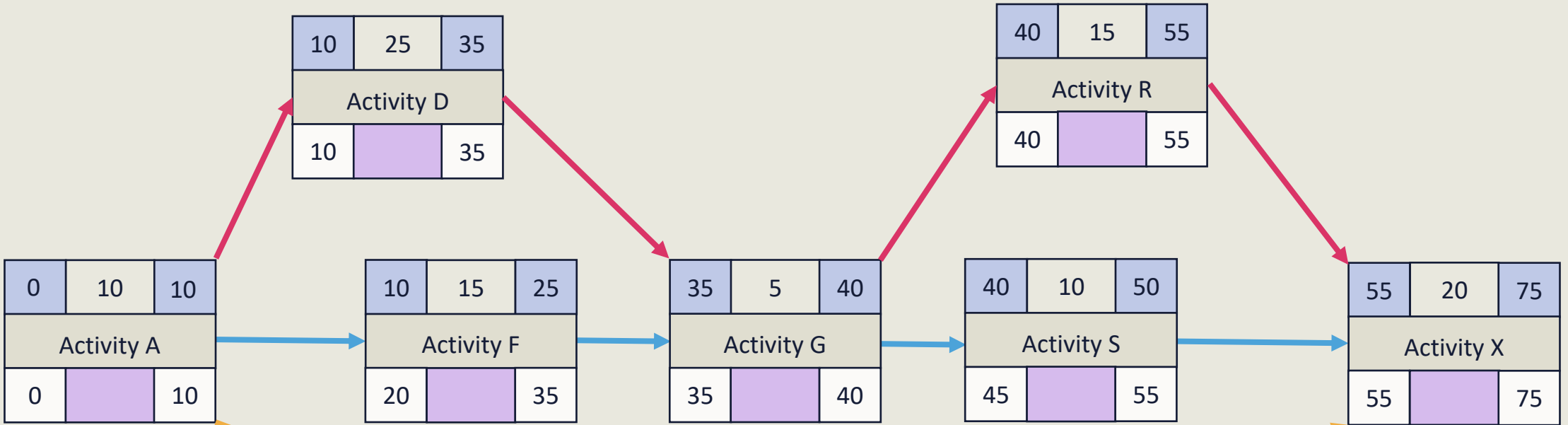
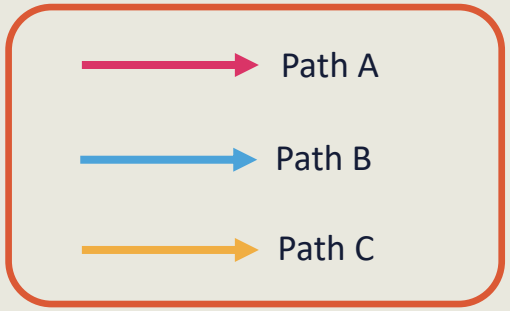
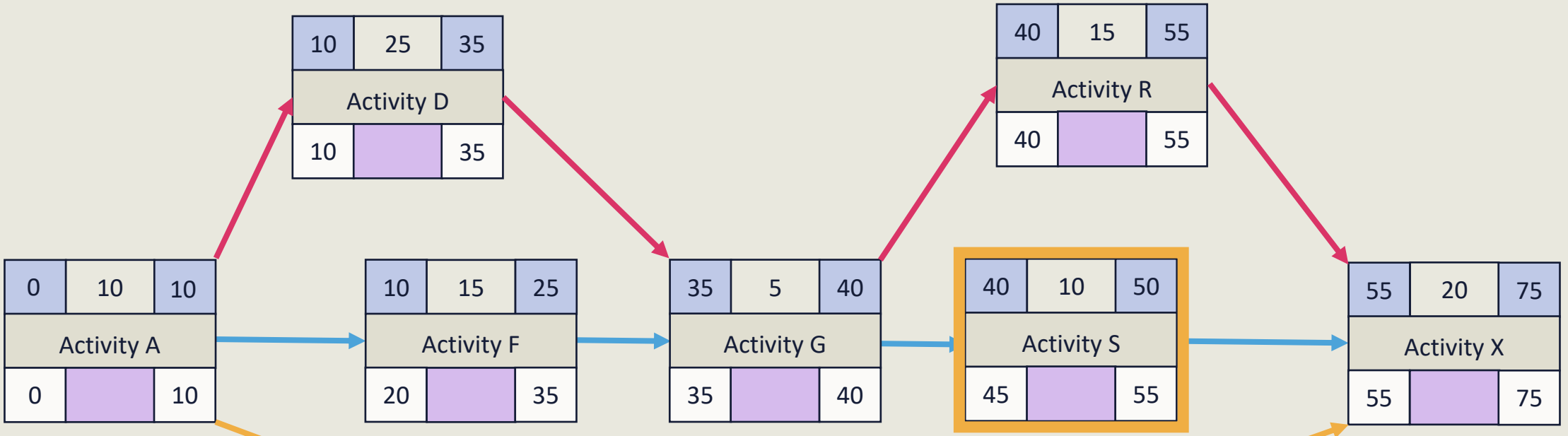


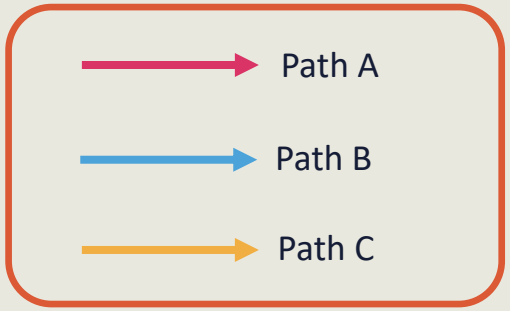


KEY

Early Start	Duration	Early Finish
Activity Name		
Late Start	Total Float	Late Finish

CALCULATING TOTAL FLOAT





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Activity Name		
Late Start	Total Float	Late Finish

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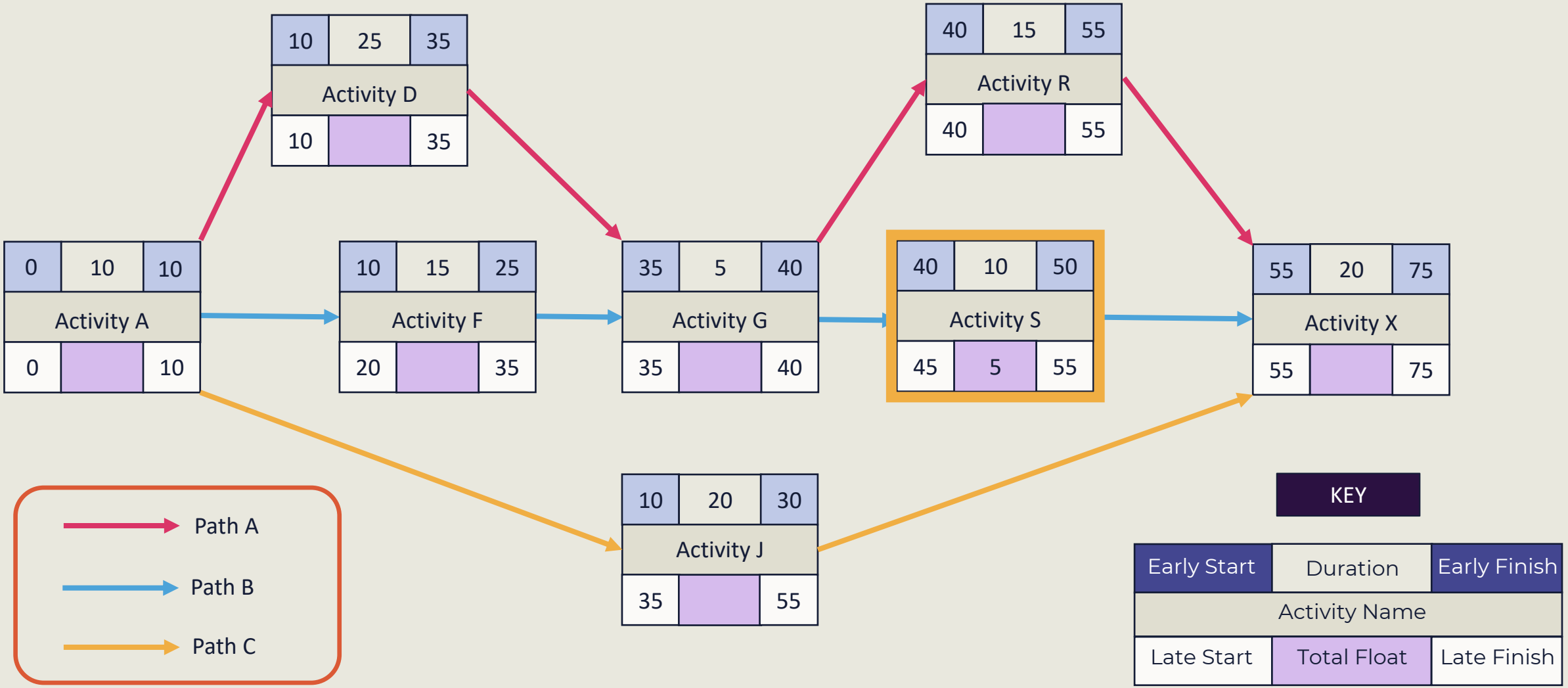
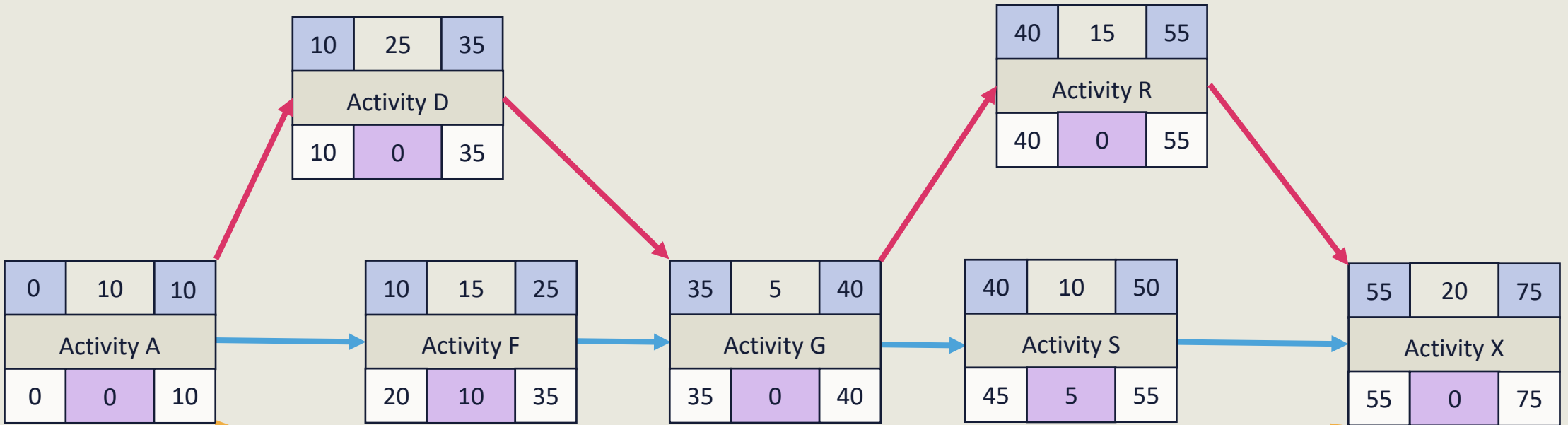


CALCULATING TOTAL FLOAT



Path A

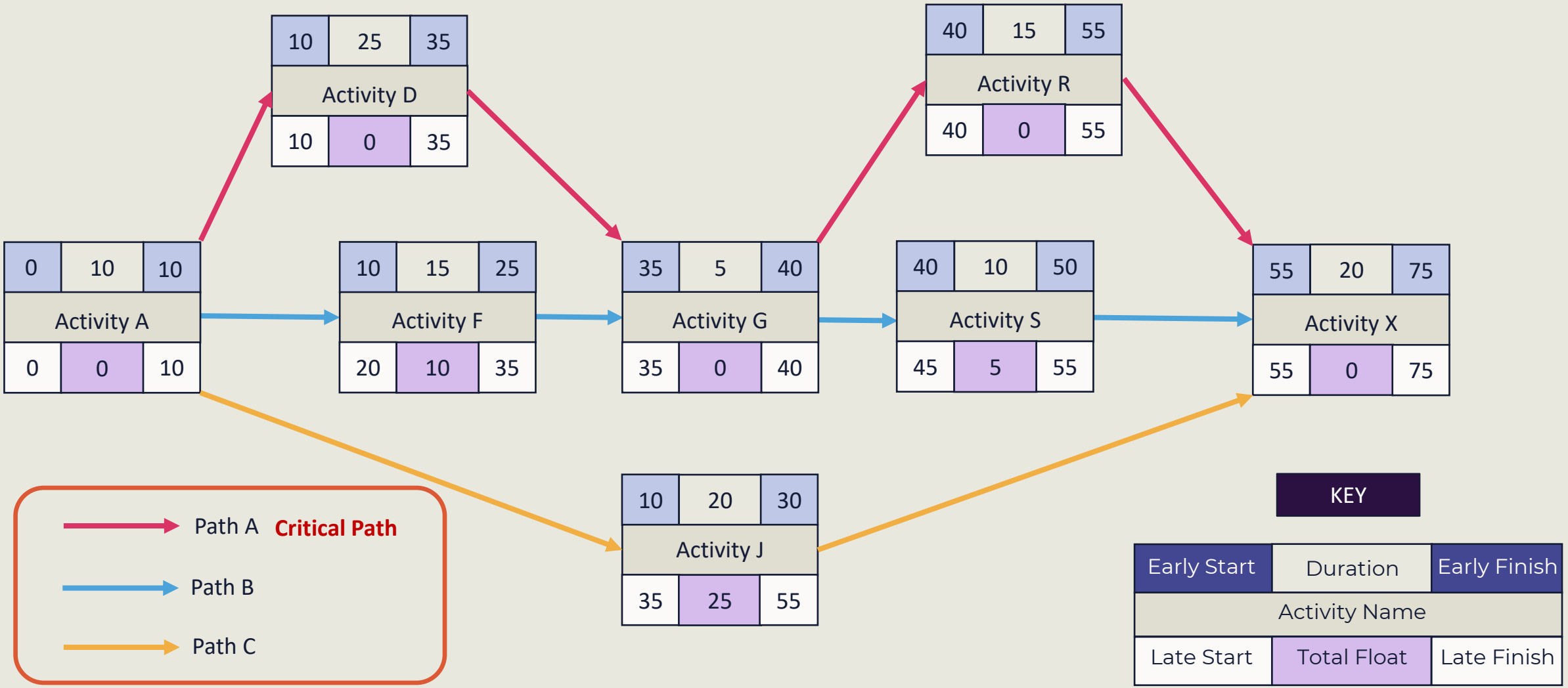
Path B

Path C

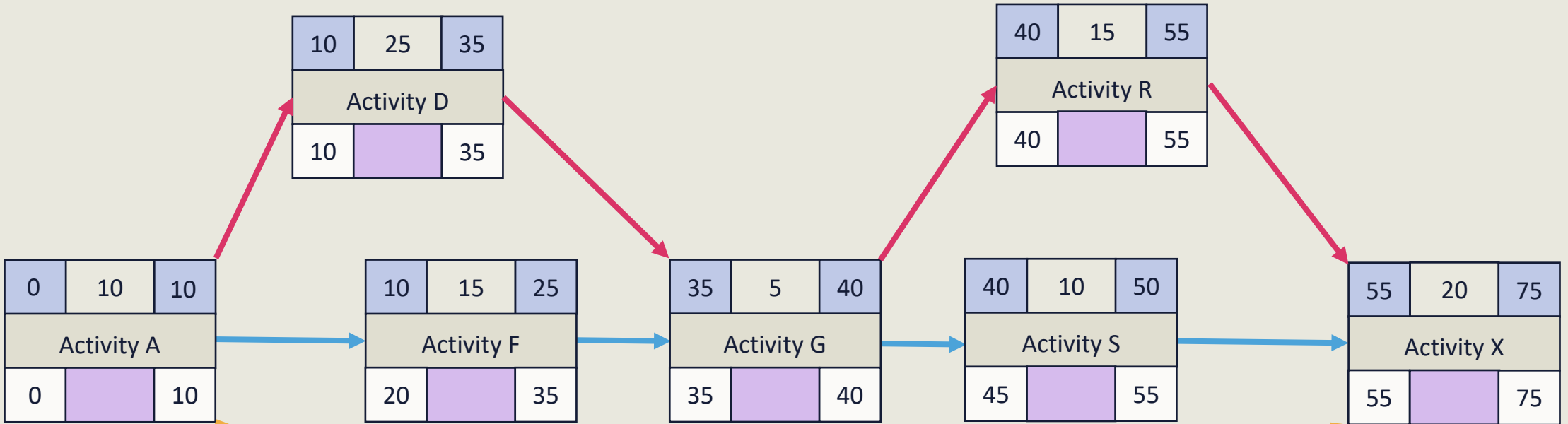
KEY

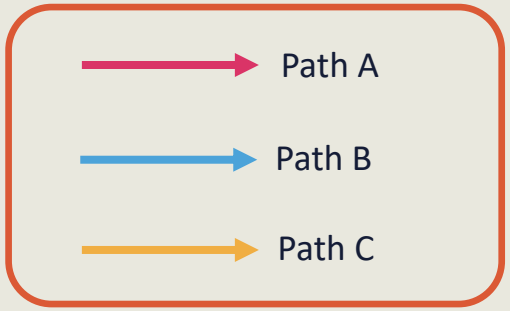
Early Start	Duration	Early Finish
Activity Name		
Late Start	Total Float	Late Finish

CALCULATING TOTAL FLOAT



CALCULATING TOTAL FLOAT

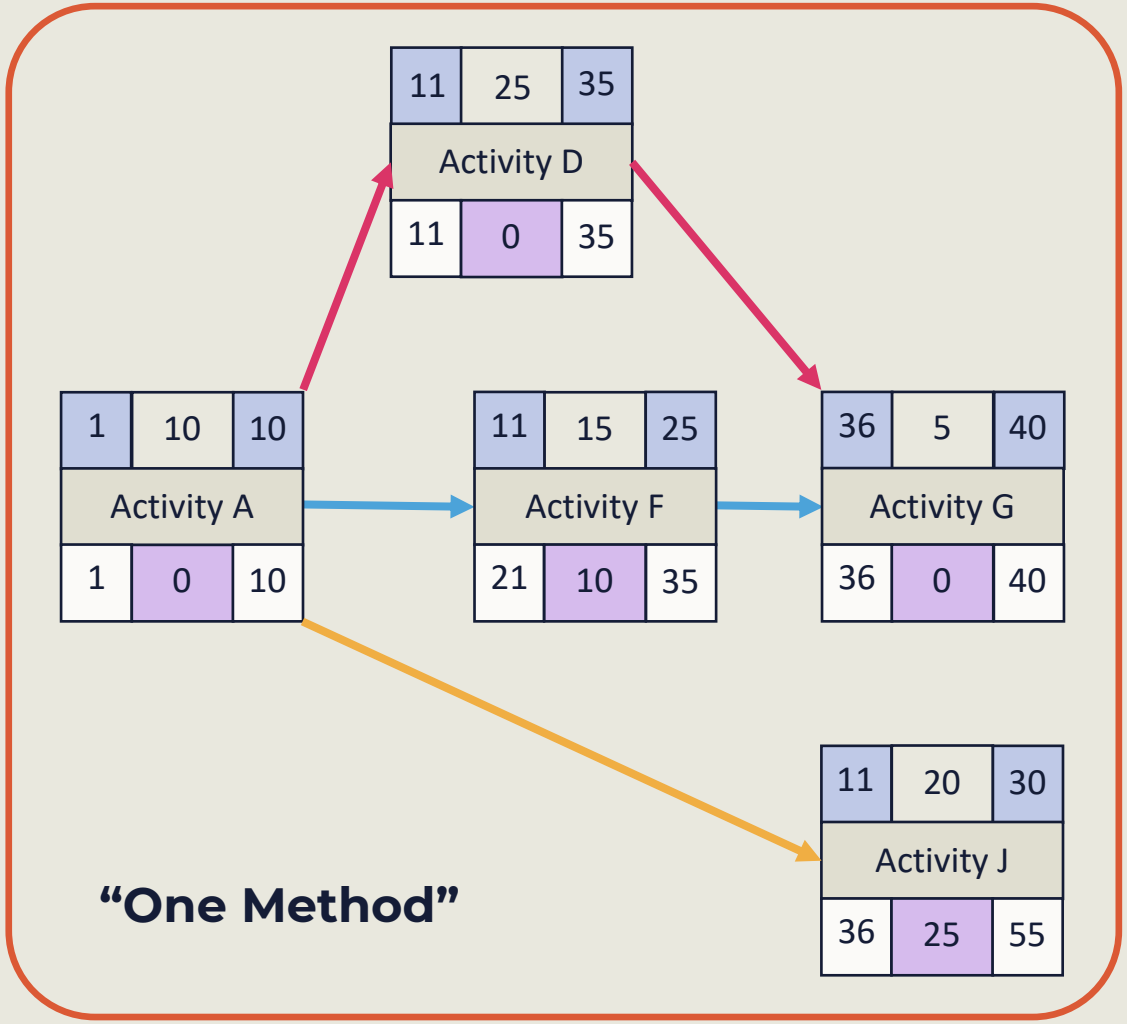


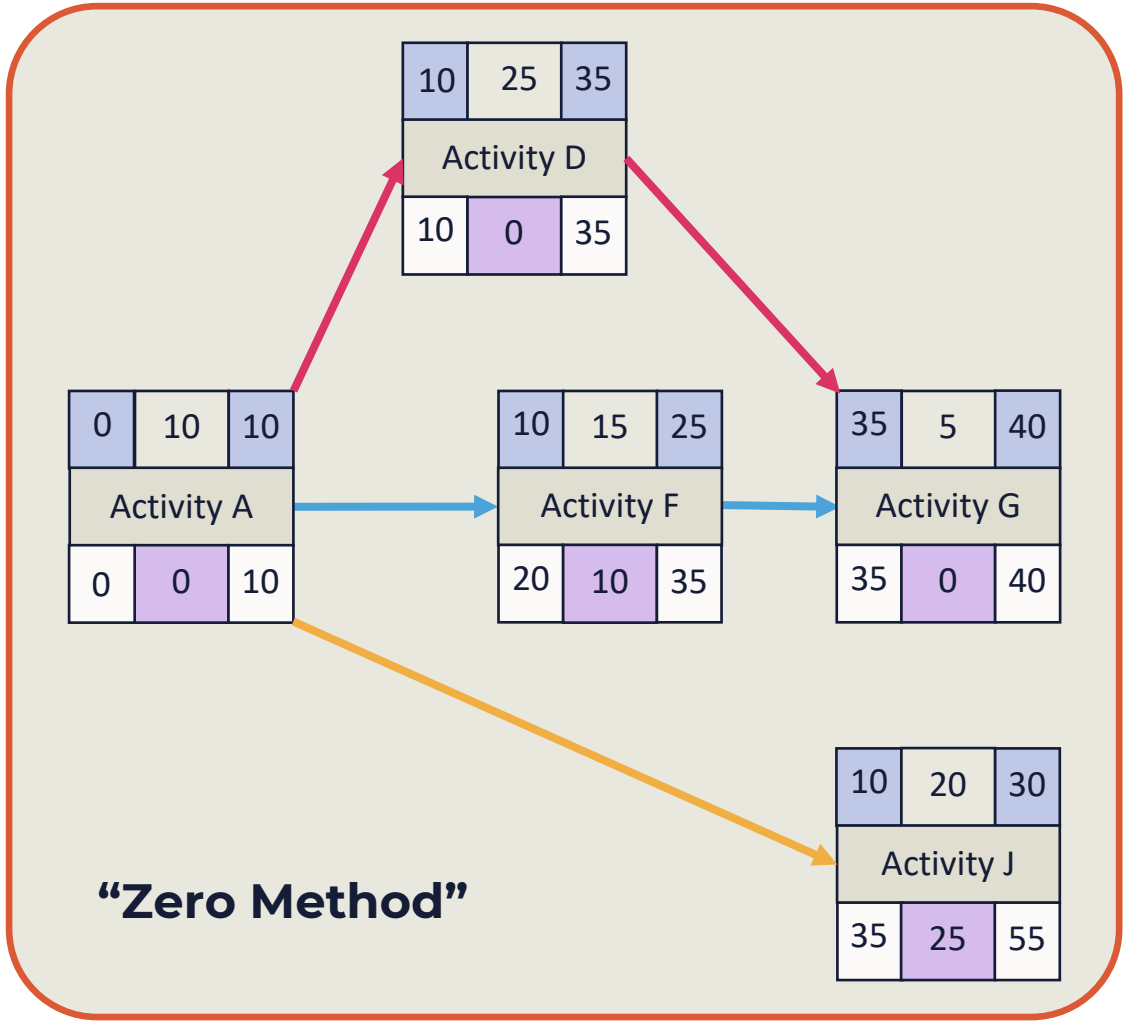


KEY

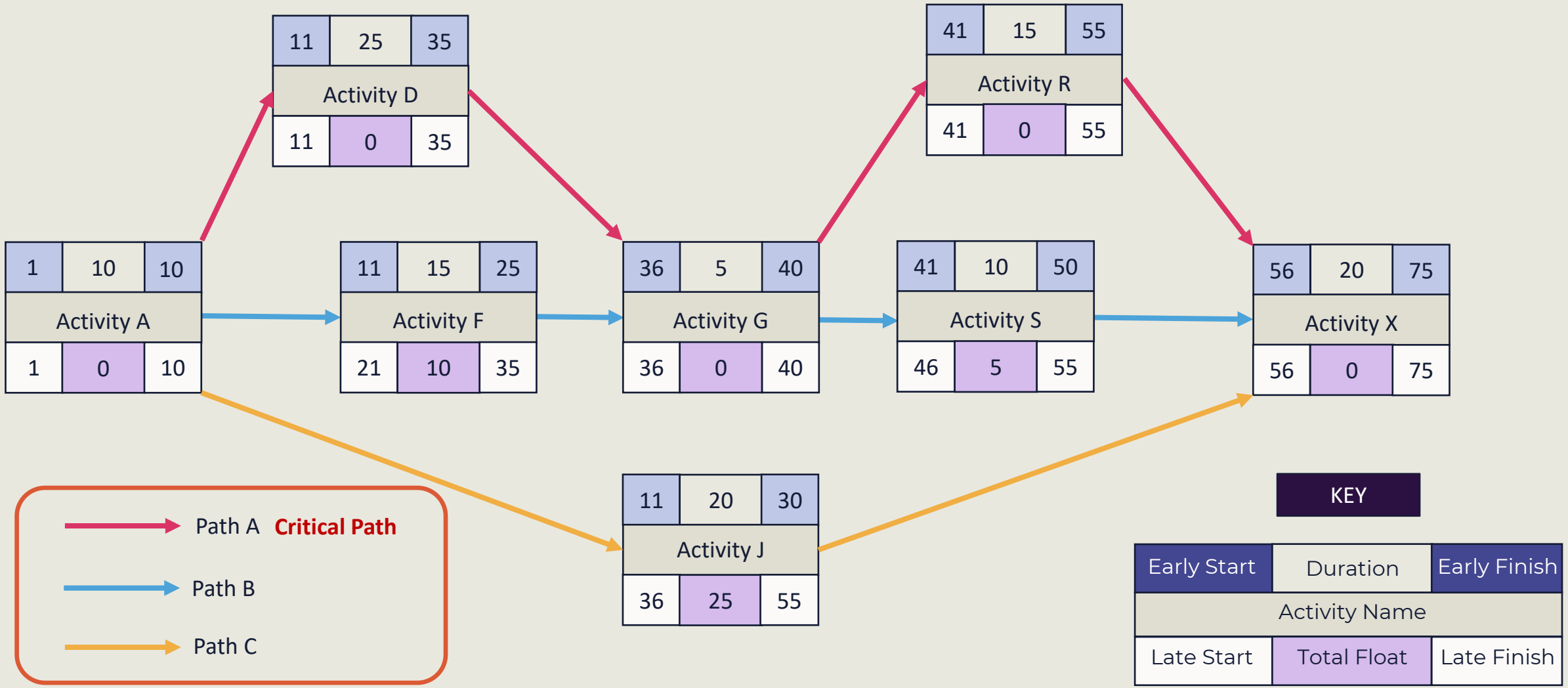
Early Start	Duration	Early Finish
Activity Name		
Late Start	Total Float	Late Finish

“ONE METHOD” VS “ZERO METHOD”

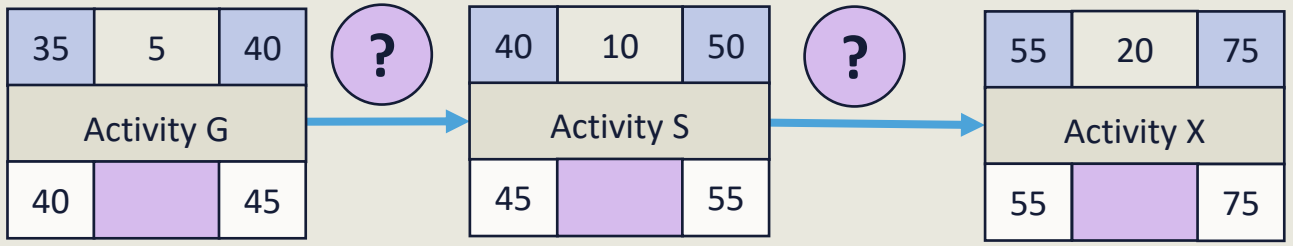


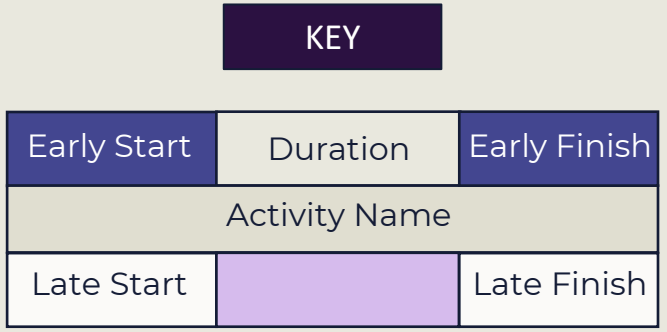


THE CRITICAL PATH (ONE METHOD)

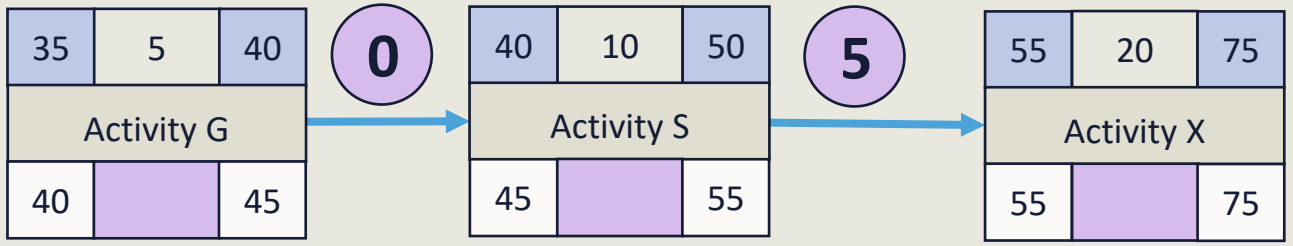


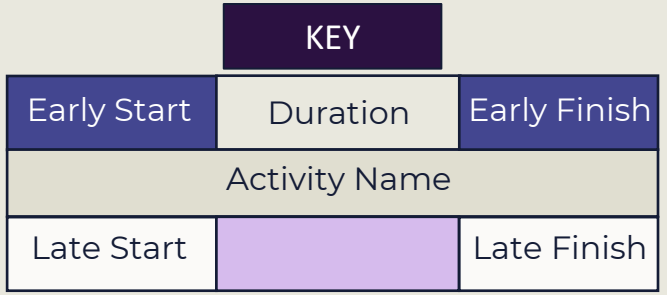
FREE FLOAT


35
5
40
Activity G
40
45
?
40
10
50
Activity S
45
55
?
55
20
75
Activity X
55
75


KEY
Early Start
Duration
Early Finish
Activity Name
Late Start
Late Finish

FREE FLOAT


35
5
40
Activity G
40
45
0
40
10
50
Activity S
45
55
5
55
20
75
Activity X
55
75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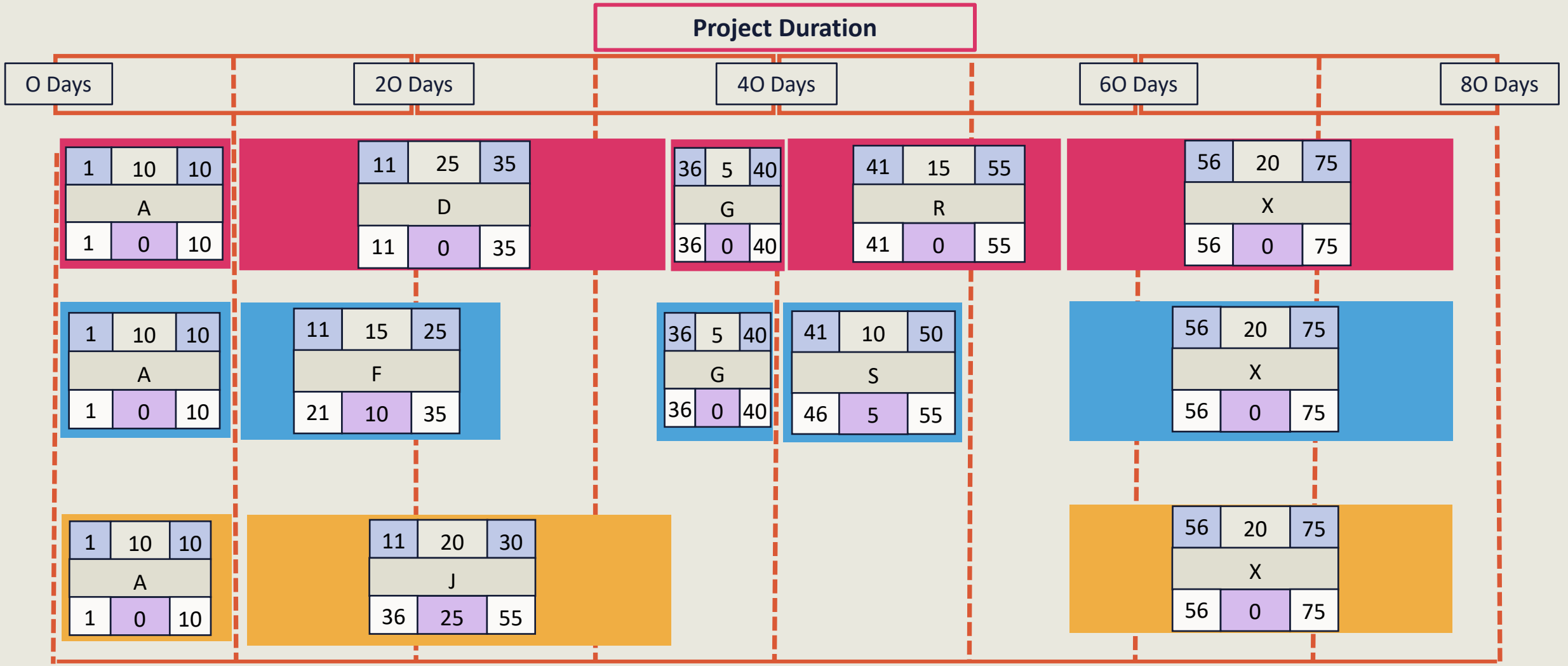
Duration
Early Finish
Activity Name
Late Start
Late Finish

HOW TO USE FLOAT



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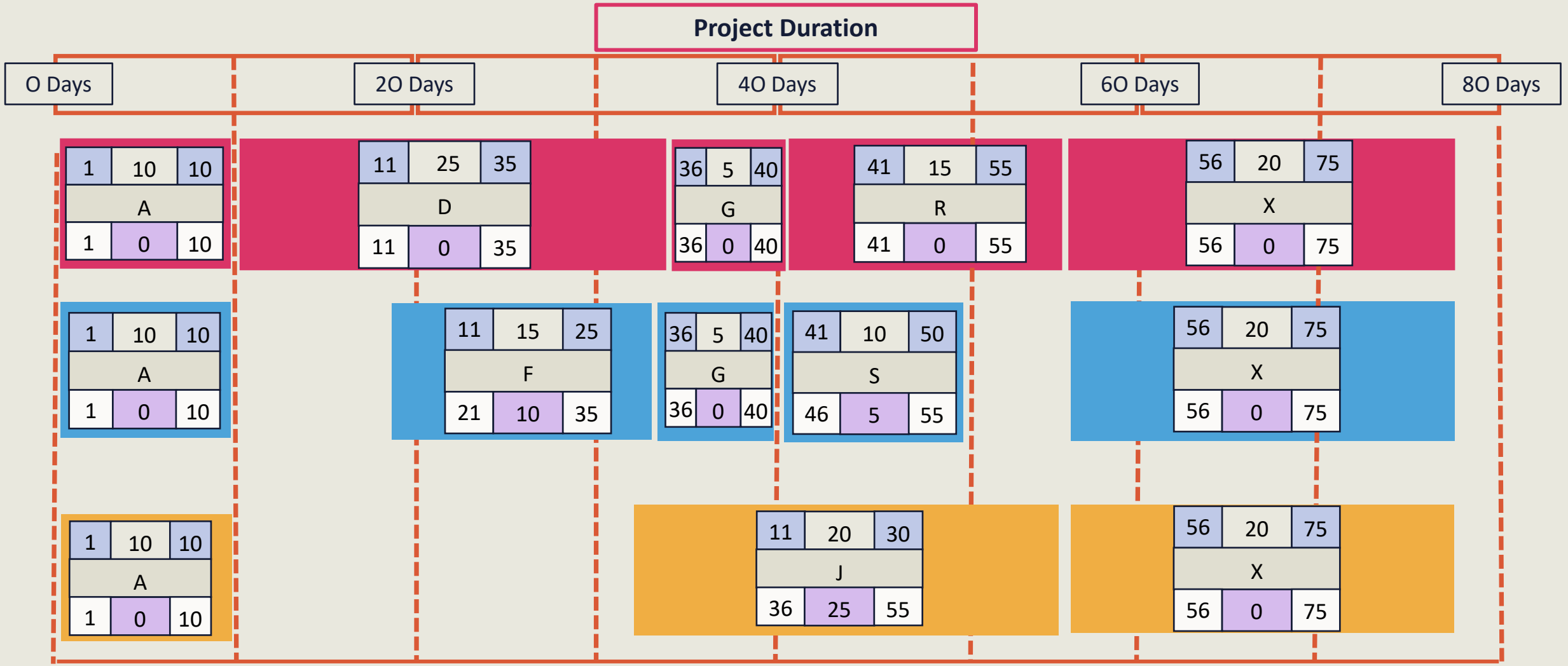


TOTAL FLOAT VS. FREE FLOAT

Total Float is the total amount of time that an activity may be delayed without delaying the **project finish date.**

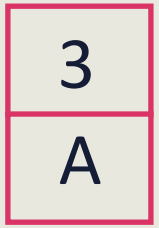
Free Float is the amount of time an activity can be delayed without delaying the scheduled or early start date of any **immediately following schedule activities.**

CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
A	3	None
B	2	A
C	5	A
D	4	B, C
E	3	D
F	6	D
G	5	D
H	3	E, F, G

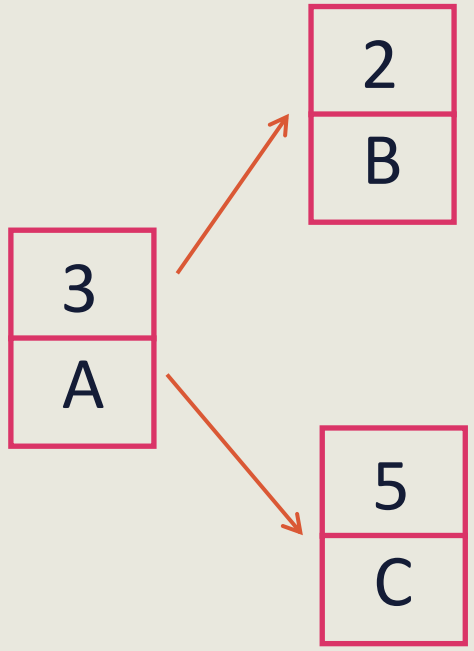
CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
A	3	None
B	2	A
C	5	A
D	4	B, C
E	3	D
F	6	D
G	5	D
H	3	E, F, G



CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
A	3	None
B	2	A
C	5	A
D	4	B, C
E	3	D
F	6	D
G	5	D
H	3	E, F, G



CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
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C	5	A
D	4	B, C
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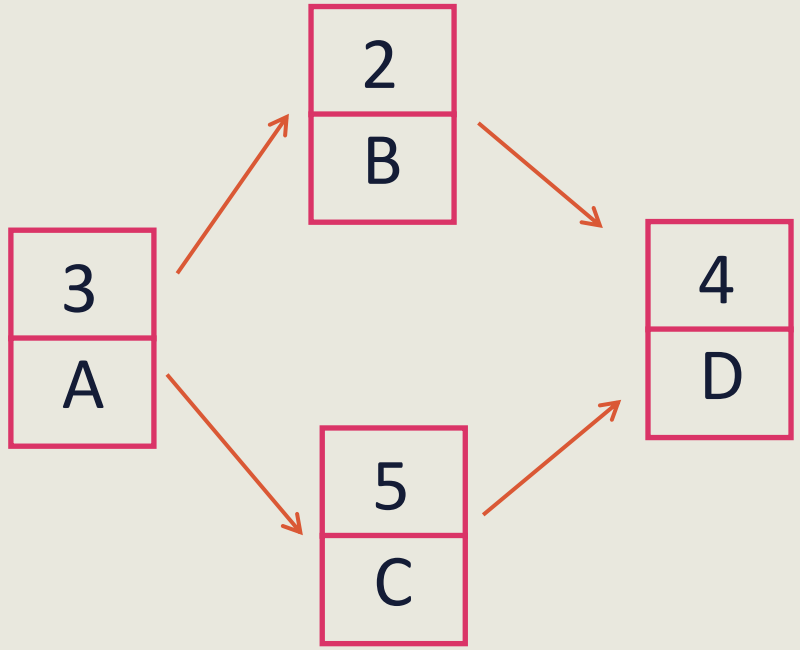
F	6	D
G	5	D
H	3	E, F, G



CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
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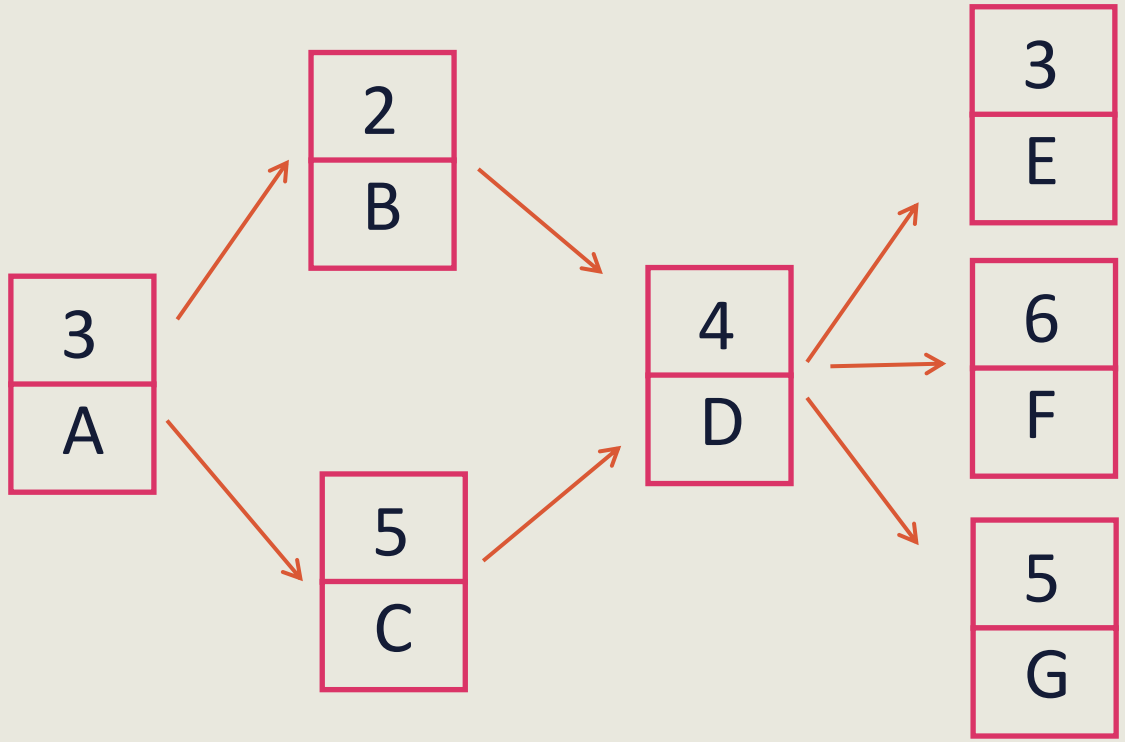

CREATING A **SCHEDULE NETWORK DIAGRAM**

Activity	Duration	Predecessor(s)
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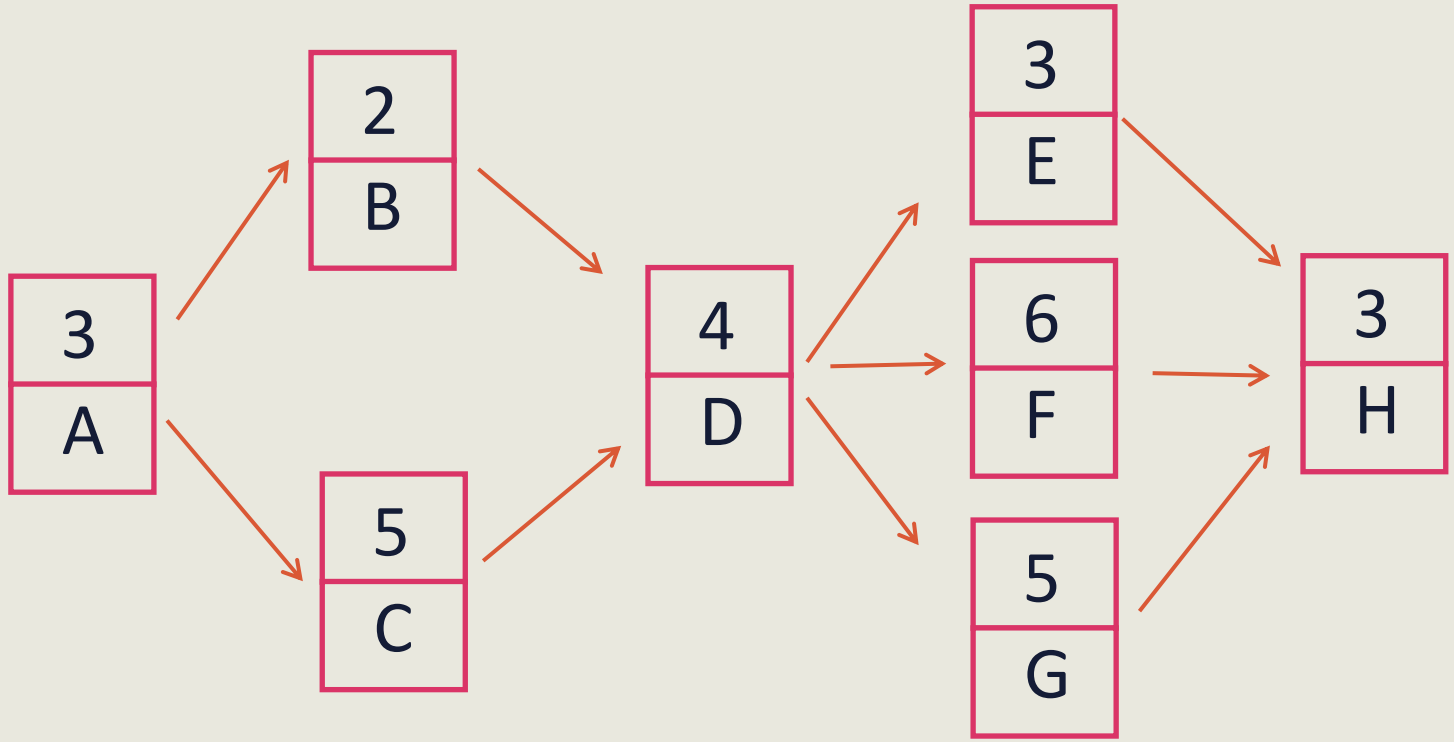
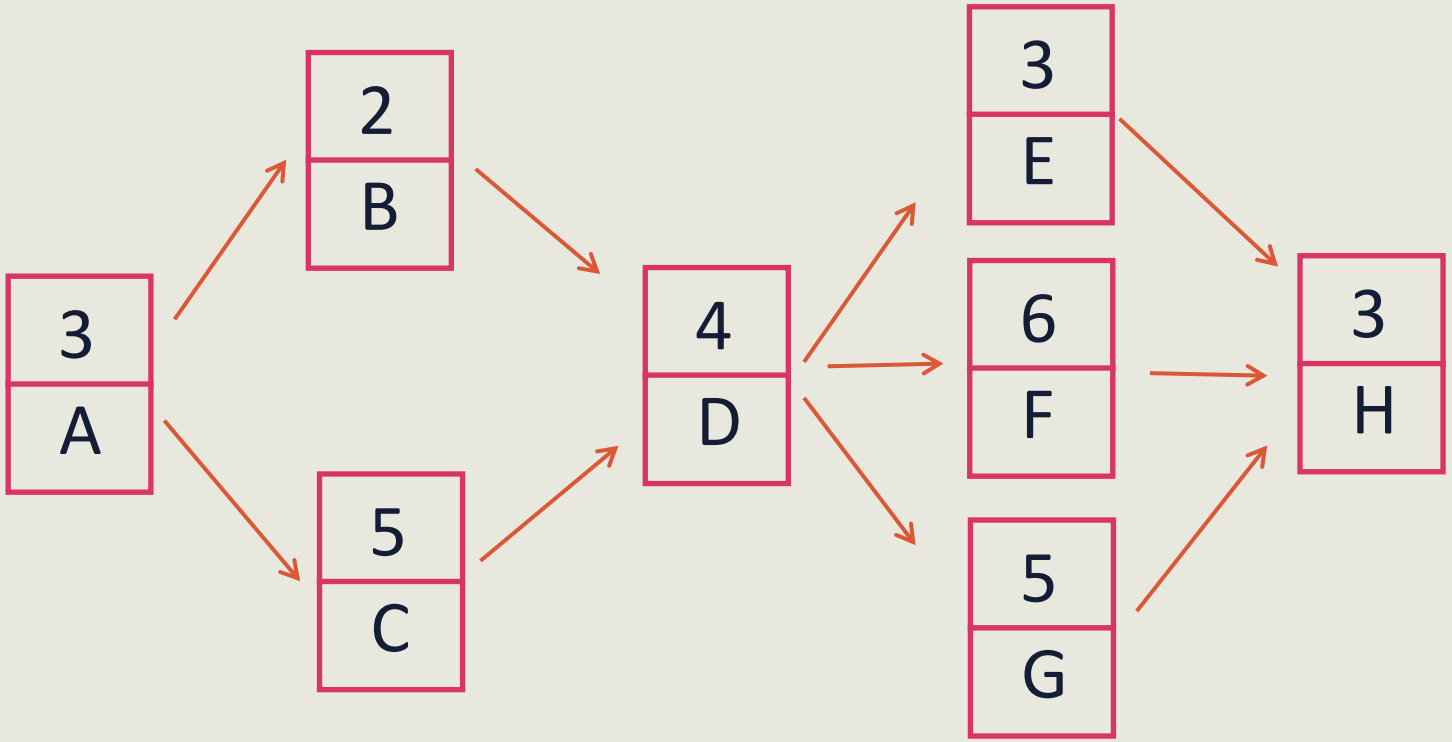
C	5	A
D	4	B, C
E	3	D
F	6	D
G	5	D
H	3	E, F, G

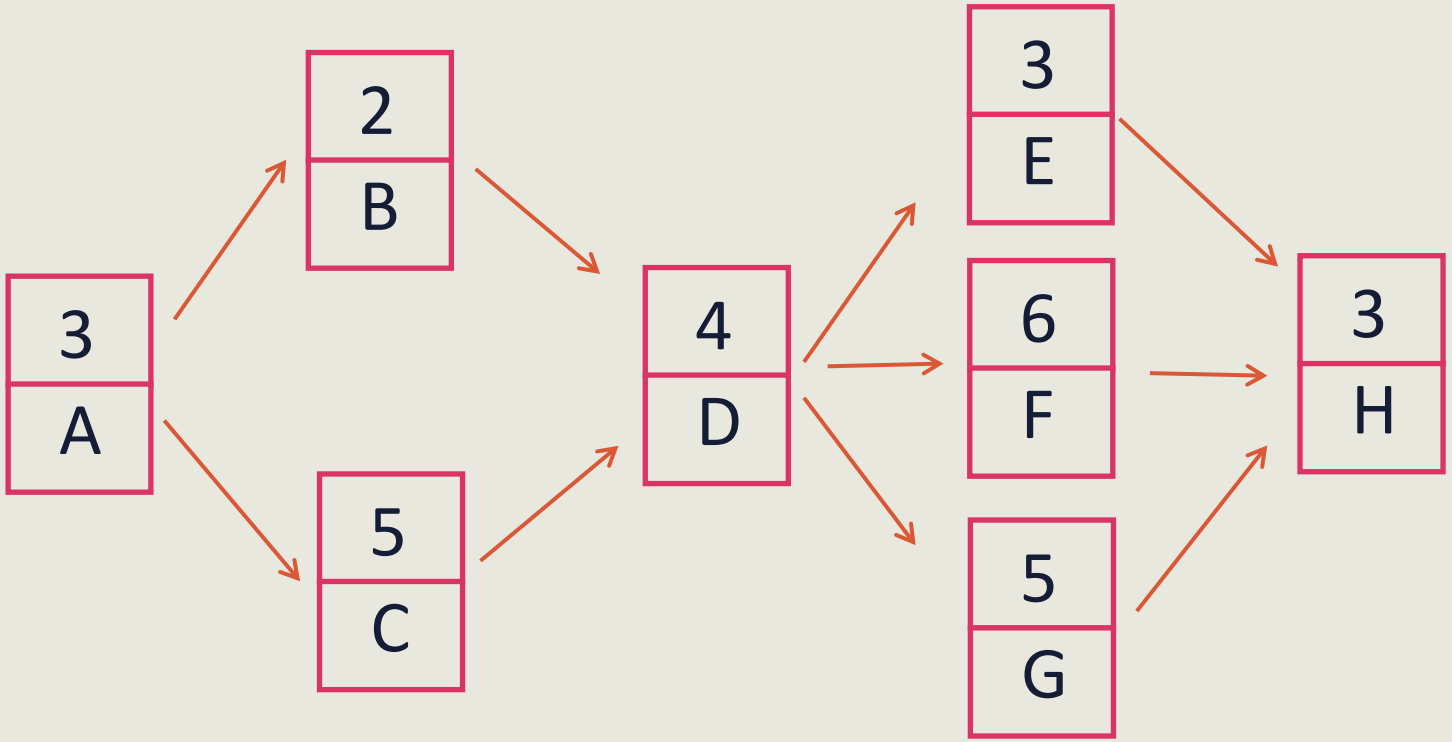


CREATING A **SCHEDULE NETWORK DIAGRAM**



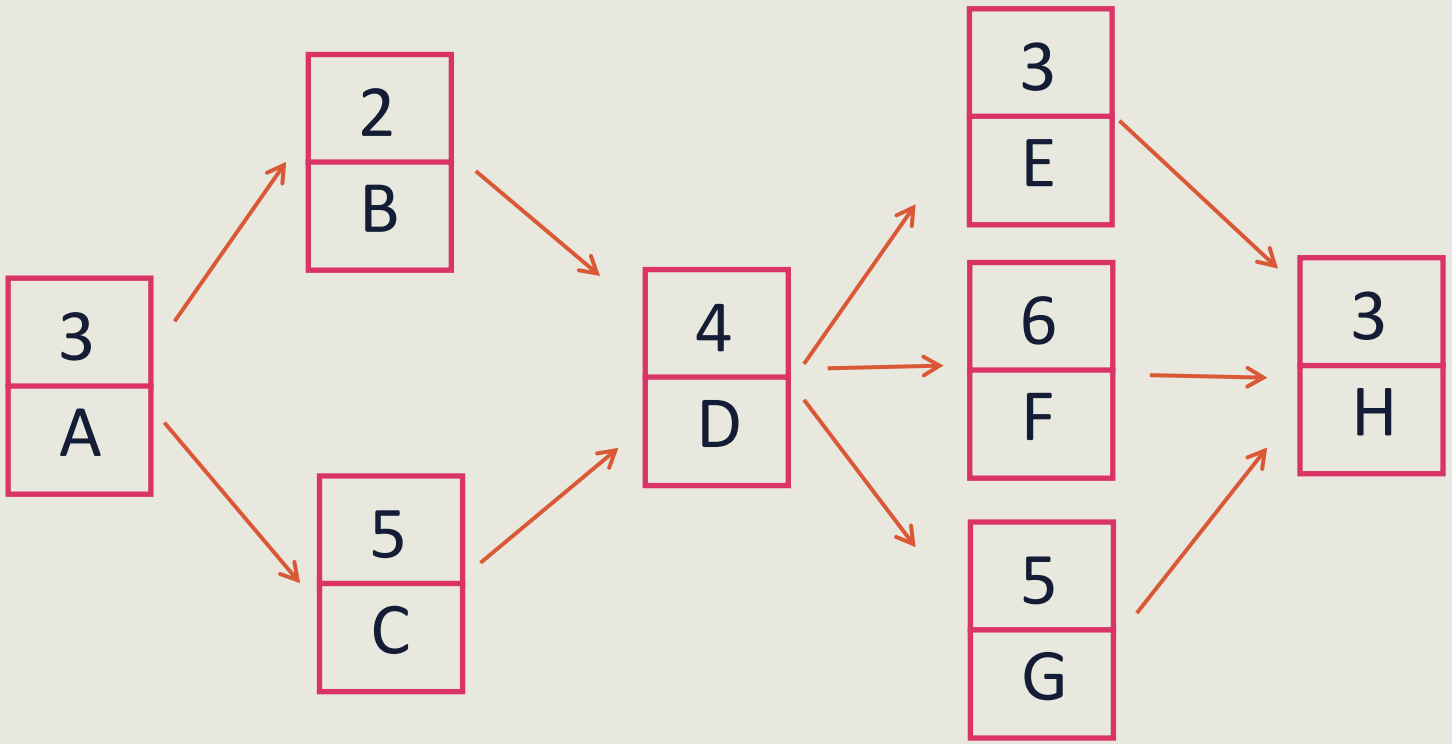
PATH	Duration	Floats
ABDEH ABDFH ABDGH ACDEH ACDFH ACDGH		

CREATING A **SCHEDULE NETWORK DIAGRAM**



PATH	Duration	Floats
ABDEH	15	
ABDFH	18	
ABDGH	17	
ACDEH	18	
ACDFH	21	
ACDGH	20	

CREATING A **SCHEDULE NETWORK DIAGRAM**



PATH	Duration	Floats
ABDEH	15	6
ABDFH	18	3
ABDGH	17	4
ACDEH	18	3
ACDFH	21	0
ACDGH	20	1

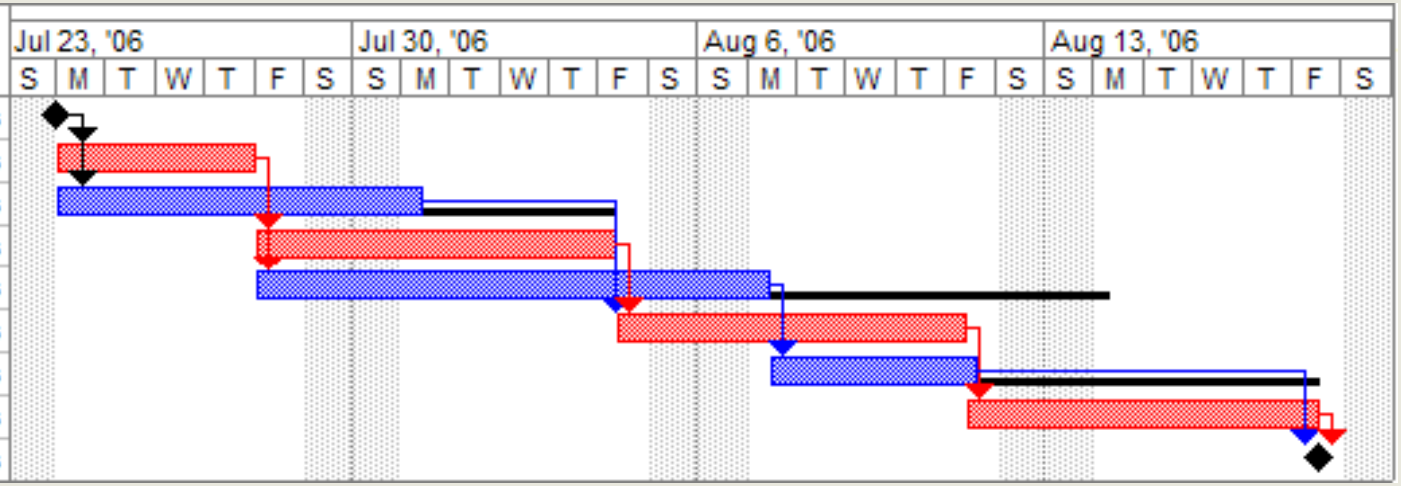
Integrated Master Schedule (IMS)

An **Integrated Master Schedule**, or **IMS**, contains project activities, events, and milestones.

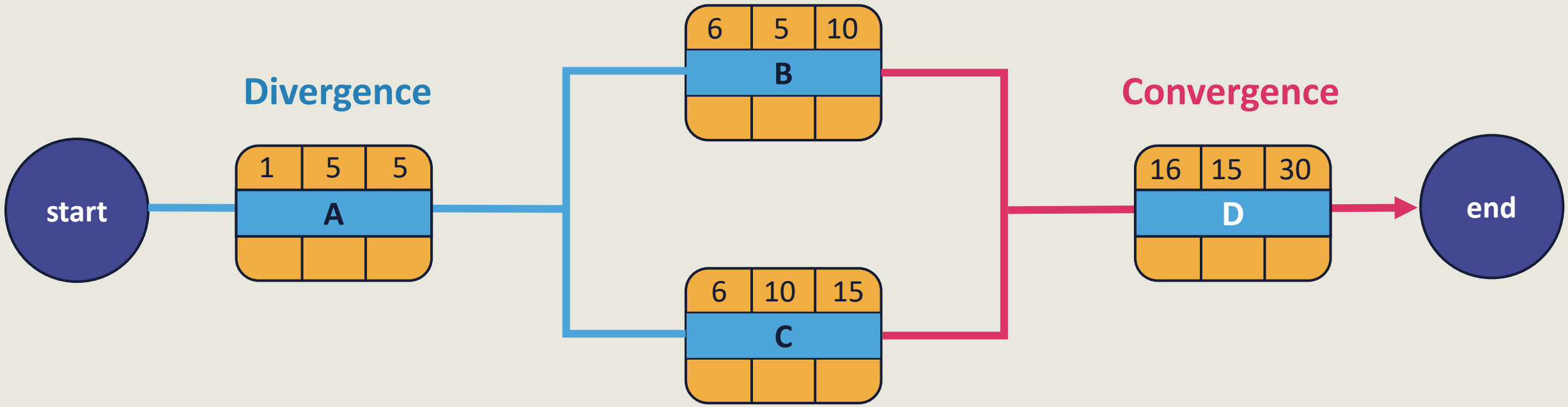
- Can be used to show ***interproject dependencies***, which are dependency relationships between two or more different projects in an organization
- Can be visually depicted using a flow chart, such as a Gantt chart

Bar Chart (Gantt Chart)

ID	Task Name	Predecessors	Duration
1	Start		0 days
2	a	1	4 days
3	b	1	5.33 days
4	c	2	5.17 days
5	d	2	6.33 days
6	e	3,4	5.17 days
7	f	5	4.5 days
8	g	6	5.17 days
9	Finish	7,8	0 days



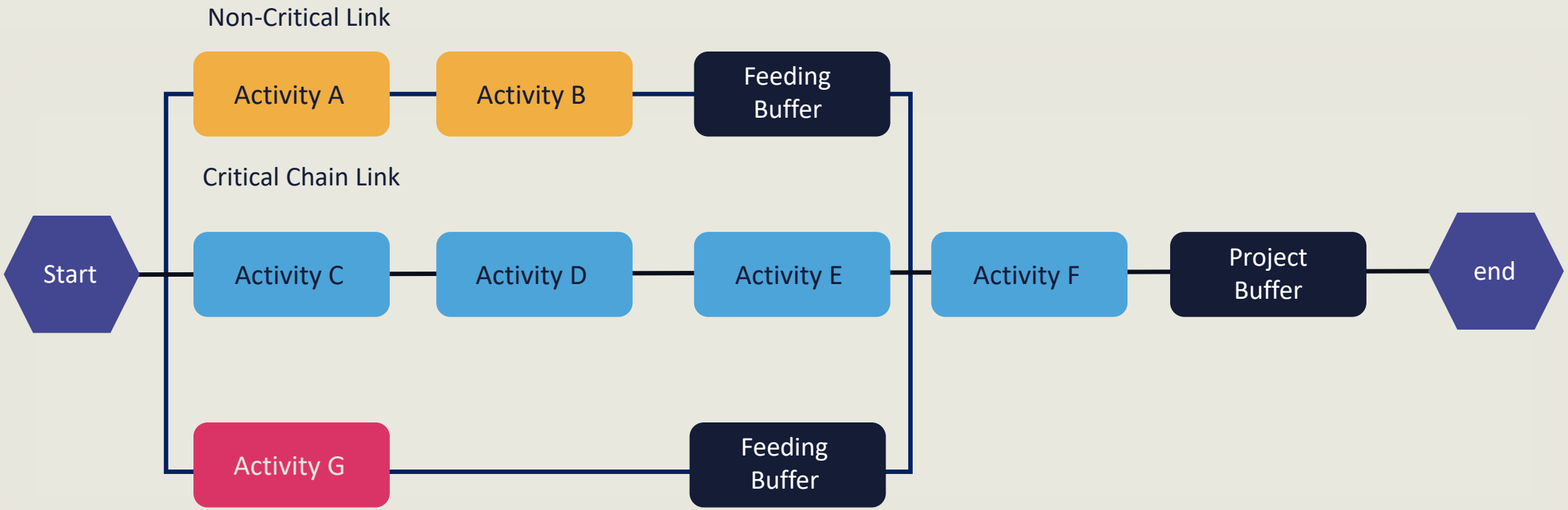
Terms to Know: Divergence and Convergence



CRITICAL CHAIN METHOD

Estimates based on limited resource availability

Duration buffers



RESOURCE LEVELING

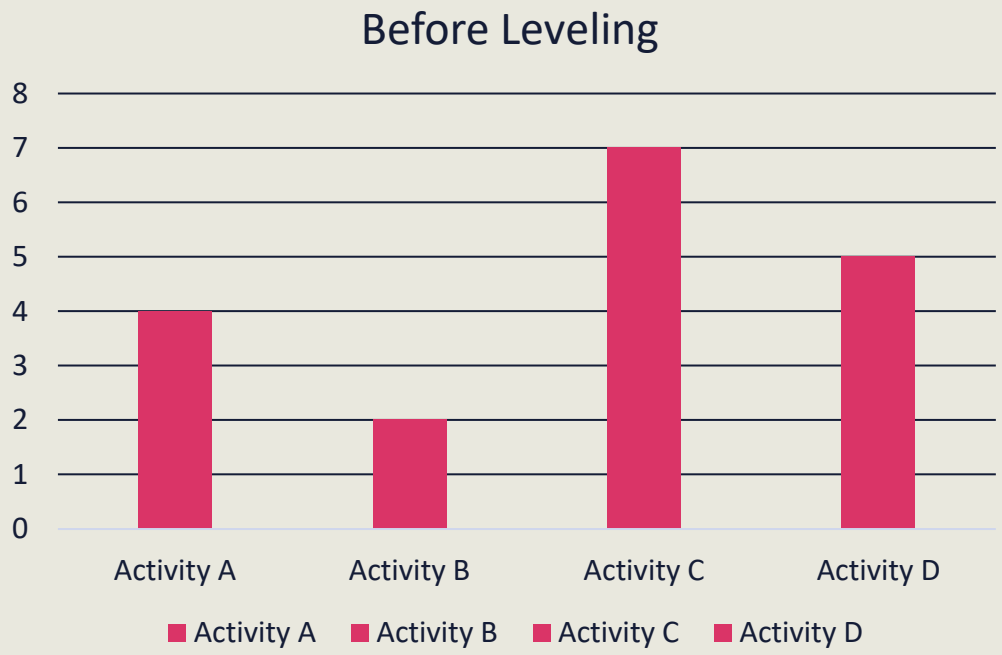
PATH 1

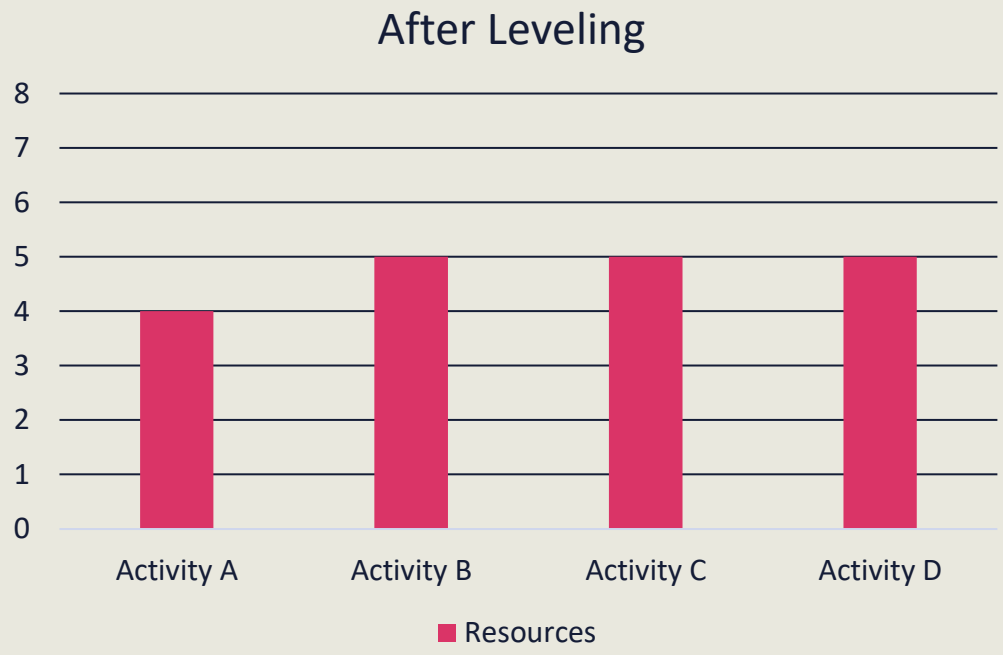
PATH 2

PATH 3

JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
1/1 A 1/31	2/1 G 3/31		4/1 H 5/31							11/1 E 11/30	12/1 F 12/31
1/1 A 1/31	2/1 I 3/31		4/1 J X 4 7/31						10/1 D 10/31	11/1 E 11/30	12/1 F 12/31
1/1 A 1/31	2/1 B 2/28	3/1 C X 4 9/30							10/1 D 10/31	11/1 E 11/30	12/1 F 12/31

RESOURCE LEVELING





RESOURCE SMOOTHING

PATH 1 | PATH 2 | PATH 3

JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
1/1 A 1/31	2/1 G 3/31		4/1 H 5/31							11/1 E 11/30	12/1 F 12/31
				Louise							
1/1 A 1/31	2/1 I 3/31		4/1 J 7/31						10/1 D 10/31	11/1 E 11/30	12/1 F 12/31
					Louise						
1/1 A 1/31	2/1 B 2/28	3/1 C 9/30							10/1 D 10/31	11/1 E 11/30	12/1 F 12/31

RESOURCE SMOOTHING

PATH 1 | PATH 2 | PATH 3

JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC
1/1 A 1/31	2/1 G 3/31						8/1 H 9/30			11/1 E 11/30	12/1 F 12/31
								Louise			
1/1 A 1/31	2/1 I 3/31		4/1 J 7/31						10/1 D 10/31	11/1 E 11/30	12/1 F 12/31
					Louise						
1/1 A 1/31	2/1 B 2/28	3/1 C 9/30							10/1 D 10/31	11/1 E 11/30	12/1 F 12/31

RESOURCE OPTIMIZATION TECHNIQUES

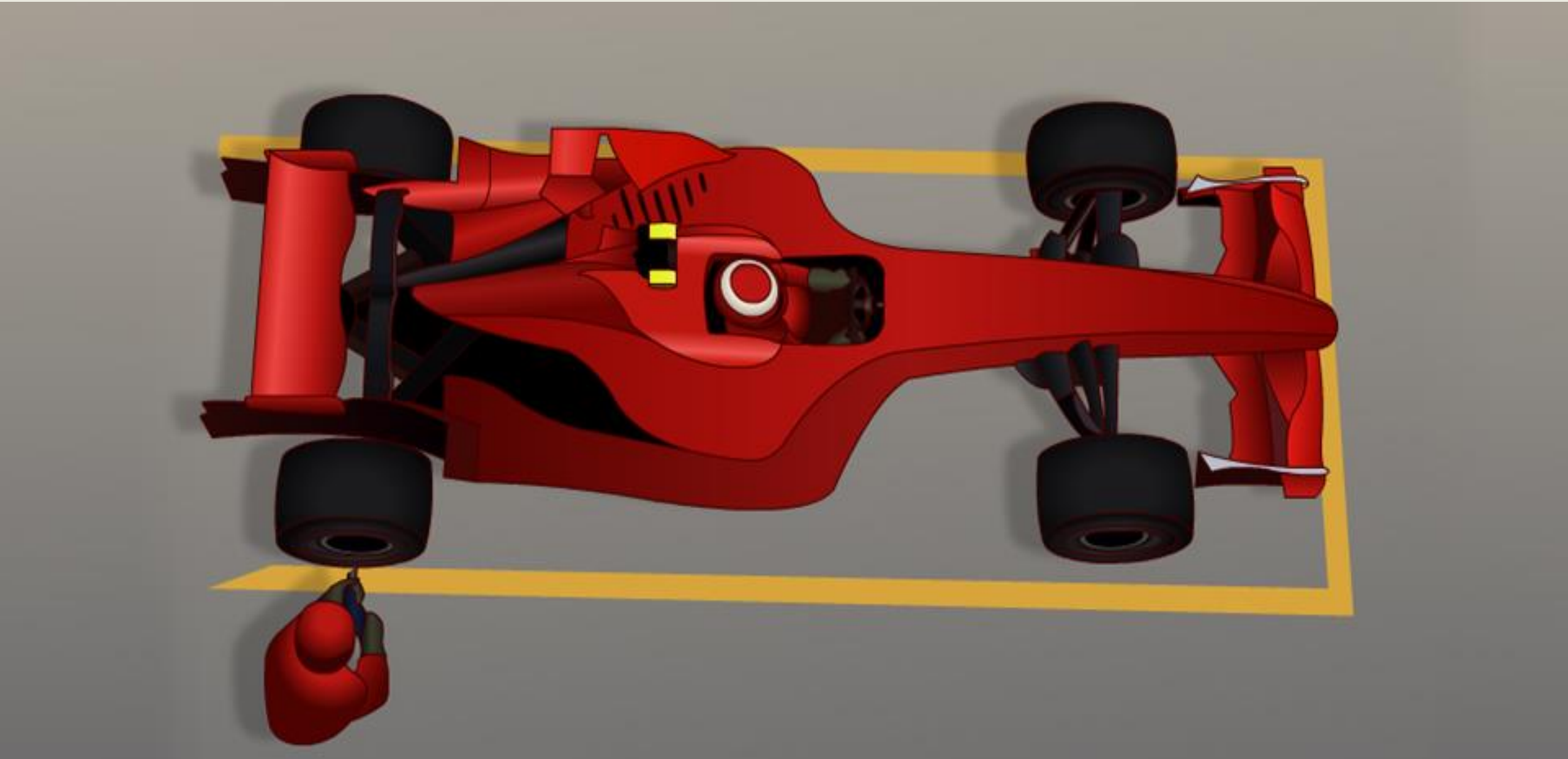
Resource Leveling. A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply.

Leveling moves resources

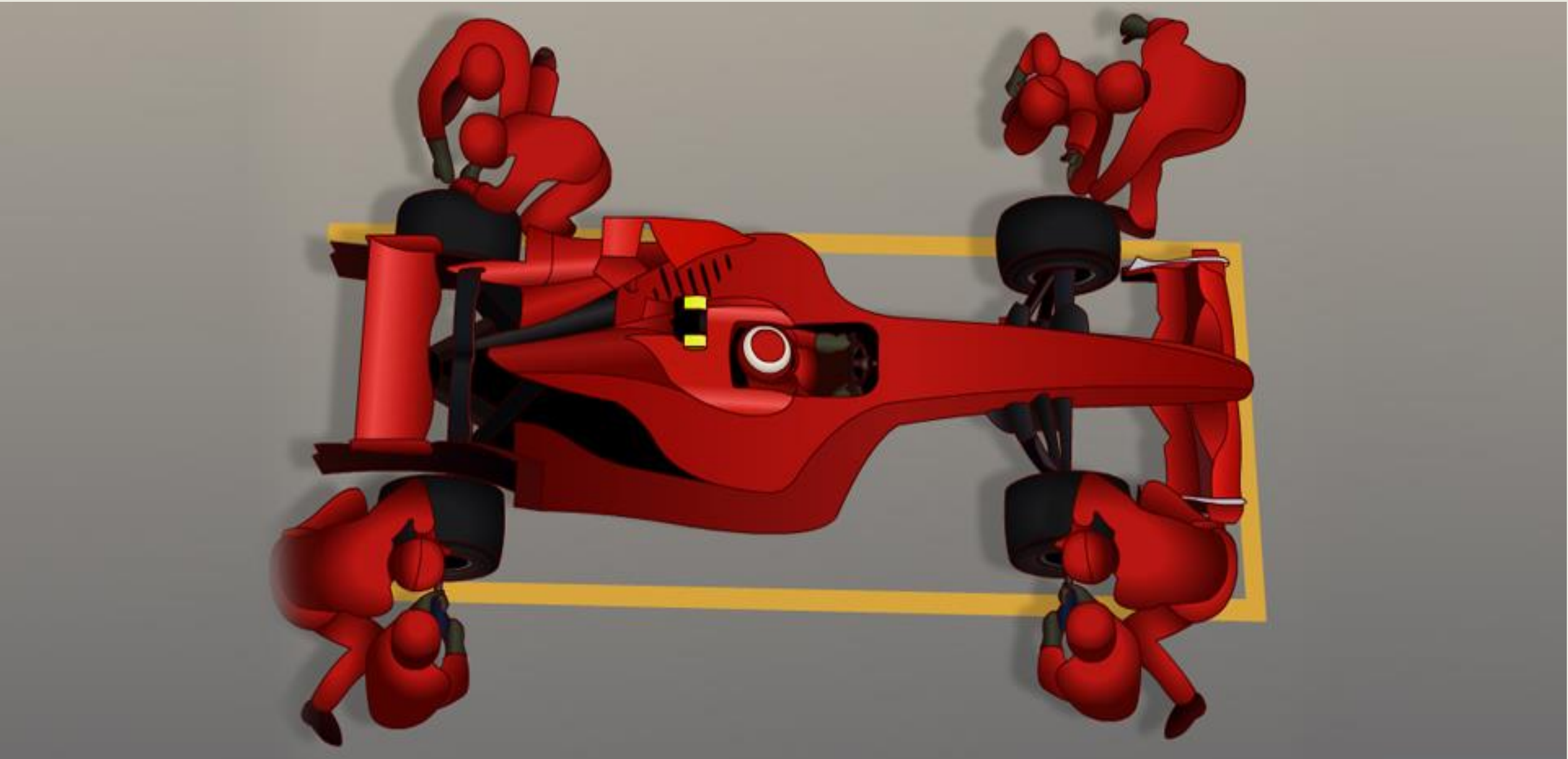
Resource Smoothing. A technique which adjusts the activities of a schedule model such that the requirement for resources on the project do not exceed certain predefined resource limits.

Smoothing moves activities

Crashing the Schedule



Crashing the Schedule



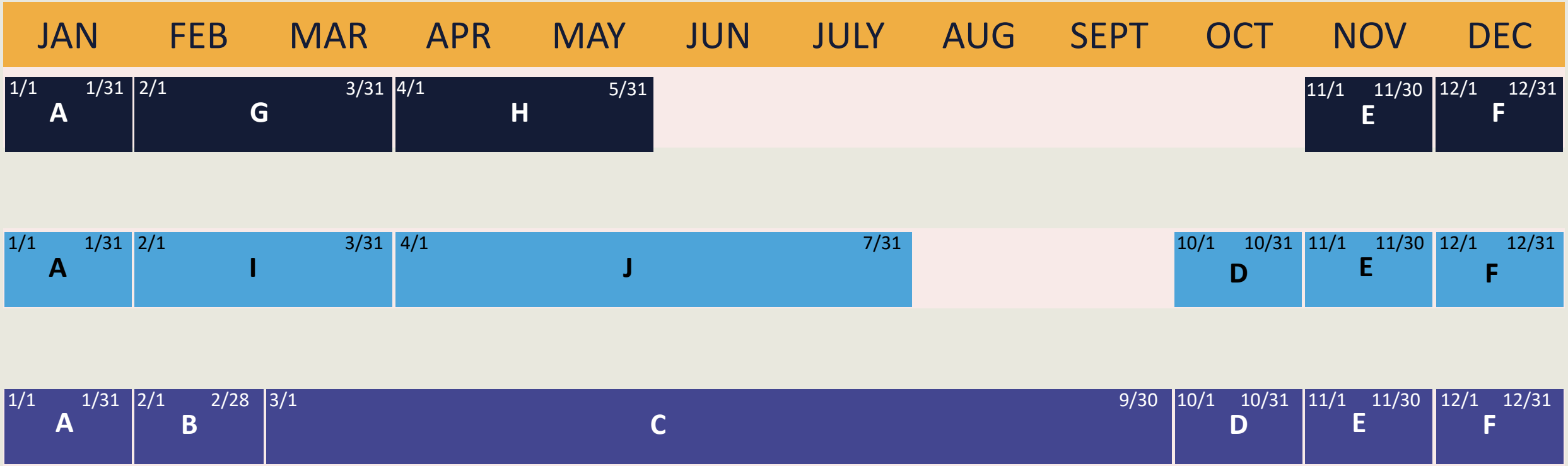
CRASHING THE SCHEDULE

	Traditional Tire Change	Pit Stop (Crashing)
Time		
Resources		
Cost	$	$$$$$$$$$

SCHEDULE CRASHING

7	10	12
PATH 1	PATH 2	PATH 3

Today is June 1st

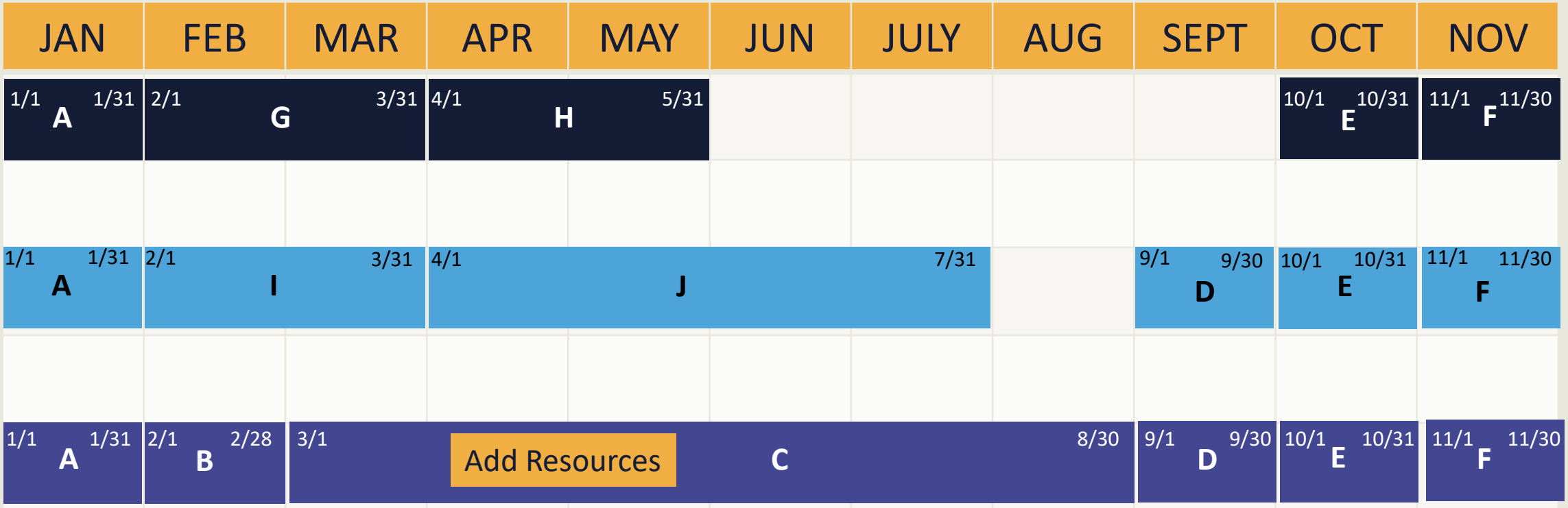


The Critical Path is the path with the longest duration.
Activities on this path will be critical to meeting the deadline.

SCHEDULE CRASHING

7	10	11
PATH 1	PATH 2	PATH 3

Today is June 1st



The Critical Path is the path with the longest duration.
Activities on this path will be critical to meeting the deadline.

CRASHING EXCEPTIONS

- Some activities cannot be crashed
  - Downloading files
  - Backing up servers

SCHEDULE COMPRESSION

Negative Float

When an activity on the critical path has an assigned finish date which is earlier than the planned finish date. This could be due to a new constraint. Negative float indicates that you will have to find a way to implement schedule compression techniques.

FAST TRACKING

FAST TRACKING

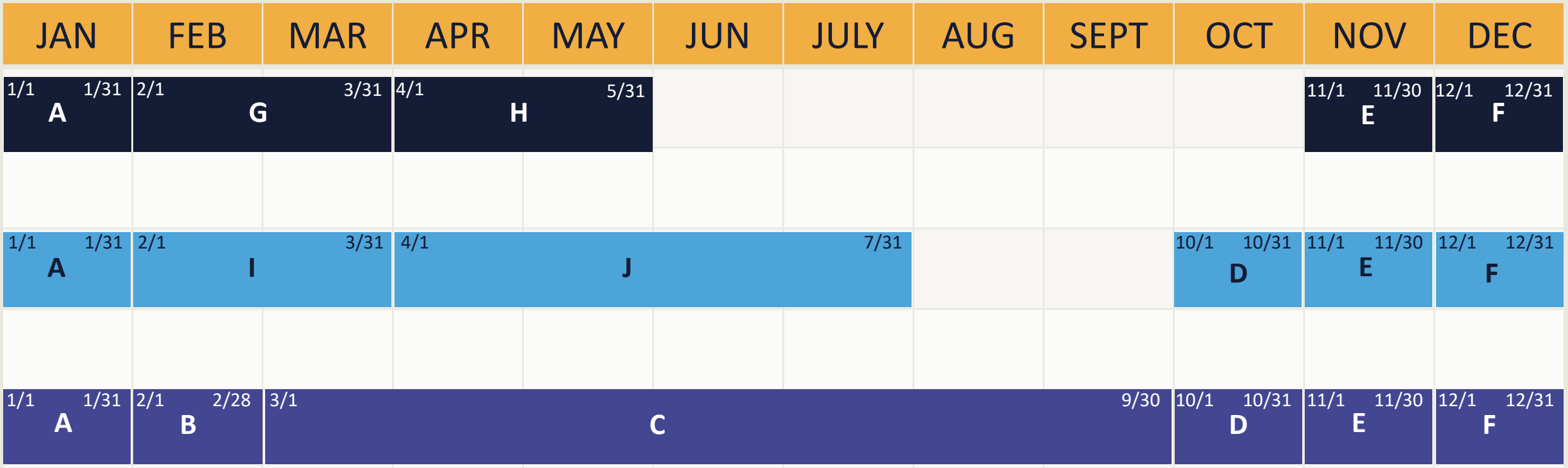
- Normally we perform activities sequentially
  - Different resources
  - Hard logic
  - Best practices

- Fast tracking means performing the activities simultaneously
  - Example: fuel car at the same time as changing tires
  - Why?

FAST TRACKING

7	10	12
PATH 1	PATH 2	PATH 3

Today is June 1st



The Critical Path is the path with the longest duration.
Activities on this path will be critical to meeting the deadline.

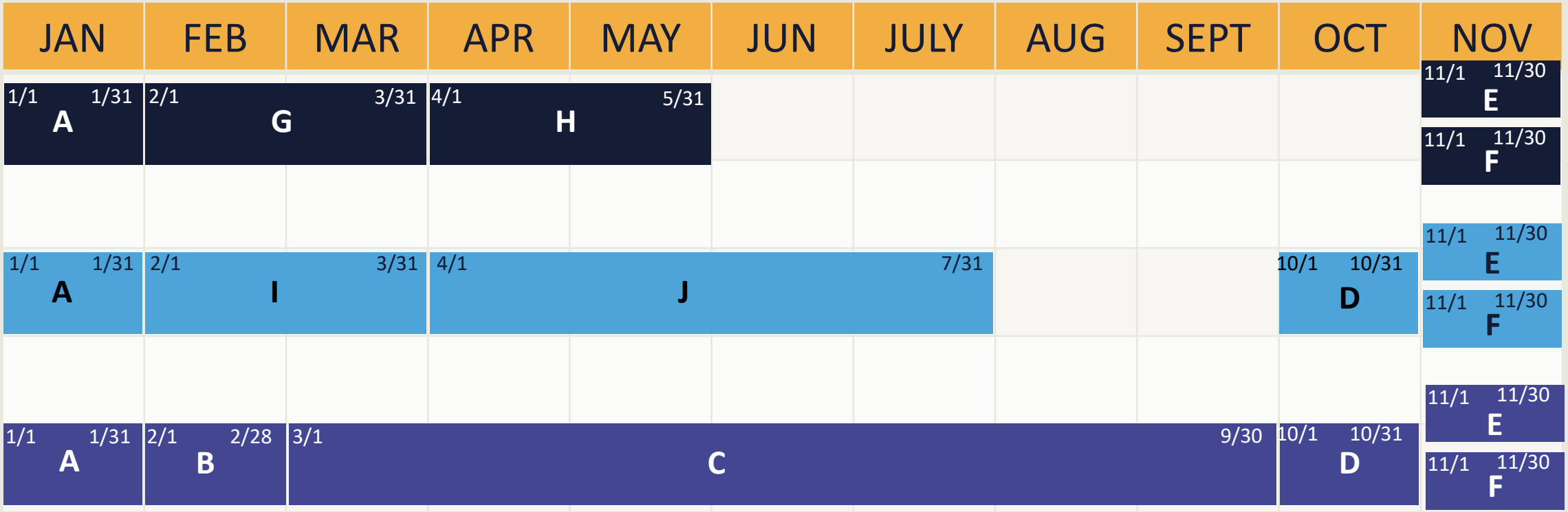
FAST TRACKING

7 PATH 1

9 PATH 2

11 PATH 3

Today is June 1st



The Critical Path is the path with the longest duration.
Activities on this path will be critical to meeting the deadline.

FAST TRACKING

- Adds Risks
- Should include consultation
  - Key stakeholders
  - Experts
- Requires integrated change control

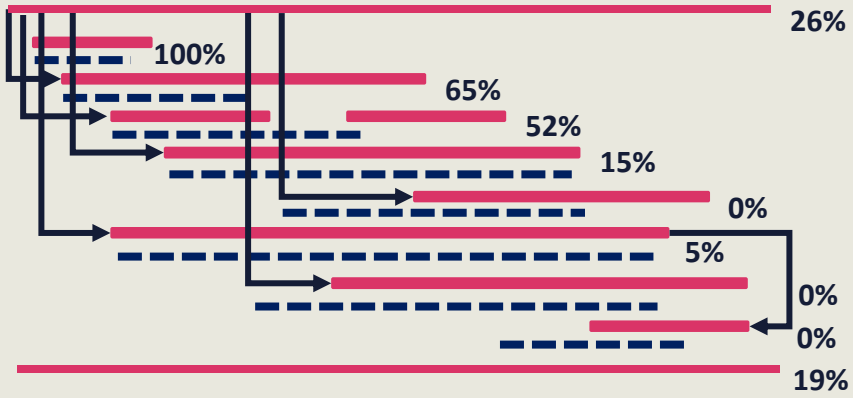
SCHEDULE COMPRESSION TECHNIQUES

Crashing. A technique in which resources are added to an activity in order to shorten its duration

Fast Tracking. A technique in which activities intended to be performed in sequence are performed in parallel in order to shorten the project schedule. Fast tracking can add risk to a project.

SCHEDULE DOCUMENTS

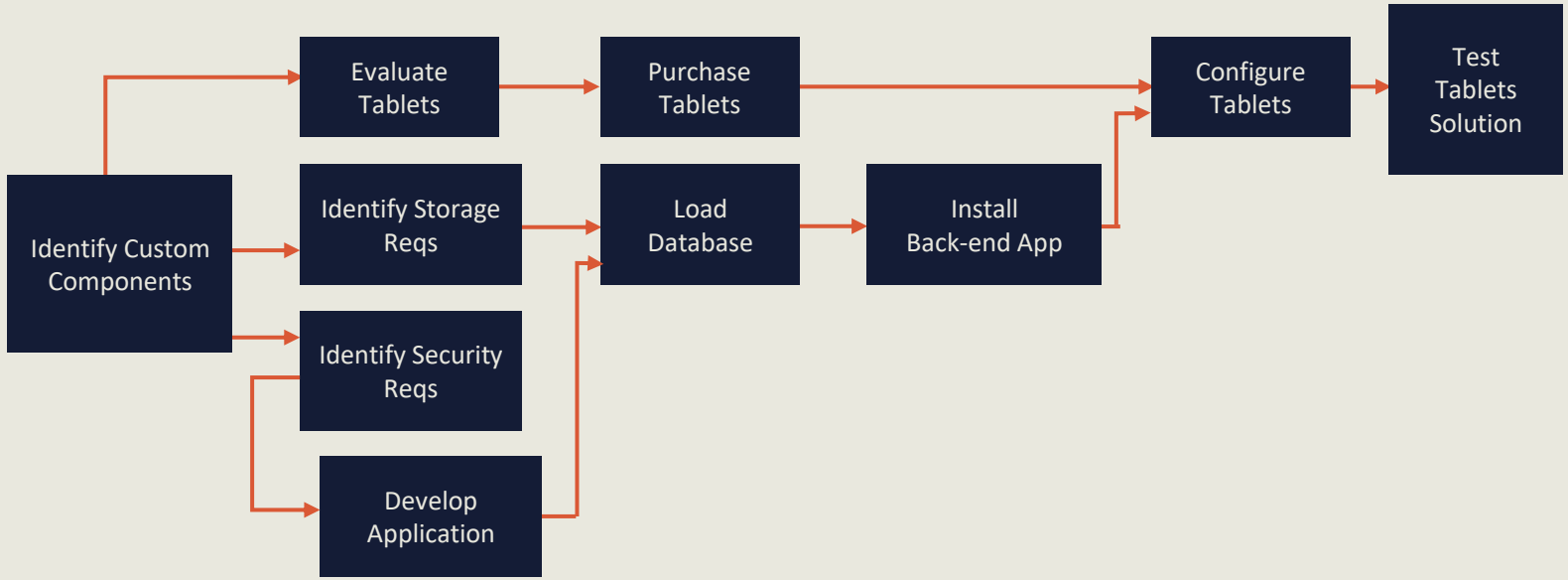
Bar or Gantt Charts



Milestone Charts

Milestone ID	Activity ID	Name	Events Triggered	Expected date

Network Diagrams



SCHEDULE BASELINE AND PLAN

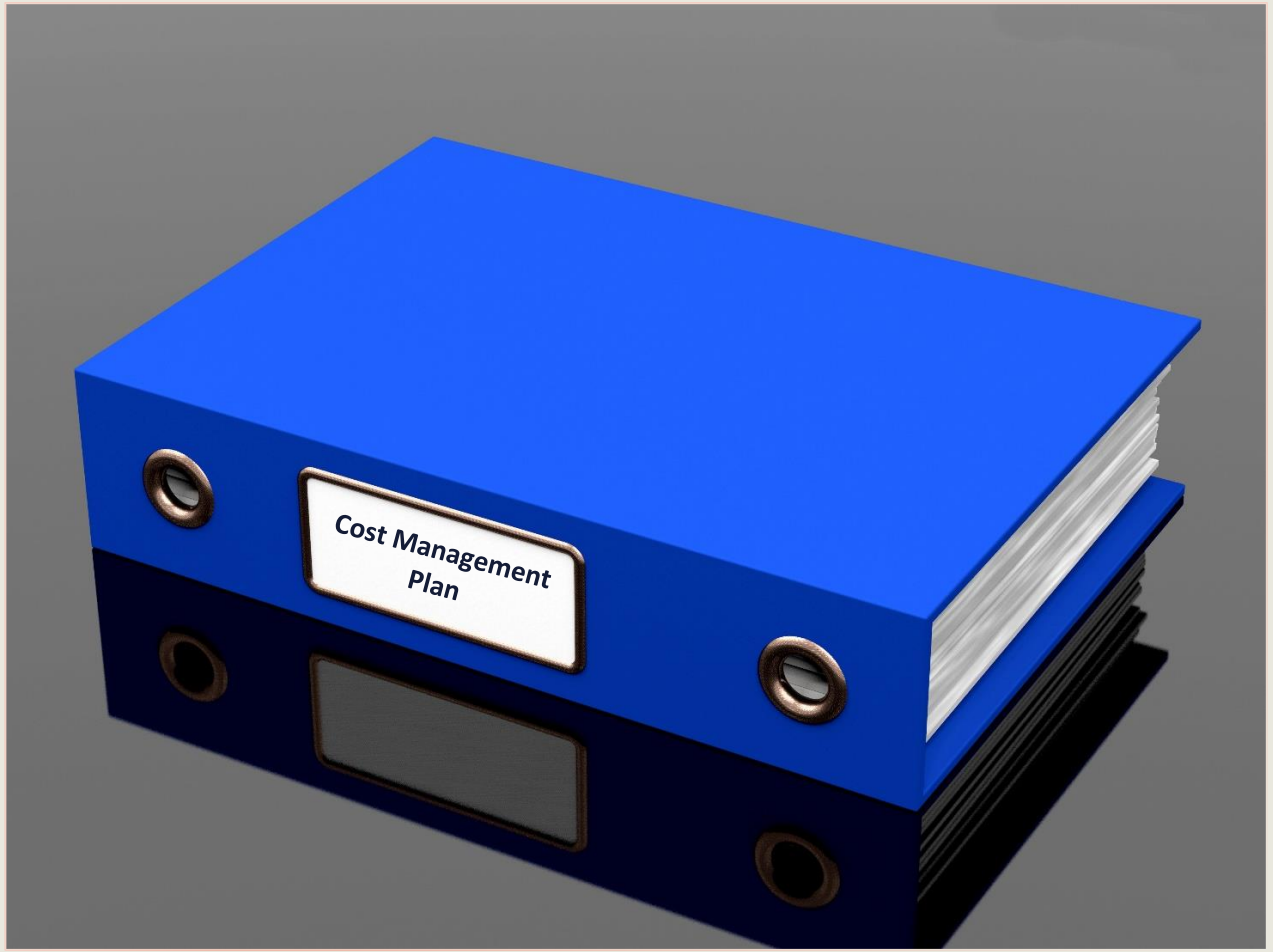
Schedule Baseline
The final approved baseline used to measure all schedule performance

Updates to Schedule Management Plan
After the baseline is approved some updates in how to execute and monitor/control the schedule may be necessary

COST MANAGEMENT PLAN

Establishes:

- Precision level
- Units of measure
- Control thresholds
- Earned value rules
- Reporting formats
- Processes and procedures



ESTIMATING COST

Initiating

Rough Order of Magnitude (ROM) Estimate

-25% to +75%

Planning

Definitive Estimates

-5% to +10%

FIXED VS. VARIABLE COSTS

Fixed Costs

- Expenses that do no change based on production
- Generally time based
- Ex: Rent stays the same for the duration of the agreement

Can be budgeted

Variable Costs

- Expenses that do change based on production
- Generally based on quality
- Ex: Utility bills are more or less expensive depending on usage

Will fluctuate

May

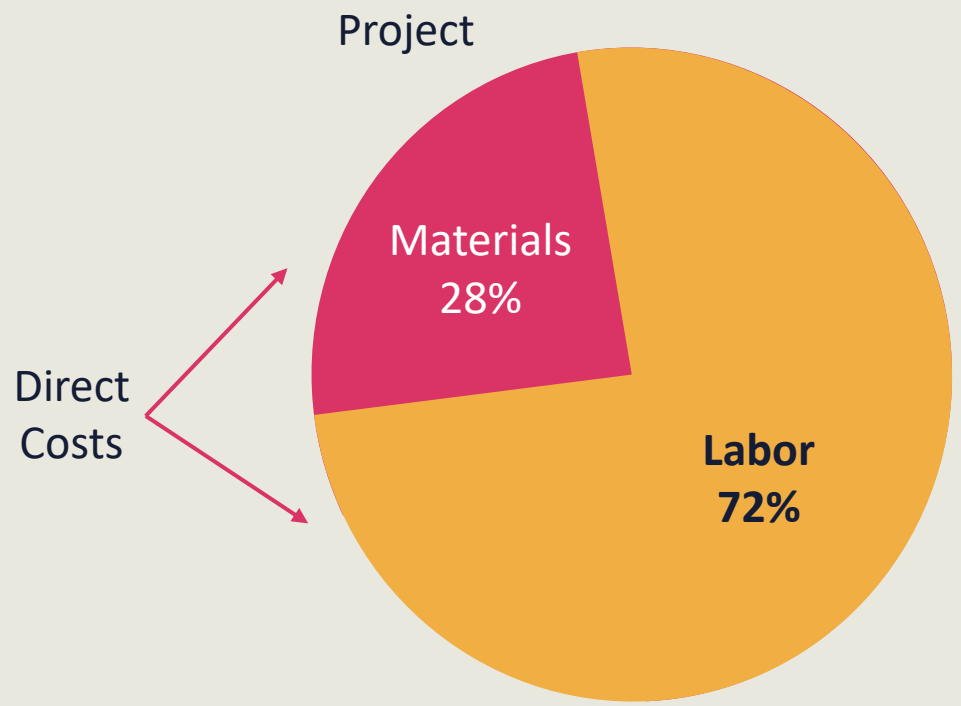
Fixed Costs	Rent	$6,000
+ Variable Costs	Utilities	$500
Total Costs		$6,500

August

Rent	$6,000
Utilities	$1,000
	$7,000

DIRECT VS. INDIRECT COSTS

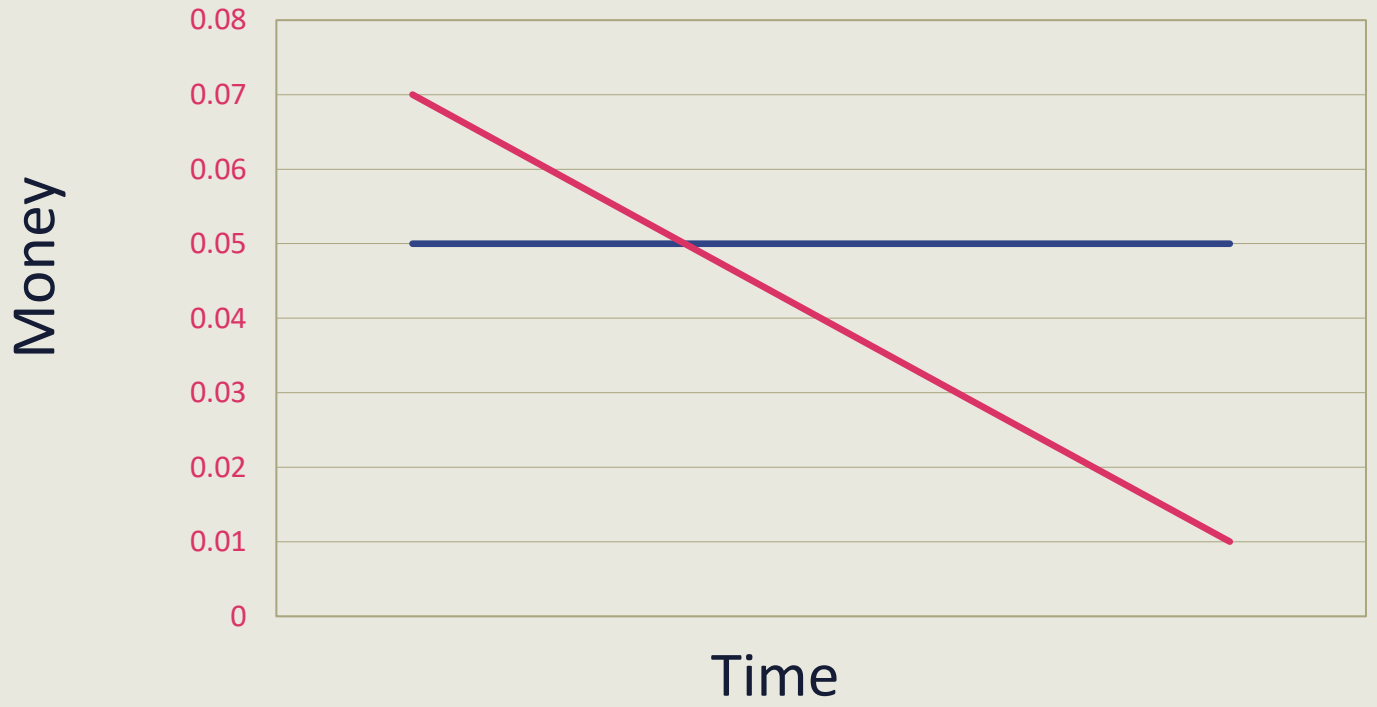
- Direct costs – Costs that can easily be traced to the project
- Example: Direct labor and materials
- Indirect costs – Costs that cannot accurately be allocated to specific activities
- Example: Power consumption, building insurance, equipment depreciation



DEPRECIATION

Straight line depreciation deducts the **same amount** of money over the life of an asset.

Accelerated depreciation deducts more money in the early life of an asset.



ANALOGOUS ESTIMATES

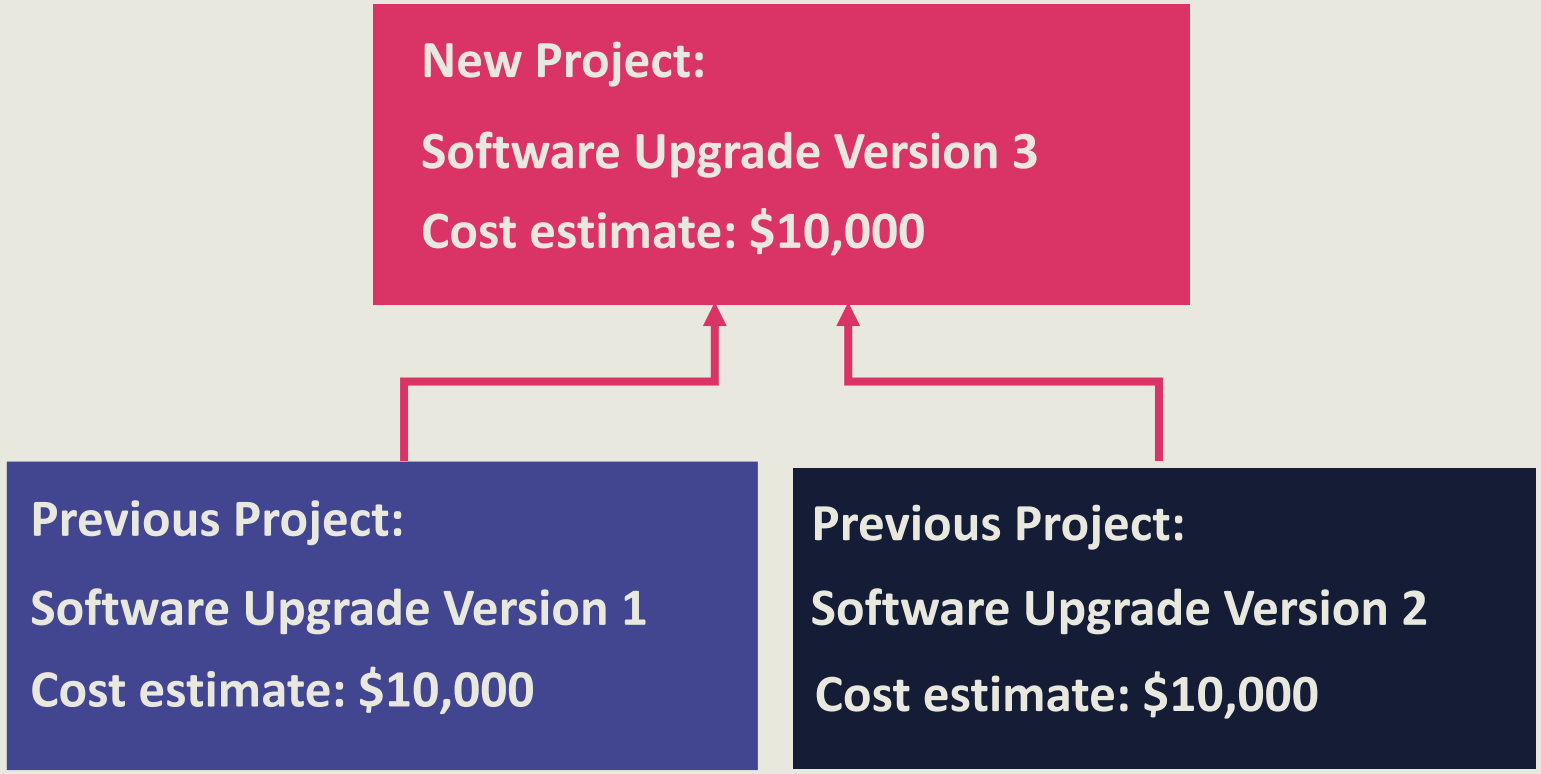
- Also known as “top-down” estimates
- Good for well-known work

Pros

- Quick
- Inexpensive

Cons

- Not always accurate



PARAMETRIC ESTIMATES

$35/hr x 40 hrs = $1,400

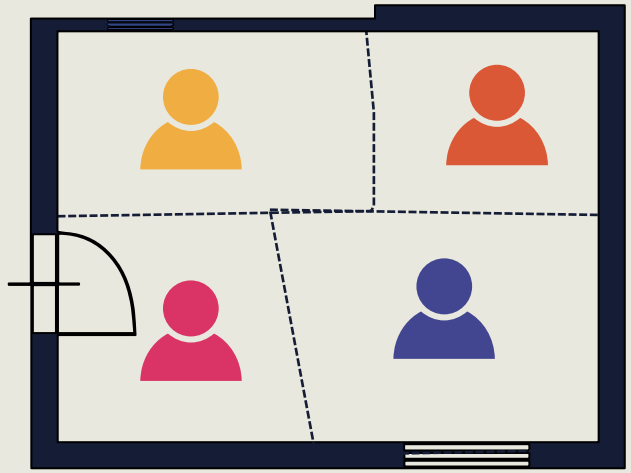
= $2,800

= $4,200

= $5,600

4 resources x $35.00/hr x 40 hours

= $5,600



Activity estimate = $5,600

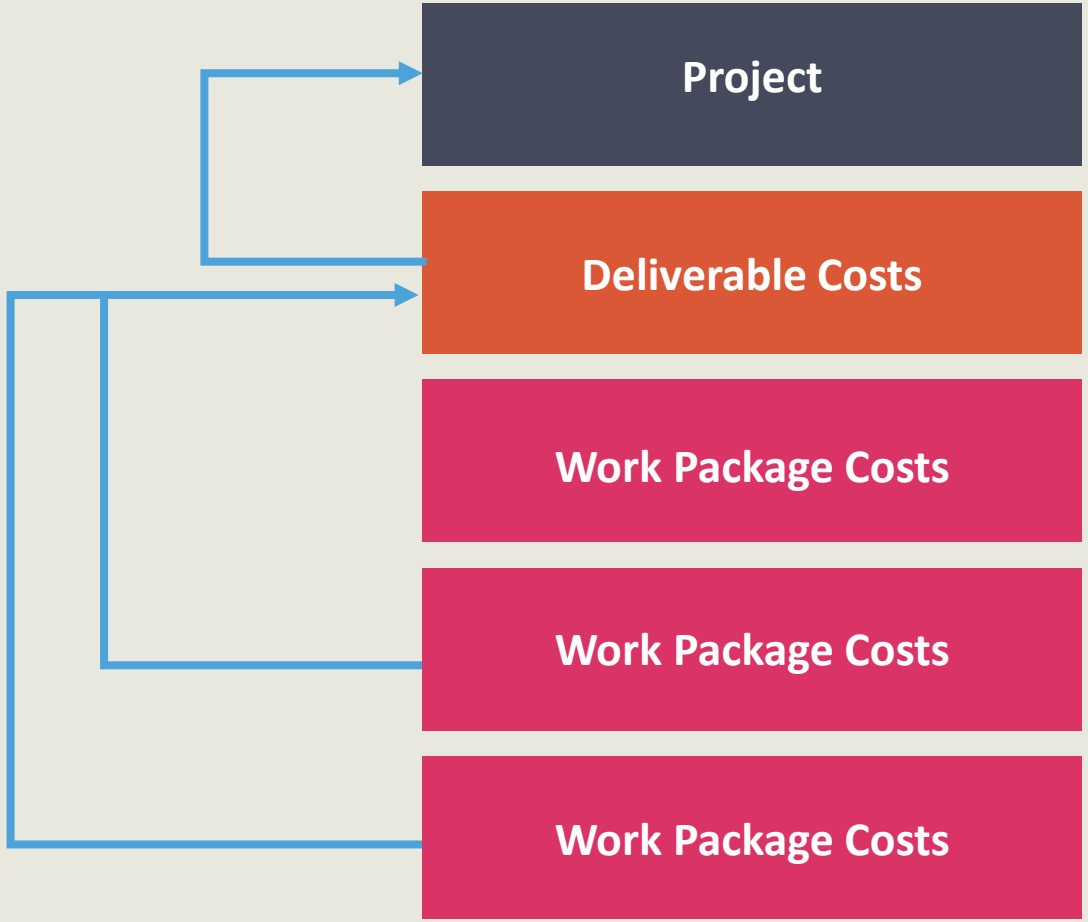
BOTTOM-UP ESTIMATES

Pros

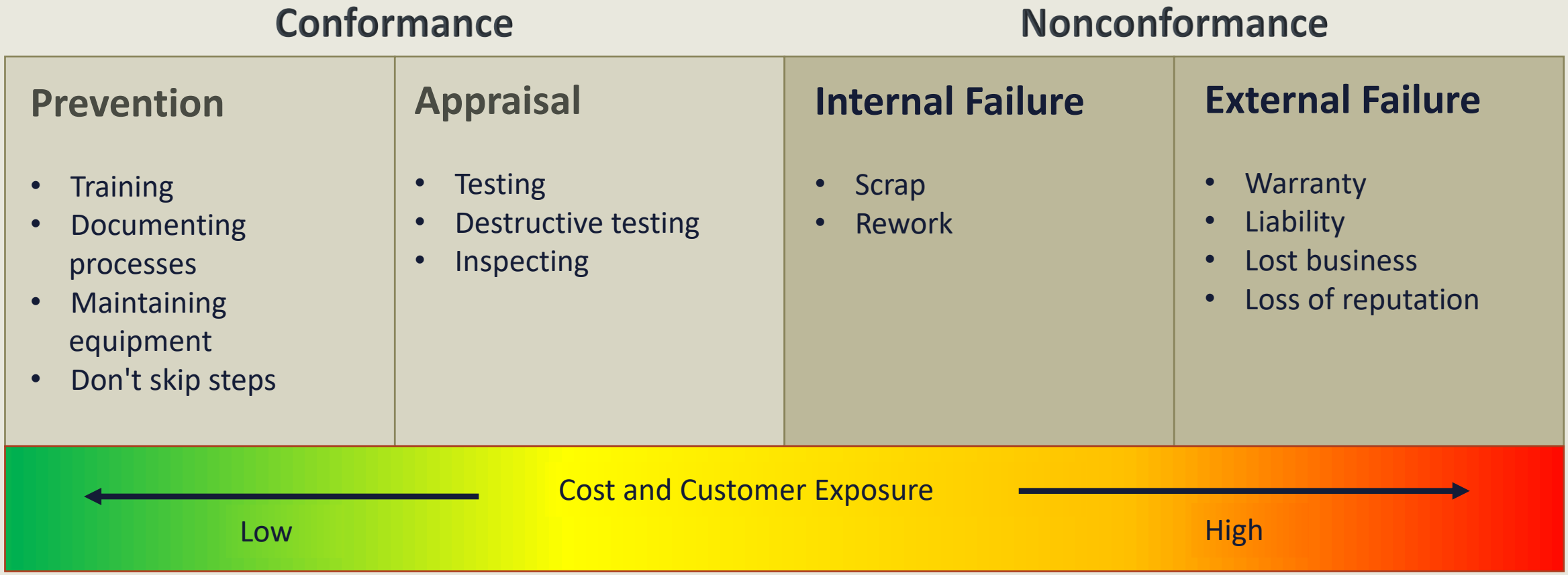
- Highly detailed
- Work package based

Cons

- Time consuming
- Expensive



COST OF QUALITY (COQ)



Cost of Quality, or **COQ**, includes the total cost of all efforts related to quality throughout the life of a product.

RISK RESERVES

Contingency Reserves	Management Reserves
Which identified risk events can be fixed with contingent or mitigation strategy using money? How much do we estimate it will cost?	We know there are risks that may occur that are outside our identification. How much money is management willing to set aside for a reserve?
Known: **Probability of occurrence** Unknown: **Until it occurs** Contingency Reserves: **Estimated** Controlled by: **The project manager and part of the baseline**	Unknown: **Not identified** Unknown: **Surprise!** Management Reserves: **How much will they set aside?** Controlled by: **Senior Management and part of the total project budget**

VENDOR BID ANALYSIS

Bid

Vendor 1:

Low Bid

Bid

Vendor 2:

Medium Bid

Bid

Vendor 3:

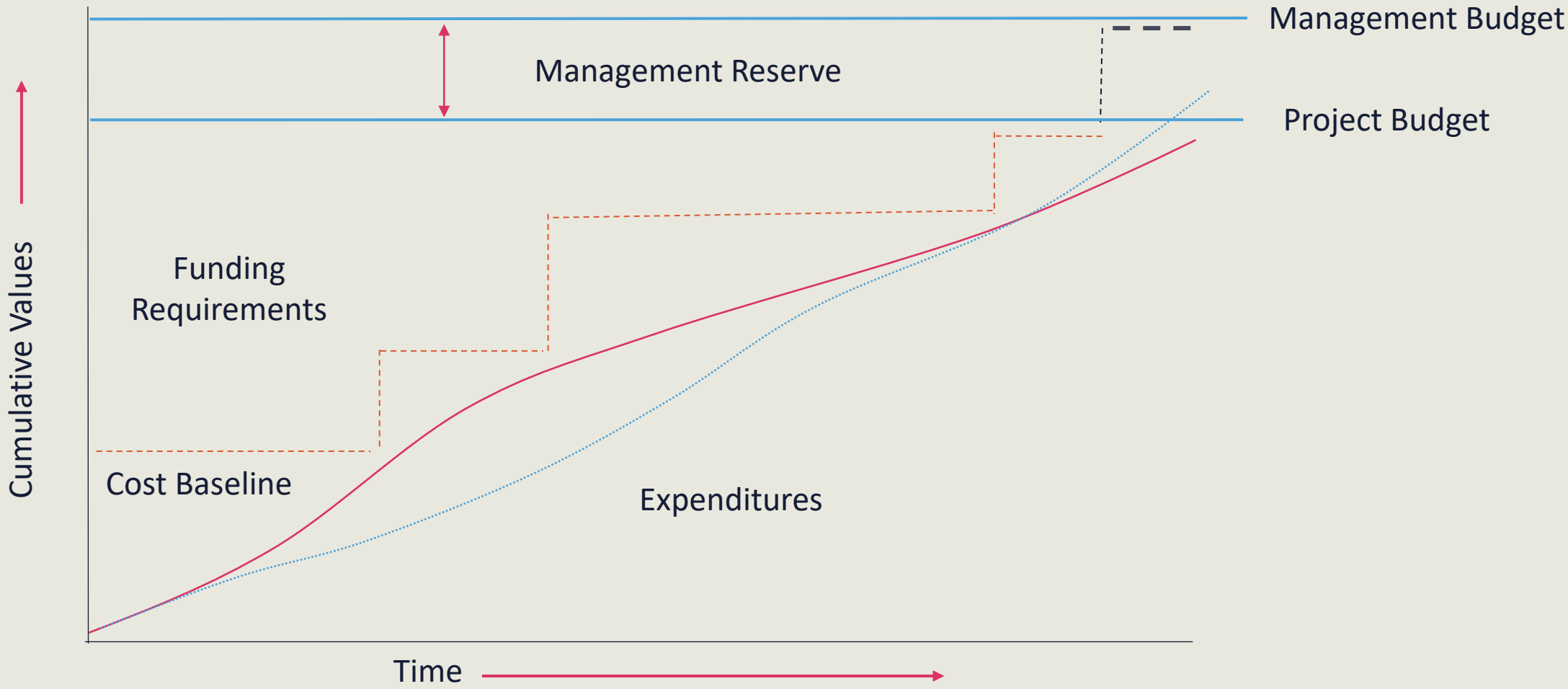
High Bid

FUNDING LIMIT RECONCILIATION

- Funding tied to milestones or schedule dates
- Expenditures are reconciled with the timing of funding
- Scheduled work may need to be smoothed

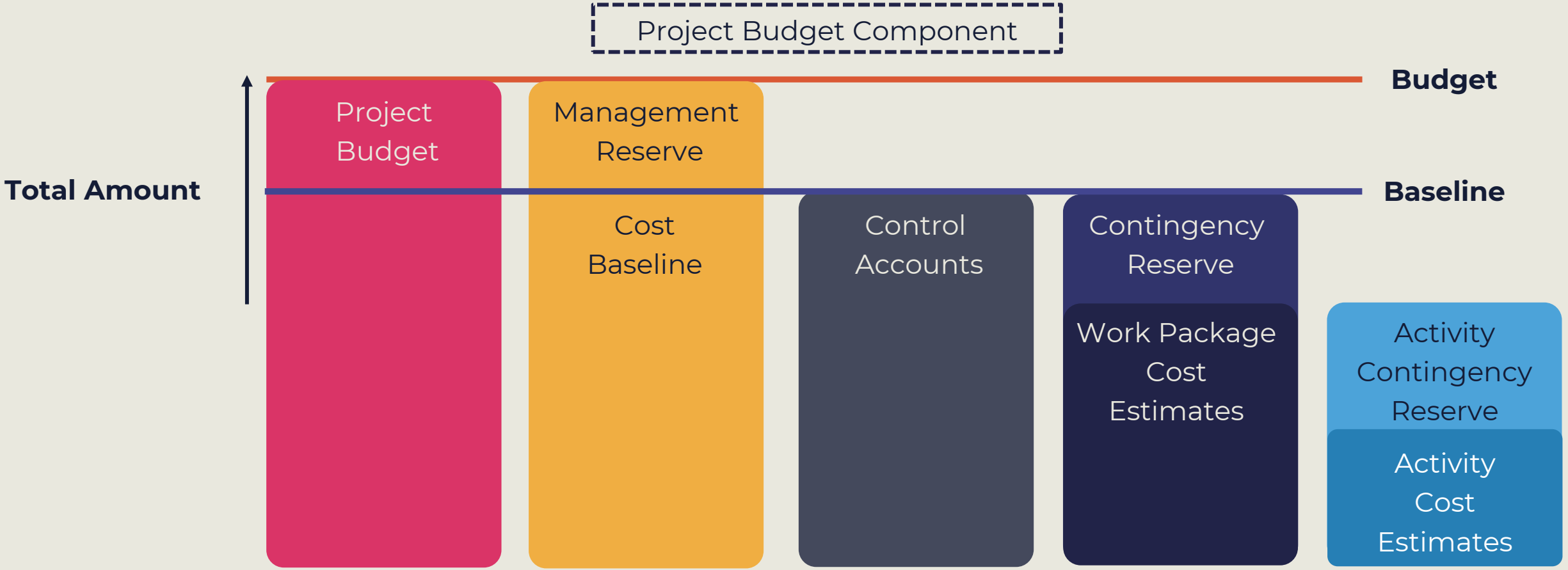
COST PERFORMANCE BASELINE

Spending may often have an “S Curve” appearance



DETERMINE BUDGET

Cost Baseline



International Organization for Standardization (ISO)

The **International Organization for Standardization**, or **ISO**, is an independent, non-governmental international organization. The ISO provides specifications for products, services, and systems. These standards ensure quality, safety, and efficiency.

ISO 9000 family of quality management standards

Definition of Quality

What is Quality?

The degree to which inherent characteristics fulfill requirements.

PROJECT QUALITY MANAGEMENT

Quality Management must address:

Quality of the project

- Meeting requirements by overworking the team may result in decreased profits and increased risks, employee attrition, errors, or rework.

Quality of the product

- Does the deliverable meet the requirements that were agreed to when the scope was defined?
- If there is variance, is it acceptable?
- Is it fit for use, and does it meet stakeholder expectations?

PROJECT QUALITY MANAGEMENT

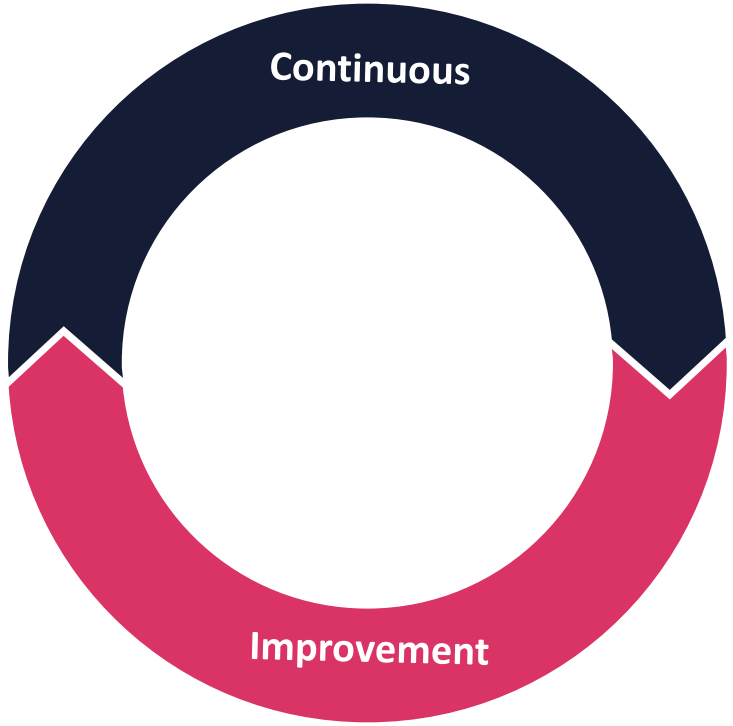
Quality Strategies

Total Quality Management

- Strategy to continuously improve
- Everyone in the company is responsible for quality
- Quality is defined by customer requirements

Other Quality Initiatives for Continuous Improvement

- Lean Manufacturing – eliminate waste and improve value
- Six Sigma (Bill Smith – Motorola, 3.4 defects per million)
- Malcolm Baldrige Award
- Deming Prize



PROJECT QUALITY MANAGEMENT

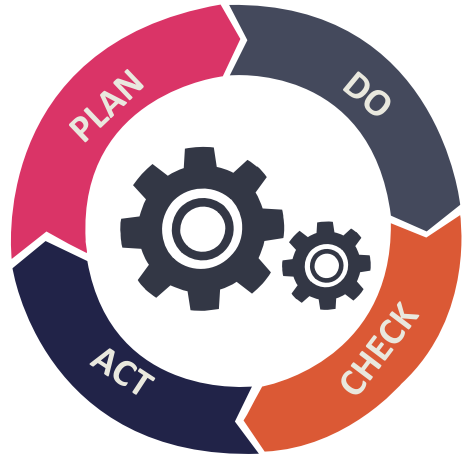
Quality Terminology

Kaizen

- “Continuous Improvement”
- Plan Do Check Act (PDCA) cycle
- W. Edwards Deming
- All employees identify and eliminate waste

Just-in-Time (JIT)

- Storage of inventory is a waste
- Inventory is delivered when needed
- Signal (“kanban”) when to order inventory



Just in time

QUALITY VS. GRADE

Quality

- Fulfilling Requirements
- High quality: it works
- Low quality: it doesn’t work

Grade

- Requirements fulfilled with differing technical characteristics
- High grade: it works, and it has more refinement or capabilities
- Low grade: it works and has fewer refinements or capabilities

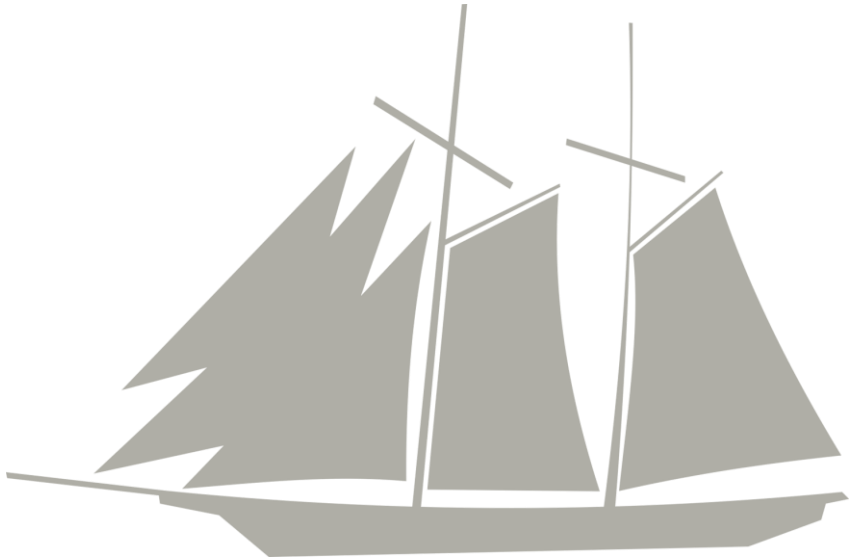
GOLD PLATING

Quality is not gold plating

- Adding features outside the original scope of work
- Incurs extra time and money
- Changes customer expectations for future relationships

Original scope of work

Extras = BAD!



PRECISION VS. ACCURACY

- Measure of exactness

- Assessment of correctness

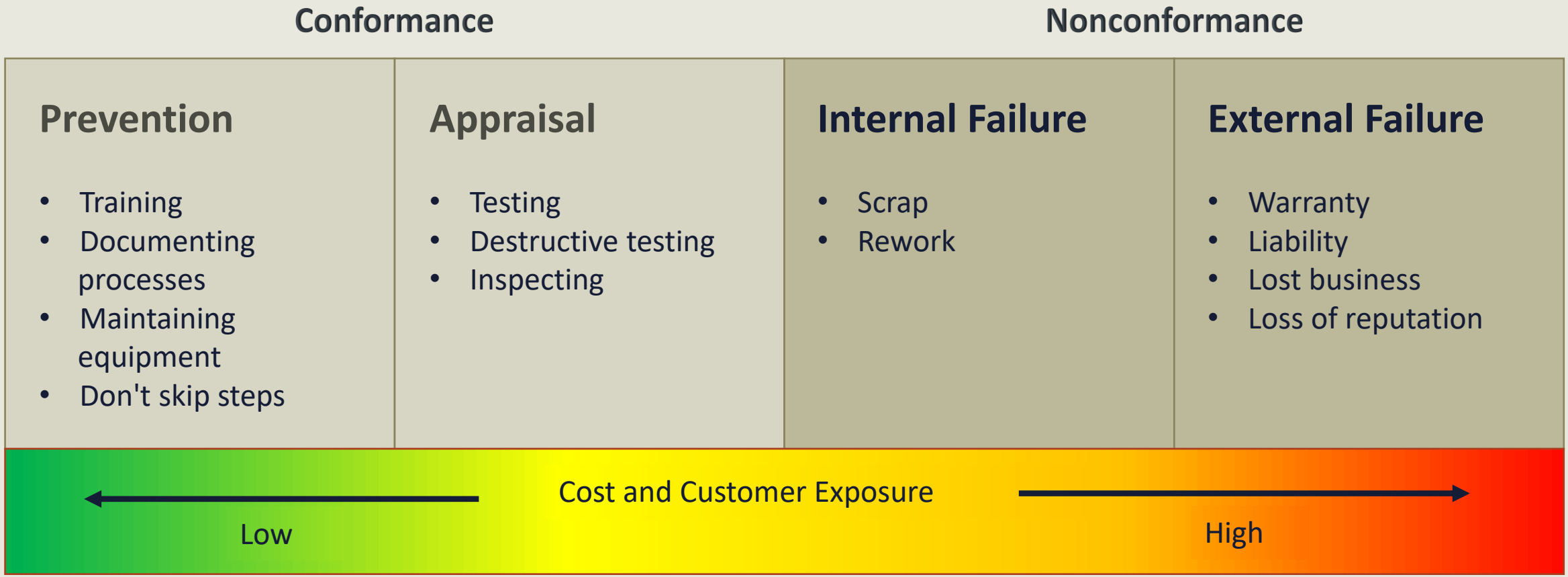
Not accurate
Low precision

Accurate
Low precision

Not accurate
high precision

Accurate
high precision

COST OF QUALITY (COQ)



Cost of Quality, or **COQ**, includes the total cost of all efforts related to quality throughout the life of a product.

TOTAL COST OF QUALITY

Total cost of quality = prevention costs

+ appraisal costs

+ internal failure costs

+ external failure costs

COST-BENEFIT ANALYSIS

List & calculate the costs
List & calculate the benefits
Compare the results

EXAMPLE

COSTS

Training materials + Trainer + Facilities + Lost productivity

$450 + $2,000 + $400 + $1,400 = $4,250

BENEFITS

Reduced rework benefit = $600

Reduced waste benefit = $300

Decreased testing benefit = $1,800

Decreased maintenance & support benefit = $1,600

Increased productivity benefit = $1,500

$4250 divided by $193 equals 22.02

Benefits total = $5,800 per month
= $193 per day

Financial benefits surpass costs in about 22 days

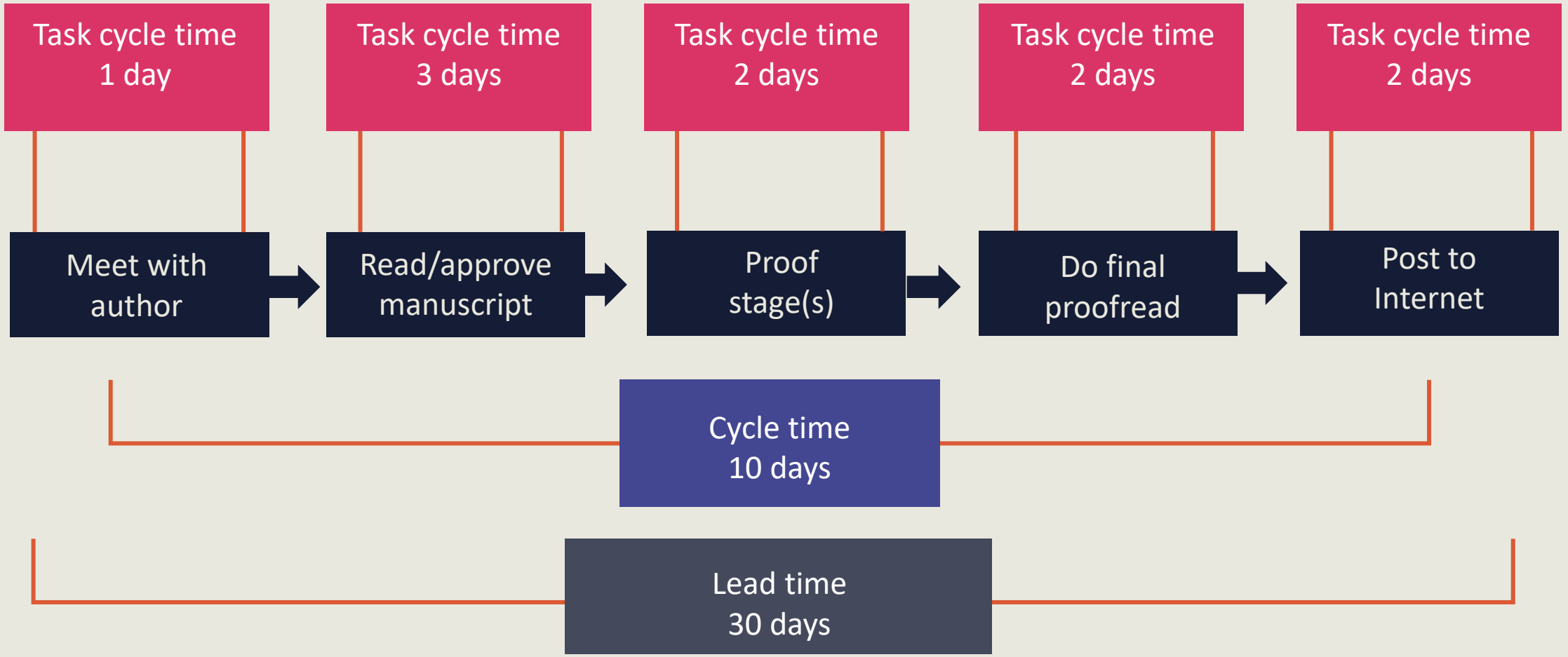
IDENTIFYING WASTE, OR MUDA

Eight Wastes

What is waste?

- Does NOT add value
- DOES add cost

VALUE STREAM MAPPING



CHECKLISTS

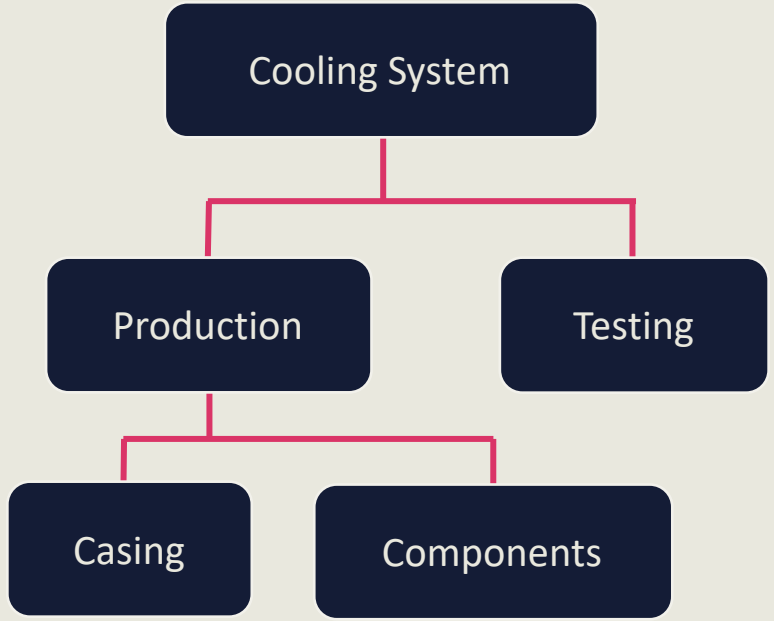
Templates for capturing information

Required steps in a process

Quality checklist

Date:
Signature:

Thermostat maintains engine temperature within two-degree threshold	Yes	No
Cooling system releases only clean air	Yes	No
Cooling system production meets quality standards	Yes	No



QUALITY METRICS

Which attributes will be measured?

What is considered acceptable

- Discrete – yes or no, one or the other
- Variable – a range of possibilities

Ensure the correct things are being measured

Part of the quality cycle between QA and QC

May lead to change requests

QUALITY MANAGEMENT PLAN

Establishes:

- Quality processes
- Quality requirements
- Level of grade
- Level of precision and accuracy
- How will PM team meet quality requirements?
- How will quality processes be implemented?

DAILY BOOTCAMP SURVEY

Please share your thoughts.

At the end of each Bootcamp session please let us know how we are doing. Your feedback helps us to offer the best possible Bootcamp experience.

Thank you for attending Session 2!