

CONSTRUCTION PROJECT MANAGEMENT

10 PROGRAMMING TECHNIQUES

2017-2018

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WHAT DO YOU HAVE TO PROGRAMME AS A PROJECT/CONSTRUCTION MANAGER?

Time

Staff

Projects

Financing

Cost

Equipment

Contracts

Purchase

Etc.





PROGRAMMES WILL IDENTIFY:

- Dates and durations
- Critical path
- Order of works (one activity after the other or simultaneously)
- Float
- Specific resources (plant, services, material supply, etc.)
- Labourers needed/working



We can cover different purposes with programmes:

- Client's overall programme – including all projects in a company
- Design programme (from inception to start construction)
- Information release schedule
- Contractor's master programme (construction activities)



When preparing a programme, particular attention given to:

- Long-lead items
- Pre-contract works
- Prefabricated elements
- Works outside of main contract
- Relationships with other projects
- Phasing and sectional completion (deadlines for different sections of the work-contracts)
- The “CDM planning period”
- Decision points (gateways) and milestones



WHAT TOOLS/TECHNIQUES DO YOU KNOW FOR PROGRAMMING?

Bar charts (Gantt charts)

Network diagrams

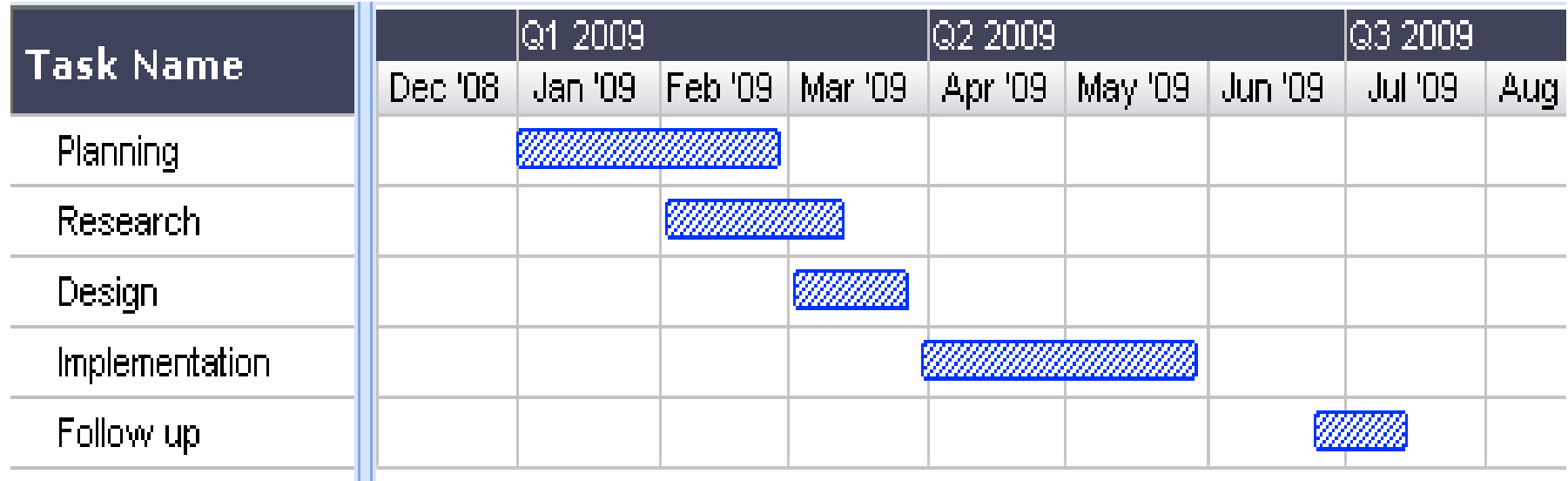
- Precedence diagrams
- Arrow diagrams

Lines of balance

Time-chainage diagrams



GANTT CHARTS

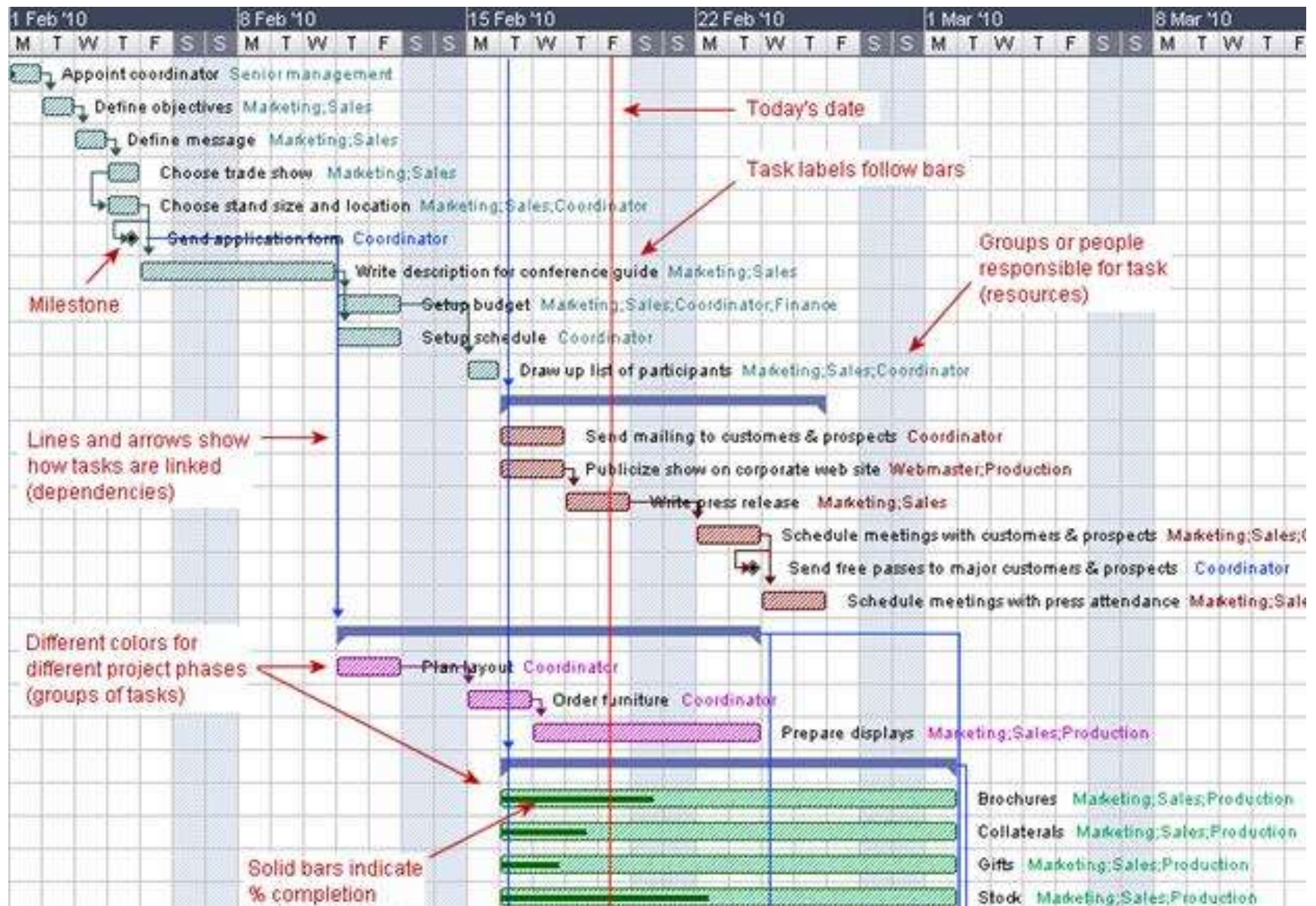


We can see at a glance:

- All activities
- When they start and finish
- Duration of every activity
- Overlapping of activities
- Start and end date of the whole project



What can we show?





Computer applications

Microsoft Project

Oracle Primavera Project Plan

Mindview Business Edition

Asta Powerproject

CS Project

Better improvement

Larger capacities for programming

Cost analysis

Reports

Subcontractors management

Resources management

Monitoring and control



Steps

1. Detailed project plan. Interdependent tasks to be performed in order
2. Establishment of relationships
3. Definition of critical path
4. Definition of activity float (if it exists)

Better improvement

Larger capacities for programming

Cost analysis

Reports

Subcontractors management

Resources management

Monitoring and control



Relationships (links)

They establish the order in which every activity should start/finish

- Finish to start (FS)
- Start to Start (SS)
- Finish to Finish (FF)
- Start to Finish (SF)

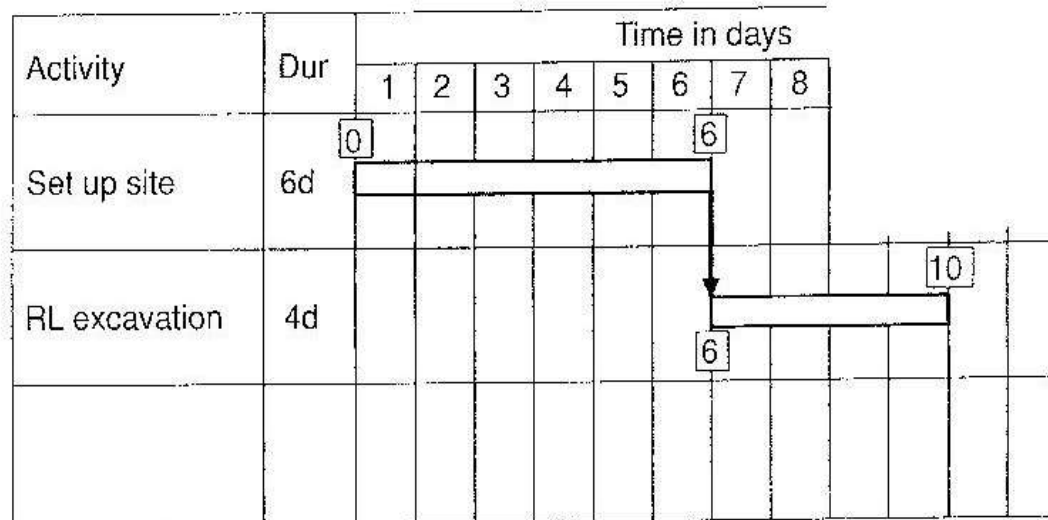


Relationships (links)

Finish to Start (FS)

The most common one

The task cannot start before the predecessor ends

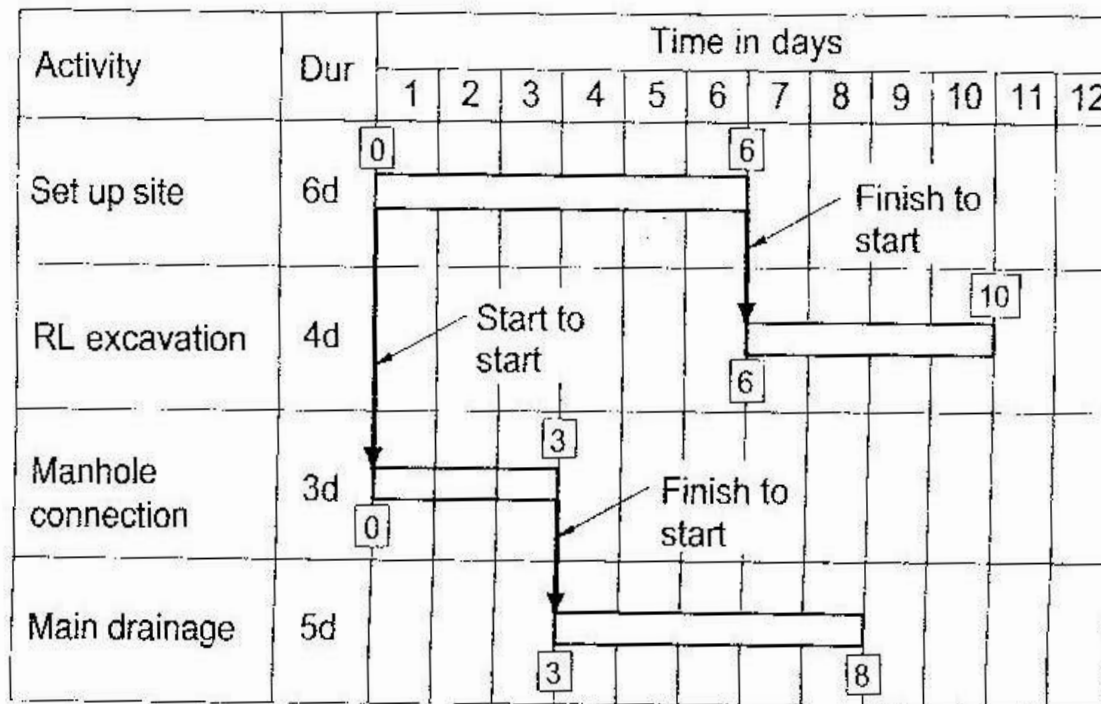




Relationships (links)

Start to Start (SS)

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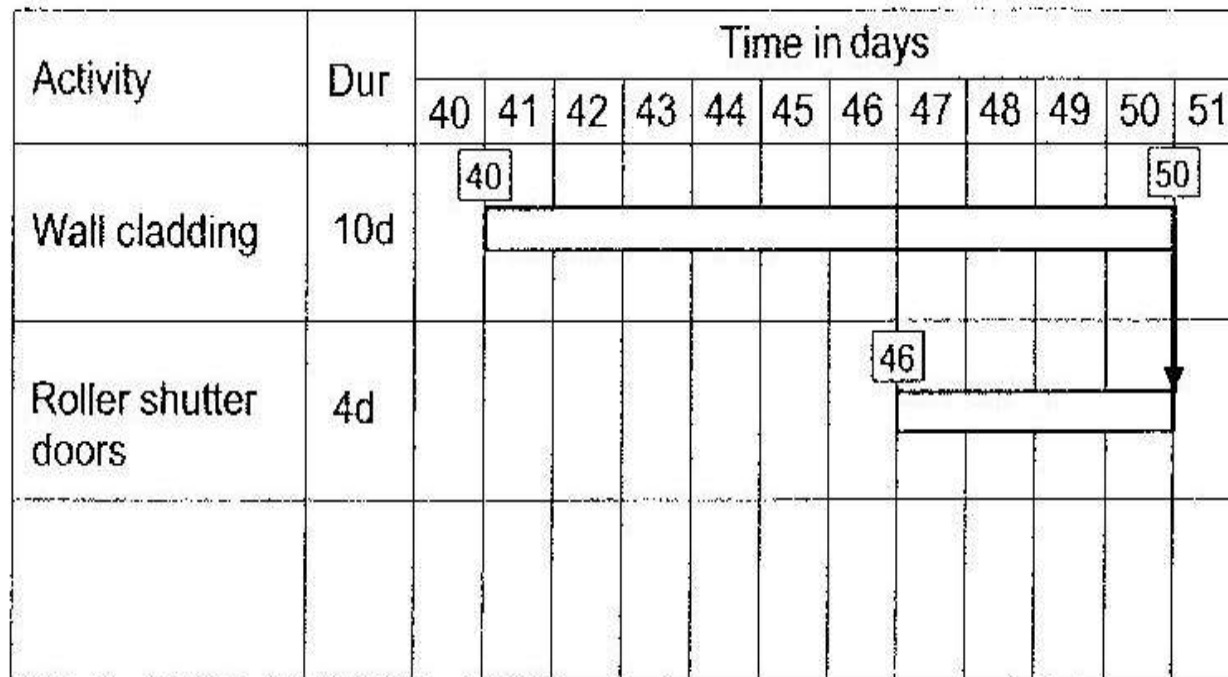




Relationships (links)

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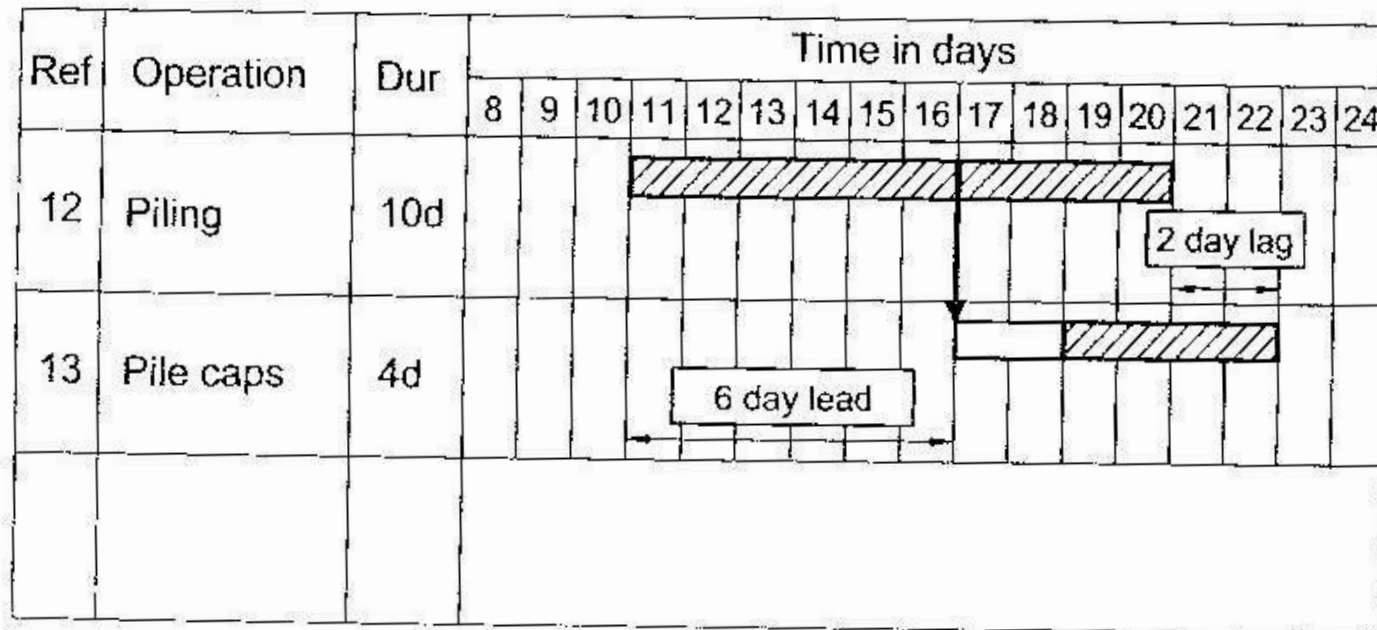




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NETWORK DIAGRAMS

Graphical way to show tasks, dependencies and critical path

Precedence diagrams

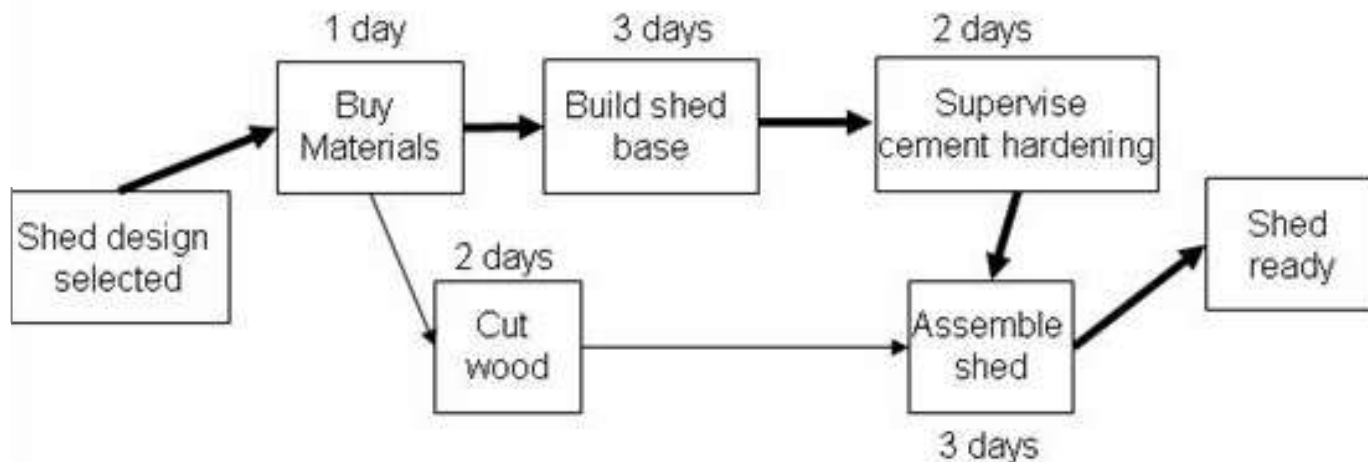
Activities in boxes

Relationships in arrows

Arrow diagrams

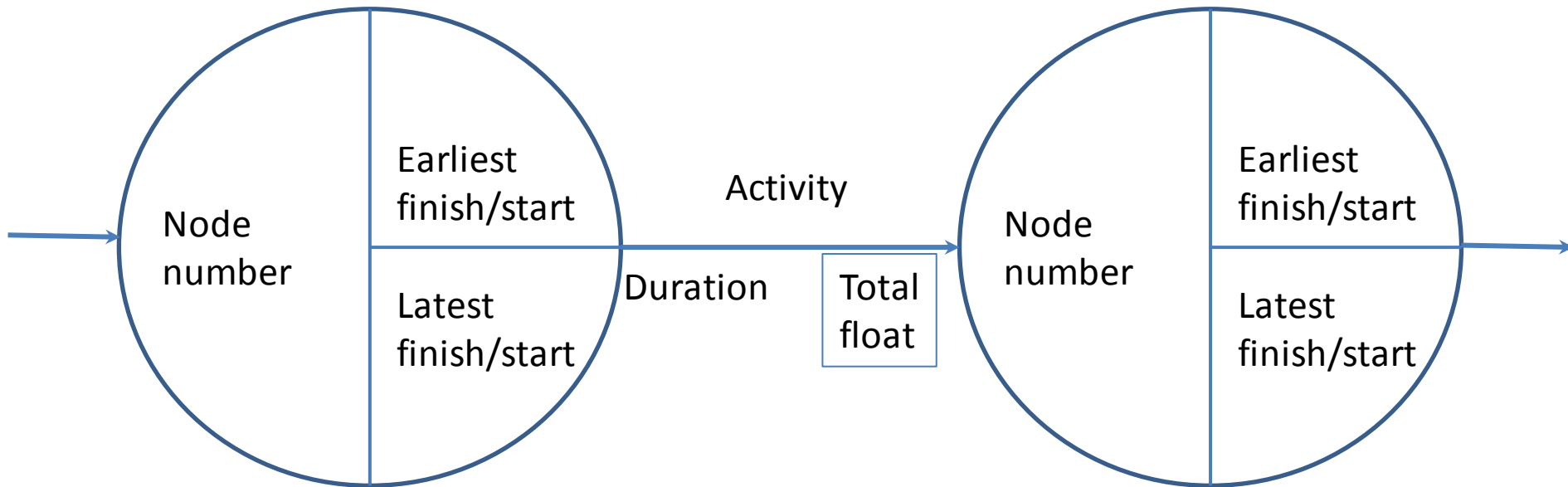
Activities in arrows

Relationships in nodes



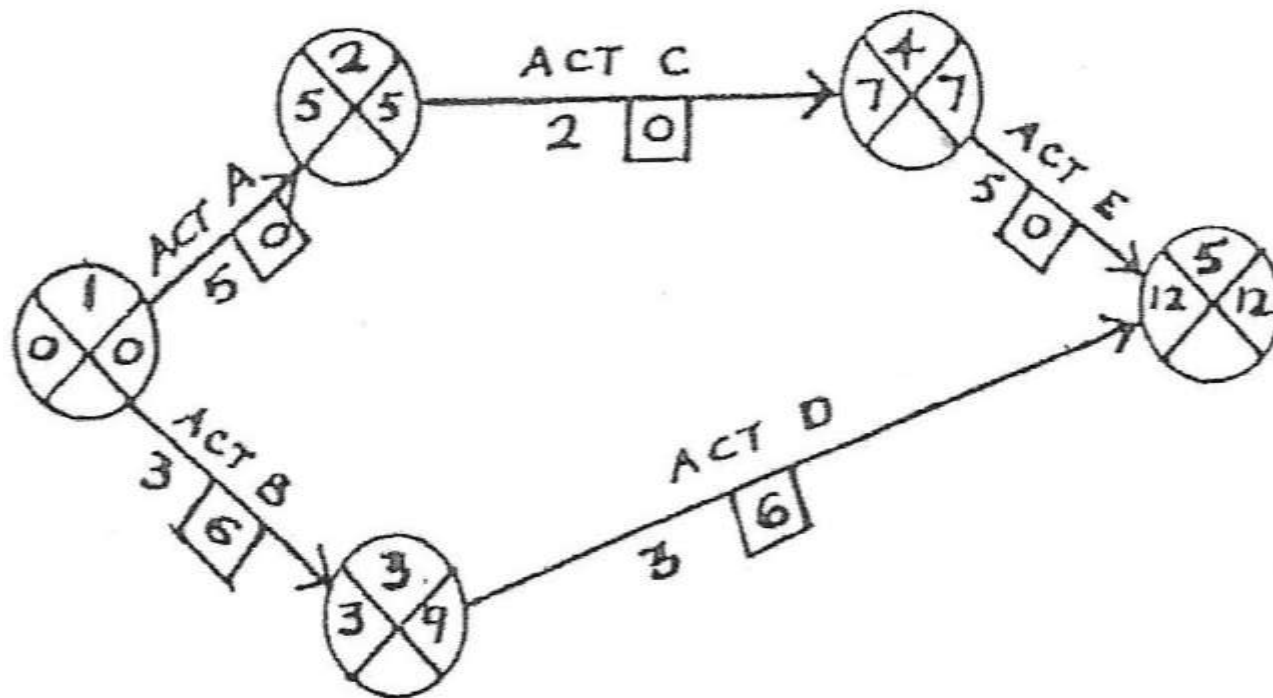


ARROW DIAGRAMS





ARROW DIAGRAMS

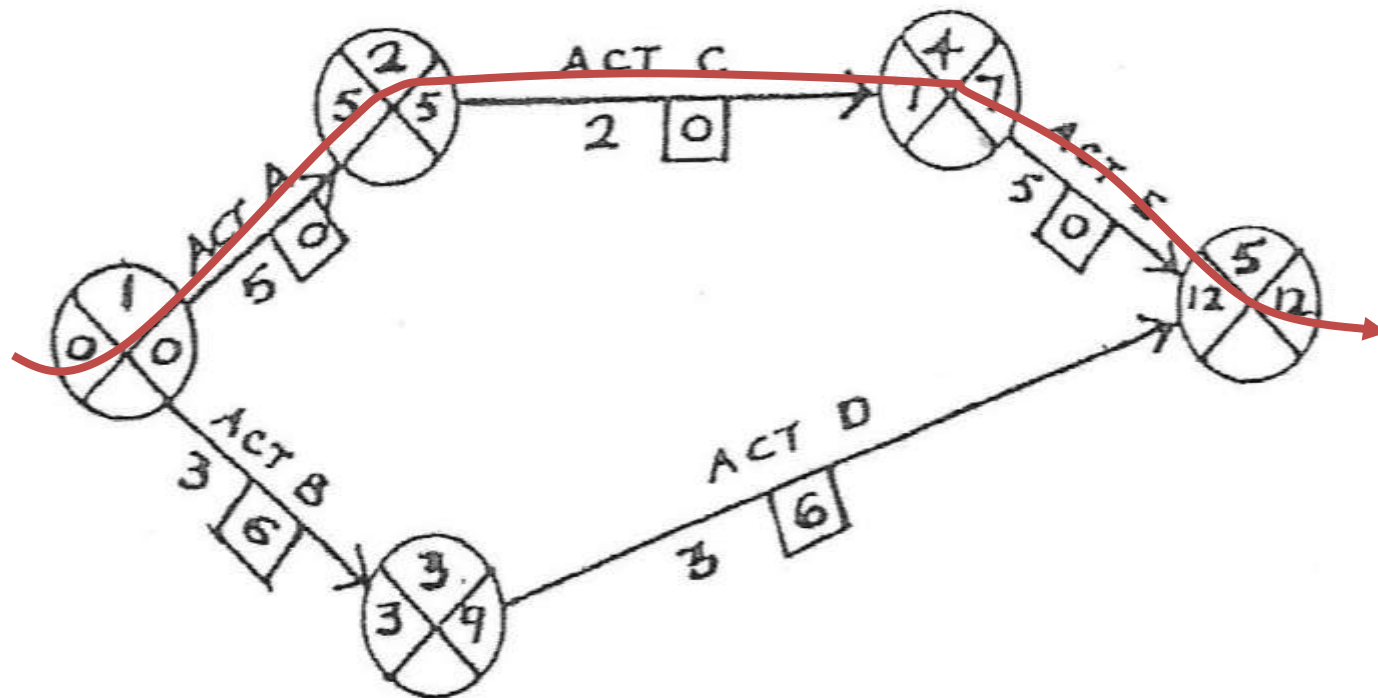




ARROW DIAGRAMS

Critical Path

The path in which activities have zero float

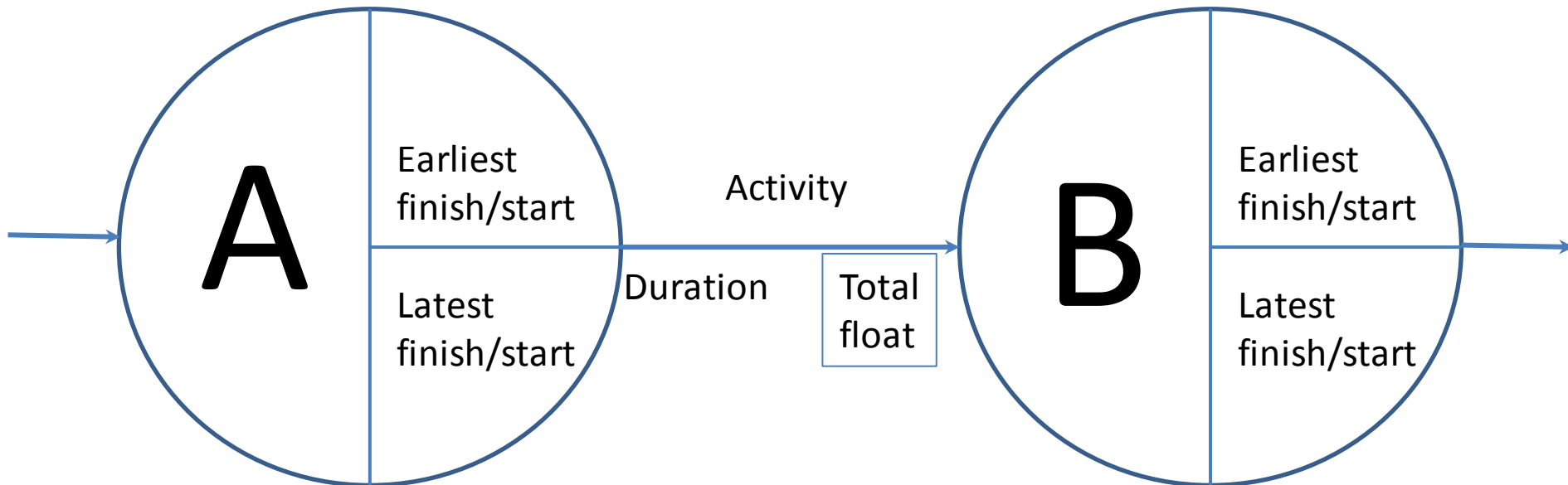




ARROW DIAGRAMS

How to calculate the total float for an activity

$$\text{Total float} = (LF - ES) - \text{Duration}$$

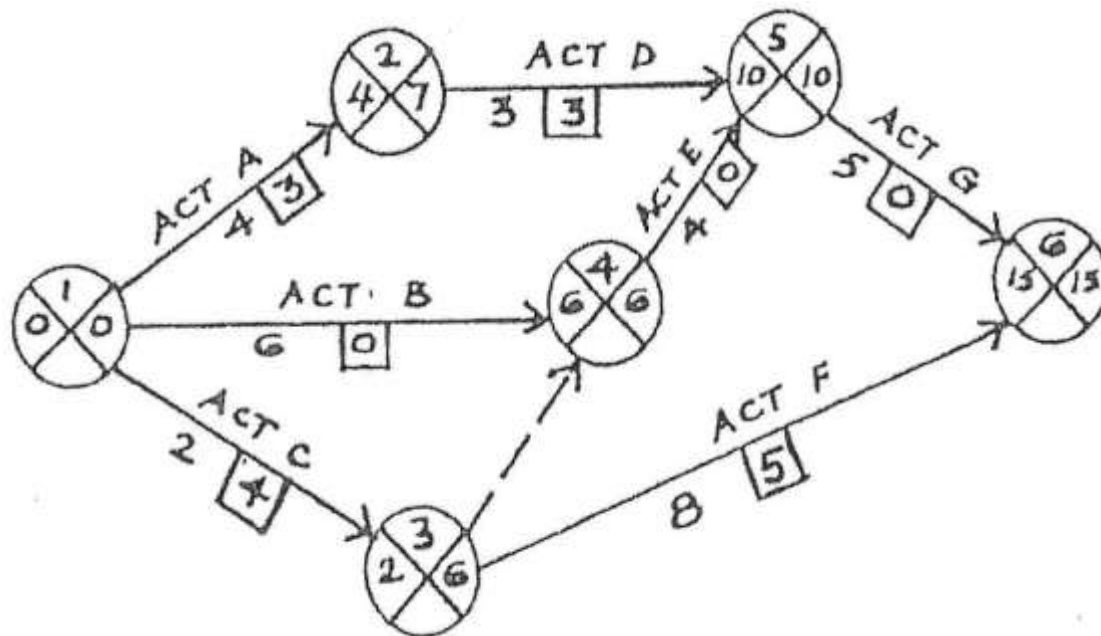




ARROW DIAGRAMS

Muddy relationships

They don't have any duration. Only express relationship.





PRECEDING DIAGRAMS

Another kind of network diagrams

- Alternative to arrow diagrams

Developed with activity boxes linked by lines

Advantages:

- Relationship between activity boxes more clearly expressed
- Similar sequences can be linked together
- Procurement symbols may be introduced for key resources
- Float times directly available by comparison of figures in the box activity
- Logic more readily understood at the construction site
- Easy conversion to arrow diagram or bar chart



PRECEDING DIAGRAMS

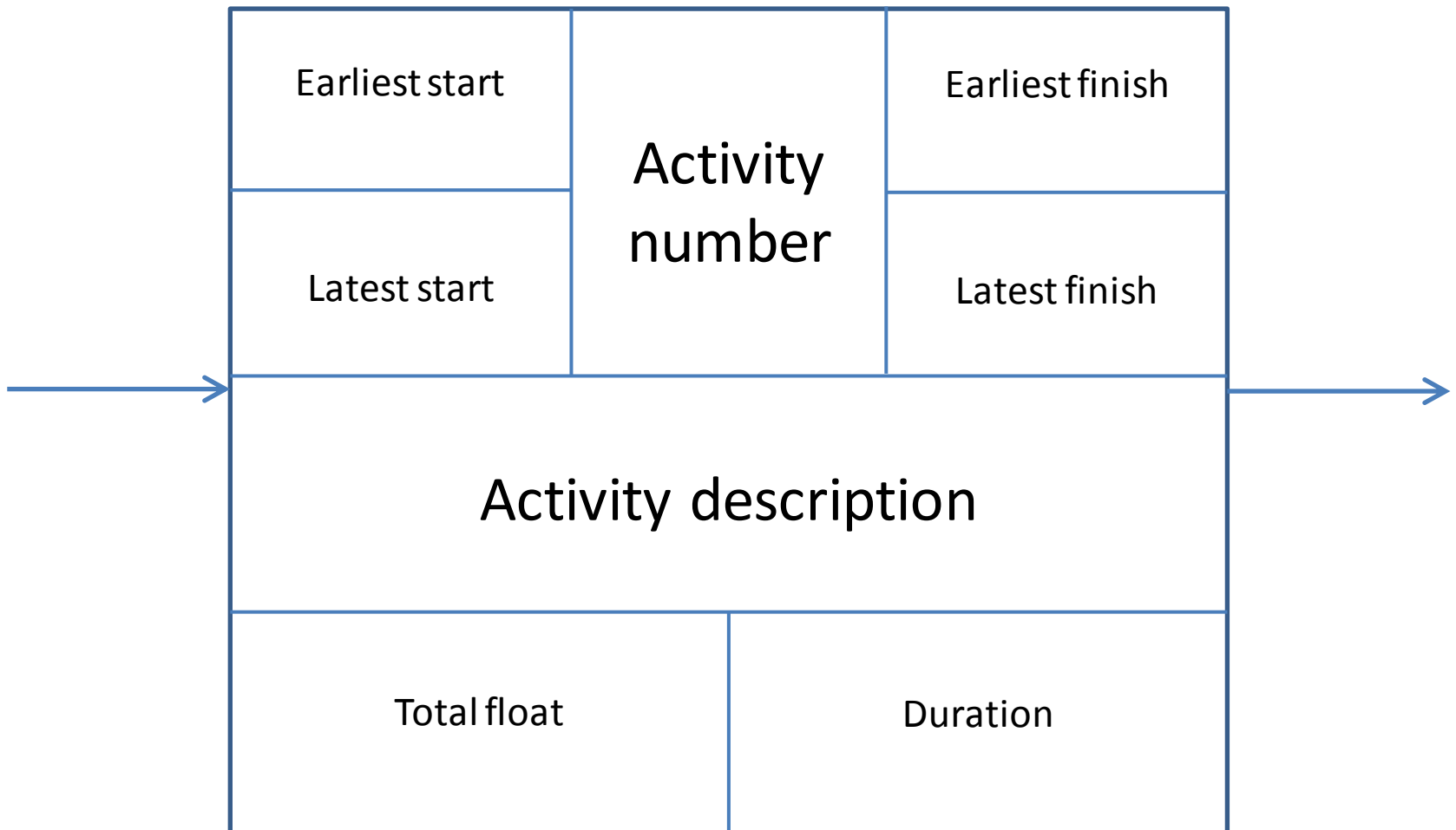
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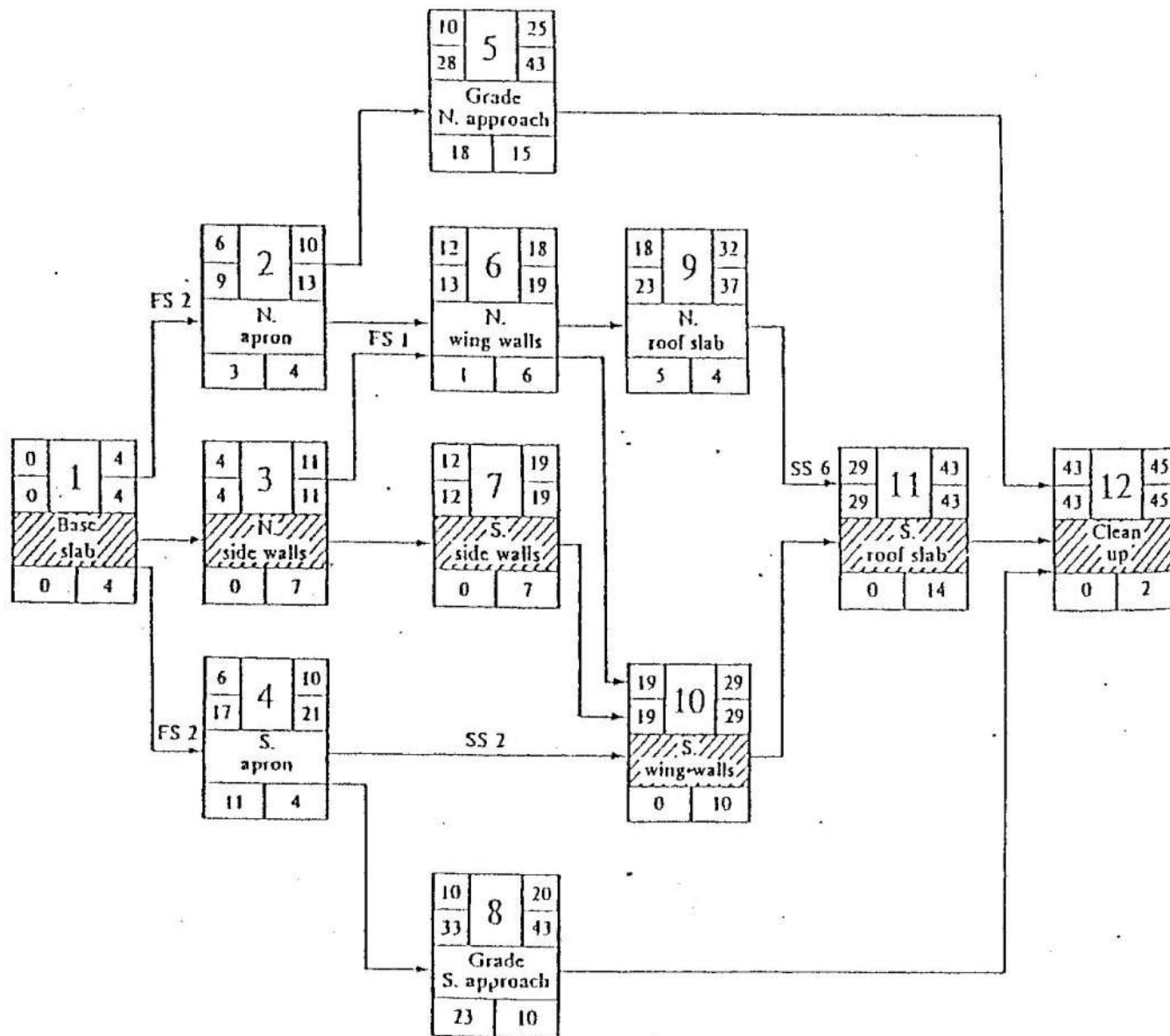
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**PRECEDING DIAGRAMS**

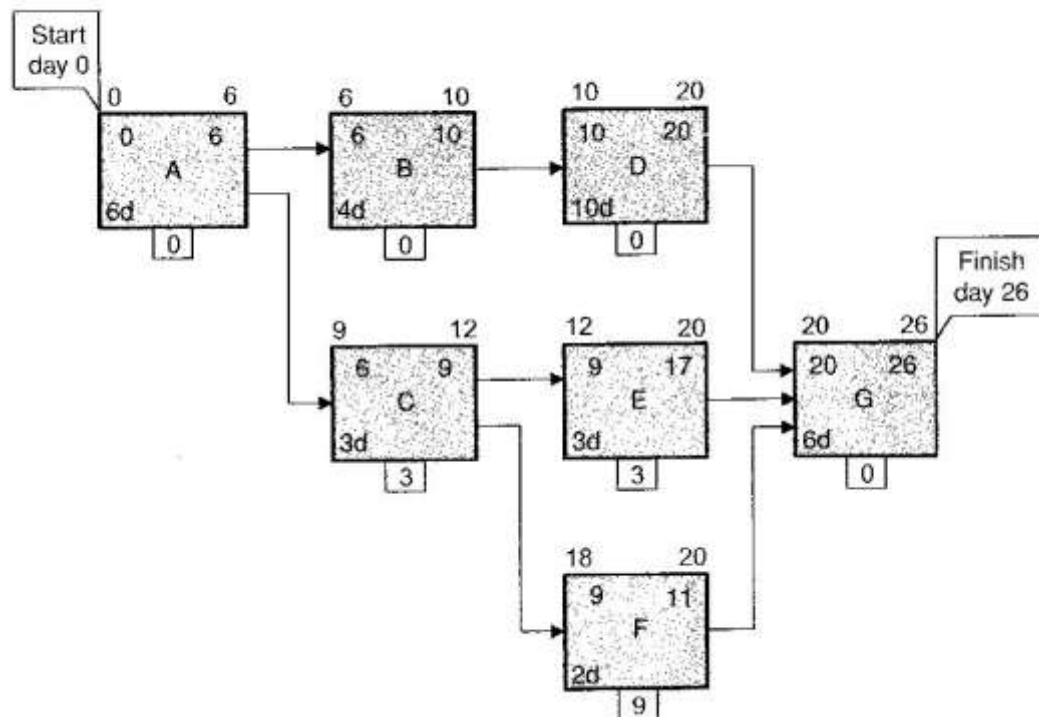
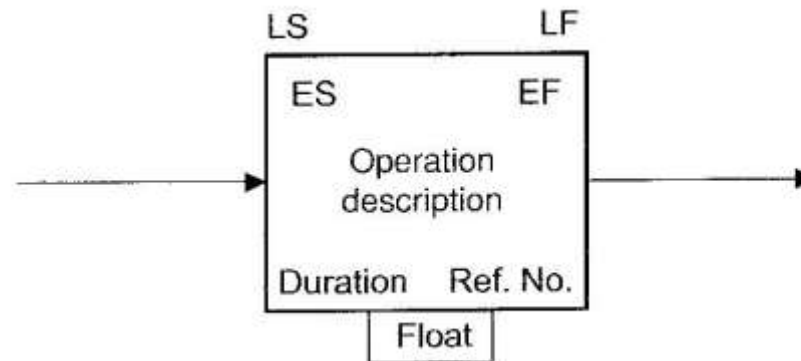


PRECEDING DIAGRAMS





PRECEDING DIAGRAMS

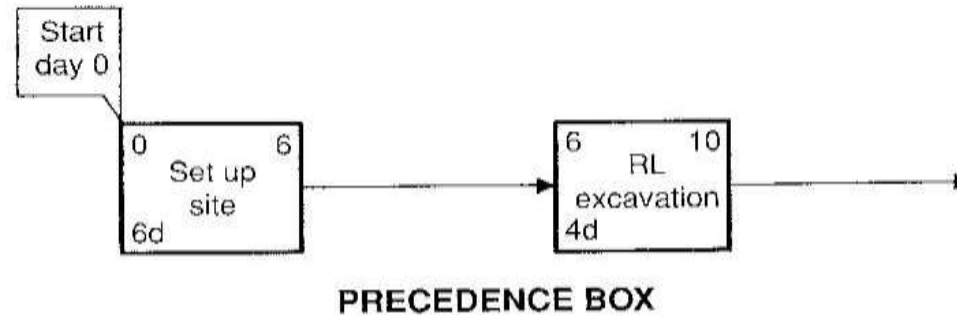




ARROW DIAGM

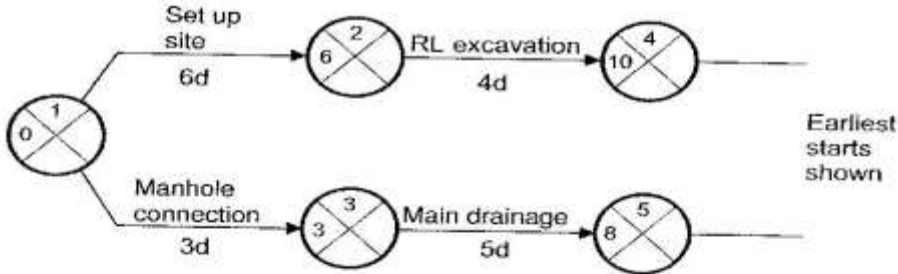
```

graph LR
    0((0)) -- "Set up site  
6d" --> 1((1))
    1 -- "RL excavation  
4d" --> 2((2))
    2 -- "" --> 3((3))
  
```

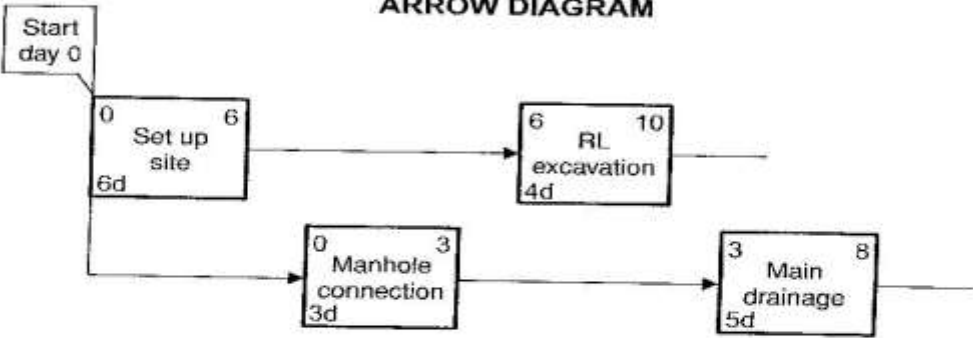




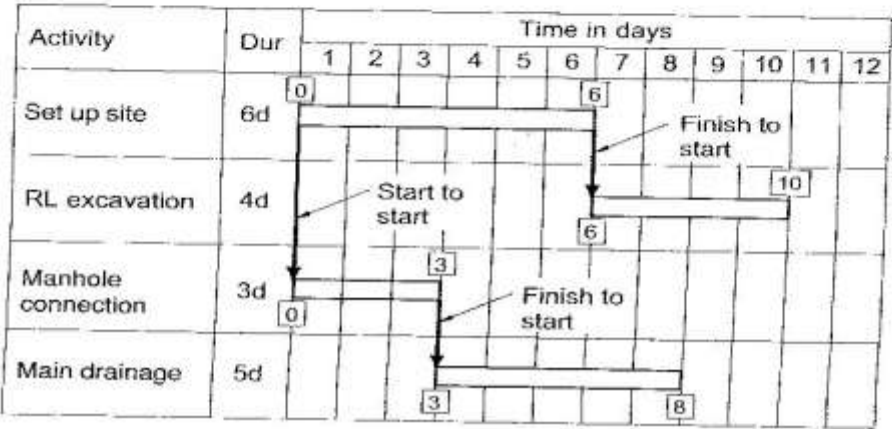
START-TO-START RELATIONSHIPS



ARROW DIAGRAM



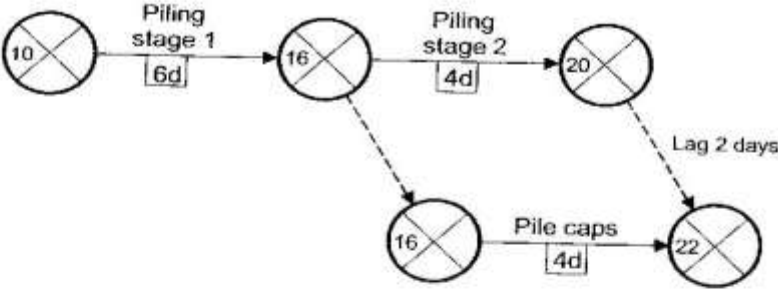
PRECEDENCE BOX



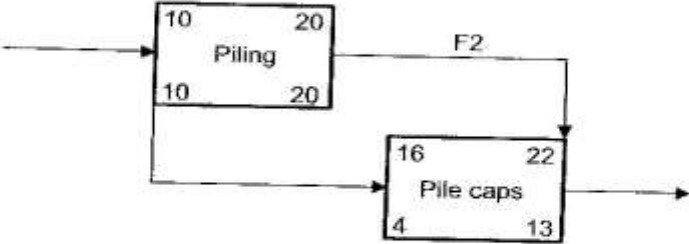
LINKED BAR CHART



START-TO-FINISH RELATIONSHIPS



ARROW DIAGRAM



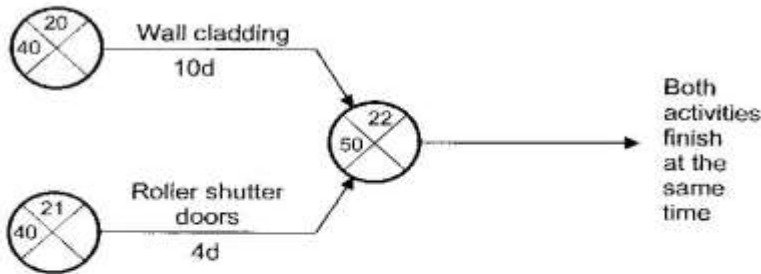
PRECEDENCE BOX

Ref	Operation	Dur	Time in days																		
			8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
12	Piling	10d																			
13	Pile caps	4d																			

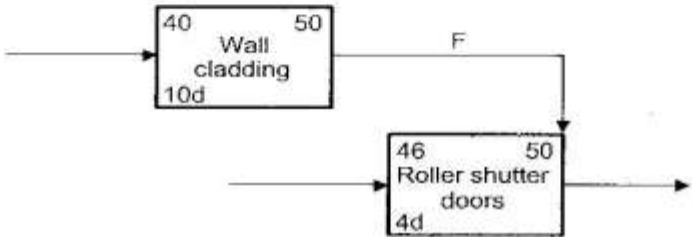
LINKED BAR CHART



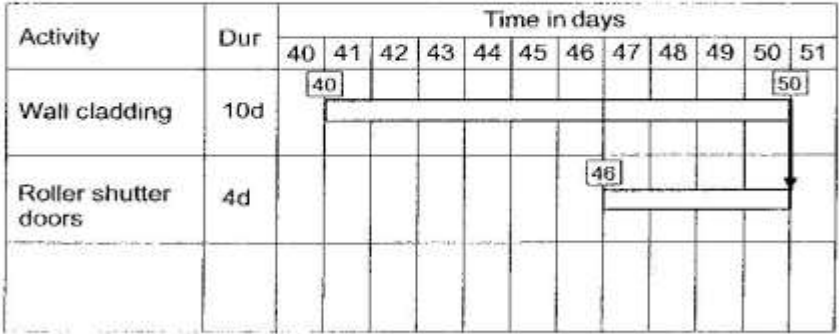
FINISH-TO-FINISH RELATIONSHIPS



ARROW DIAGRAM



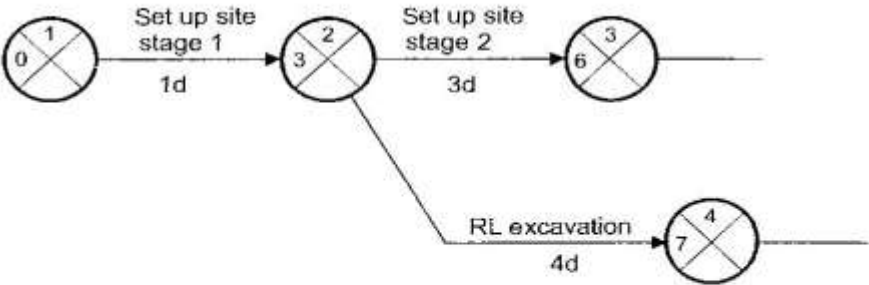
PRECEDENCE BOX



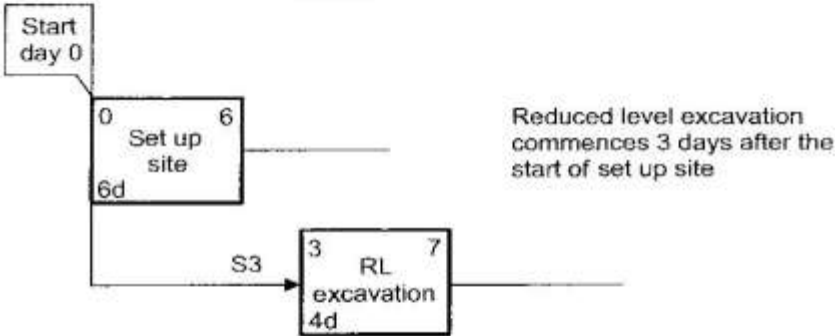
LINKED BAR CHART



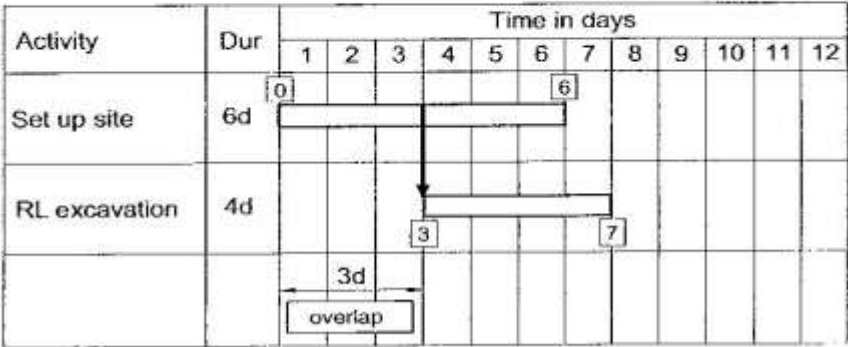
START-TO-START RELATIONSHIPS
(Overlapping Activities)



ARROW DIAGRAM



PRECEDENCE BOX



LINKED BAR CHART



PRECEDING DIAGRAMS

EXERCISES 1 AND 2

Solve the preceding diagrams given.



LINES OF BALANCE

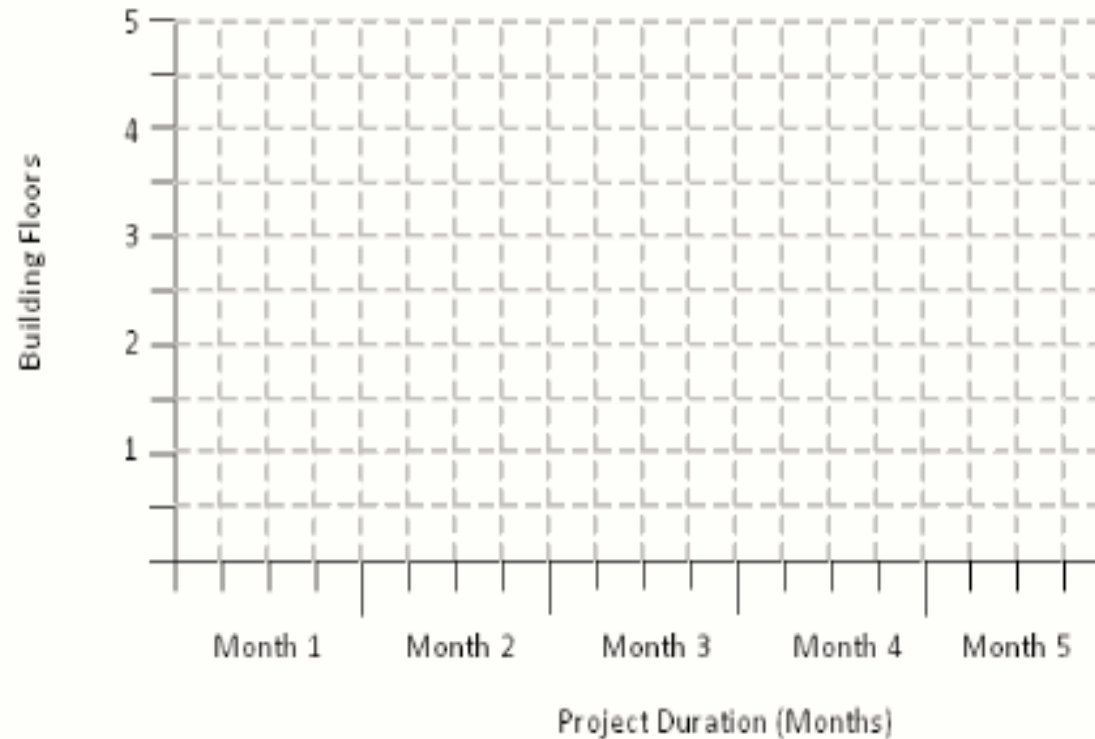
Inclined lines representing the working rate

For repetitive operations

Repeated block of activities (road or high-rise building)

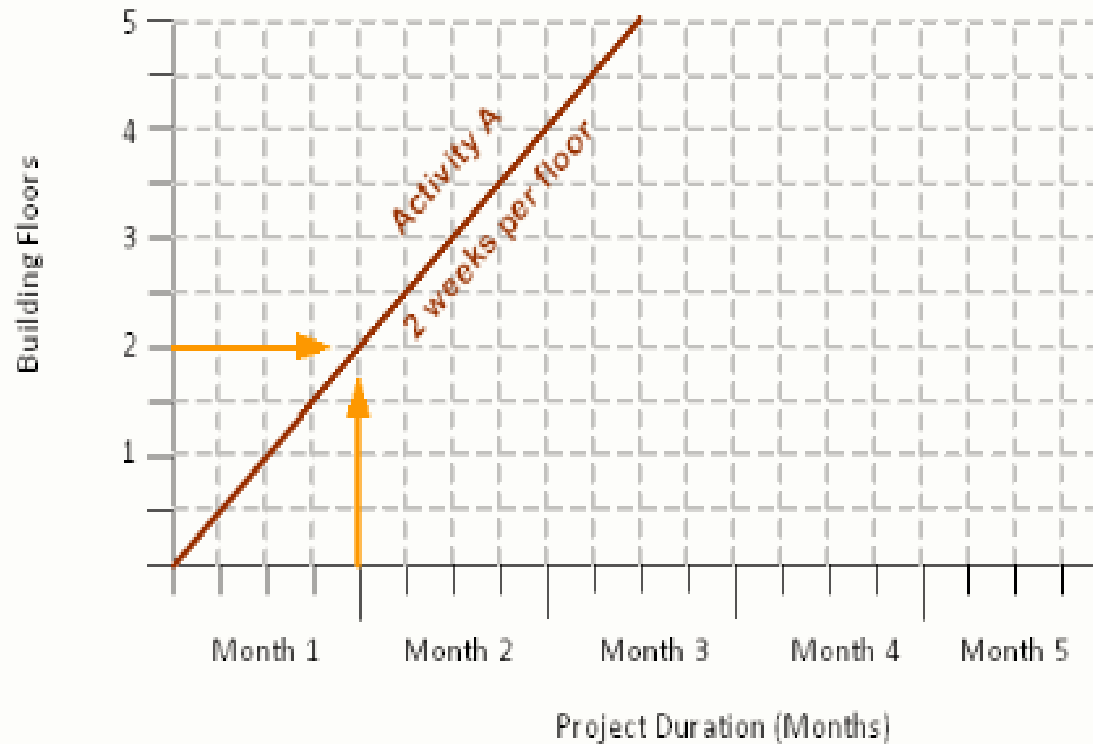


LINES OF BALANCE



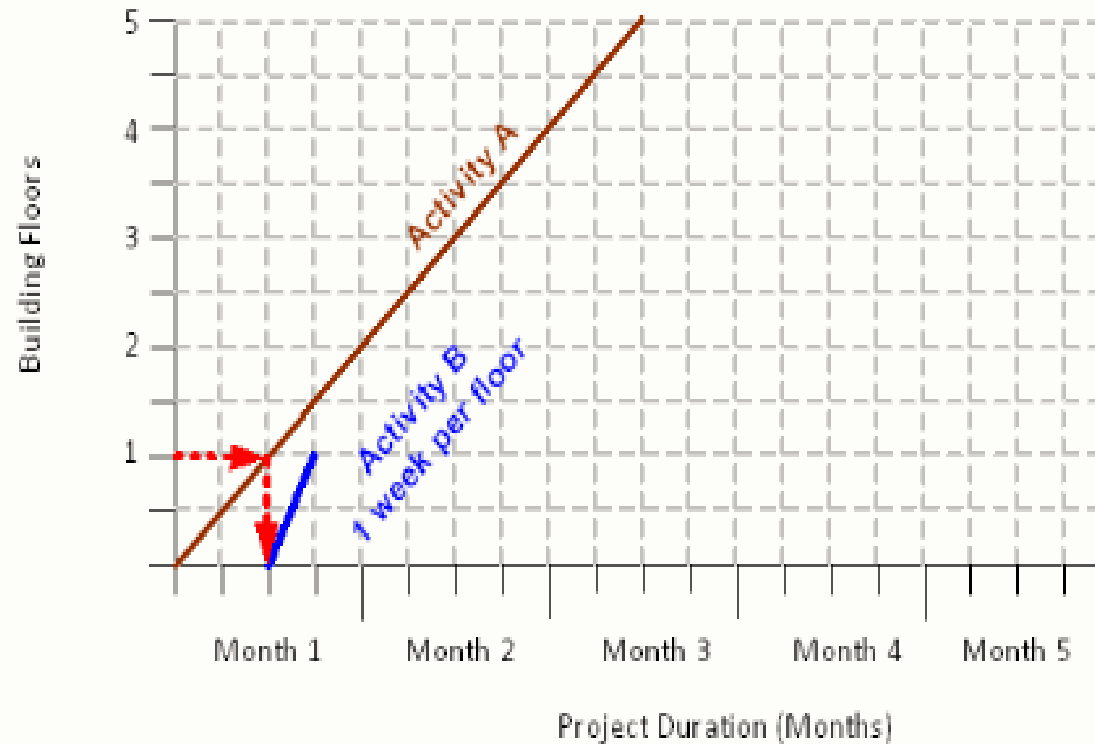


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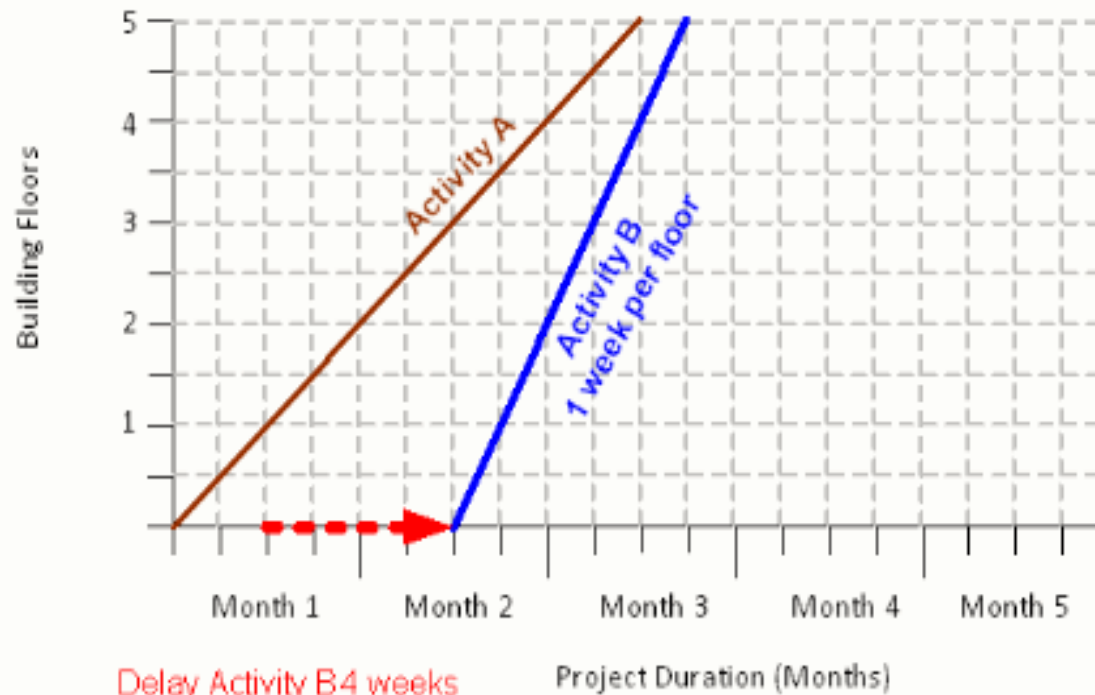


LINES OF BALANCE





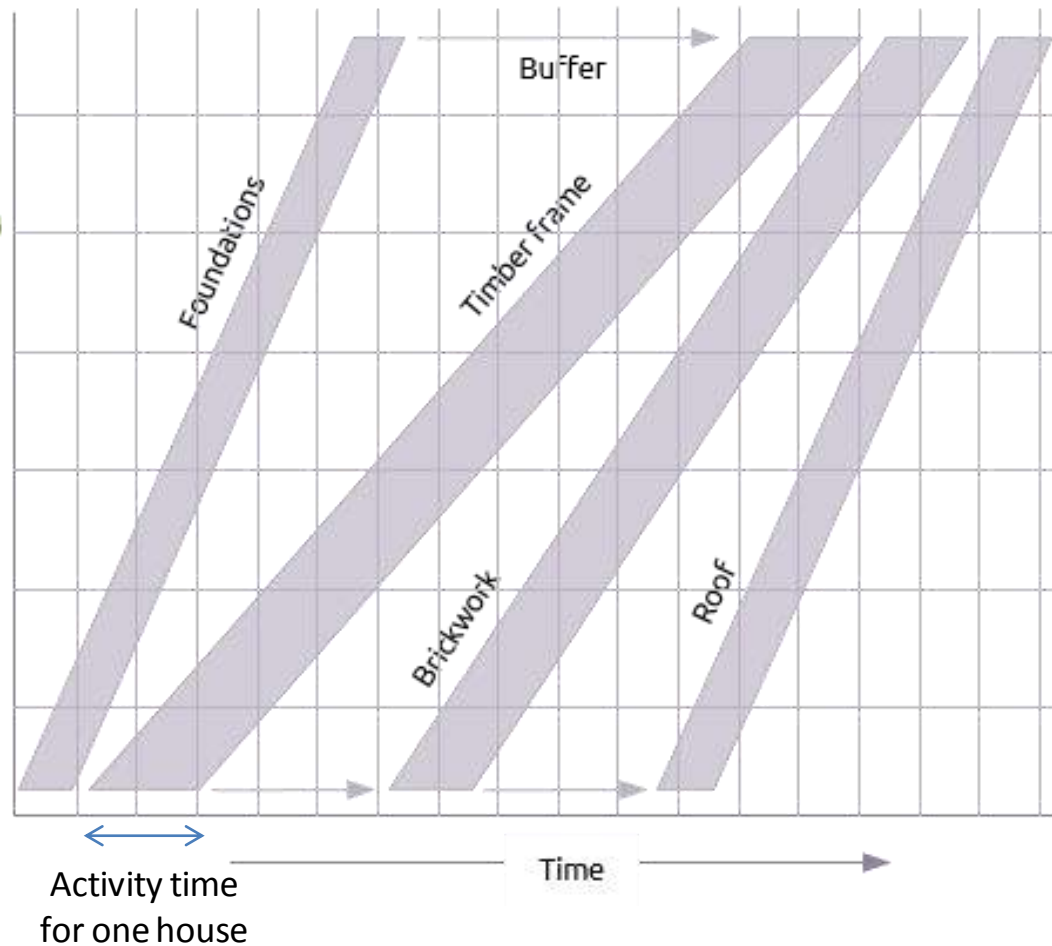
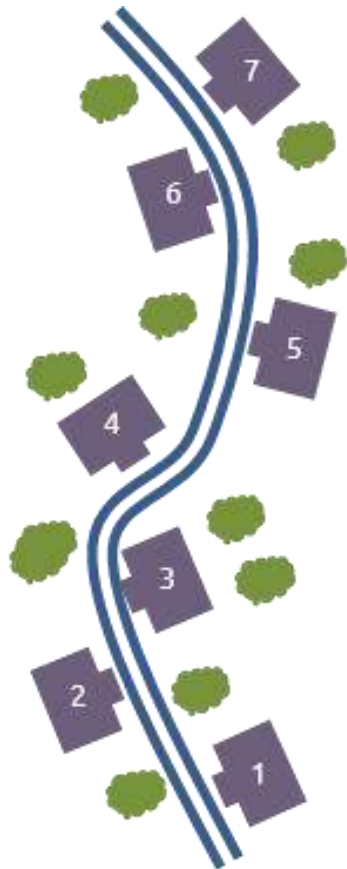
LINES OF BALANCE



Delay Activity B 4 weeks
to keep crew productive

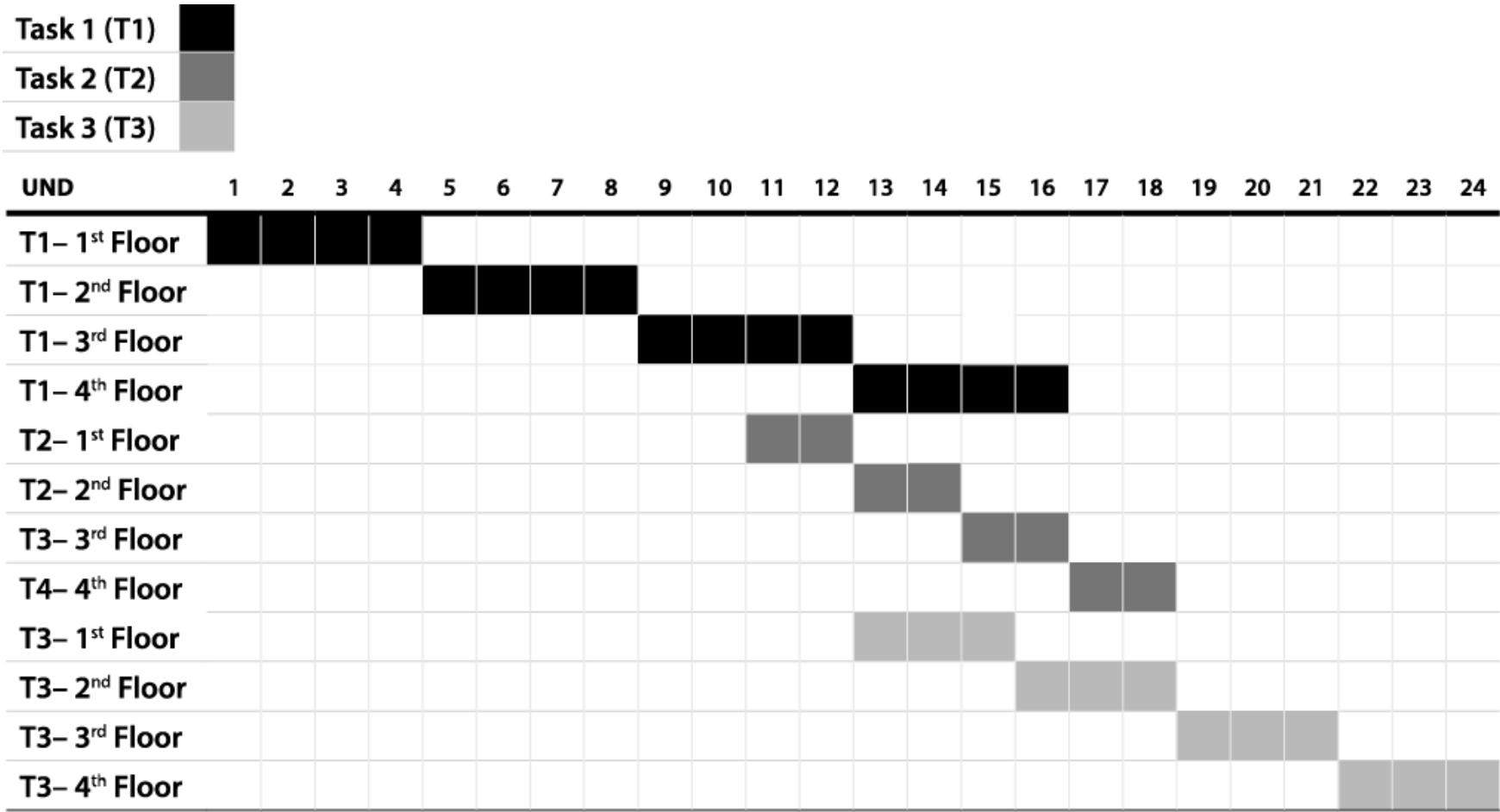


LINES OF BALANCE





LINES OF BALANCE





LINES OF BALANCE

EXERCISE 3

Solve the exercise given.



TIME-CHAINAGE DIAGRAMS

It represents the relationship between time and distance

Very useful for roads, pipelines, tunnelling, etc.

Starting at one point – order of activities progressing

The operations take place on a forward travel basis

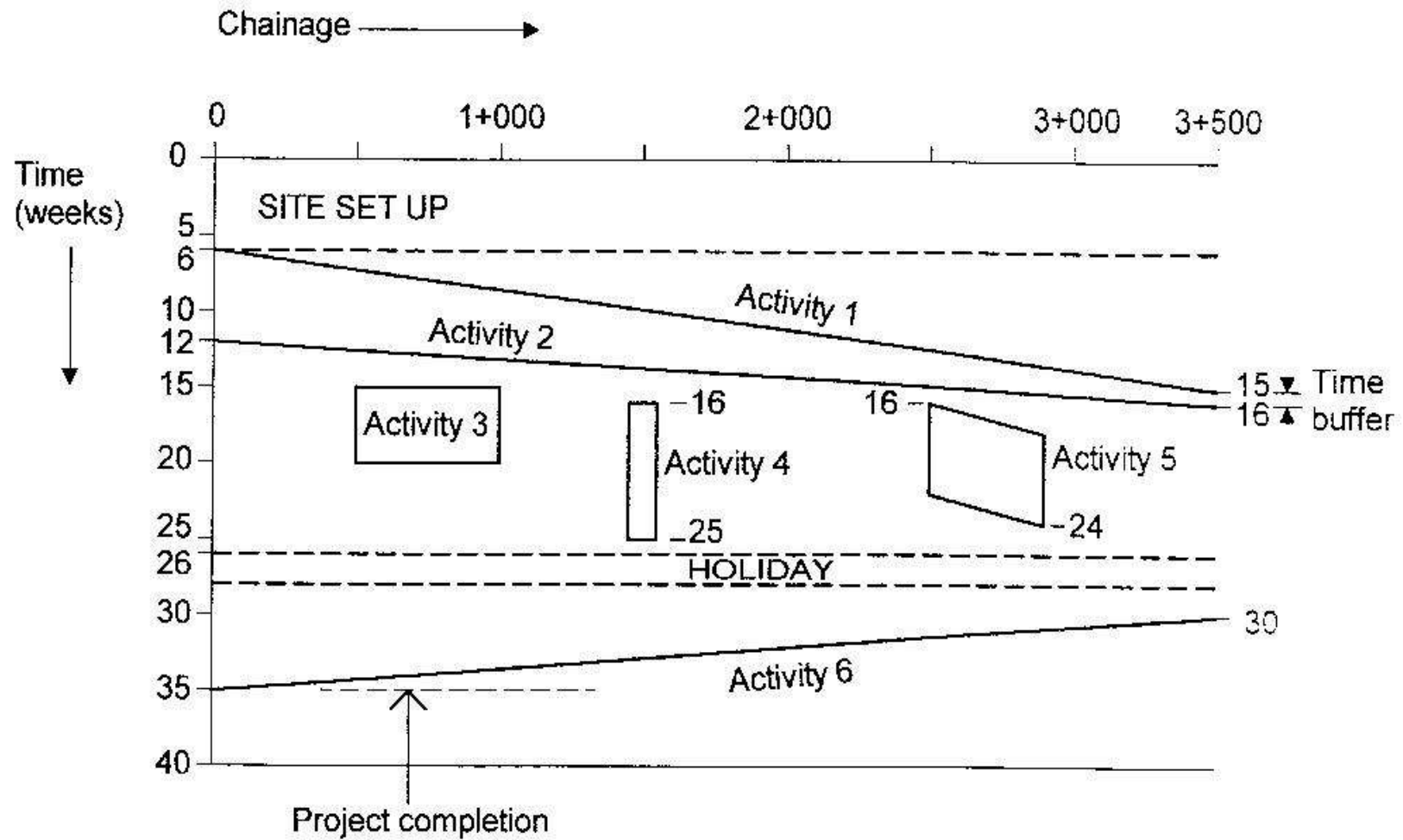
The gang starting at one point and moving along the job

Activities shown as lines or bars. Depending on the duration on the place

- Starting and completion chainages
- Inclined in the direction of progress
- Static activities represented with a vertical line
- Punctual activities (a bridge) shown as an area

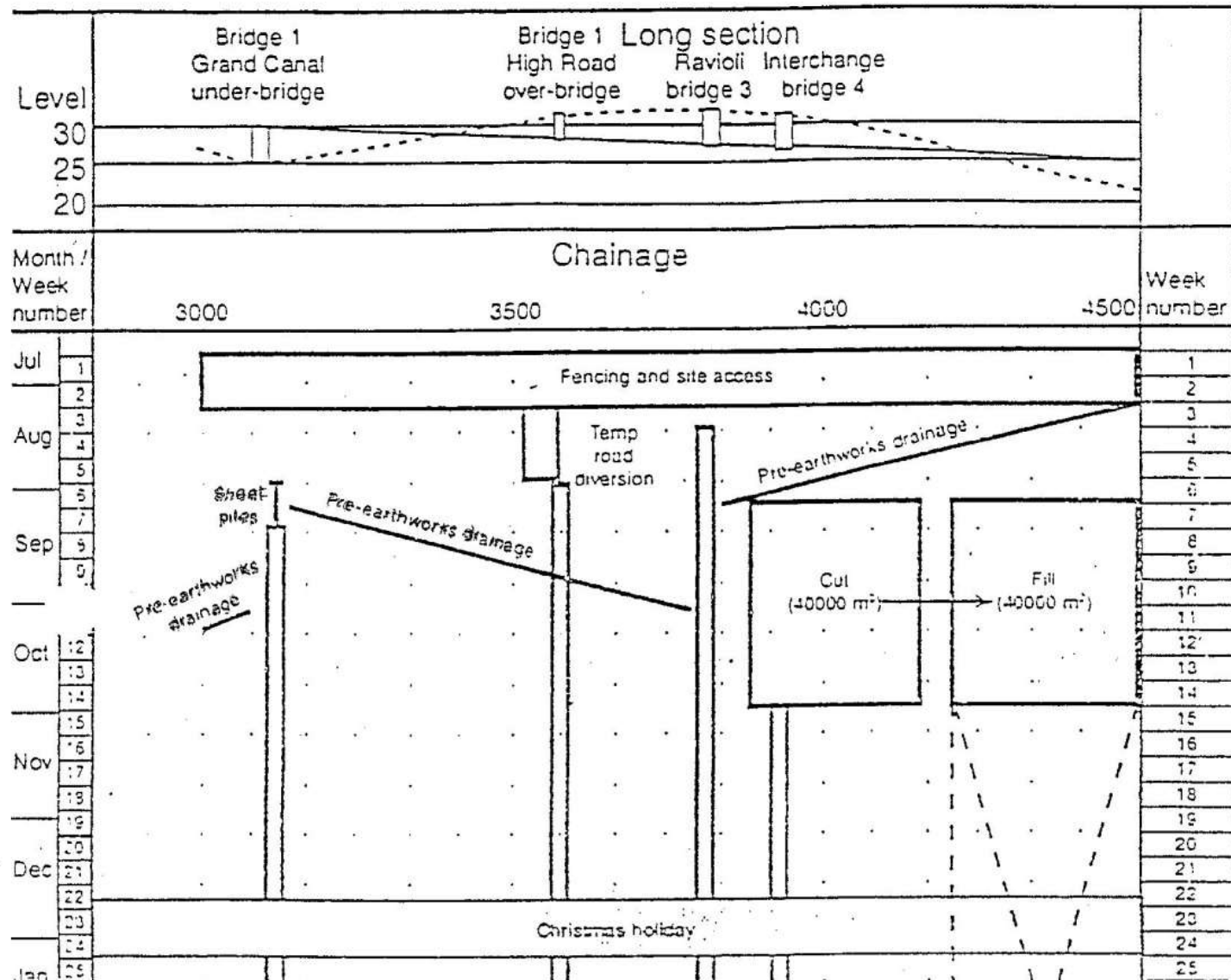


TIME-CHAINAGE DIAGRAMS



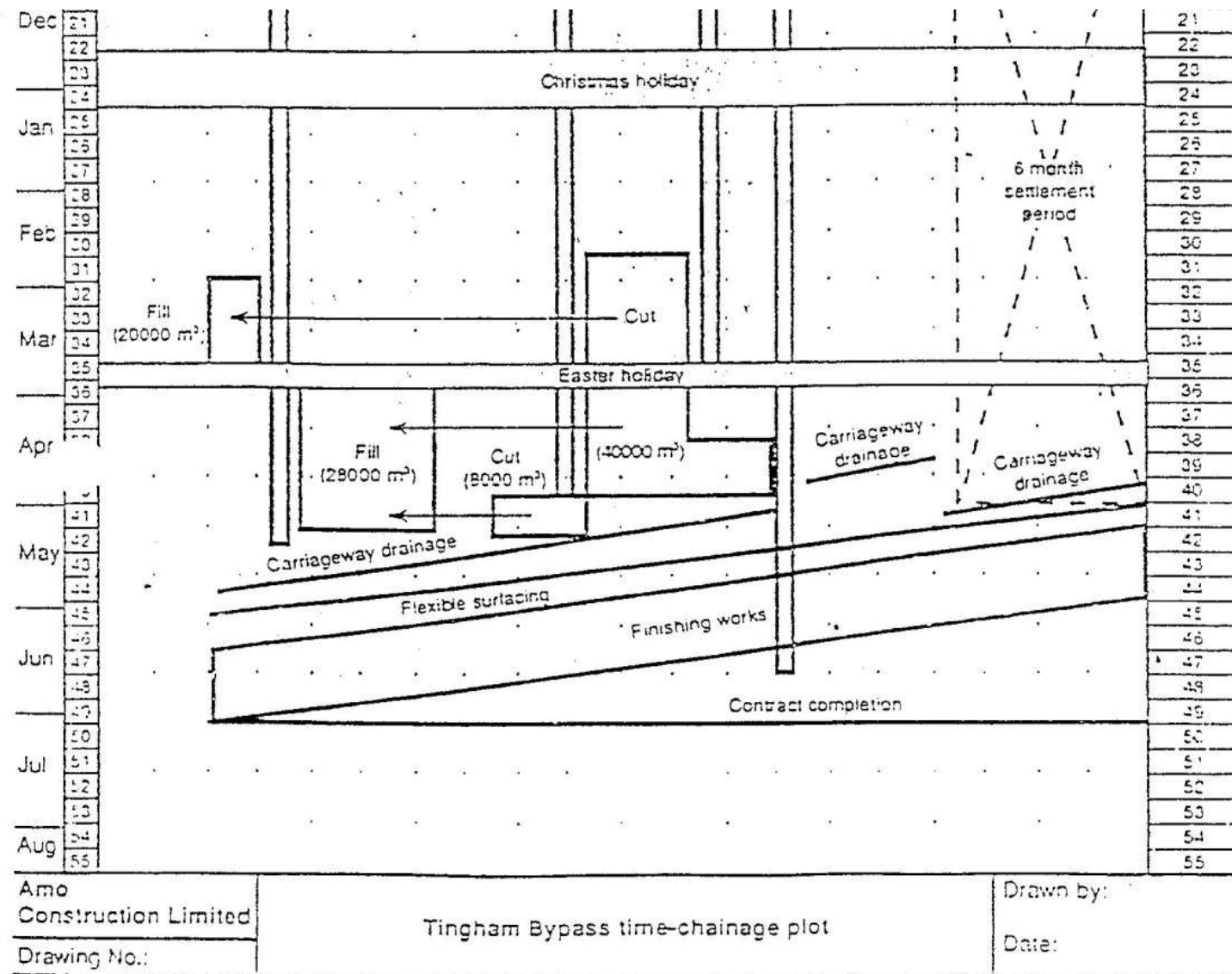


TIME-CHAINAGE DIAGRAMS





TIME-CHAINAGE DIAGRAMS





TIME-CHAINAGE DIAGRAM

EXERCISE 4

Solve the exercise given.