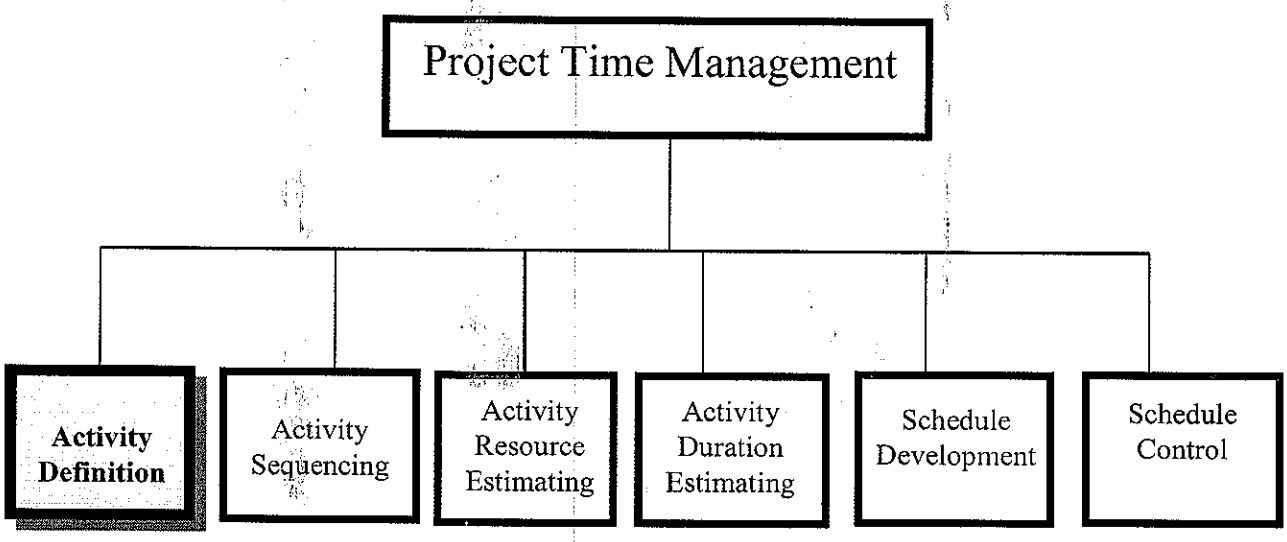
Unit 5B: Planning Projects – Time Management

Upon completion, you will be able to ...

- Identify the inputs and outputs of Time Management processes within the Planning processes
- Describe the function and the means to develop planning deliverables such as a network diagram, and milestone chart
- List the major tools and techniques used in Time Management
- Apply the technique to a simple project

Time Management: Activity Definition



Core Planning Processes
Activity Definition

Input	Tools & Techniques	Output
1. WBS 2. Project scope statement 3. Enterprise environmental factors 4. Organizational process assets 5. WBS dictionary 6. Project management plan	1. Decomposition 2. Templates 3. Rolling wave planning 4. Expert judgment 5. Planning component	1. Activity list 2. Activity attributes 3. Milestone list 4. Requested changes

Defining Activities

- Identify activities from WBS (which is built from deliverables)
- Identify & validate activities that produce deliverables
- Meet Project Objectives
- Activities can be further breaking down to tasks
- Use decomposition, templates, "Post-it notes"

Activity Definition: Tools and Techniques

- Decomposition: Sub-dividing work packages into small components, making the activity items small enough for assignment and monitoring purpose
- Templates: Templates from previous projects or developed for specific project categories. Use of templates will save time and effort.
- Rolling Wave Planning: Progressively elaborate the activity details. For example, use 2 or 3 iterations, or only focus on activities of the current phase or next 2 reporting periods.
- Expert Judgment: Assign experienced staff to develop the activity list
- Planning Component: When the team does not have sufficient details in a branch of WBS, develop and schedule activities by using summary activities either at "Control Account" level or "Planning Package" level

Activity Definition: Outputs

- Activity List: All scheduled activities that are planned to be performed. It is part of the project schedule. It is NOT considered as part of WBS (too much details)
- Activity Attributes: Parameters that characterize an activity. For example, name, code, description, effort required, duration, predecessor, successor, etc. It is part of the schedule model
- Milestone List: New milestones may be identified. Milestones can be mandatory or act as internal check points
- Requested Changes: Change requests can be raised as a result of defining activity list

From WBS to Activity List

Project A : Plan a 2 weeks vacation in USA

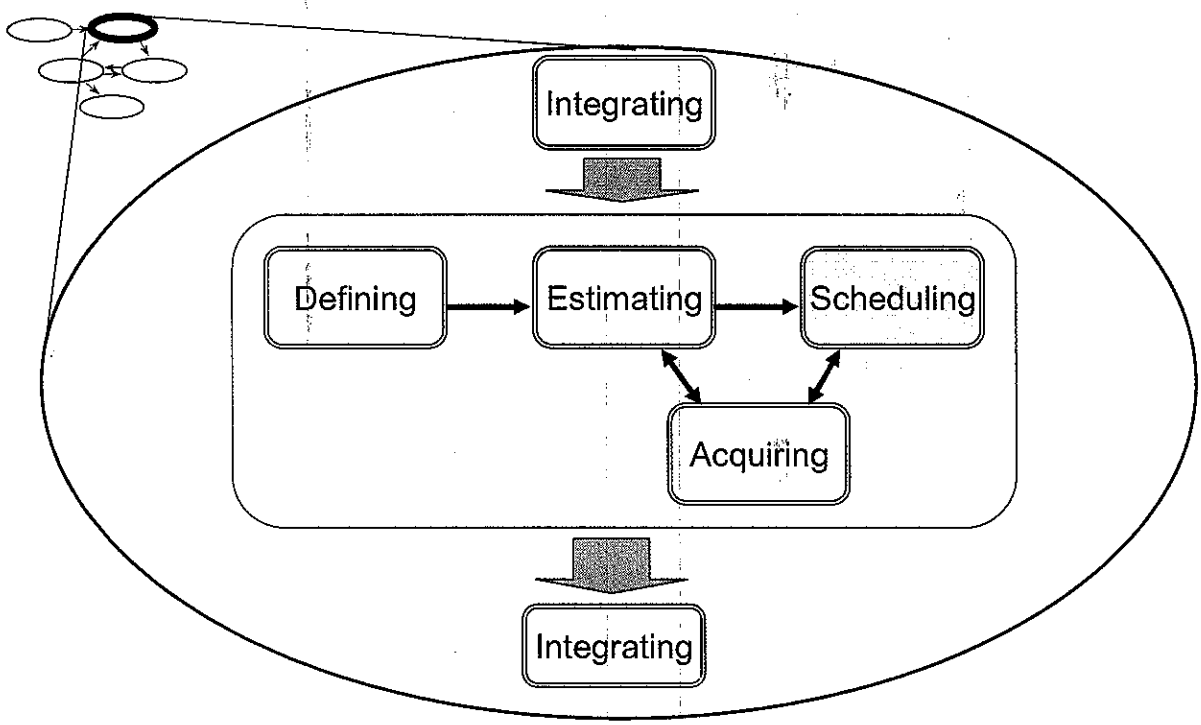
Trip logistics

- **Maps & Tourist Information**
  - **Orlando, Florida**
  - **New York City**
- **Transportation**
  - **Between Home & Airport**
  - **Air Flight**
  - **Local Florida**
  - **Local NY City**
- **Traveling Document**
  - **Yours**
  - **Spouse**
  - **Elder Son**
  - **Baby**

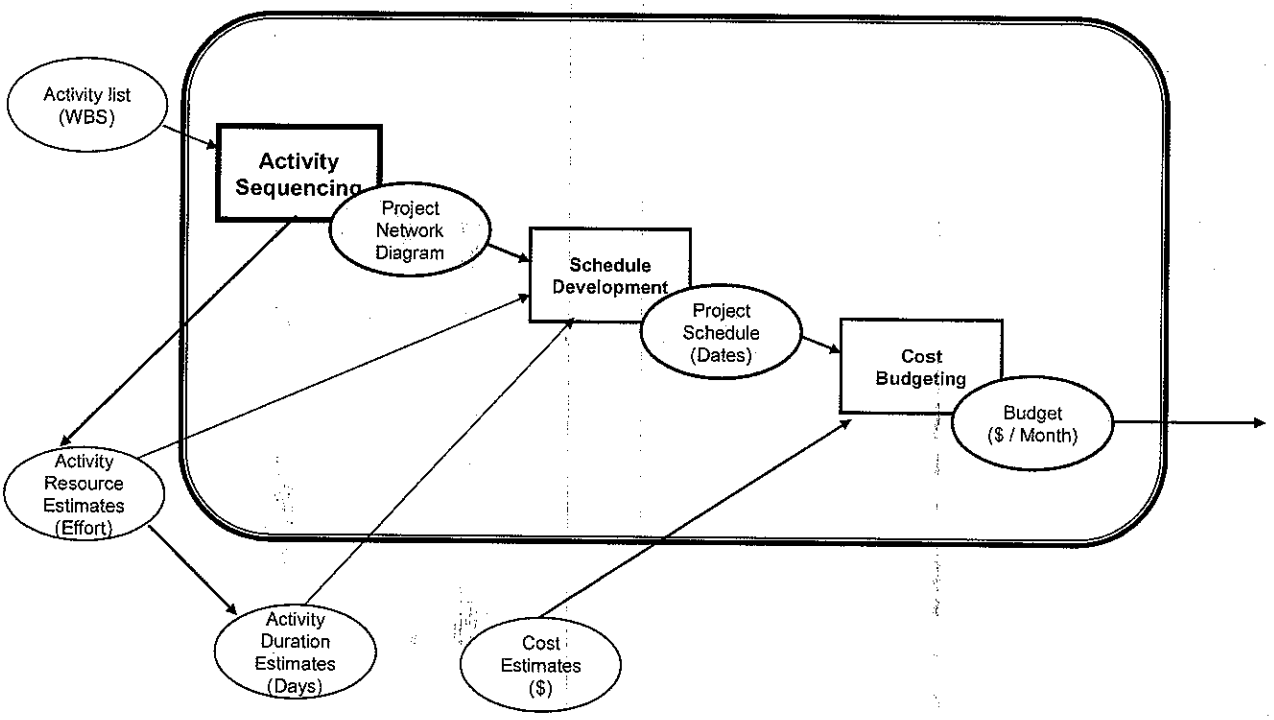
Activity list for Orlando, Florida

1. **Get Orlando Map**
2. **Get Tourist hot spot booklet**
3. **Ask info from friends**
4. **Plan out travel routing info**
5. **Find out accommodation info**
6. **Book accommodations**
7. **Book transportation**

The Planning Processes



Planning Process: Scheduling



4 Estimating & Scheduling
PMBOK 2000-Rev 1

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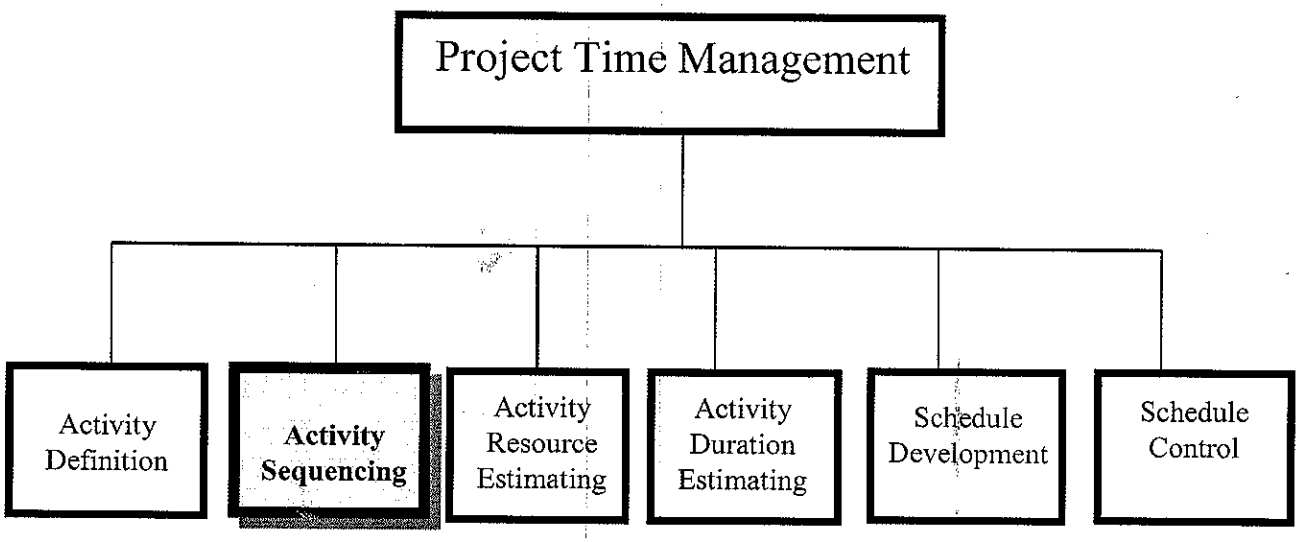
Time Management: Activity Sequencing



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Core Planning Processes
Activity Sequencing

Input	Tools and Techniques	Output
1. Activity list 2. Activity attributes 3. Milestone list 4. Project scope statement 5. Approved change requests	1. Precedence diagramming method (PDM) 2. Arrow diagramming method 3. Dependency determination 4. Schedule network templates 5. Applying leads and lags	1. Project schedule network diagrams 2. Activity list (updates) 3. Activity attributes (updates) 4. Requested changes

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Schedule Purpose

- Converts the project plan to an operating plan that is the basic tool for monitoring and controlling project activities

  Discuss with the class about benefits of a realistic schedule

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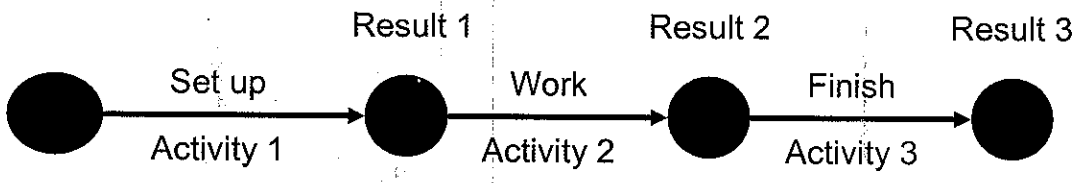
Various Network Diagramming Methods

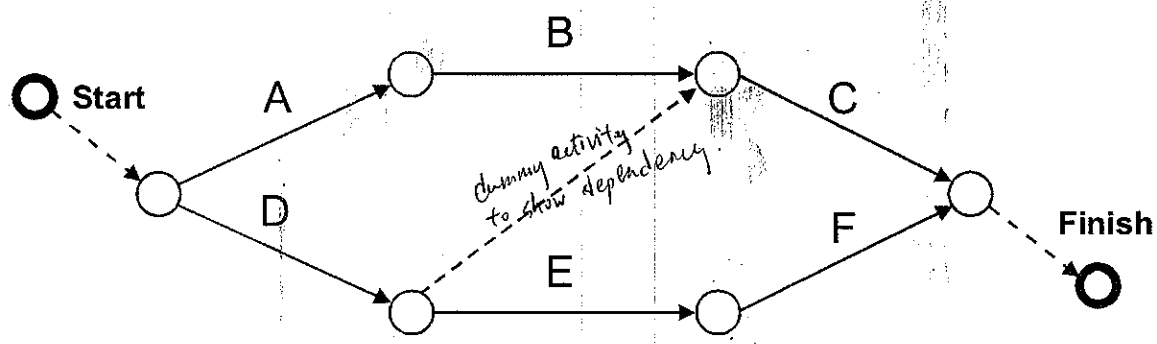
- Activity on Arrow Method (AOA, ADM)
- Activity on Node Method (AON)
- Program Evaluation & Review Techniques (PERT): probabilistic US gov.
- Precedence Diagramming Method (PDM - AON): Deterministic MS Project default
- Graphical Evaluation & Review Techniques (GERT): probabilistic what-if tests

Network Techniques
AOA Example

- Activities specified on arrows
- Also called arrow diagramming method (ADM)
- Nodes show relationship

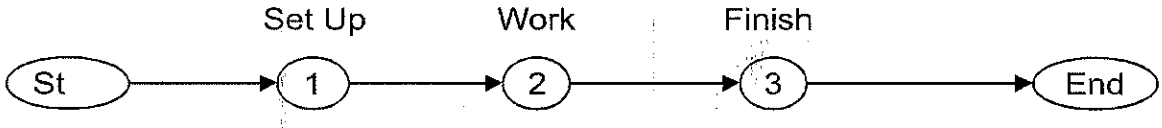


Scheduling Techniques
Activity on Arrow Example



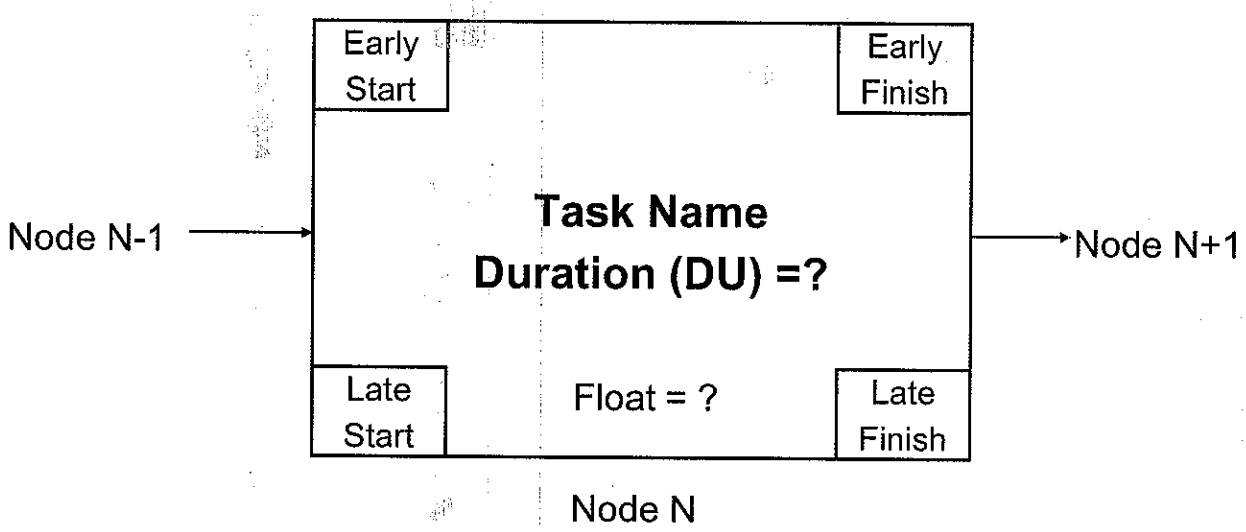
Scheduling Techniques
Activity on Node

- Activity on node network format
  - Arrows show precedence relationships
  - Nodes show activities
- 3 types of precedence relationships
  - Activity on node 1—successor but no predecessor
  - Activity on node 2—predecessor and successor
  - Activity on node 3—predecessor but no successor

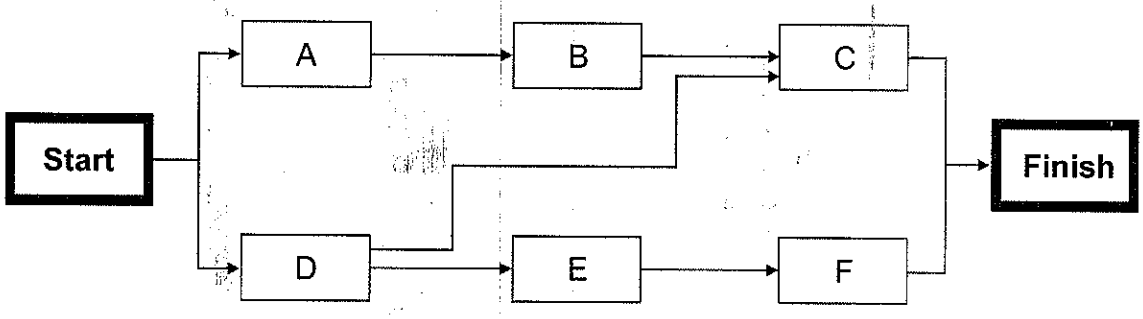


Precedence Diagramming Method

Activity on Node diagram



Precedence Diagramming Method



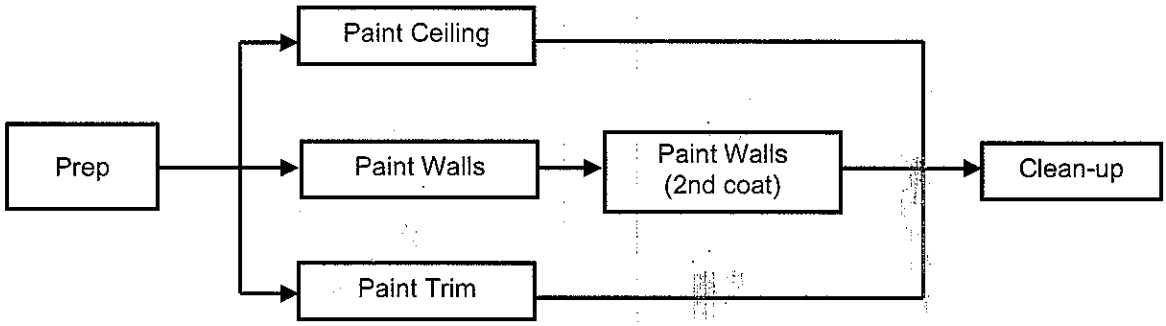
PDM Example
Diverging-Converging Activities

Diverging Activities

Single predecessor with multiple successors

Converging Activities

Multiple predecessors with single successor



Activity Definition: Tools and Techniques

- Dependency Determination:
  - Mandatory: Those dependencies that are inherent in the nature of work. Typically, these are physical limitations, sometimes called hard logic.
  - Discretionary: Those dependencies that are based on best practices, or resource limitation. Sometimes, it is called soft logic.
  - External: Those dependencies that are given by external parties, sometimes out of the control of a project team. Typically, external dependencies are based on outcomes of other projects that are not considered as part of the scope of the affected project.

Precedence Relationships
Finish to Start

The "from" activity Task A must finish before the "to" activity Task B can start

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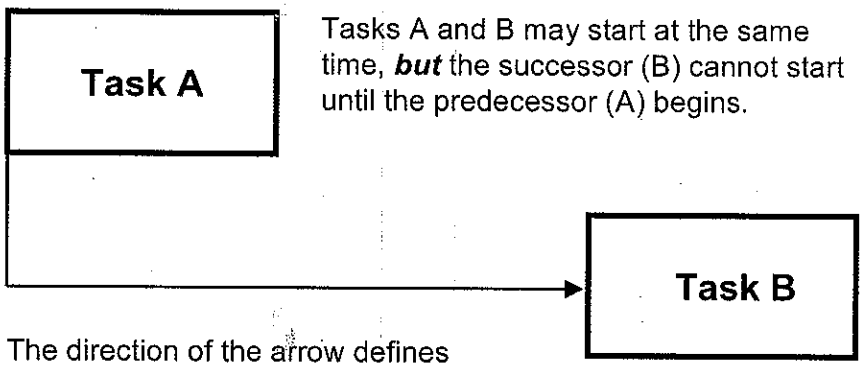
Precedence Relationships
Start to Start



Tasks A and B may start at the same time, ***but*** the successor (B) cannot start until the predecessor (A) begins.

The direction of the arrow defines which task is the predecessor and which is the successor.

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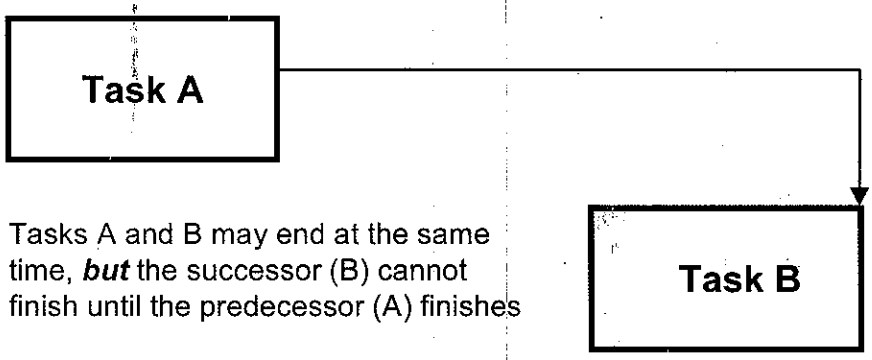
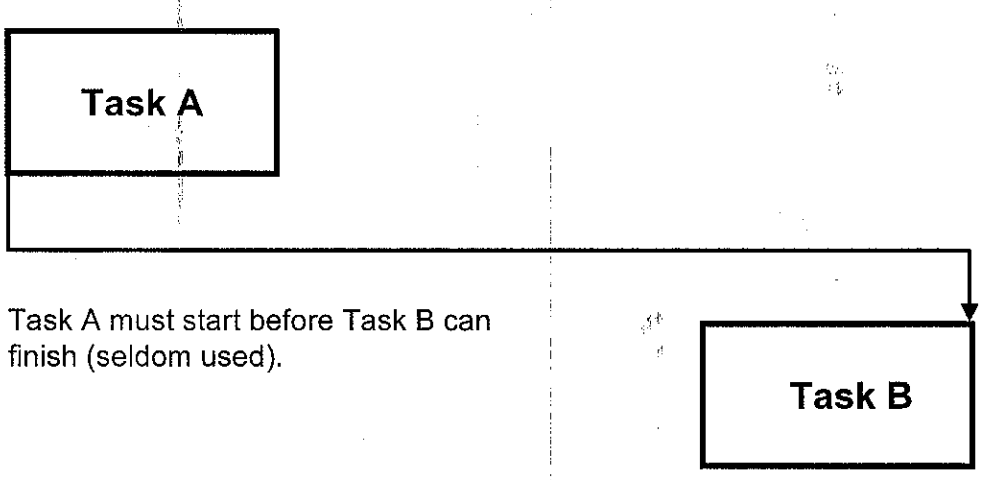
Precedence Relationships
Finish to Finish



Tasks A and B may end at the same time, ***but*** the successor (B) cannot finish until the predecessor (A) finishes

Precedence Relationships
Start to Finish



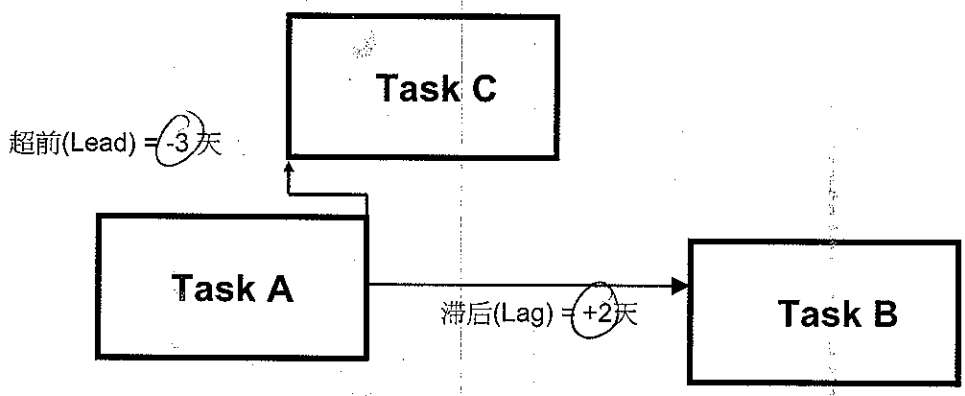
Task A must start before Task B can finish (seldom used).

Activity Definition: Tools and Techniques

- Applying Leads and Lags:
  - Leads: It allows for the acceleration of the successor activity (use of minus sign to indicate the number of time unit to be accelerated).
  - Lags: It forces a delay of the successor activity (use of plus sign to indicate the number of time unit to be delayed), such as mandatory waiting time after the completion of the current task.
  - Both techniques are used very frequently in real life projects

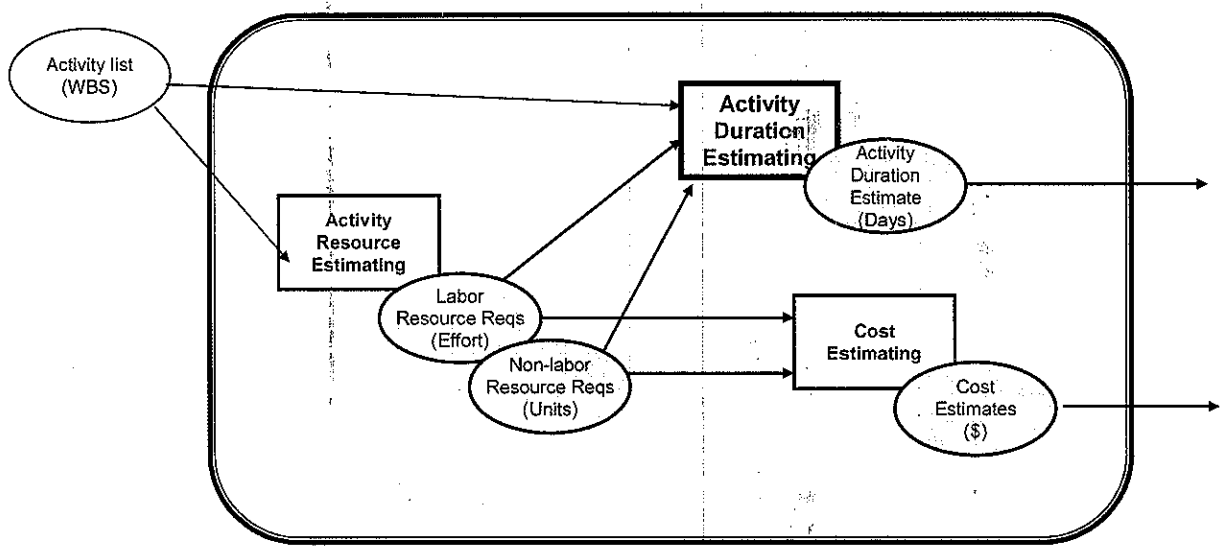
Lead & Lag Precedence Relationship

(Lead): Task C can start 3 days before the completion of Task A, normally lead should be zero.



(Lag): Task B must start 2 days after the completion of Task A, normally the Lag should be zero

Planning Processes: Estimating



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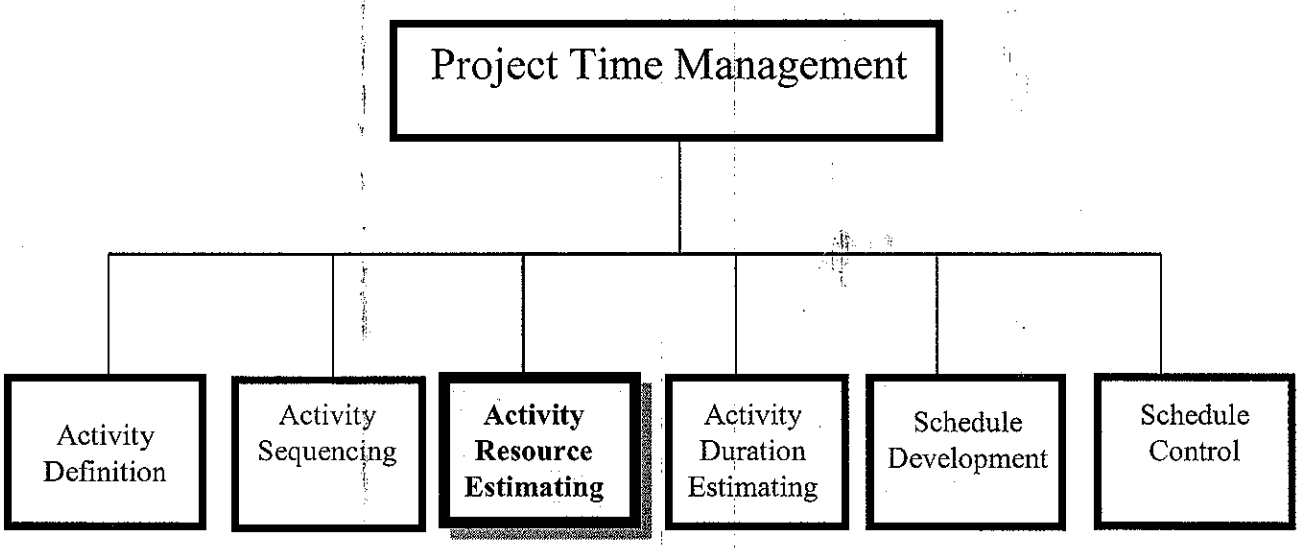
Time Management: Activity Resource Estimating



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Core Planning Processes
Activity Resource Estimating

Input	Tools and Techniques	Output
1. Activity list 2. Enterprise environmental factors 3. Organizational process assets 4. Activity attributes 5. Resource availability 6. Project management plan	1. Expert judgment 2. Alternatives analysis 3. Published estimating data 4. Project management software 5. Bottom-up estimating	1. Activity resource requirements 2. Activity attributes (updates) 3. Resource breakdown structure 4. Resource calendars (updates) 5. Requested changes

Activity Resource Estimating: Inputs

- Resource Availability
  - Info regarding what is available (people, equipment, material, facilities)
  - Location of the resource is also a consideration
  - What is available by resource type and when

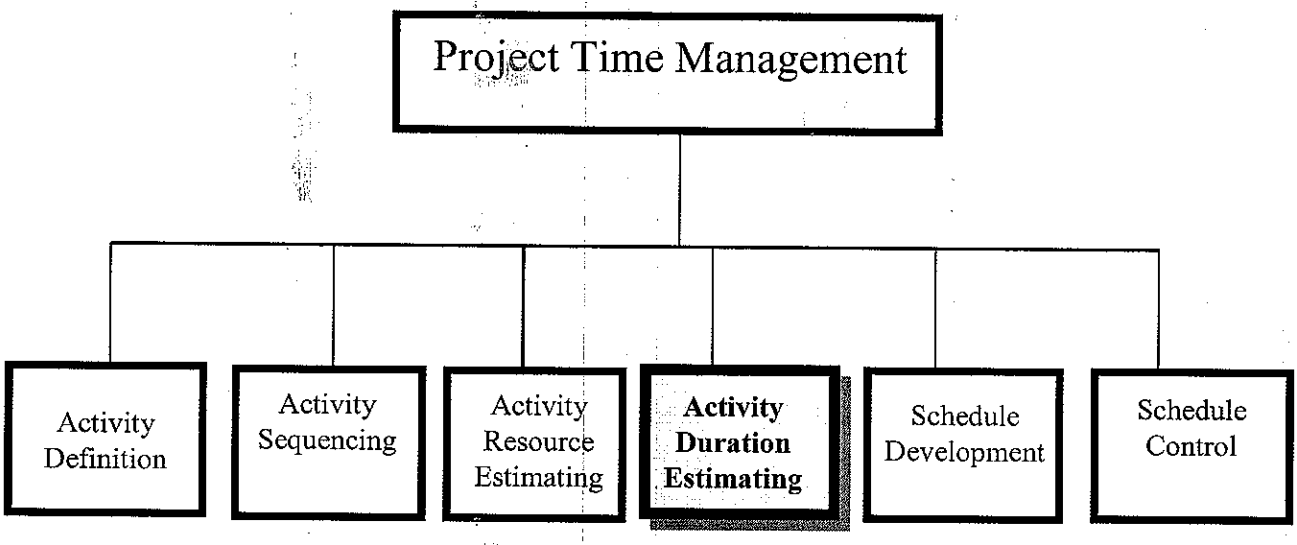
Activity Resource Estimating: Tools & Techniques

- Expert Judgment: Guess based on knowledge and experience
- Alternatives Analysis: Try different tools and methods to come up with alternate solutions and schedules. For example use of manual method vs automation, average labor vs skilled labor
- Published Estimating Data: In some trades, there are companies whose business are to publish data regarding material and labor cost
- Project Management Software: Some sophisticate software has the capability to estimate resource requirement by resource type
- Bottom-up Estimating: Estimate the requirement at work package level or activity level. If it is not clear, decompose the work package or activity into more detailed components

Activity Resource Estimating: Outputs

- Activity Resource Requirements: Type and quantity required at activity level. This info can be aggregated to determine summary data at higher levels (Control Account)
- Activity Attributes (updates): Resource type and quantity are part of activity attributes
- Resource Breakdown Structure: RBS is a hierarchical structure of resources by category and by type
- Resource Calendar (Updates): Special calendar for each resource type shows availability of that specific resource during the course of the project
- Requested Changes: After determining the requirement, there may be change requests to add or delete tasks from schedule

Time Management: Activity Duration Estimating



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Core Planning Processes
Activity Duration Estimating

Input	Tools and Techniques	Output
1. Activity list 2. Project scope statement 3. Enterprise environmental factors 4. Organizational process assets 5. Activity attributes 6. Activity resource requirements 7. Resource calendars 8. Project management plan - Risk register - Activity cost estimates	1. Expert judgment 2. Analogous estimating 3. Parametric estimating 4. Three-point estimates 5. Reserve analysis	1. Activity duration estimates 2. Activity attributes (updates)

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Activity Duration Estimating: Inputs

- Enterprise Environment Factors: Organization may have historical data or commercial data about some standardized activities
- Organizational Process Assets: Standard templates or historic records from previous projects
- Project Scope Statement: For example, estimate may change based on constraints and assumptions in scope statement
- Activity Resource Requirements: Types of resource used may affect the activity duration, e.g. use of senior designers will shorten the design activity duration.
- Resource Calendar: Specific calendar of a given resource type contains info regarding resource availability
- Project Management Plan:
  - Risk Register: Duration may be adjusted to reflect risk involved
  - Activity Cost Estimate: Cost of an activity may be used to compute quantity which in turn helps to determine duration

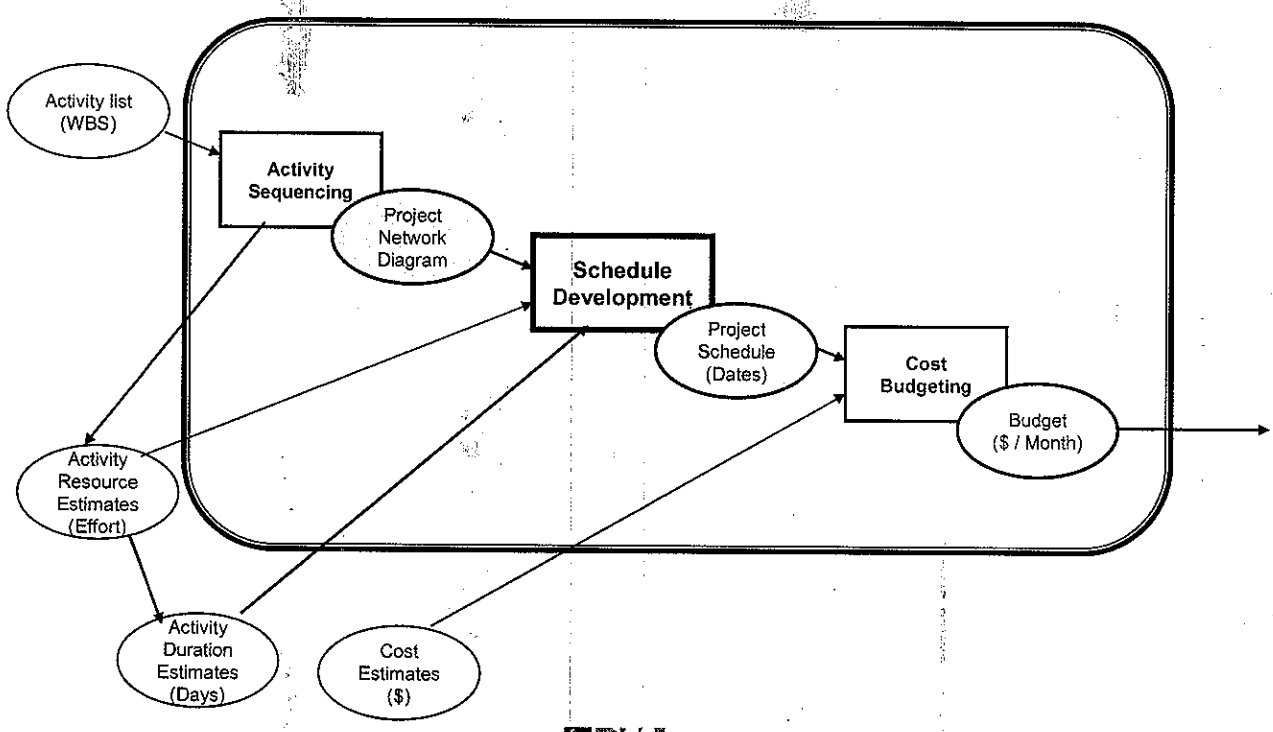
Activity Duration Estimating: Tools & Techniques

- Expert Judgment: Subject matter experts may be able to estimate duration based of historic data, such as resource level and productivity
- Analogous Estimating: Use a previous similar activity to estimate future schedule activity duration
- Parametric Estimating: Formula to be used to calculate duration based on quantity of work, e.g. number of drawings required times hours spend per drawing
- Three-Point Estimating: Use Mostly likely, Optimistic, and Pessimistic value to determine an average value
- Reserve Analysis: Incorporate additional time to be used as a buffer

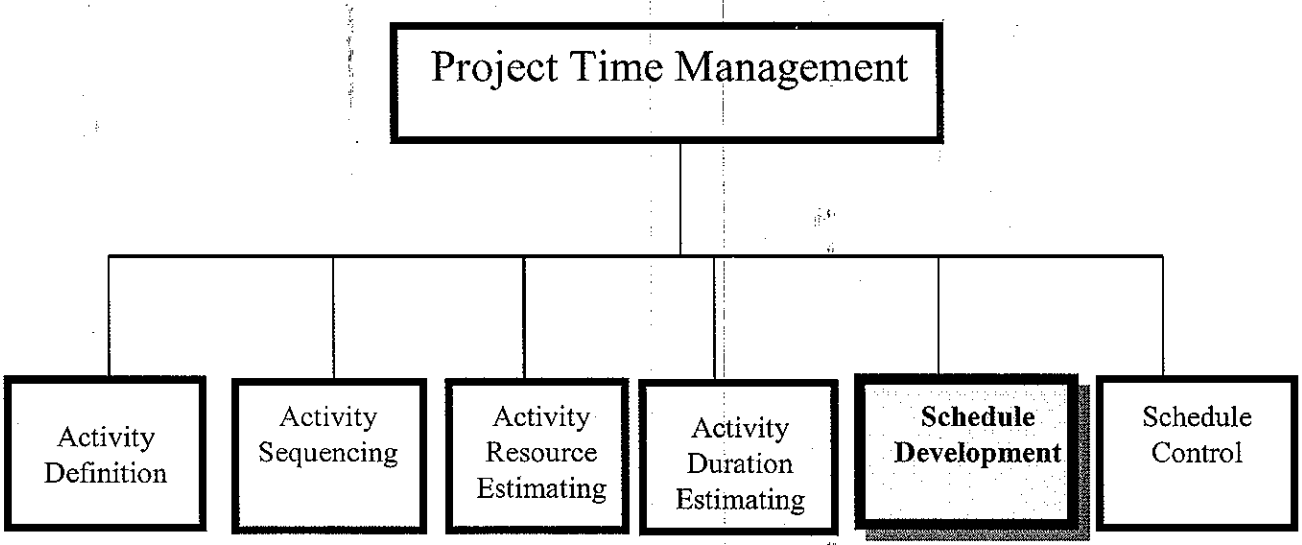
Activity Duration Estimating: Outputs

- Activity Duration Estimates: The likely number of work periods (hours, days, months) that will be required to complete the activity. Duration estimates may include a range instead of a single number
- Activity Attributes (updates): Duration is part of the activity attributes

Planning Processes: Schedule Development



Time Management: Schedule Development



Core Planning Processes
Schedule Development

Input	Tools and Techniques	Output
1. Activity list 2. Project scope statement 3. Enterprise environmental factors 4. Organizational process assets 5. Activity attributes 6. Activity resource requirements 7. Resource calendars 8. Project schedule network diagrams 9. Project management plan - Risk register	1. Schedule network analysis 2. Critical path method 3. Schedule compression 4. What-if scenario analysis 5. Resource leveling 6. Critical chain methods 7. Project management software 8. Appling calendars 9. Adjusting leads and lags 10. Schedule model	1. Project schedule 2. Schedule model data 3. Schedule baseline 4. Resource requirements (updates) 5. Activity attributes (updates) 6. Project calendar (updates) 7. Requested changes 8. Project management plan (updates) - Schedule management plan (updates)

Schedule Development: Inputs

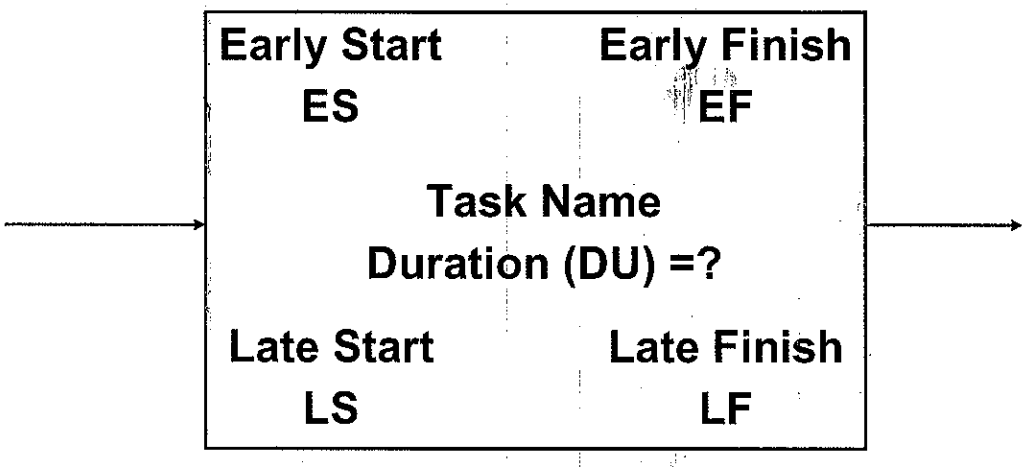
- Project Scope Statement: Assumptions and constraints may impact the development of project schedule. For example, imposed deadlines by contract, stakeholders, market conditions, etc.
- Project Management Plan: This document contains the project schedule management plan. The risk register may identify risk response plan that must be considered when developing the project schedule

Schedule Development: Tools & Techniques

- Schedule Network Analysis: Techniques (e.g. Critical Path Method) for calculating early start/finish, late start/finish. See next few slides
- Critical Path Method: See next few slides
- What-if Scenario Analysis: Use manual or computer modeling tool, e.g. Monte Carlo Analysis to model adverse conditions, such as bad whether, or a strike, etc.
- Project Management Software: Widely used to assist scheduling development and schedule printing. Some software can perform what-if analysis
- Applying Calendars: resource and project calendars to identify working days and hours
- Adjust Leads and Lags: Use realistic figures
- Schedule Model: Data and info are compiled into a schedule model for the purpose of schedule network analysis performed manually or by software

Tools and Techniques: Precedence Diagramming Method

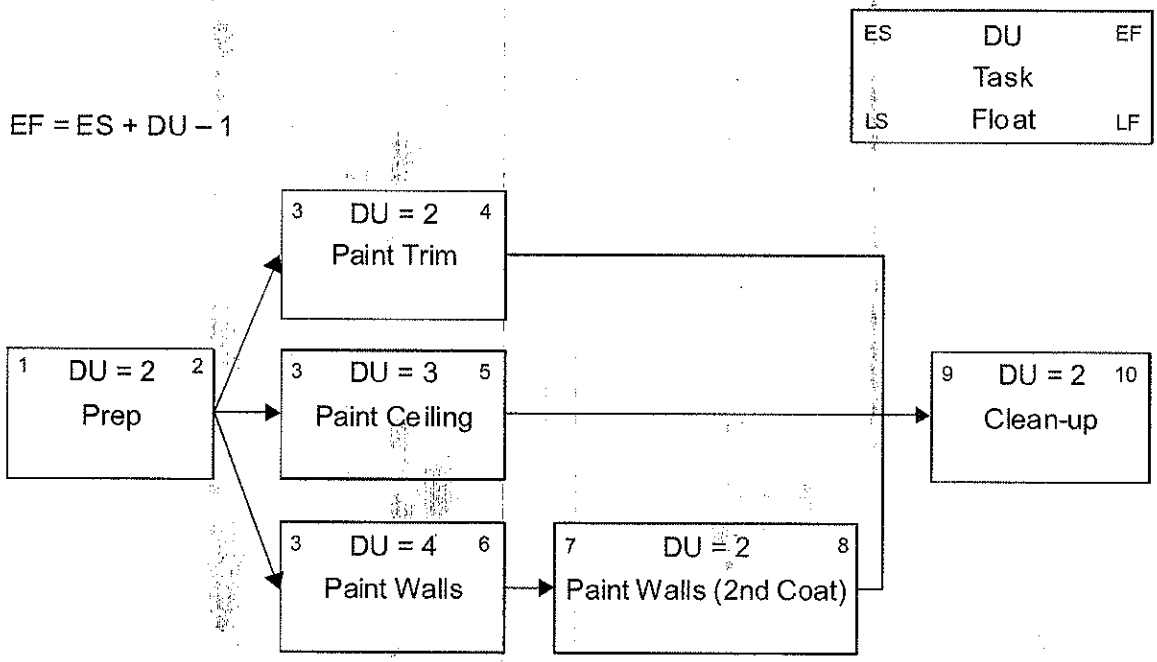
Activity on Node diagram



Critical Path Method: Forward Pass Definitions

- **Early Start Date (ES)**
  - Earliest possible point in time an activity can start, based on the network logic and any schedule constraints
- **Duration (DU)**
  - Number of work periods, excluding holidays or other nonworking periods, required to complete the activity; expressed as workdays or workweeks
- **Early Finish Date (EF)**
  - Earliest possible time the activity can finish
- **Forward Pass**
  - Starting at the beginning (left) of the network develop early start and early finish dates for each task, progressing to end (right-most box) of the network

Forward Pass Calculation



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Critical Path Method: Backward Pass Definitions

- **Late Start Date (LS)**
  - Latest point in time that an activity may begin without delaying that activity's successor
  - If the activity is on the critical path, the project end date will be affected
- **Float or Slack or Total Float (TF)**
  - Latest point in time a task may be delayed from its earliest start date without delaying the project finish date
- **Late Finish (LF)**
  - Latest point in time a task may be completed without delaying that activity's successor
  - If the activity is on the critical path, the project end date will be affected
- **Backward Pass**
  - Calculate late start and late finish dates by starting at project completion, using finish times and working backwards

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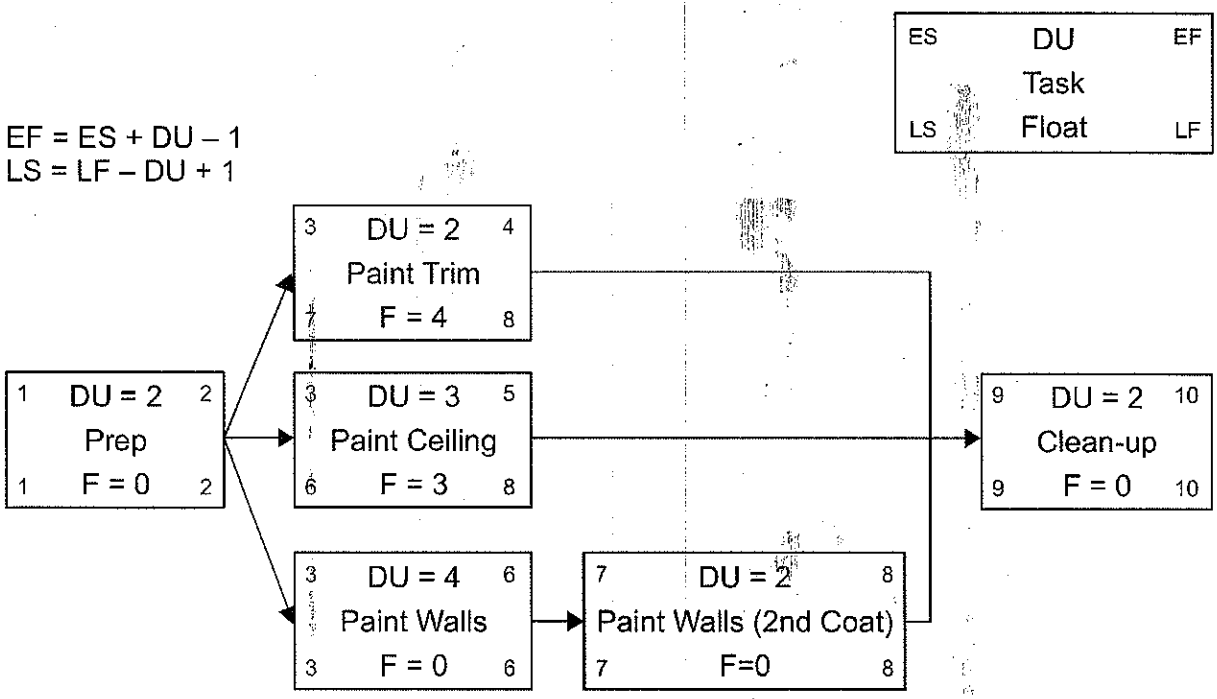
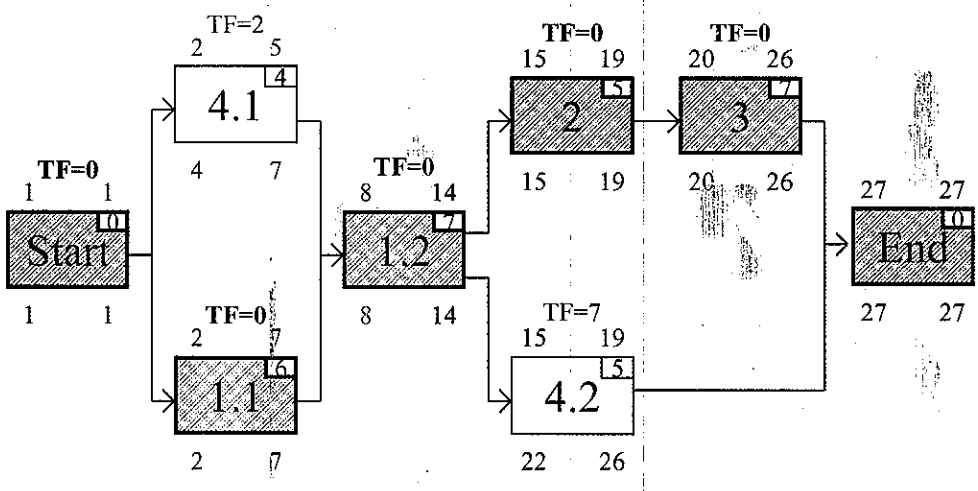
Backward Pass Calculation



Critical Path: Prep, Paint Walls, Paint Walls (2nd Coat), Clean-up

Find the critical Path
Forward Pass, then Backward pass

For Each Activity, Find Early Start, Early Finish, Late Start, Late Finish, Float, and then Critical Path of the project



1. **Longest path of the project**
2. **Path with zero or negative total float**
3. **Shortest time to complete the project**

Exercise 5-2A: Network Diagramming (AOA)

Build an Activity on Arrow Diagram.

Activity	Duration
Start-A	4
Start-B	5
A-C	3
B-C	1
B-E	4
C-D	2
C-E	0
D-E	4
D-F	2
E-F	2
E-End	3
F-End	1

- What are the predecessors for activity C-D?
- How long it takes to finish the project?
- You have 7 minutes

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Exercise 5-2B: Work programme issues

- Project: Your senior manager just called you in, and asked you to be the PM of a project which the contract is just won (HK$2.5M) . The project is to design and implement a CCTV system to a new campus of one of the universities in NT (5 buildings, each building has 5 floors, each floor has 5 to 10 classrooms).
- Requirement:
  - 350 fixed in-door cam, 50 moving out-door cam (company ABC products), assume you only need cams, cam controllers (1 controller to 20 cams), servers, DVD storage, LDC display (1display to 20 cams). All will go to one control room to be sub-con to another company. There is another company to act as main con for the University in the project.
  - Cabling included, all installation parts and labour incl. (ongoing services to be discussed)
  - Fixed price contract, L/D of $50,000 per day
- The deadline is the campus must be opened to public by 15 Nov 2006. Today is 14 July, you were not part of the bid team, and you know little about the details of the project
- What are the potential delays of this project. Name 10 items / activities. You have 20 minutes.

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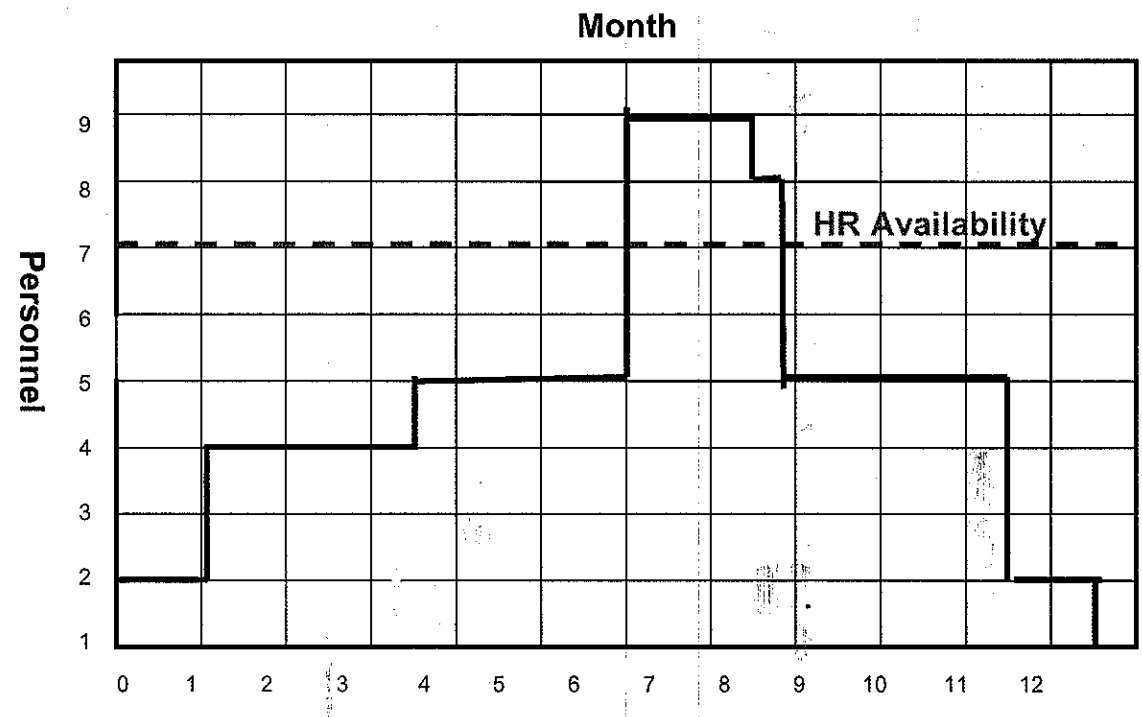
Schedule Development: Tools & Techniques

Resource Leveling

- To address the situation where the project has resource constraints, e.g. max number of staff, or max of the engineers, etc.
- To accommodate the constraint, the critical path must be changed by moving activities around to meet the resource constraints

Tools & Techniques: Resource Leveling



Review the Benefits of a Realistic Schedule

- Framework for managing critical project activities
- Determines planned start and completion dates
- Identifies activity and task precedence relationships
- Aids project team in defining critical communication content
- Specifies times when staff must be available
- No surprises
- Other?

Tools & Techniques: How to compress a schedule

Shortening the schedule without changing the scope

- Crashing

  Most compression of the critical path for the least cost by adding more resource

- Fast Tracking

  Tasks progressing concurrently (concurrent engineering)

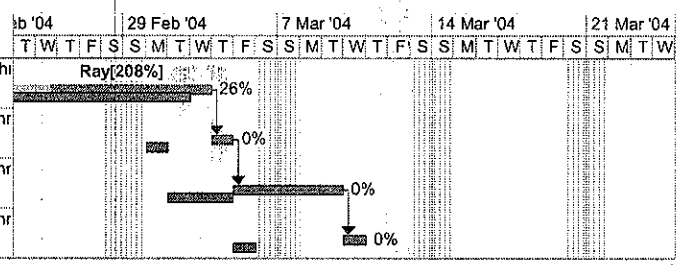
- Class to discuss other methods

Schedule Development: Outputs

- Project Schedule: Activities with start date, end date and resource assignment. It is usually presented graphically in a format of network diagrams, bar charts, and milestones charts.
- Schedule Model Data: Milestones, activities, activity attributes, and related documents. It also contains resource requirements by period, alternate schedule, contingency reserve
- Schedule Baseline: One of the approved version for the purpose of progress measurement
- Resource Requirements (Updates): Data updates, say after resource leveling
- Activity Attributes (Updates): Say latest finish date updates
- Project Calendar (Updates): In order to maintain the deadlines, double shift or non-working days need to be updated
- Requested Changes: Requests can be raised for many reasons
- Project Management Plan (Updates): Schedule management plan may be updated within the Project Management Plan

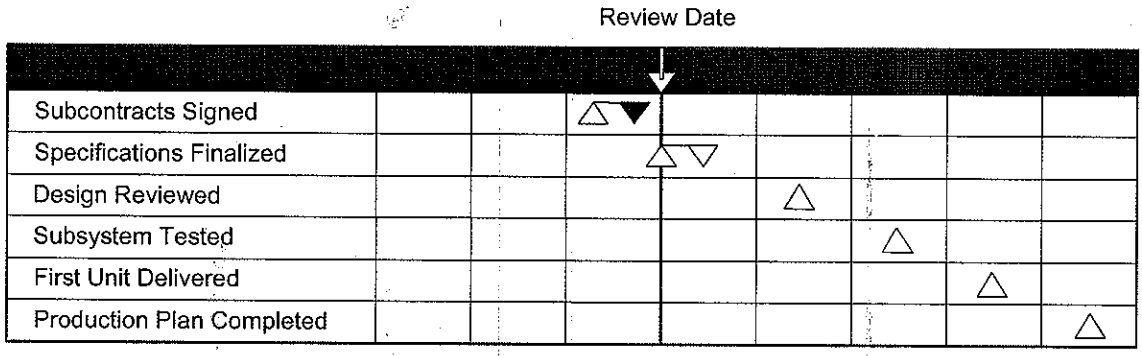
Scheduling Techniques Bar/Gantt Chart

ID	Type	Task Name	Duration	Work
1	Fixed W	Write Report	7 day	100 hr
2	Fixed Ur	Translate	1 da	16 hr
3	Fixed Dura	Profread	3 day	24 hr
4	Fixed Ur	review	1 da	16 hr



Gantt Chart can take many forms

Milestone Chart



There are many other acceptable ways to display project information on a milestone chart.

Unit 5B: Planning
Time Management Summary

- Identified the inputs, techniques, and outputs of Activity Definition, Activity Sequencing, Resource Estimating, and Duration Estimating process
- Described the function and the means to develop scheduling related deliverables such as a network diagram, and milestone chart
- Discussed how to accelerate a schedule or catch-up when you are behind schedule.
- Applied the technique to a simple project