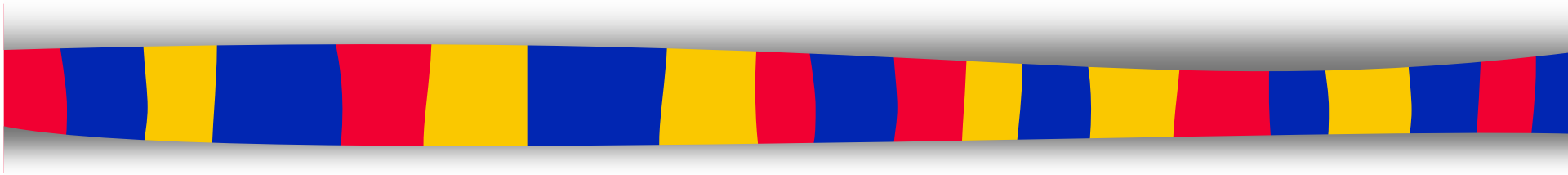
CISC 322

Software Architecture



Lecture 17:

Project Scheduling 1

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Slides adapted from Ahmed E. Hassan

Project Management

- Project management is the application of knowledge, skills, tools and techniques to achieve **specific targets** within specified **budget** and **time constraints**

Project Management

- Very important field
  - Has been studied in theory and practice for many years
- Before discussing project management, we need to understand what a project is

Project

- A project is
  - a temporary endeavor undertaken to create a "unique" product or service
- A project is composed of
  - a number of **related activities** that are directed to the accomplishment of a **desired objective**

Project

- A project starts when
  - **at least one** of its activities is ready to start
- A project is completed when
  - **all of its activities** have been completed

Activity

- An activity
  - Must have a **clear start** and a clear **stop**
  - Must have a **duration** that can be forecasted
  - May require the **completion of other activities** before it begins
  - Should have some **deliverables** for ease of monitoring

Project Planning

- The goal of time activity and time planning is to:
  - **Define the activities** required to accomplish the project
  - Bring activities into an **appropriate sequence**
  - Determine the **resources and time needed** to perform an activity
  - **Create a schedule** based on an analysis of the activities and their relationships

Project Planning

- Managers should consider:
  - **Resource availability** - resources are there when needed
  - **Resource allocation** - there are no competing resources
  - **Staff responsibility** - which staff carry out each activity
  - **Cash flow forecasting** - a timed cash flow forecast
- Mangers need to monitor and re-plan as the project progresses

Work Breakdown Structure (WBS)

- Overall work has to be decomposed into manageable units
- Complex tasks are broken down into subtasks and further refined called Work Breakdown Structures (WBS)

Work Breakdown Structure (WBS)

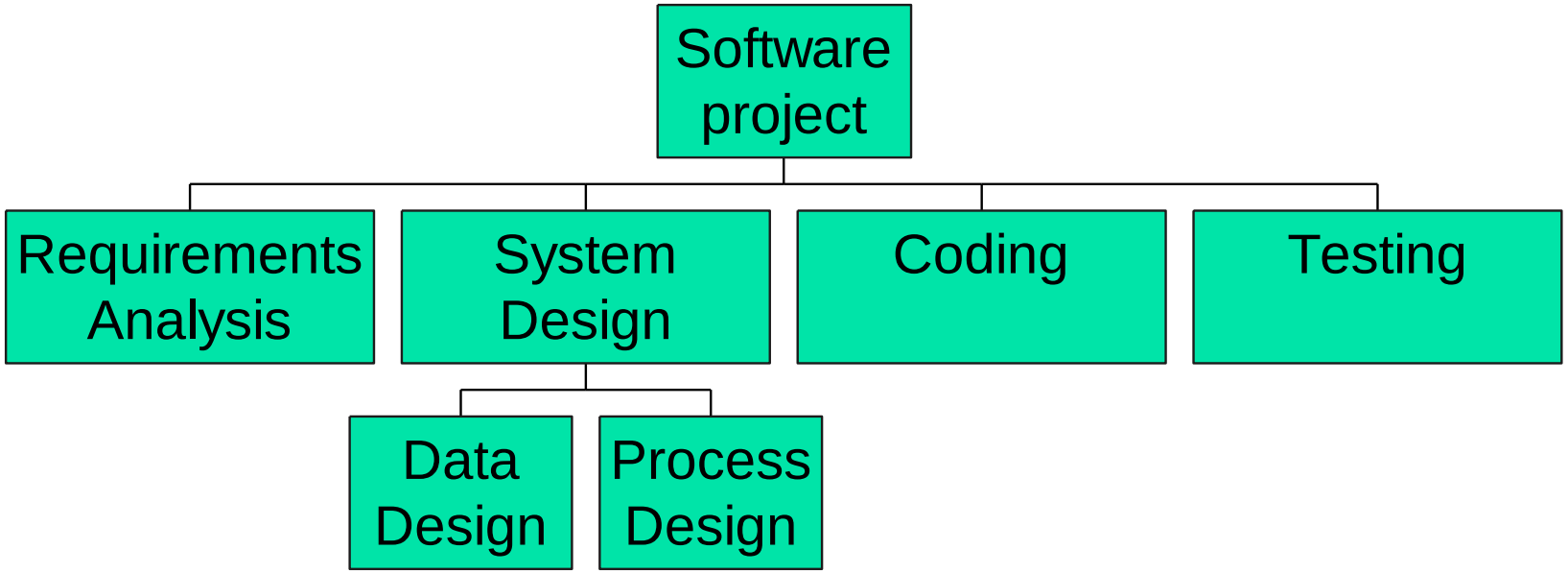
- Contains a list of activities, derived from:
  - Previous experience
  - Expert brainstorming
- WBS helps in
  - identifying the main activities
  - break each main activity down into sub-activities which can further be broken down into lower level sub-activities

Creating WBS

- Phase based approach
- Product based approach
- Hybrid approach

Example of Phase-based Approach

Work Breakdown Structure (an extract)

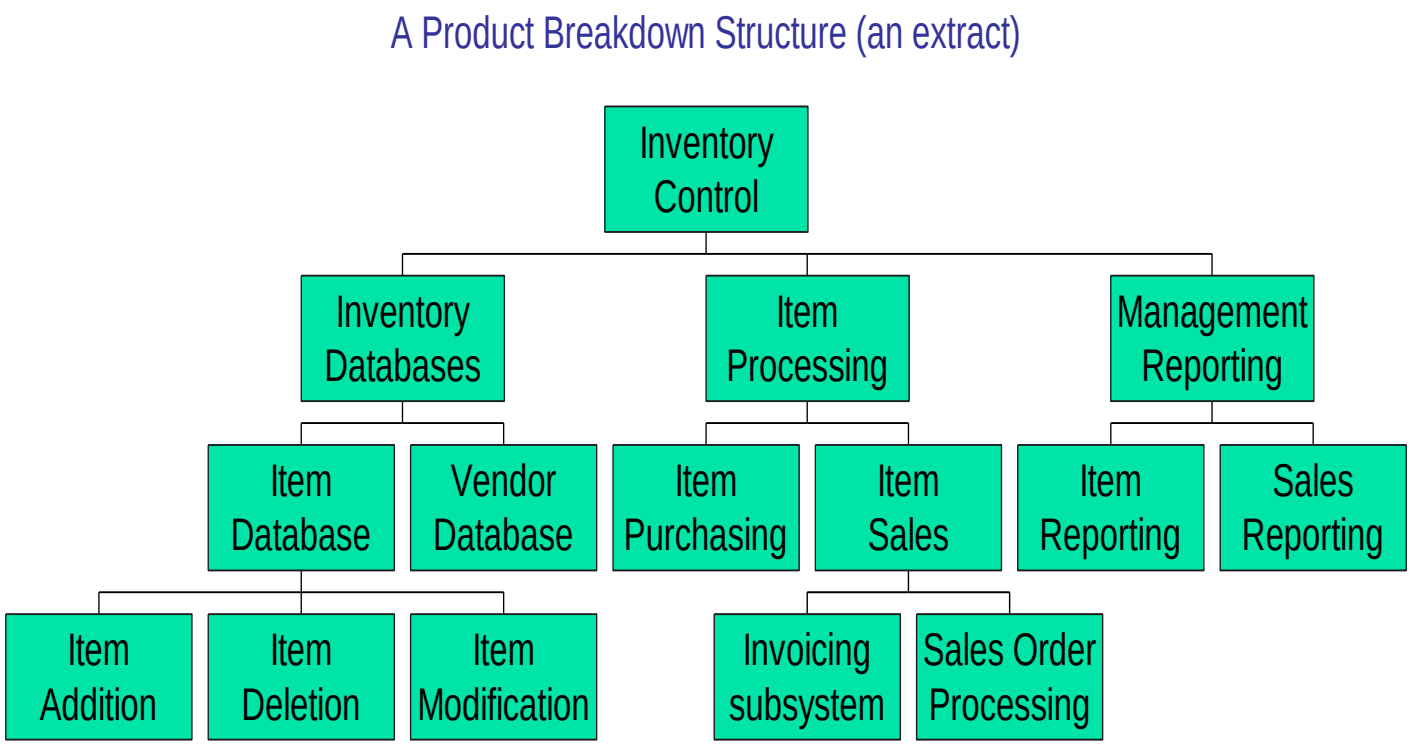


Phase-based Approach

- Advantage
  - Activity list likely complete and non-overlapping
- Disadvantage
  - May miss some activities related to final product

Product based approach

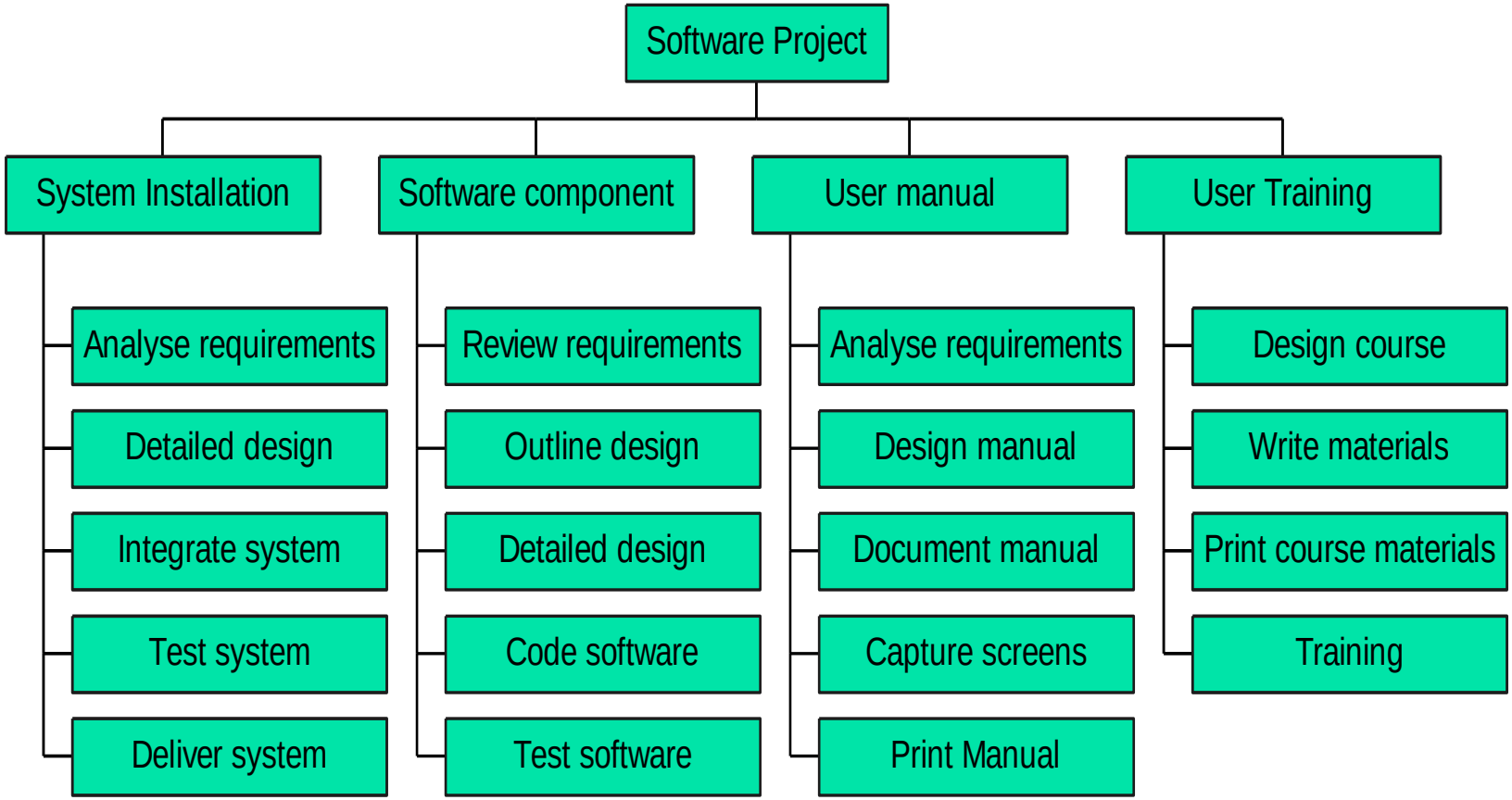
- Product Breakdown Structure (PBS)



Hybrid Approach

- A mix of the phase-based and product-based approaches (most commonly used)
- The WBS consists of
  - a list of the products of the project; and
  - a list of phases for each product

Hybrid WBS


Software Project
System Installation
Software component
User manual
User Training
Analyse requirements
Detailed design
Integrate system
Test system
Deliver system
Review requirements
Outline design
Detailed design
Code software
Test software
Analyse requirements
Design manual
Document manual
Capture screens
Print Manual
Design course
Write materials
Print course materials
Training

Schedule Development Methods

- Need to develop a schedule in which planned start and end dates are assigned to all activities
- Need to consider:
  - Activity precedence
  - Activity duration
  - Available resources

Project Scheduling

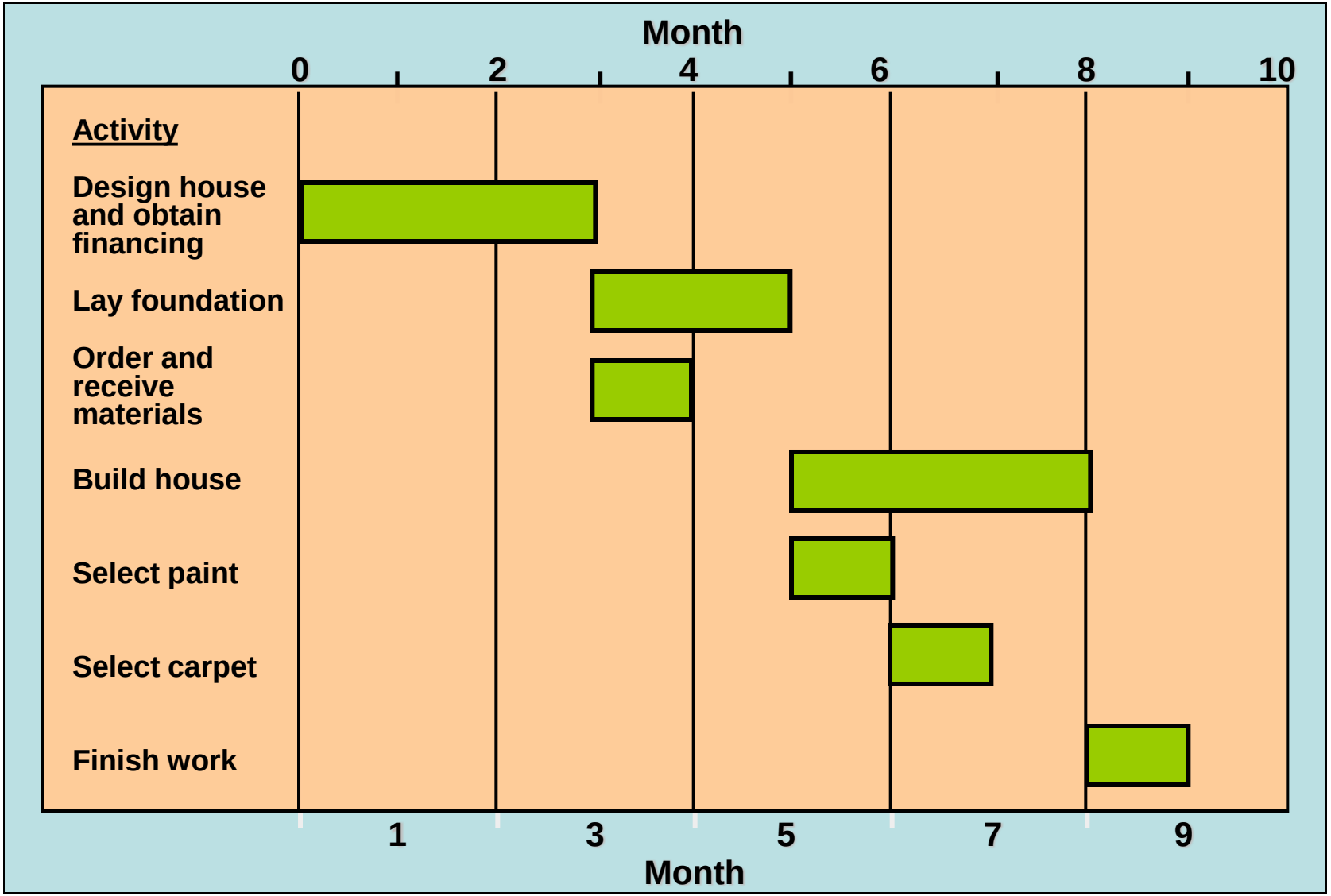
- **Steps**
  - Define activities
  - Sequence activities
  - Estimate time
- **Techniques**
  - Gantt chart
  - CPM
  - PERT

Defining Activities

Gantt Chart

- Developed in 1918 by H.L. Gantt
- Graph or bar chart with a bar for each project activity that shows passage of time
- Provides visual display of project schedule

Example of Gantt Chart



Gantt Chart Limitations

- Does not clearly indicate details regarding the **progress of activities**
- Does not give a clear indication of **interrelation between the activities**

Sequence Activities

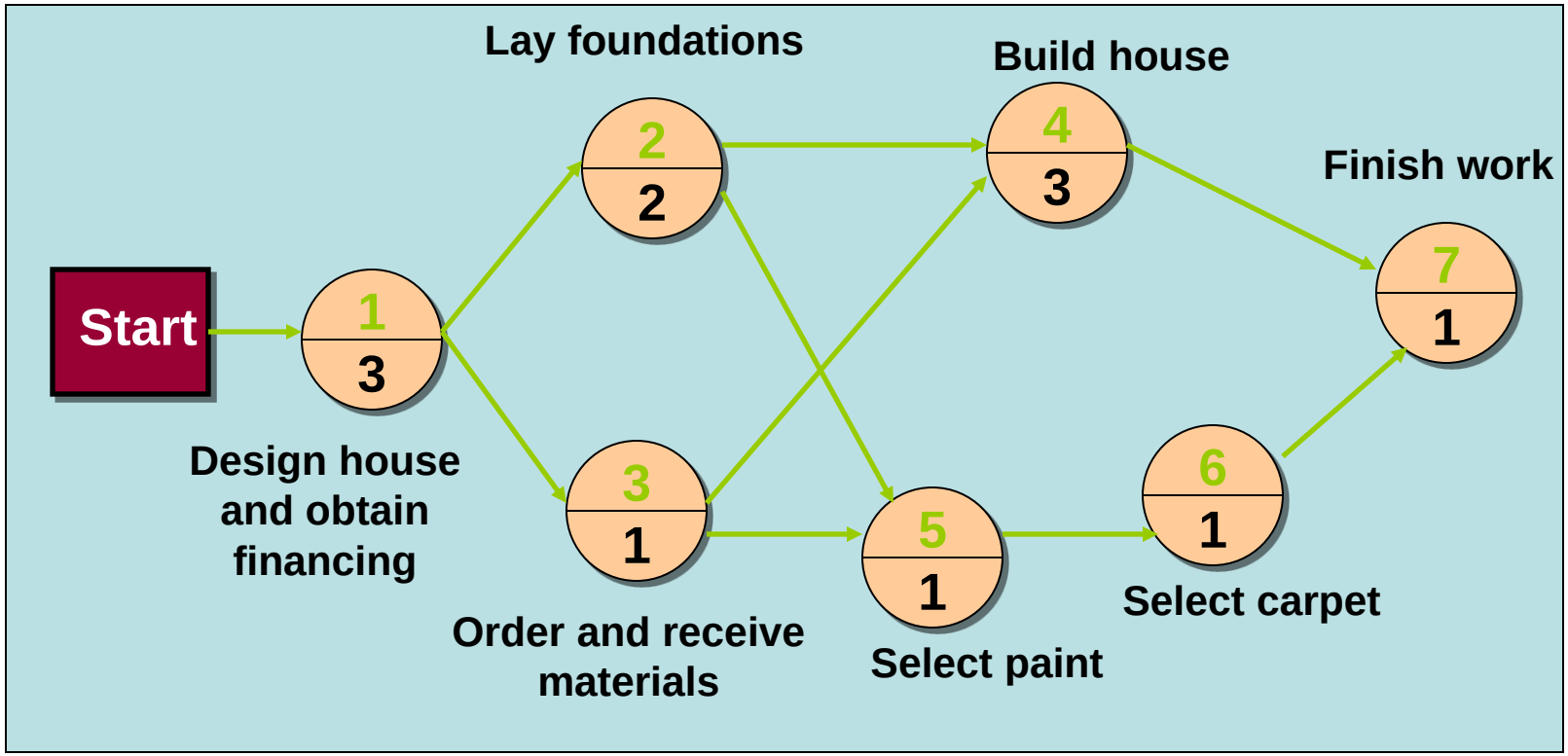
Critical Path

- Sequential activities upon which the project completion depends
- Calculated as the longest path through a network (i.e. longest overall duration)
  - The shortest time possible to complete the project

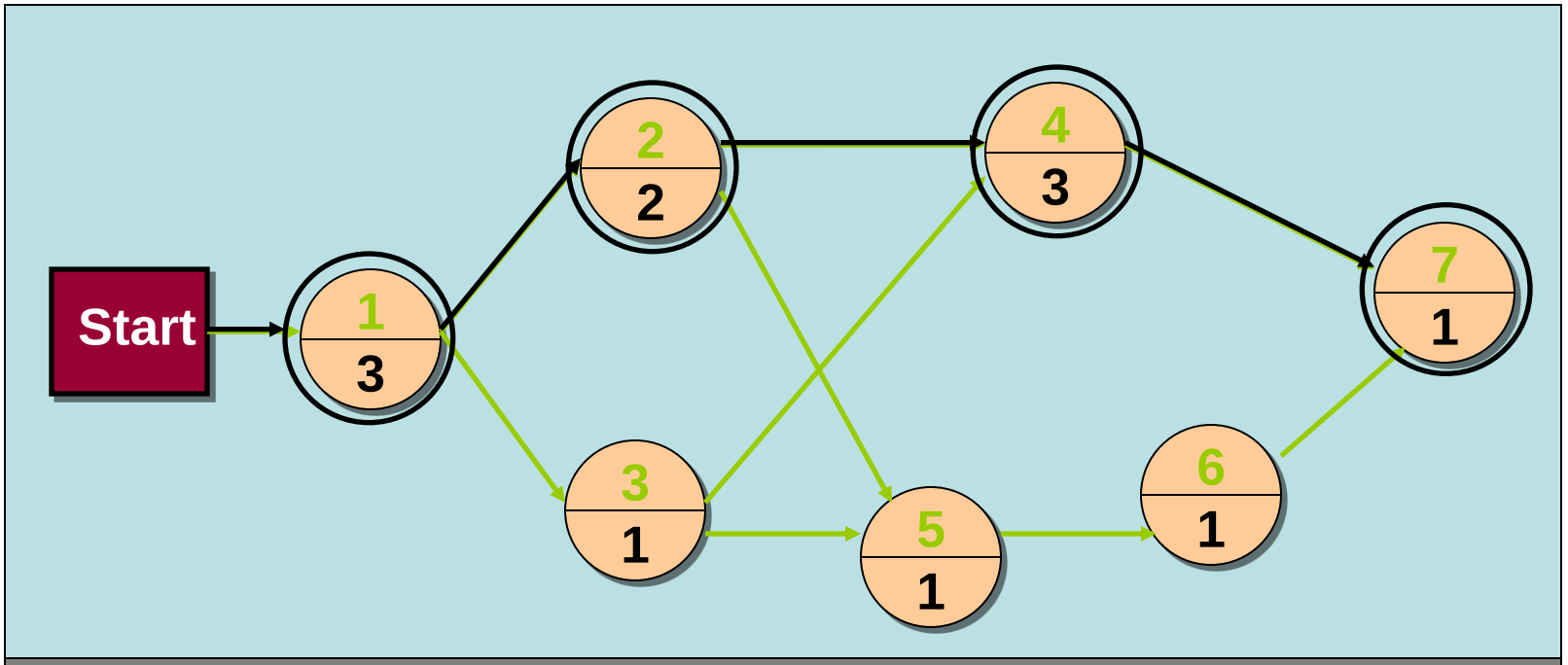
Critical Path Notes

- All projects have a critical path
- Any delay in activities on the critical path will impact the project completion time
- Shortening non-critical path tasks does not necessarily shorten the project schedule

Scheduling Network for House Building Project



Critical Path



A: 1-2-4-7
3 + 2 + 3 + 1 = 9 months

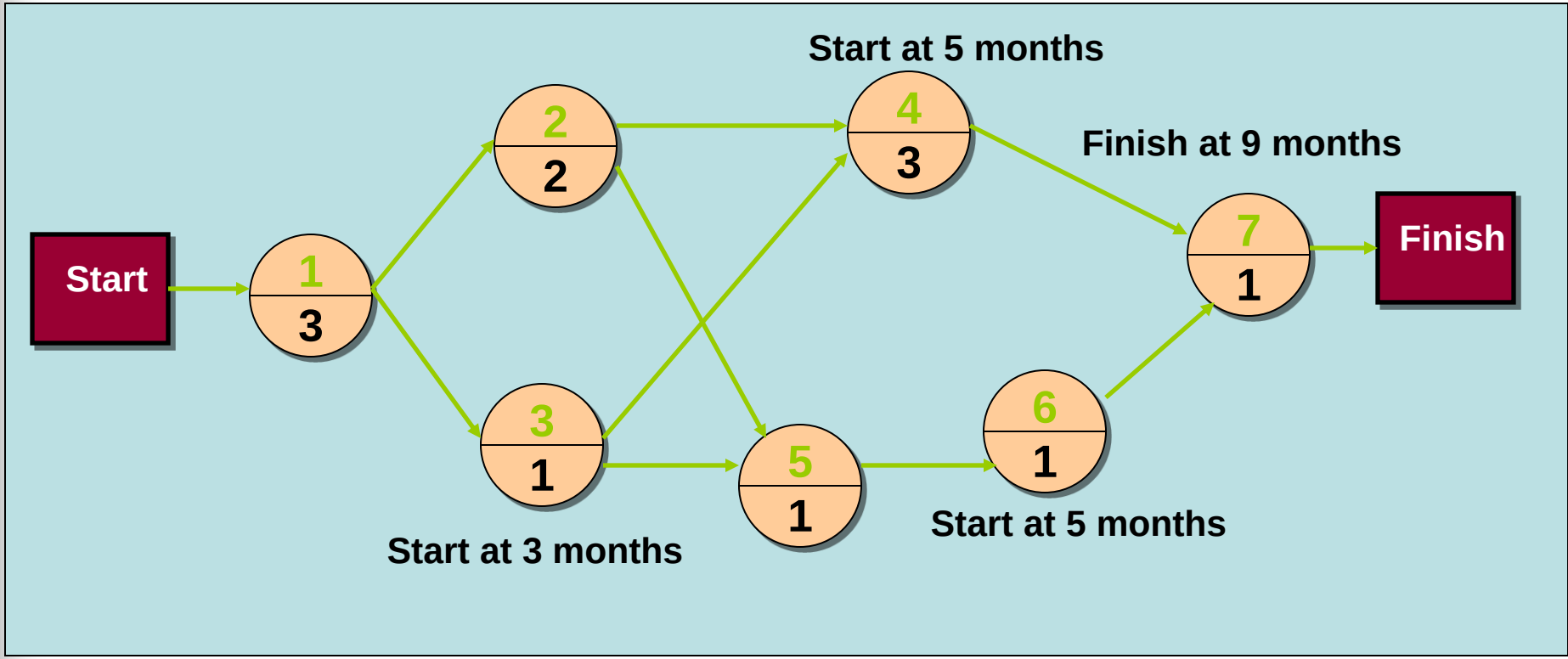
B: 1-2-5-6-7
3 + 2 + 1 + 1 + 1 = 8 months

C: 1-3-4-7
3 + 1 + 3 + 1 = 8 months

D: 1-3-5-6-7
3 + 1 + 1 + 1 + 1 = 7 months

- Critical path
  - Longest path through a network
  - Minimum project completion time

Activity Start Times



Estimating Time

Critical Path Method (CPM) Overview

- Developed for industrial projects where activity times are generally known
- Process to determine and optimize critical path
- Should consult with functional expert

Critical Path Method (CPM) Overview Cont'd…

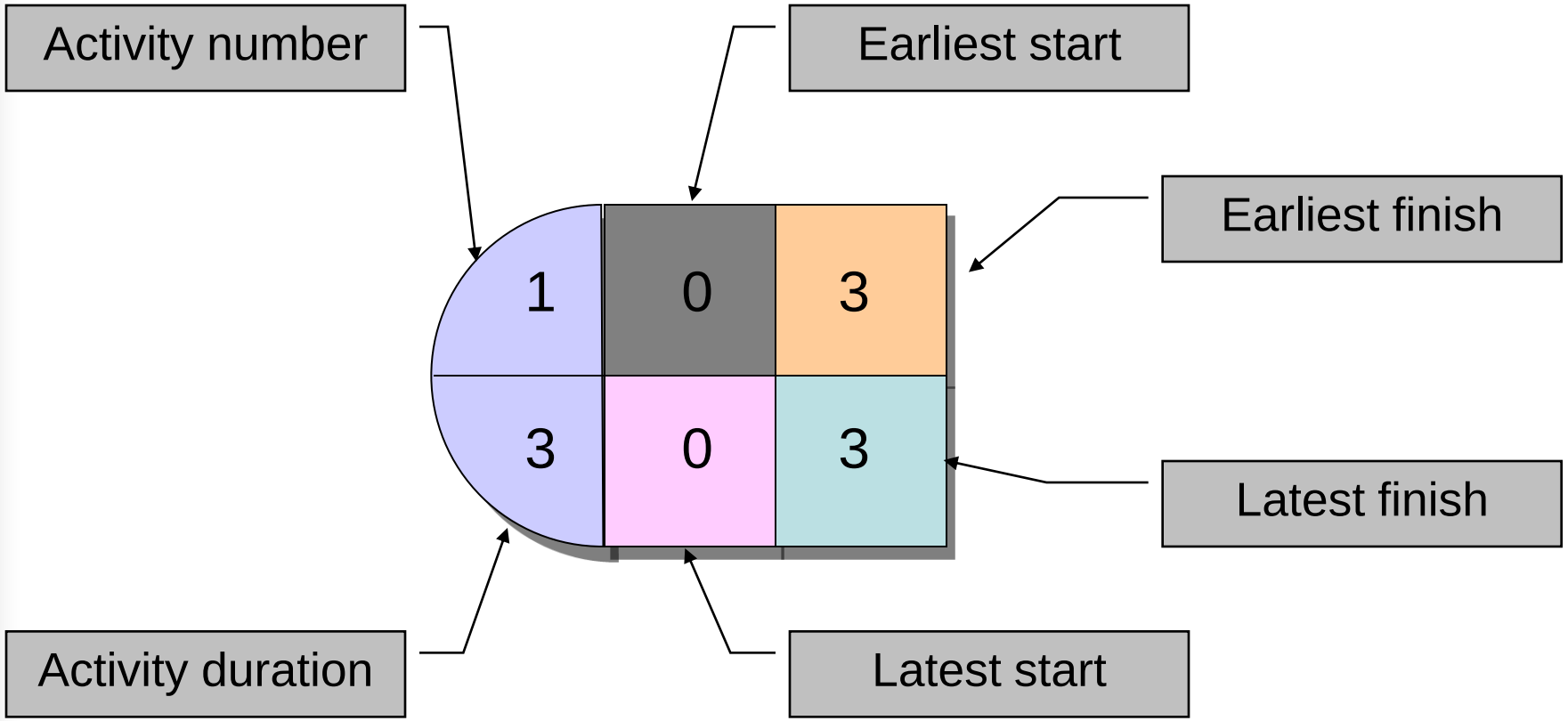
- Plan for the fastest completion of the project
- Identify activities whose delays is likely to affect the completion date for the whole project
- Very useful for repetitive activities with well known completion time

Critical Path and Events

- Critical event: an event that has zero *slack*
- Critical path: a path joining critical events

- Benefit of Critical Path Analysis:
  - Shortening the critical path will reduce the overall project duration (planning stage)
  - Pay more attention to those activities which fall in the critical path (management stage)

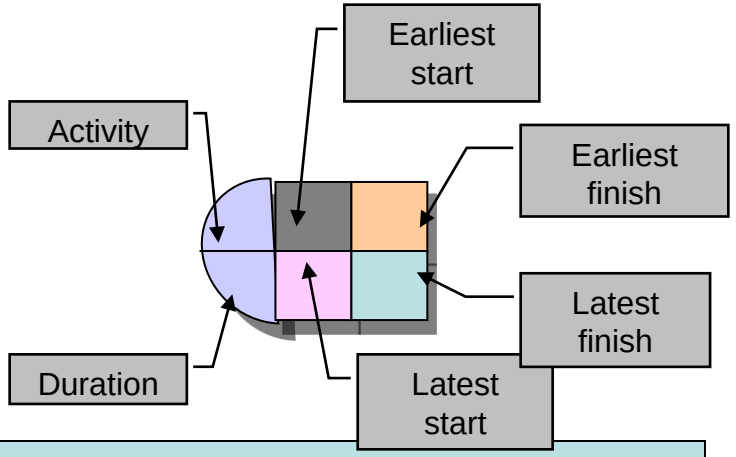
Mode Configuration

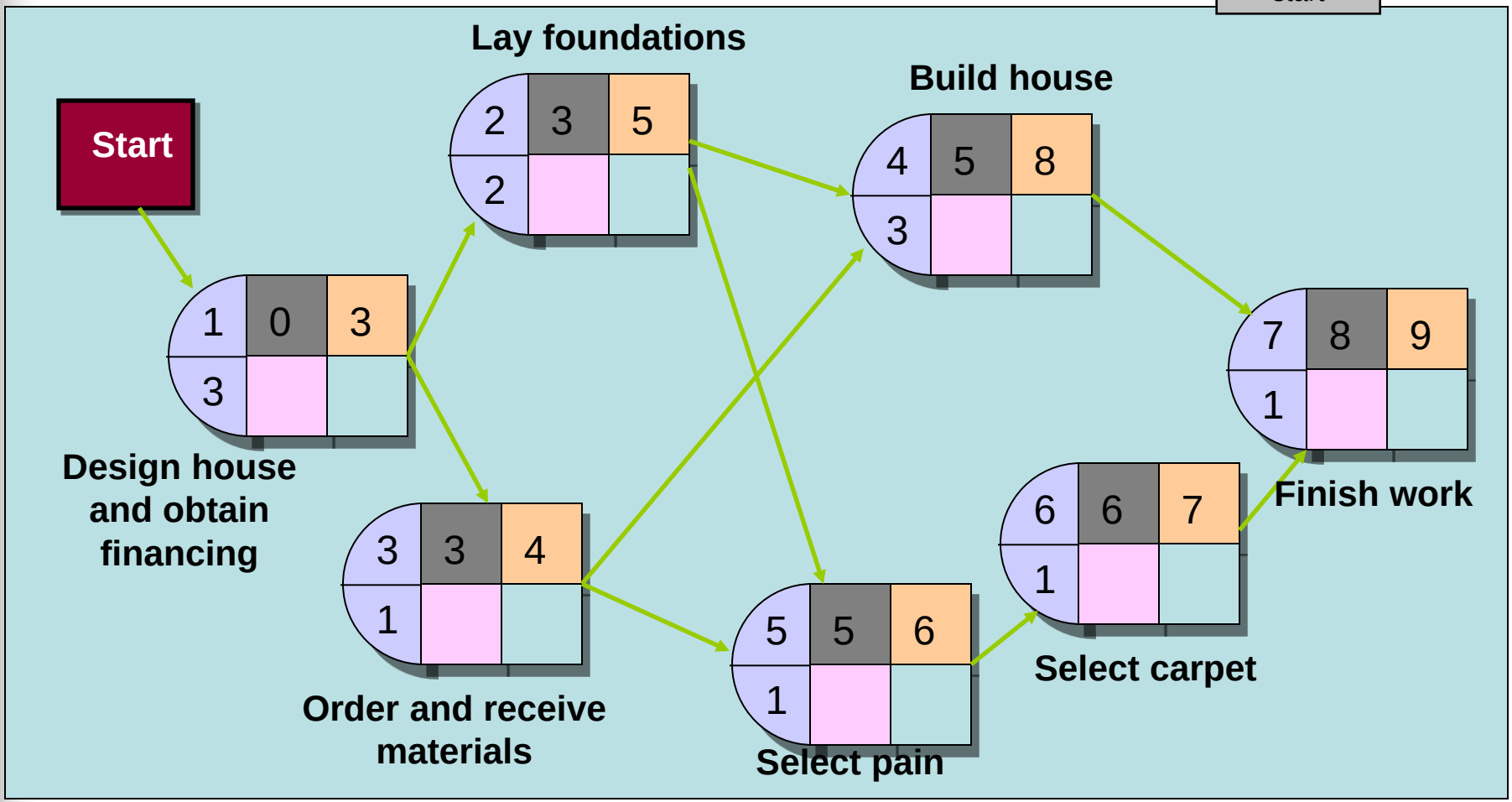


CPM Forward Pass

- Calculate the **earliest start** (ES) and the **earliest finish** (EF) dates of the activities
- Always start from left to right
- If several tasks converge, use the largest EF time to determine the ES for the next activity

Earliest Activity Start and Finish Times

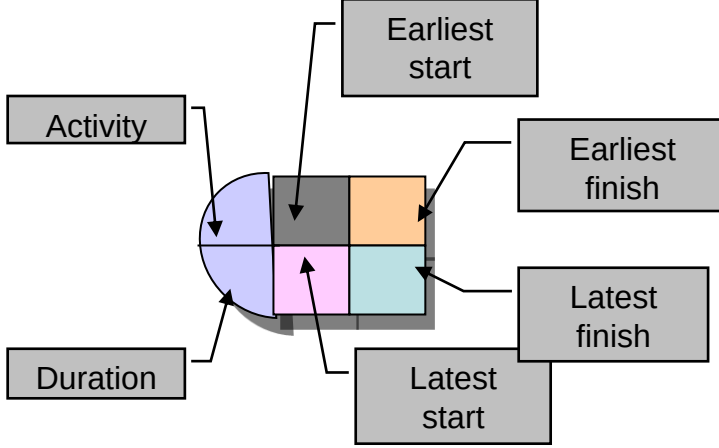


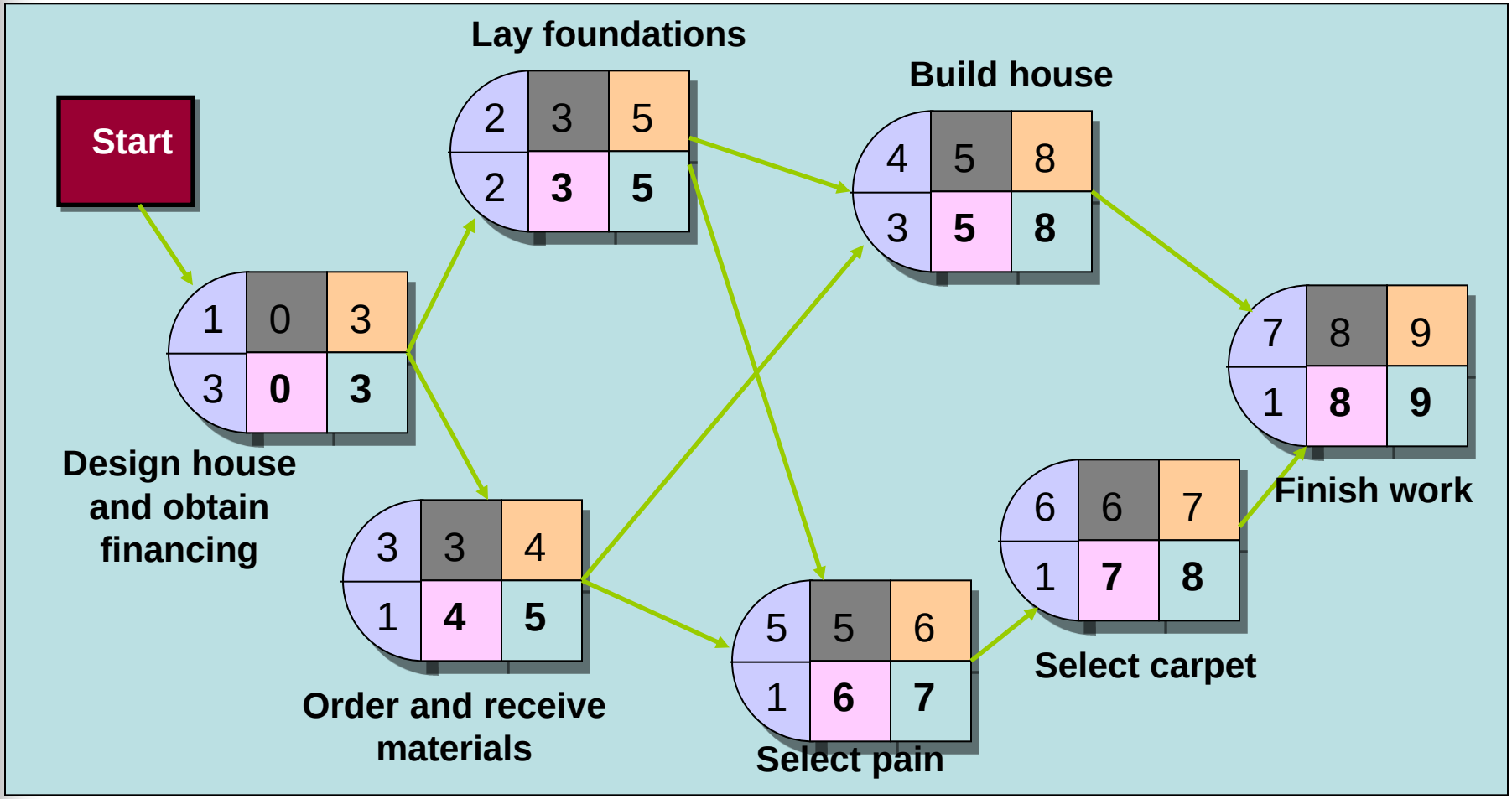


CPM Backward Pass

- Determine the **latest finish** (LF) and **latest start** (LS) times
- From right (end node) to left
- Subtract duration from connecting node's latest start time

Latest Activity Start and Finish Times





Activity Slack

Activity	LS	ES	LF	EF	Slack S
*1	0	0	3	3	0
*2	3	3	5	5	0
3	4	3	5	4	1
*4	5	5	8	8	0
5	6	5	7	6	1
6	7	6	8	7	1
*7	8	8	9	9	0
* Critical Path					

Slack: amount of time an activity can be delayed without delaying the project

activity slack = *LS - ES = LF - EF*

Critical activities: have zero slack and lie on a critical path.