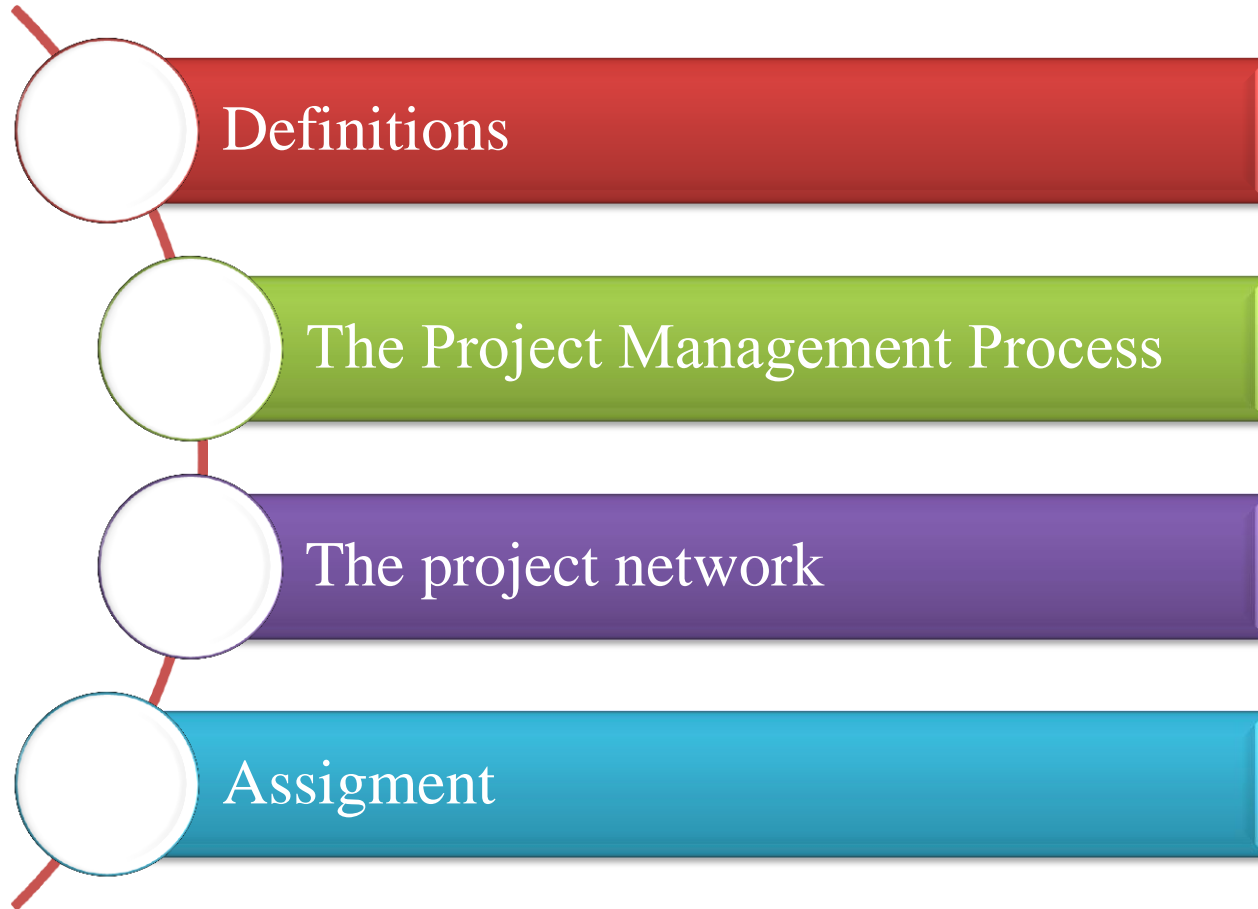# PROJECT MANAGEMENT

Topic 1

Introduction

Contents

Definitions

Examples of projects

- Split the atom
- Channel between England and France
- Introduce Apple's Watch
- Introduce Google glass

"Projects, rather than repetitive tasks, are now the basis for most value-added in business"

-Tom Peters

Definitions

Project Life Cycles

Man Hours

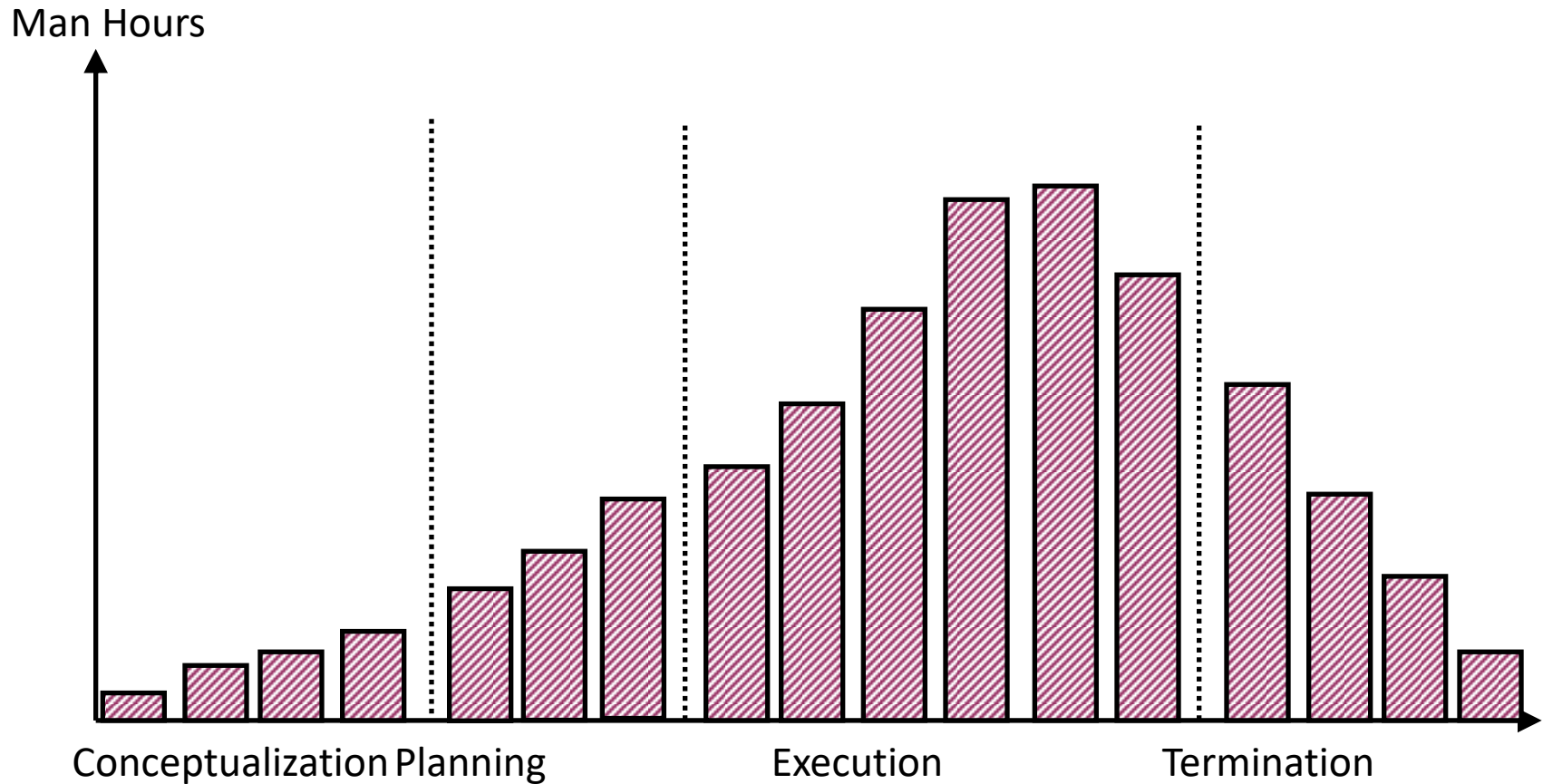Conceptualization Planning   Execution   Termination

Fig 1.1. *Project Life Cycle stages*

Definitions

Project Life cycles

Conceptualization - the development of the initial goal and technical specifications.

Planning – all detailed specifications, schedules, schematics, and plans are developed

Execution – the actual "work" of the project is performed

Termination – project is transferred to the customer, resources reassigned, project is closed out.
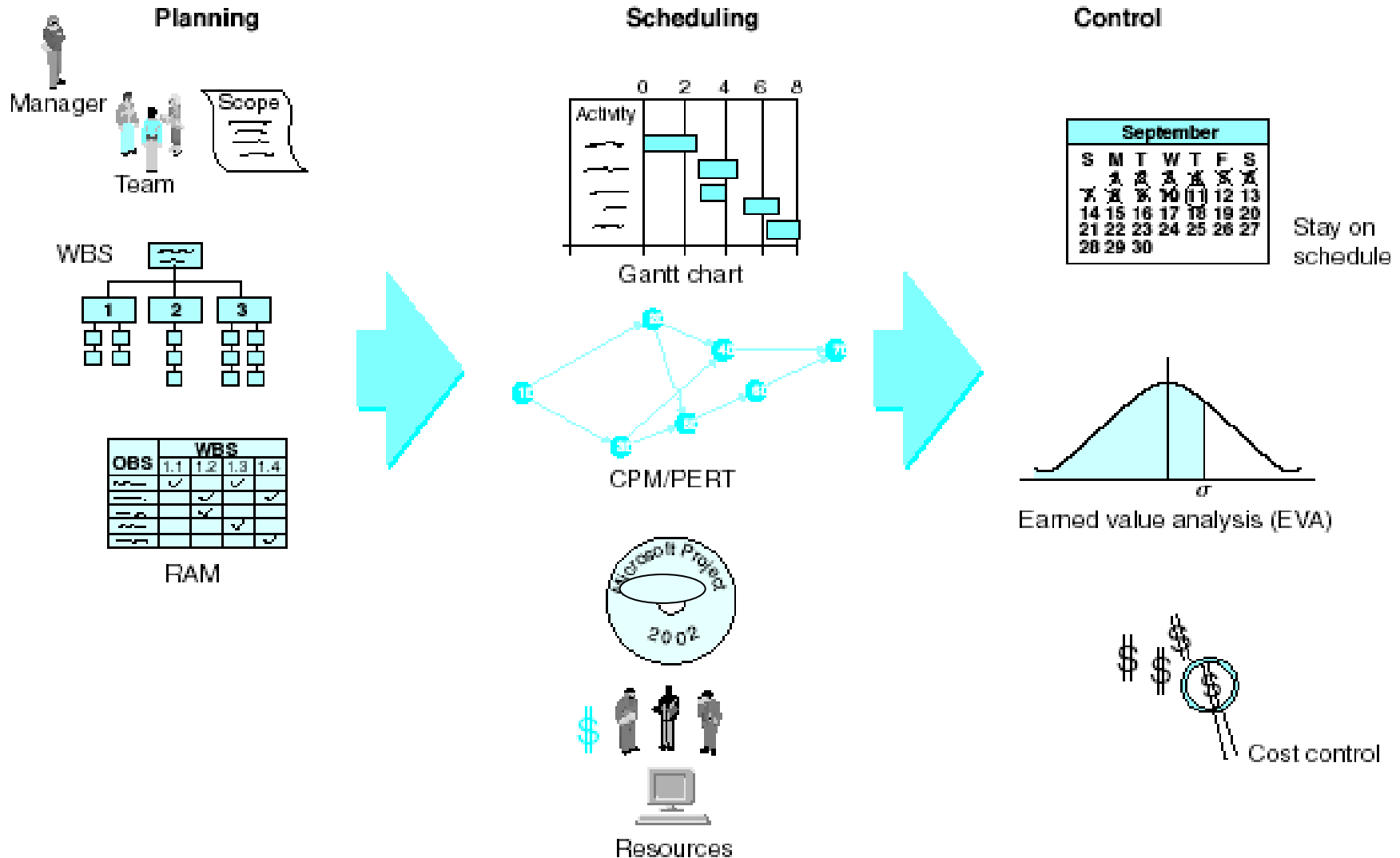
The Project Management Process

Figure 1.2. *The project management process*

The Project Management Process

Work Breakdown Structure (WBS)

- ***WBS breaks down project*** into major components (modules).

- ***Modules*** are further broken down into ***activities*** and, finally, into individual ***tasks***.

- Identifies activities, tasks, resource requirements and relationships between modules and activities.

- Helps avoid duplication of effort.

- Basis for project development, management , schedule, resources and modifications.

- Approaches for WBS development:

  1. Top down process   2. Brainstorm entire project
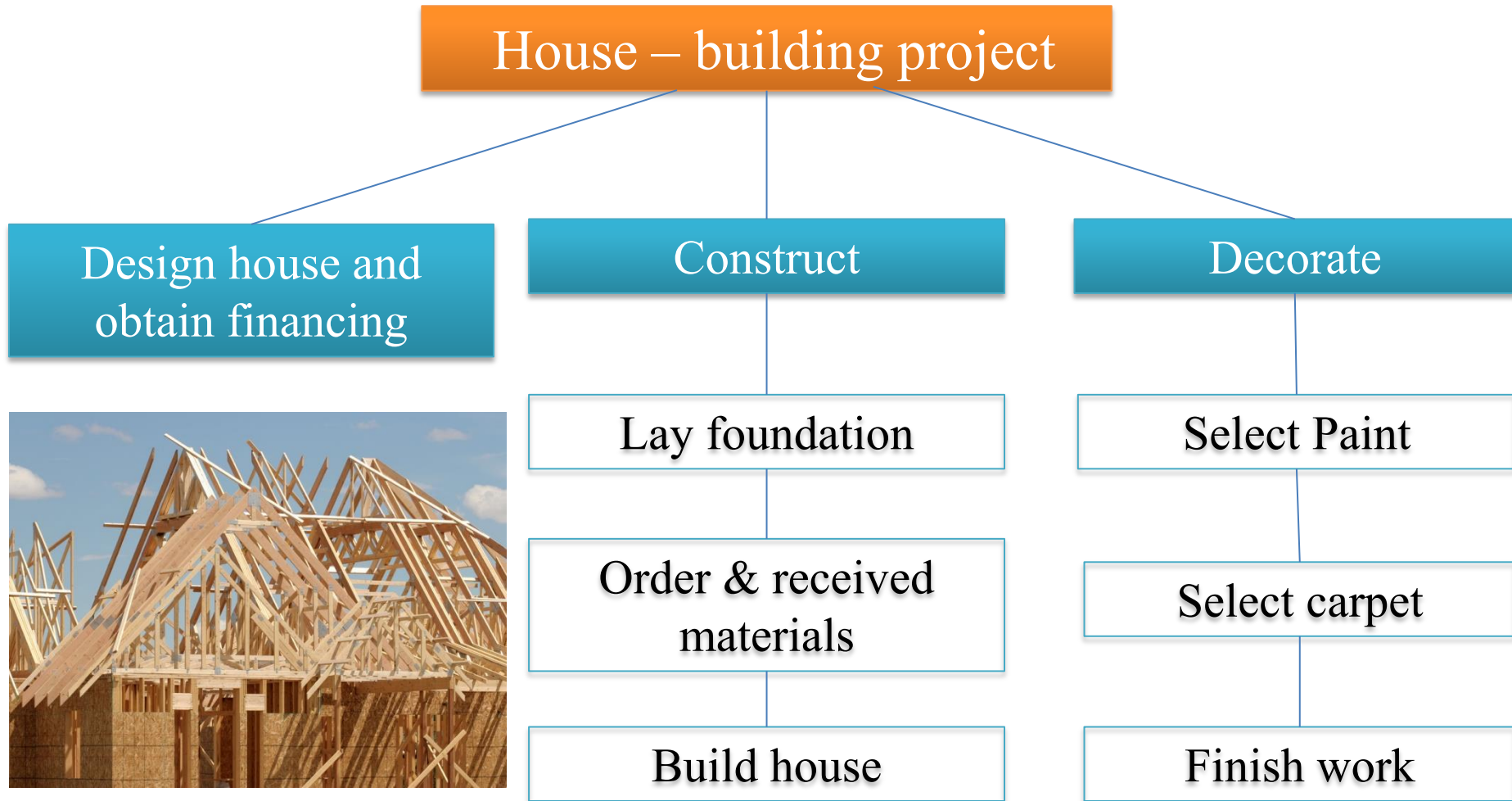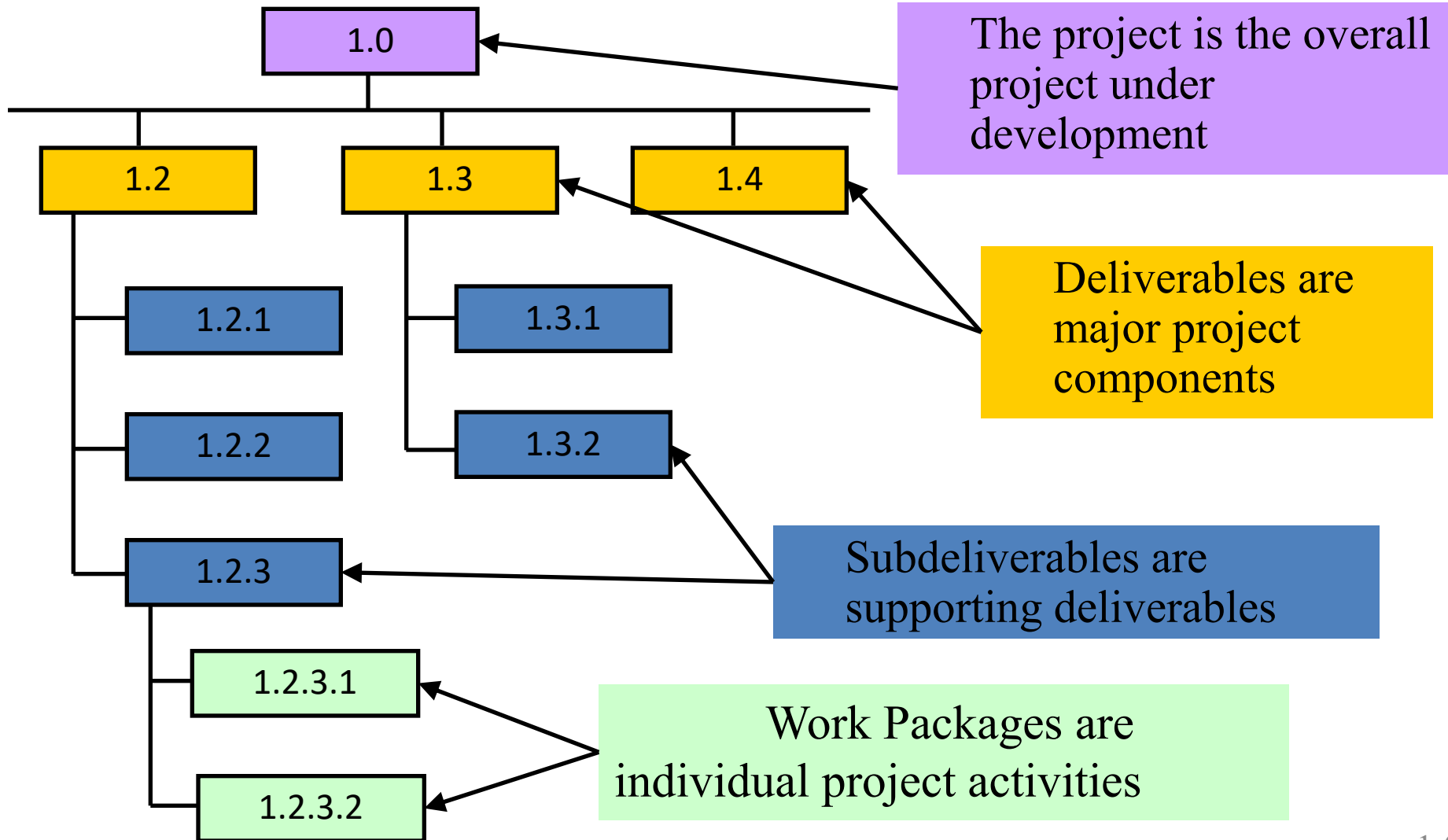
The Project Management Process

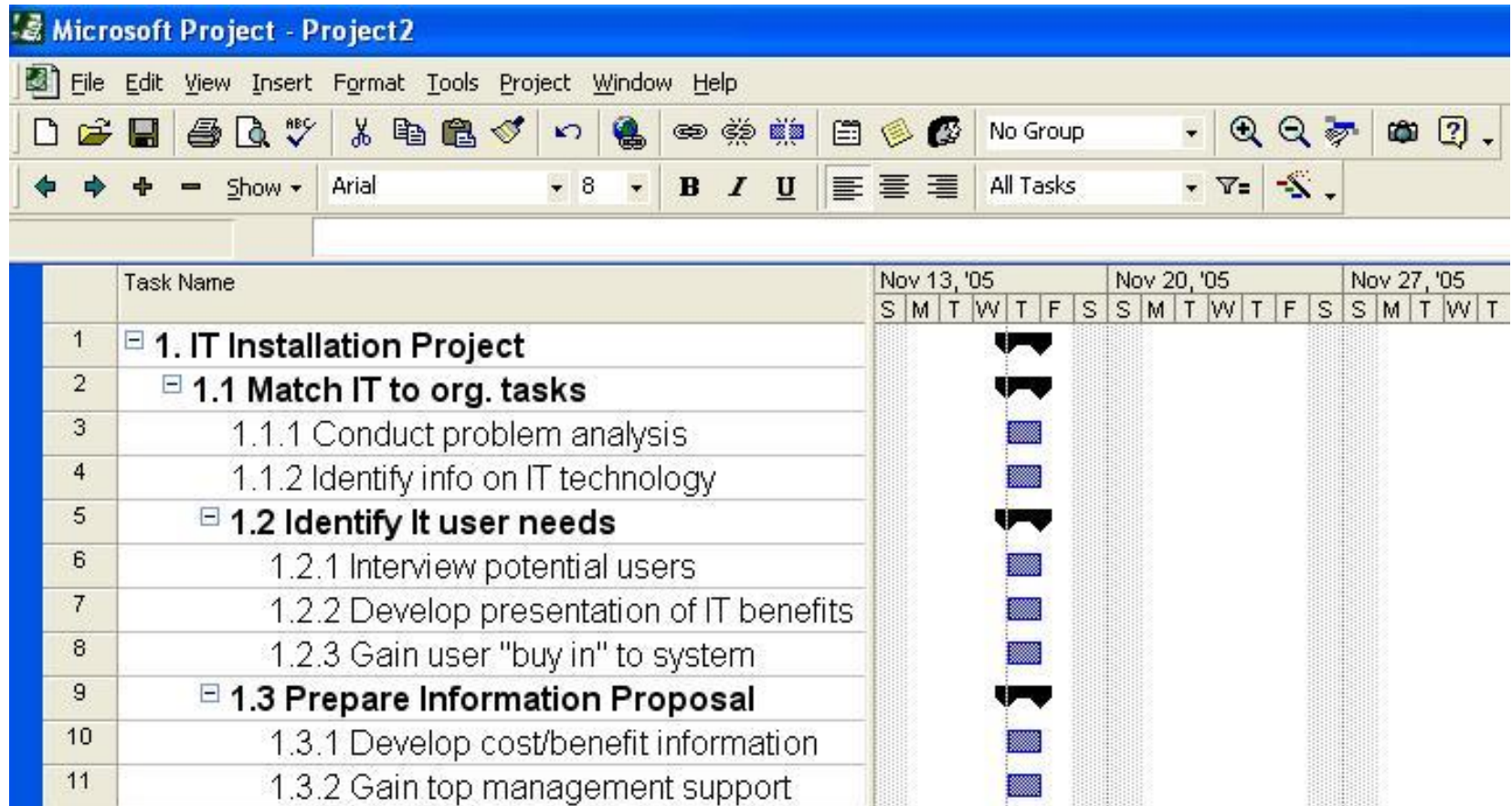**Figure 1.3**. *WBS for a house – building project*

The Project Management Process

Work Breakdown Structure and Codes

```
                        ┌──────────┐
                        │   1.0    │◄──────── The project is the overall
                        └────┬─────┘          project under development
          ┌──────────────────┼──────────────────┐
     ┌─────────┐        ┌─────────┐        ┌─────────┐
     │   1.2   │        │   1.3   │◄───┐   │   1.4   │◄───┐
     └────┬────┘        └────┬────┘    │   └─────────┘    │
          │                  │         │                  │
     ┌─────────┐        ┌─────────┐    │  Deliverables are
     │  1.2.1  │        │  1.3.1  │    └──major project
     └─────────┘        └─────────┘       components
          │                  │
     ┌─────────┐        ┌─────────┐
     │  1.2.2  │        │  1.3.2  │◄───┐
     └─────────┘        └─────────┘    │
          │                            │
     ┌─────────┐                       │
     │  1.2.3  │◄──────────────────────┤ Subdeliverables are
     └────┬────┘                       └ supporting deliverables
          │
     ┌─────────┐
     │ 1.2.3.1 │◄───┐
     └─────────┘    │  Work Packages are
          │         └─individual project activities
     ┌─────────┐    │
     │ 1.2.3.2 │◄───┘
     └─────────┘
```

The project is the overall project under development

Deliverables are major project components

Subdeliverables are supporting deliverables

Work Packages are individual project activities

The Project Management Process

WBS in MS Project

The Project Management Process

Responsibility Assignment Matrix

- Project manager assigns work elements to organizational units, departments, groups, individuals or subcontractors.

- Uses an organizational breakdown structure (OBS).

- OBS is a table or a chart showing which organizational units are responsible for work items.

- OBS leads to the responsibility assignment matrix (RAM)

- RAM shows who is responsible for doing the necessary work in the project.

The Project Management Process

Responsibility Assignment Matrix

■ Tasks are described in tables or charts

■ Project mangement assigns tasks to groups, inviduals hay or subcontractors. This matrix is called responsibility assignment matrix: RAM

In charge	3.1 Select paint	3.2 Select carpet	3.3 Finish work
Husband	2$^{(*)}$	2	2
Wife	1	1	1
Materials	3	3	3
Contractor	2	2	2

$^{(*)}$Response level: 1: Overral, 2: Perform, 3: Support, supply

Table 1.1. *RAM for Decoration task*

The Project Management Process

Gantt Charts

✓   Establish a time-phased network

✓   Can be used as a tracking tool

Benefits of Gantt charts

1. Easy to **create** and **comprehend**
2. Identify the schedule **baseline** network
3. Allow for **updating** and **control**
4. Identify **resource needs**

The Project Management Process

Create a Gantt chart based on the activities listed in the table.

Activity	Time	Pred	Activity	Time	Pred
Z	8	--	U	3	W
Y	5	Z	T	6	V
X	8	Z	S	7	U,T
W	4	Y,X	R	9	S
V	5	W			

The Project Management Process
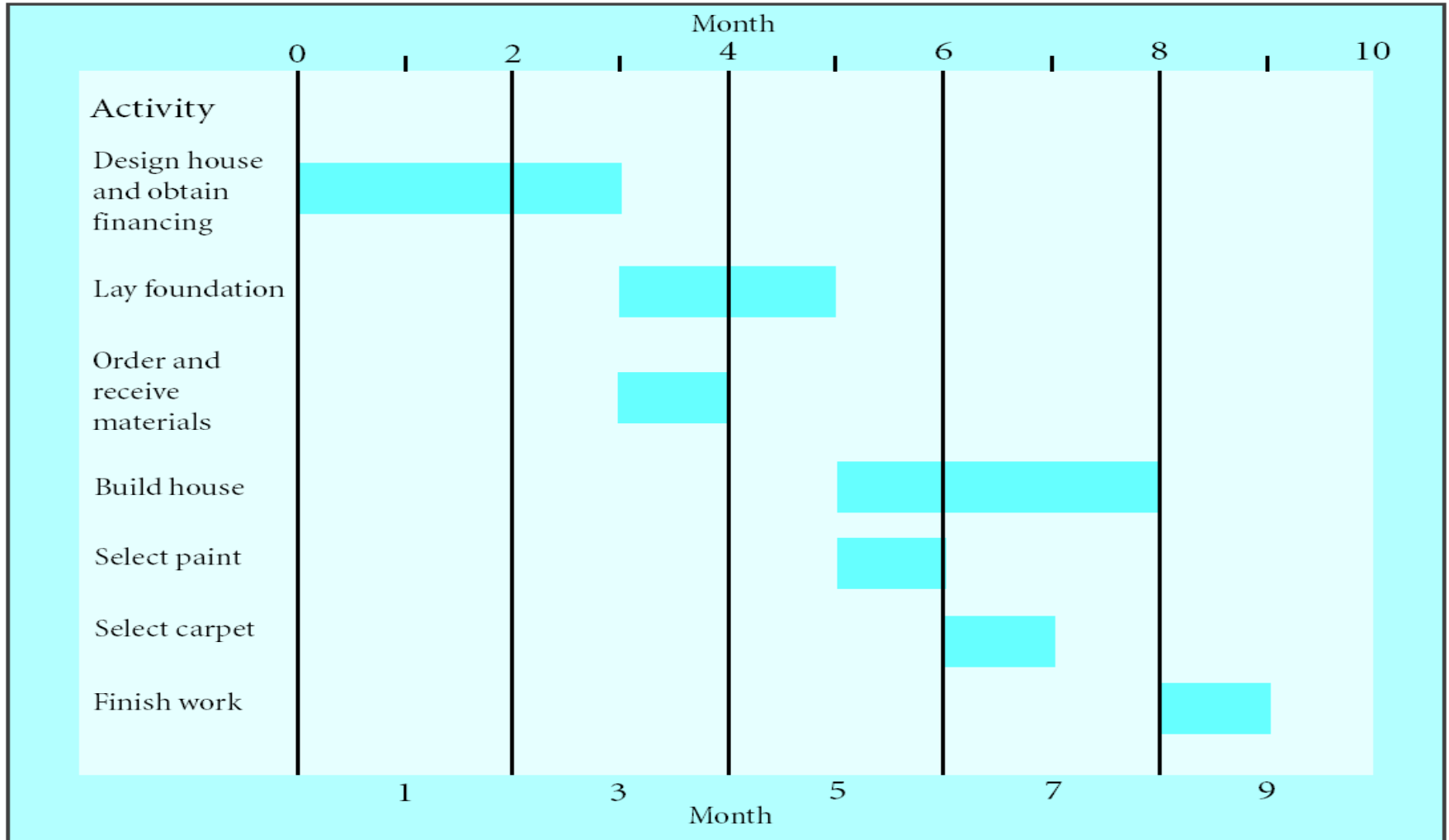
Gantt Chart

Table 1.2. *A Gantt chart*

The Project Management Process

Project Control

- Process of ensuring progress toward successful completion.

- Monitoring project to minimize deviations from project plan and schedule.

- Corrective actions necessary if deviations occur.

- Key elements of project control
    - Time management
    - Cost management
    - Performance management
    - Earned value analysis.

The Project Network

House Building Project Data

No.	Activity	Activity Predecessor	Duration (Months)
1.	Design house and obtain financing	-	3
2.	Lay foundation	1	2
3.	Order Materials	1	1
4.	Build house	2, 3	3
5.	Select paint	2, 3	1
6.	Select carpet	5	1
7.	Finish work	4, 6	1

The Project Network

Activity-on-Arc (AOA) Network

- A branch reflects an *activity* of a project.

- A node represents the beginning and end of activities, referred to as *events*.

- Branches in the network indicate *precedence relationships*.

- When an activity is completed at a node, it has been *realized*.
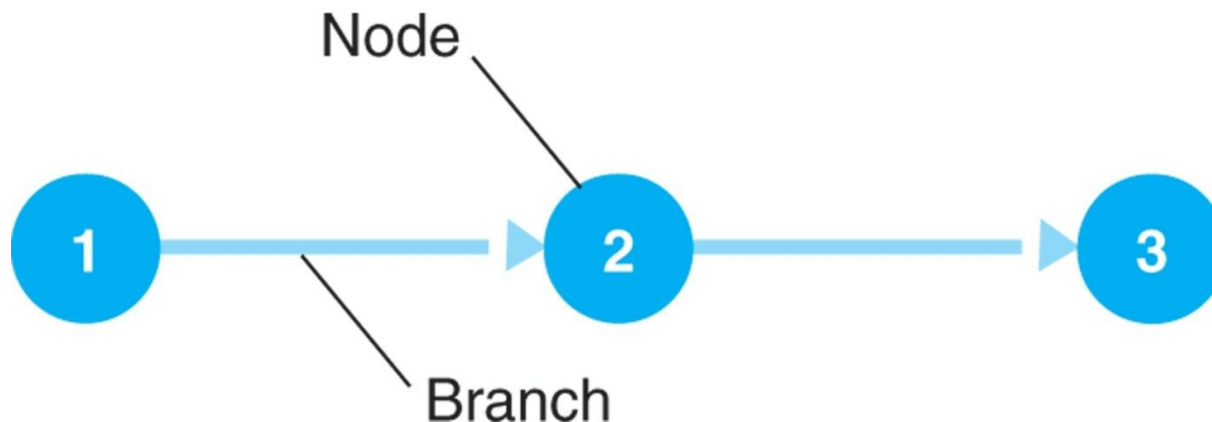
Figure 1.4. *Nodes and Branches*

The Project Network (Concurrent Activities)

- Network aids in planning and scheduling.
- Time duration of activities shown on branches.
- Activities can occur at the same time (concurrently).
- A *dummy activity* shows a *precedence relationship* but reflects no passage of time.
- Two or more activities cannot share the same start and end nodes.
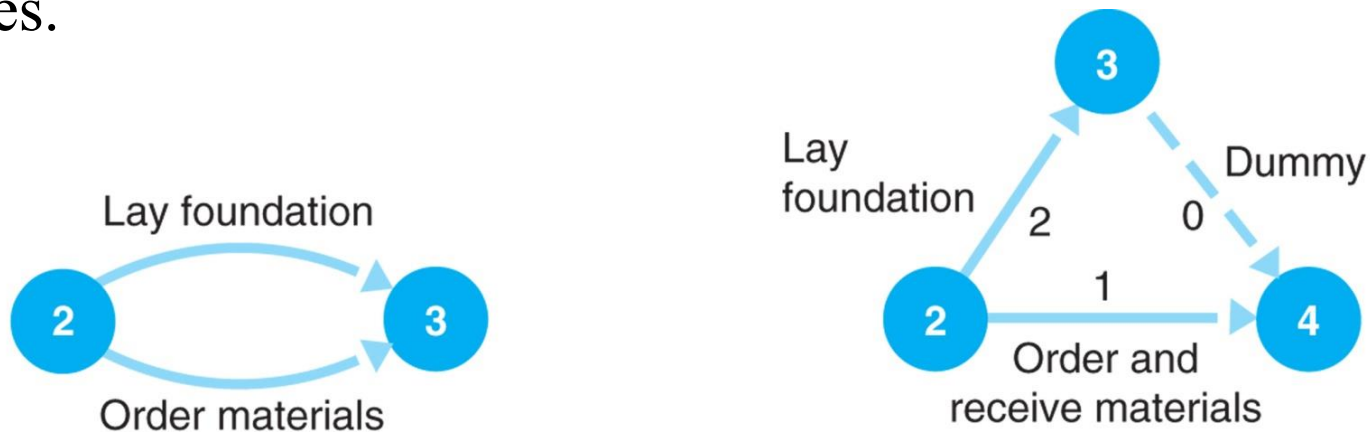
(a) Incorrect precedence relationship

(b) Correct precedence relationship

Figure 1.5. *A Dummy Activity*

The Project Network

AOA Network for House Building Project
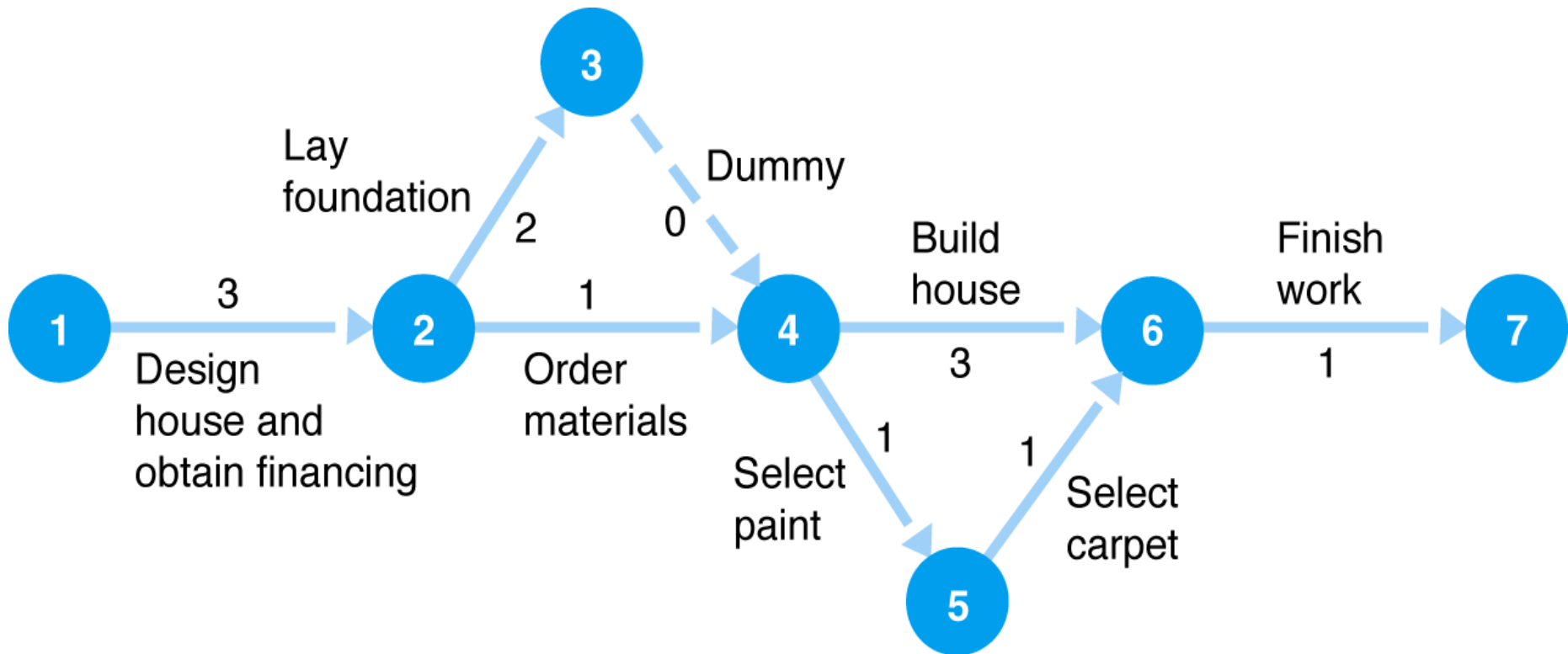
Figure 1.6. *Expanded Network for Building a House Showing Concurrent Activities*

The Project Network

Activity-on-Node (AON) Network
- A node represents an activity, with its label and time shown on the node
- The branches show the precedence relationships
- Convention used in Microsoft Project software.
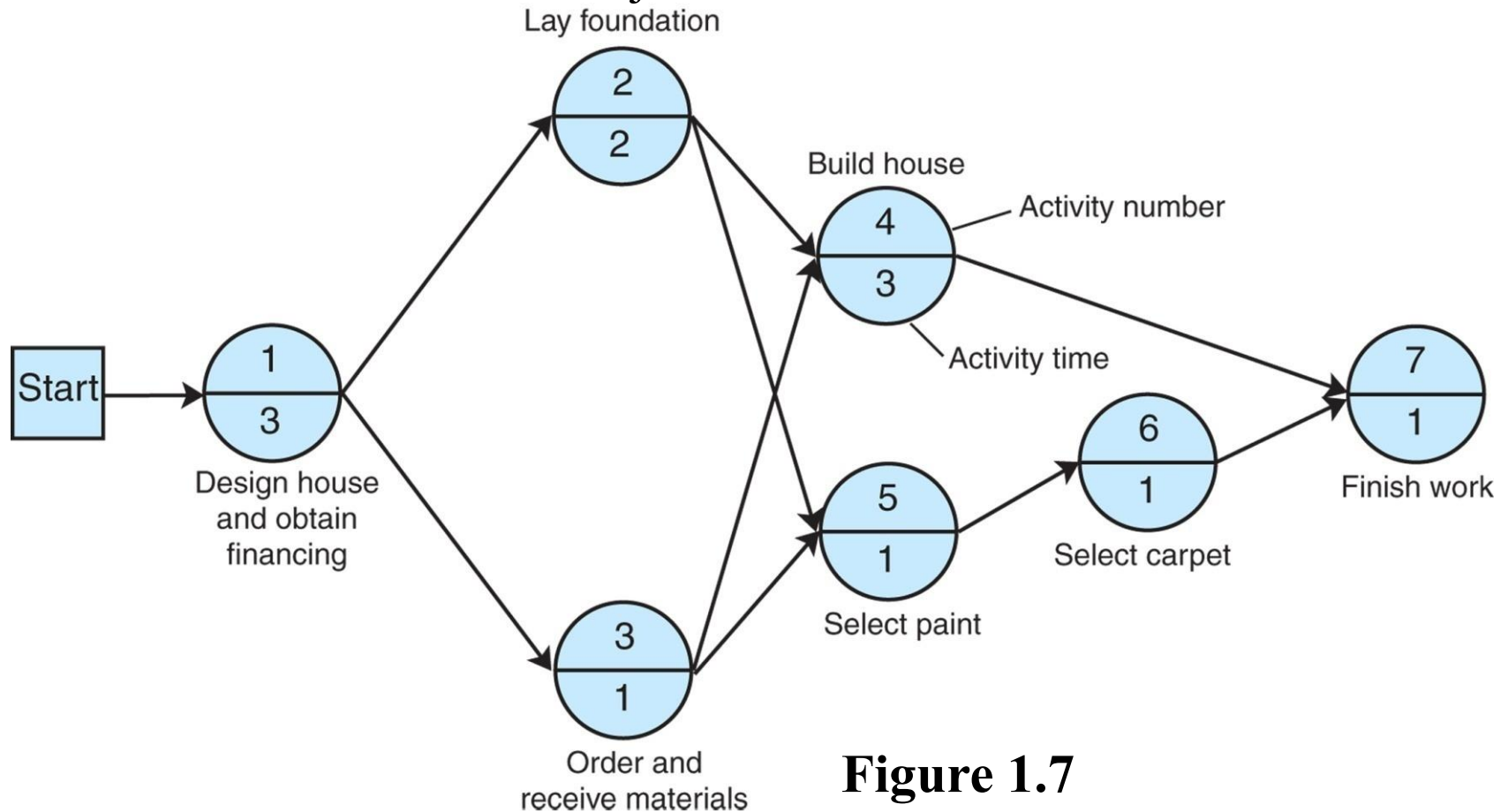
Figure 1.7

The Project Network

Paths Through a Network

Path	Events
A	1→2→4→7
B	1→2→5→6→7
C	1→3→4→7
D	1→3→5→6→7

Critical Path = All tasks with slack = zero

The *critical path* is the longest path through the network; the minimum time the network can be completed. From Figure 8.8:

Path A: 1 → 2 → 4 → 7   3 + 2 + 3 + 1 = 9 months

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

Path C: 1 → 3 → 4 → 7   3 + 1 + 3 + 1 = 8 months

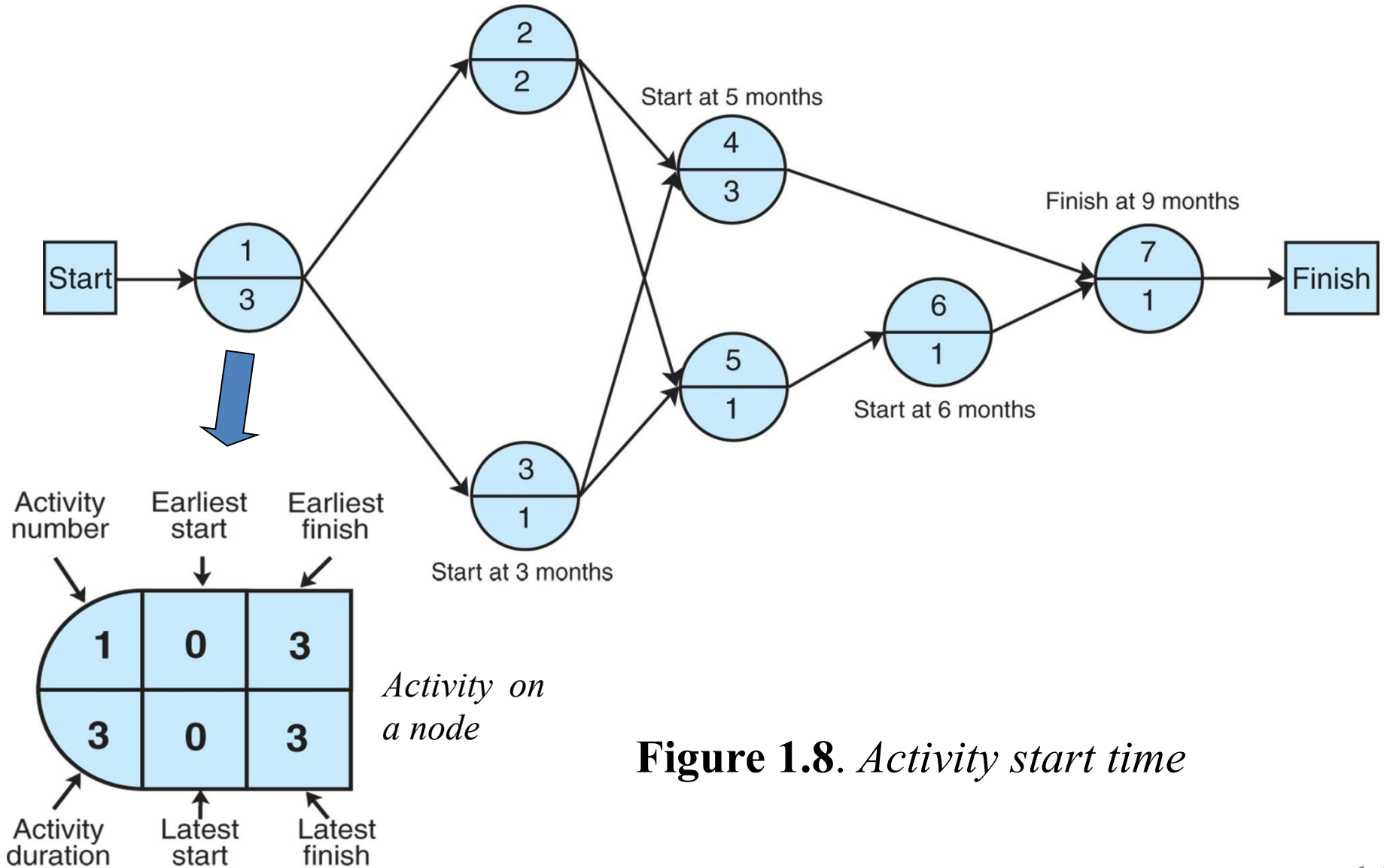Path D: 1 → 3 → 5 → 6 → 7   3 + 1 + 1 + 1 + 1 = 7 months

The Project Network

Figure 1.8. *Activity start time*

The Project Network (Earliest Times)

- ES is the earliest time an activity can start: ES = Maximum (EF)
- EF is the earliest start time plus the activity time: EF = ES + t
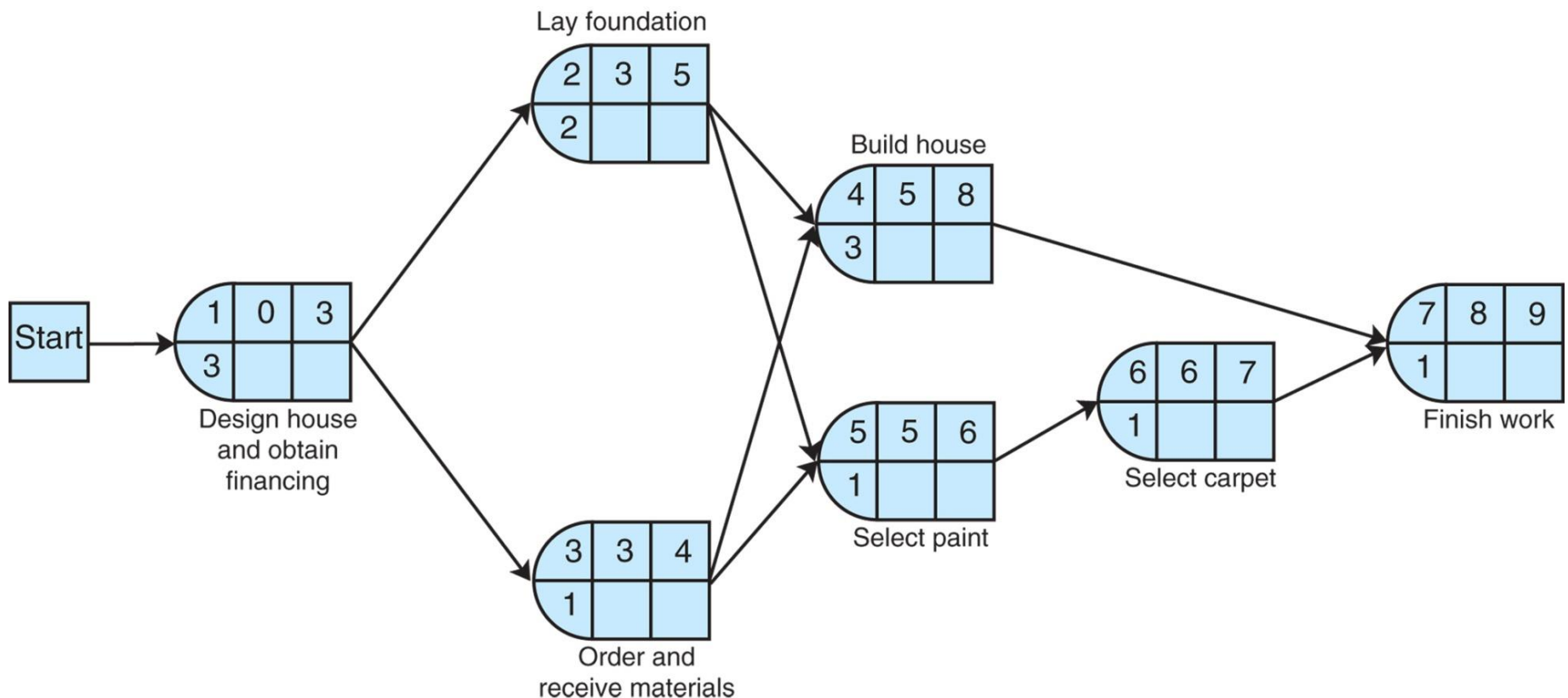

Figure 1.9. *Earliest activity start and finish times*

The Project Network (Latest Times)

- LS is the latest time an activity can start without delaying critical path time: LS = LF - t
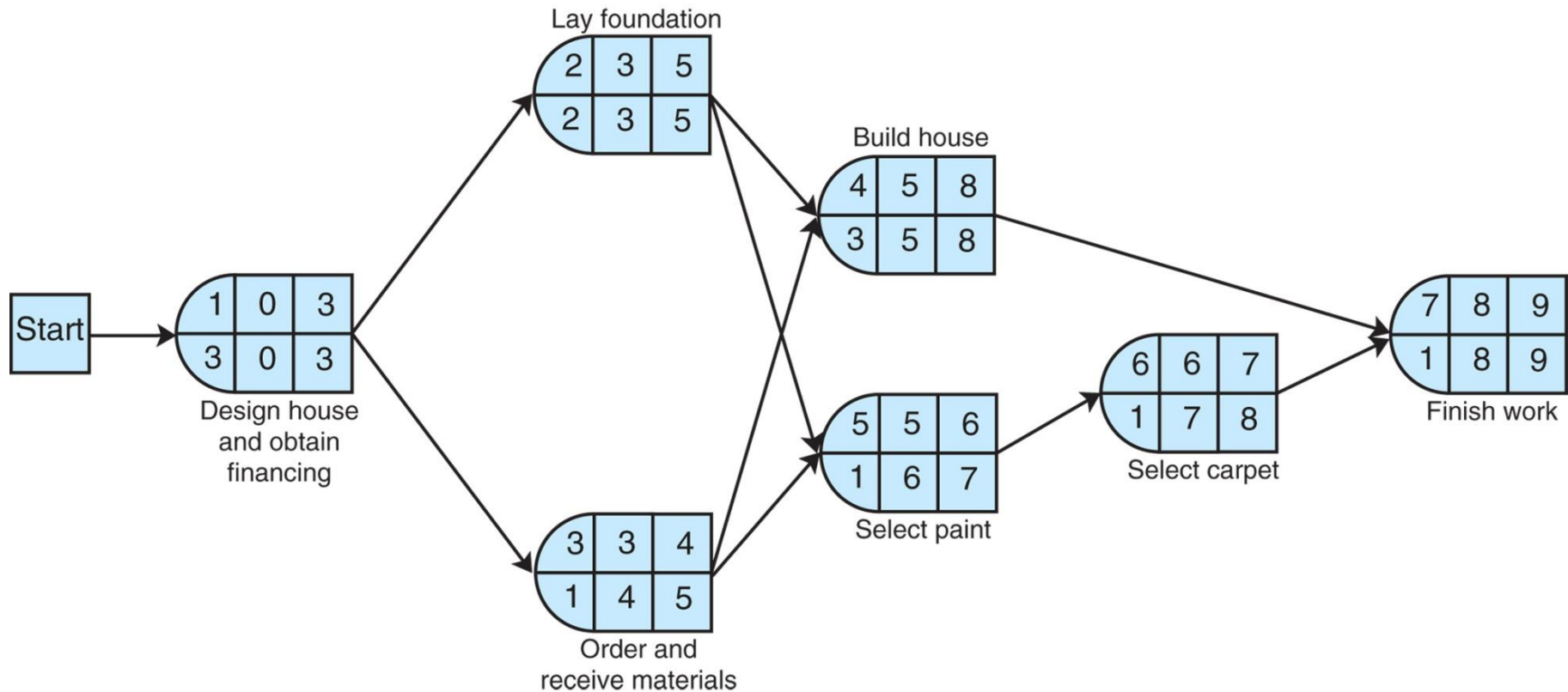- LF is the latest finish time. LF = Minimum (LS)

Figure 1.10. *Latest activity start and finish times*

The Project Network (Activity Slack Time)

- *Slack* is the amount of time an activity can be delayed without delaying the project: $S = LS - ES = LF - EF$
- *Slack Time* exists for those activities not on the critical path for which the earliest and latest start times are not equal.
- *Shared Slack* is slack available for a sequence of activities.

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

Table 1.3

*Critical path

The Project Network (Activity Slack Time)

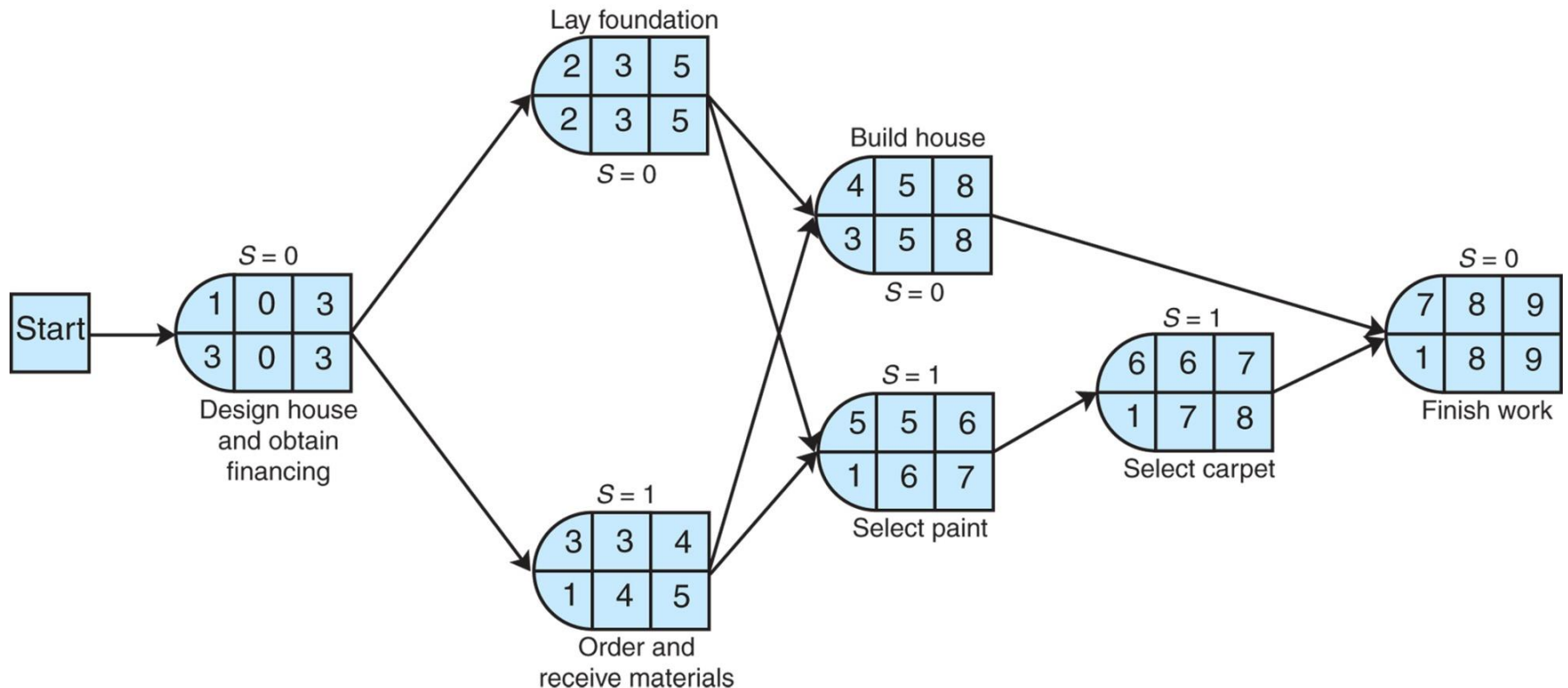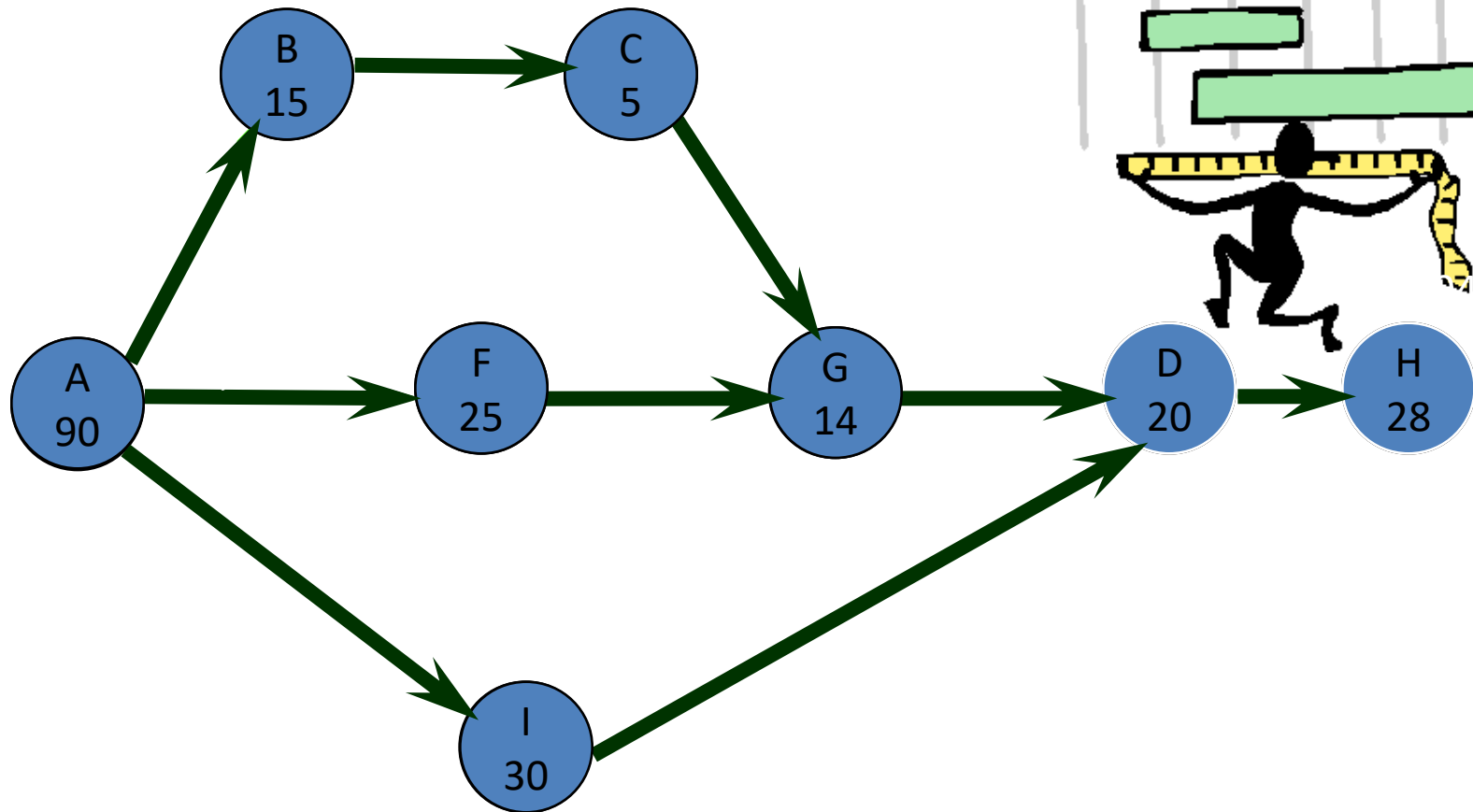**Critical path**: - The longest path through the network; s = 0

- Min time.

Figure 1.11. *Activity slack*

Home work

Data:

Find Critical path?