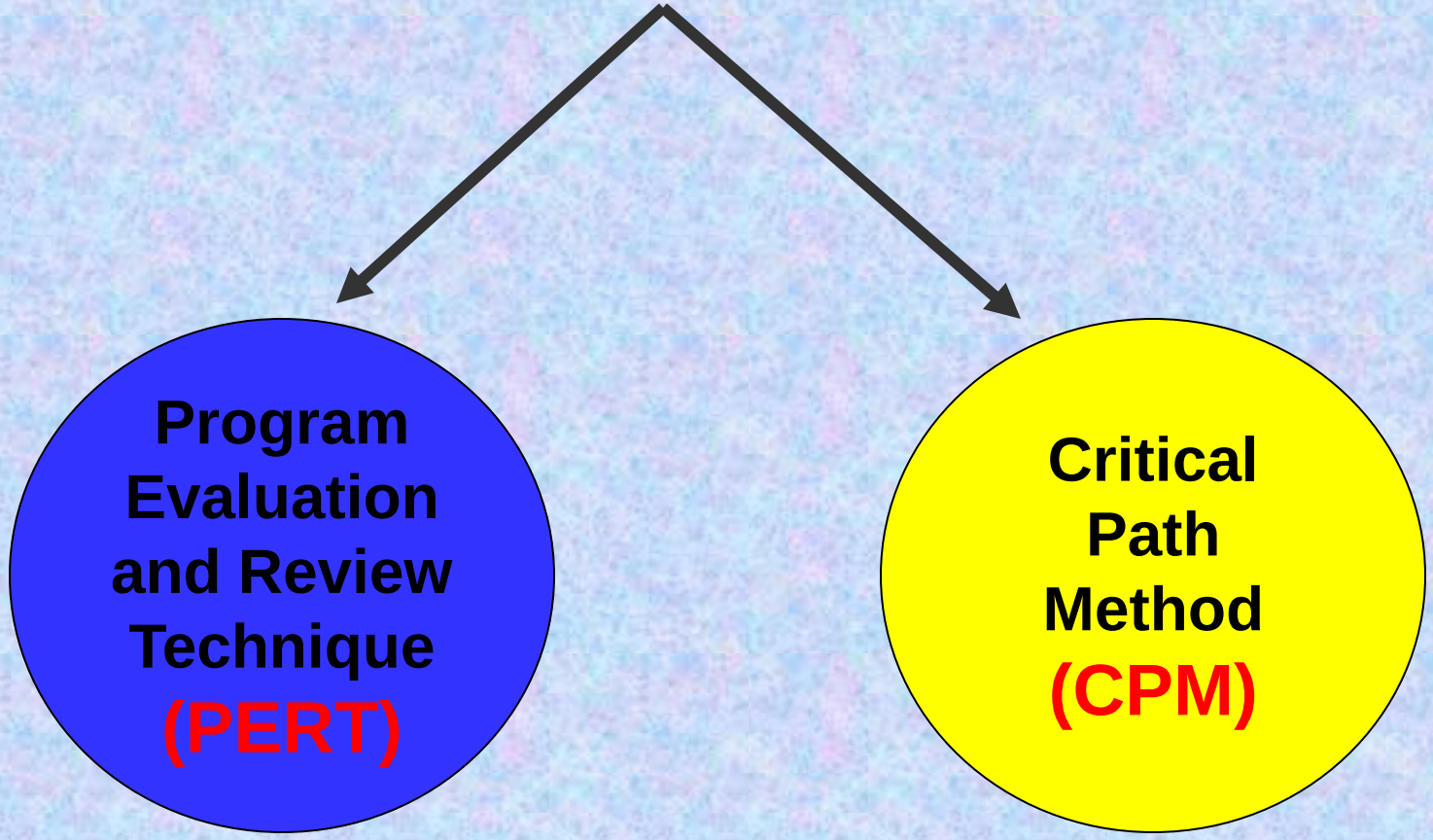
Lecture- 11

Project Scheduling

Dronacharya College of Engineering

Project Scheduling



Project Scheduling

Both techniques (PERT and CPM) are driven by information already developed in earlier project planning activities:

- Estimates of efforts
- Decomposition of product function
- selection of appropriate process model and task set
- Decomposition of tasks

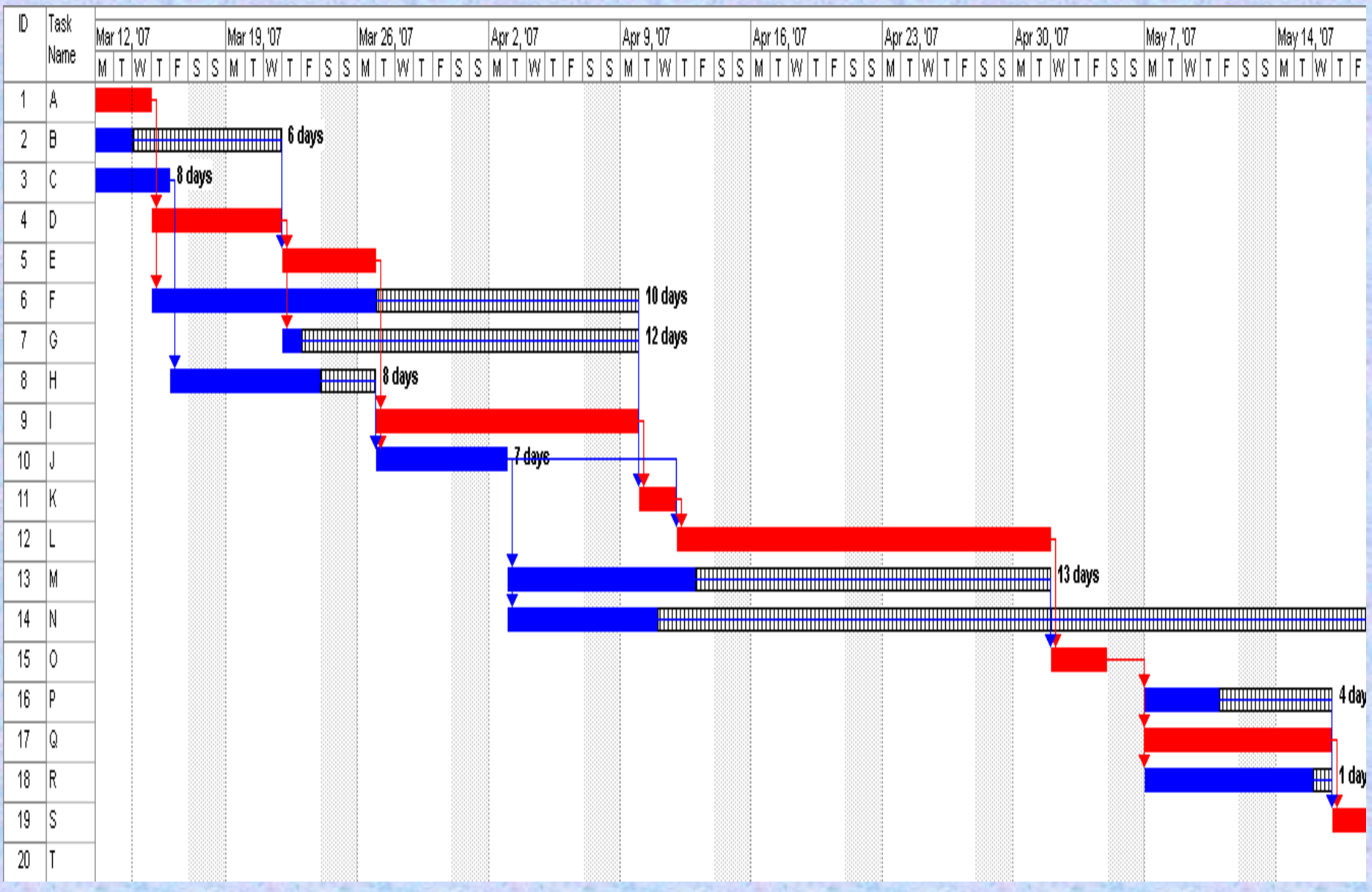
Project Scheduling

- Both PERT and CPM provides quantitative tools to
  - determine the critical path
  - establish the most likely time estimated for individual tasks by applying statistical models
  - calculate boundary time (window) for a particular task

Gantt Chart

- A GANTT chart is a type of bar chart that illustrates a project schedule.
- After the PERT/CPM analysis is completed, the following phase is to construct the GANTT chart and then to re-allocate resources and re-schedule if necessary.
- GANTT charts have become a common technique for representing the phases and activities of a project work breakdown structure.
- It was introduced by Henry Gantt around 1910 – 1915.

Gantt Chart


ID
Task Name
Mar 12, '07
Mar 19, '07
Mar 26, '07
Apr 2, '07
Apr 9, '07
Apr 16, '07
Apr 23, '07
Apr 30, '07
May 7, '07
May 14, '07
M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F
1 A
2 B
3 C
4 D
5 E
6 F
7 G
8 H
9 I
10 J
11 K
12 L
13 M
14 N
15 O
16 P
17 Q
18 R
19 S
20 T
6 days
8 days
10 days
12 days
8 days
7 days
13 days
4 day
1 day

Gantt Chart

- **Characteristics:**
  - ❖ The bar in each row identifies the corresponding task
  - ❖ The horizontal position of the bar identifies start and end times of the task
  - ❖ Bar length represents the duration of the task
  - ❖ Task durations can be compared easily
  - ❖ Good for allocating resources and re-scheduling
  - ❖ Precedence relationships can be represented using arrows
  - ❖ Critical activities are usually highlighted
  - ❖ Slack times are represented using bars with doted lines
  - ❖ The bar of each activity begins at the activity earliest start time (ES)
  - ❖ The bar of each activity ends at the activity latest finish time (LF).

Gantt Chart

- Advantages
  - Simple
  - Good visual communication to others
  - Task durations can be compared easily
  - Good for scheduling resources
- Disadvantages
  - Dependencies are more difficult to visualise
  - Minor changes in data can cause major changes in the chart

Constructing Gantt Chart

- **The steps to construct a GANTT chart from the information obtained by PERT/CPM are:**
  1. **Schedule the critical tasks in the correct position.**
  2. **Place the time windows in which the non-critical tasks can be scheduled.**
  3. **Schedule the non-critical tasks according to their earliest starting times.**
  4. **Indicate precedence relationships between tasks.**

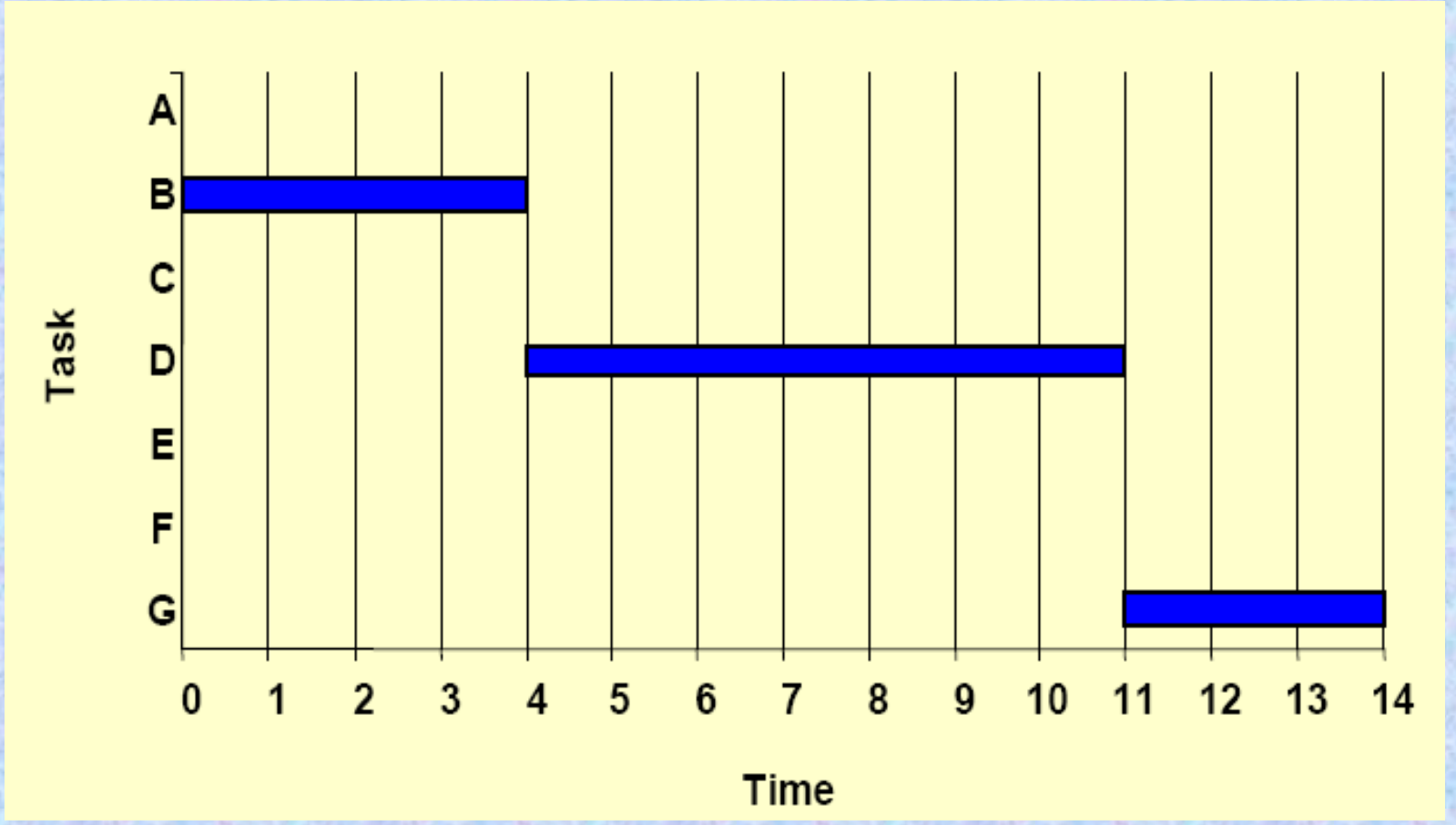
Constructing Gantt Chart

- **Example of an early GANTT chart construction:**

Task	Duration	Precedence	ES	EF	LS	LF	Slack Time	Critical Task
A	3		0	3	3	6	3	N
B	4		0	4	0	4	0	Y
C	5	A	3	8	6	11	3	N
D	7	B	4	11	4	11	0	Y
E	2	B	4	6	8	10	4	N
F	4	E	6	10	10	14	4	N
G	3	C,D	11	14	11	14	0	Y

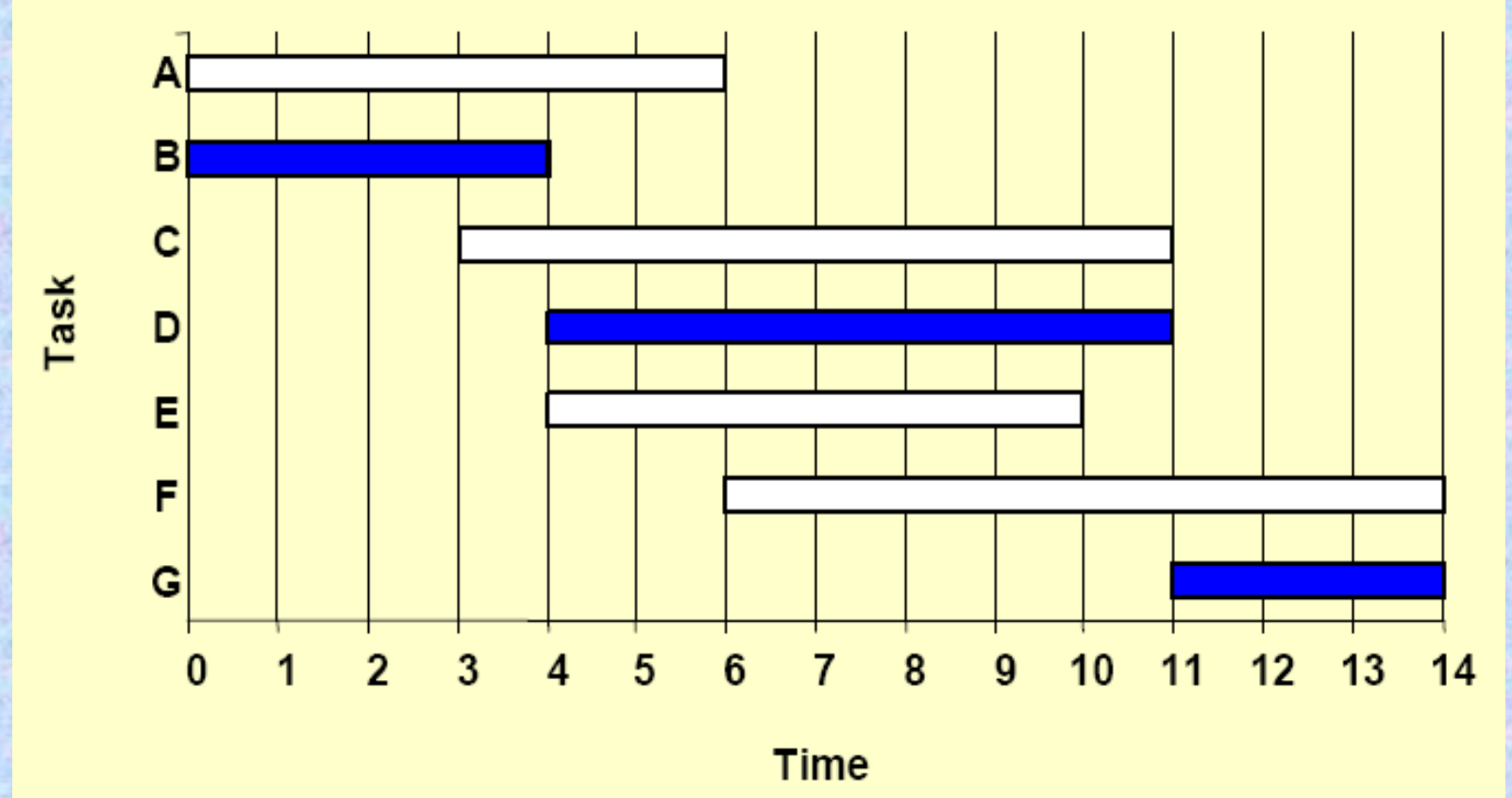
Constructing Gantt Chart

Step 1. Schedule critical tasks:



Constructing Gantt Chart

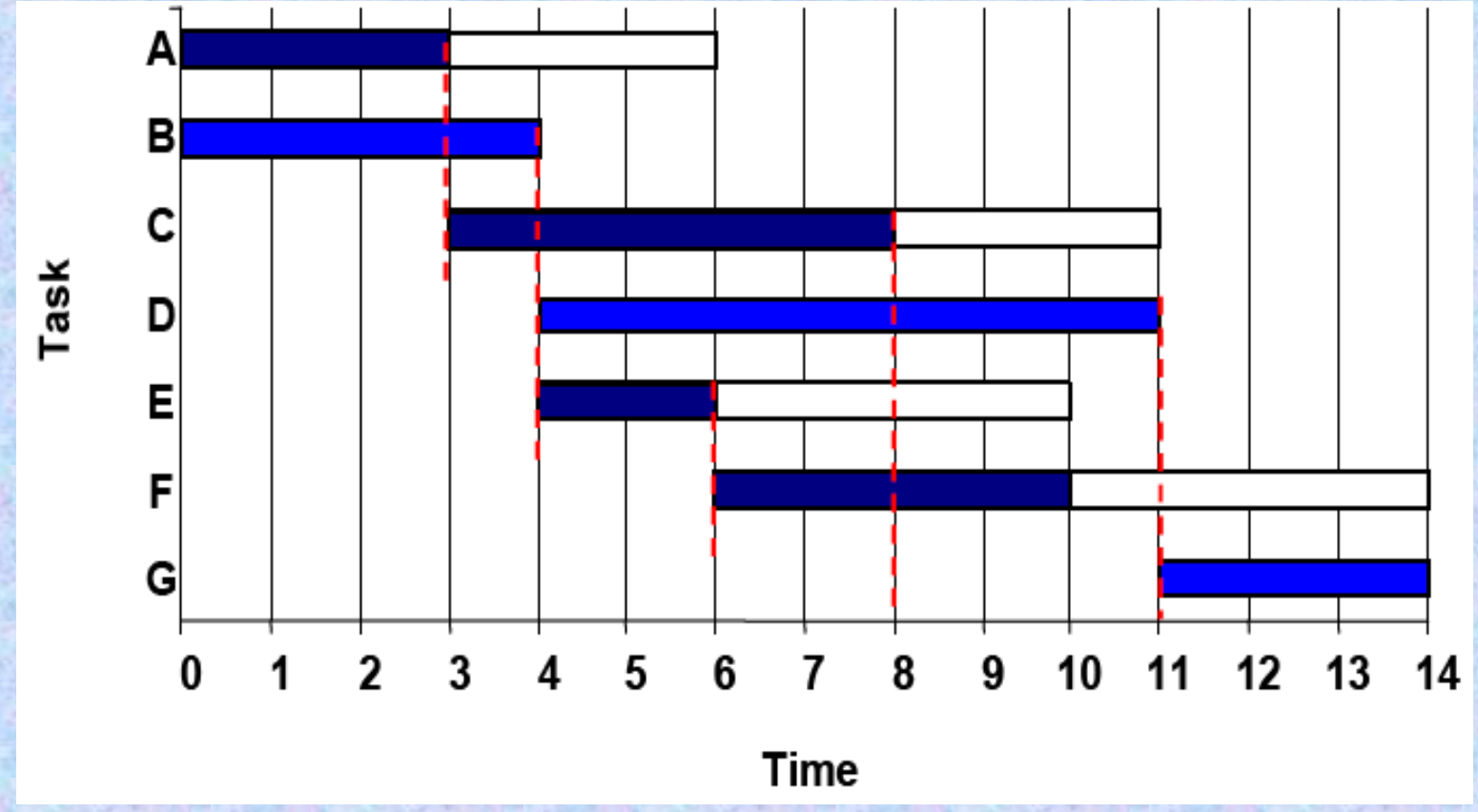
Step 2. Place time windows for non-critical tasks:



Constructing Gantt Chart

Step 3. Schedule non-critical tasks

Step 4. Indicate precedence relationships:



Staffing & Re-scheduling

- Once the project schedule, (*e.g. GANTT chart),* has been constructed, take into account
  - available staff hours
  - slack times and
  - the project schedule

Assign staff and other resources to each activity in the project

Staffing & Re-scheduling

- **Resource Smoothing** is a technique used to *re-allocate resources* and *re-schedule activities.*
- In resource smoothing, **non-critical tasks** are **re-scheduled** within their time window.
- **Staff Utilization***:(duration of activity x staff required for each activity*, all added together) / (*maximum staff required x duration of project*)

Staffing & Re-scheduling

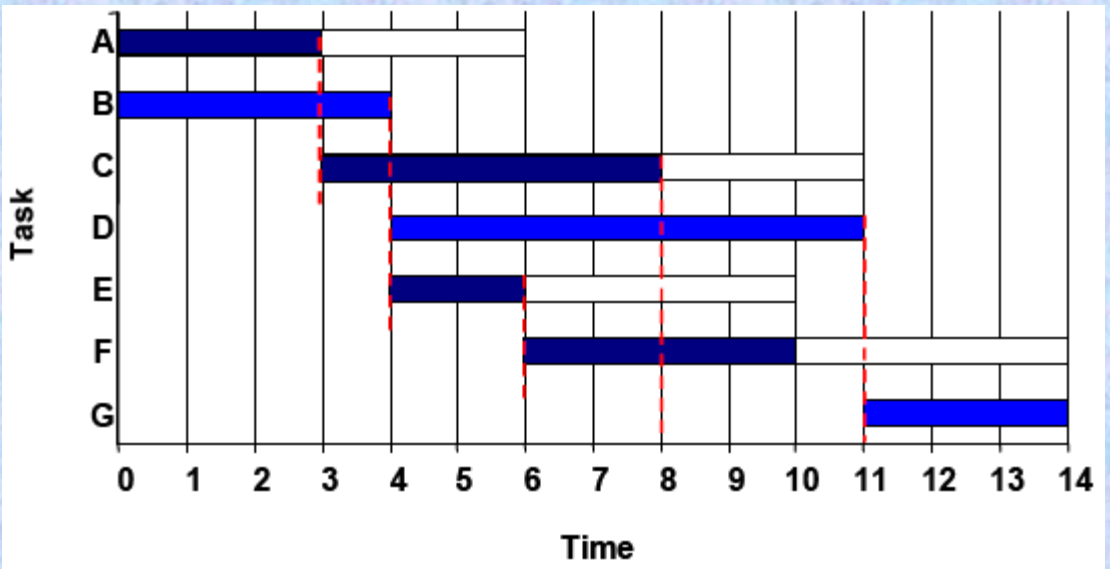
Example1

Task	Duration	Precedence	ES	EF	LS	LF	Slack Time	Critical Task
A	3		0	3	3	6	3	N
B	4		0	4	0	4	0	Y
C	5	A	3	8	6	11	3	N
D	7	B	4	11	4	11	0	Y
E	2	B	4	6	8	10	4	N
F	4	E	6	10	10	14	4	N
G	3	C,D	11	14	11	14	0	Y

Staffing & Re-scheduling

The original schedule (constructed above) for this project is as shown below.

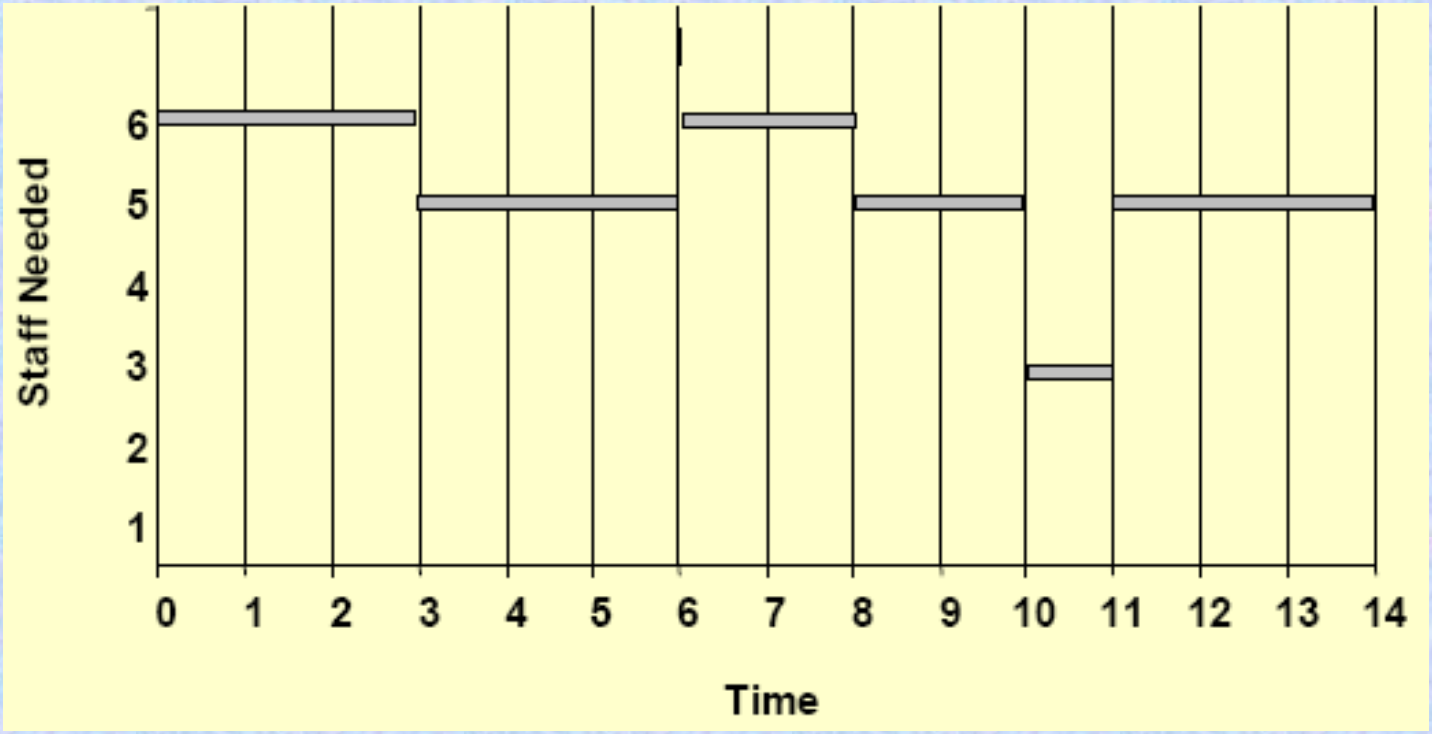
Task	Duration	Staff Needed
A	3	2
B	4	4
C	5	1
D	7	3
E	2	1
F	4	2
G	3	5



1. Staff utilisation = (3x2+4x4+5x1+7x3+2x1+4x2+3x5)/(14x6) = 0.857 = 85.5%

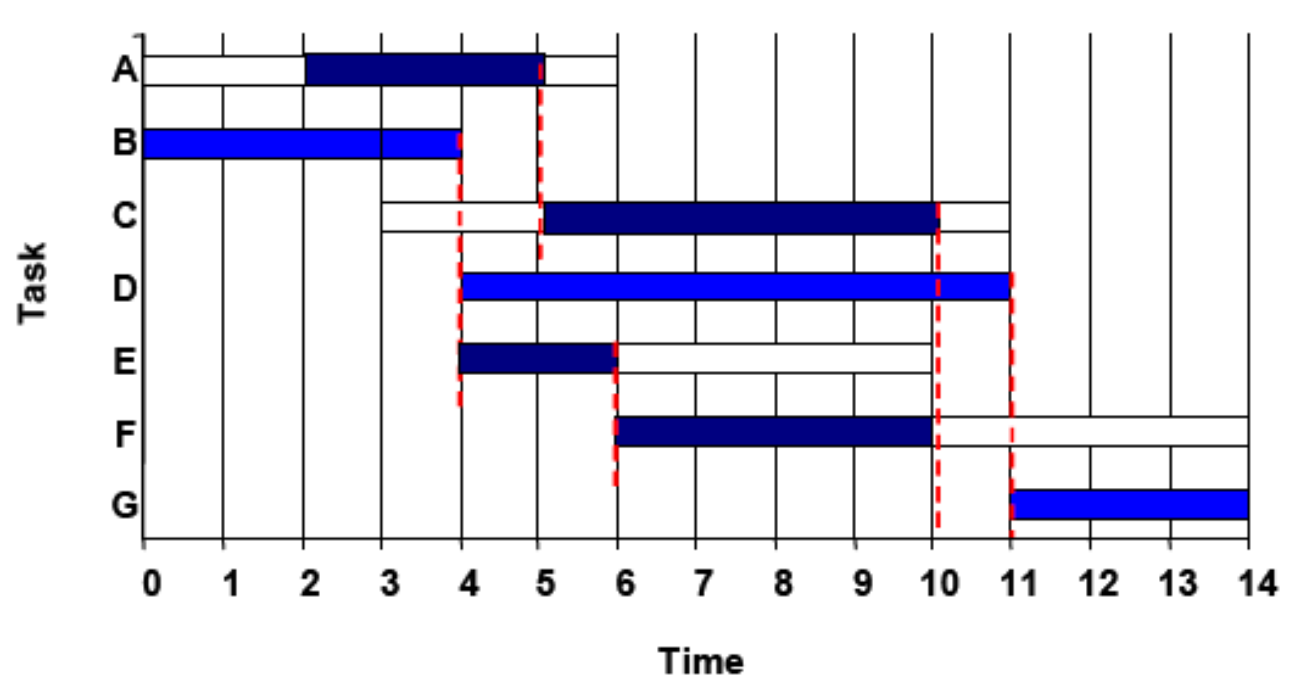
Staffing & Re-scheduling

2. Work out the Staff Profile



Staffing & Re-scheduling

- Now, assume that there are 6 people available for working in this project but one of them returns from holidays at time=2.
- So *re-scheduling* is needed because activities A and B cannot be carried out in parallel until time=2.



Comparison of Gantt and PERT Charts

- **Gantt**
  - Visually shows duration of tasks
  - Visually shows time overlap between tasks
  - Visually shows slack time
- **PERT**
  - Visually shows dependencies between tasks
  - Visually shows which tasks can be done in parallel
  - Shows slack time by data in rectangles

Tracking the Project Schedule

- It is a road map for the Software Project
- It defines the tasks and milestones
- Tracking can be done by:
  - Conducting periodic project status meetings
  - Evaluating the results of all reviews
  - Determining whether milestones were reached by the scheduled date
  - Compare actual start date to planned start date
  - Meeting informally with professionals to get their subjective opinion
  - Using earned value analysis

Tracking the Project Schedule

Administer Project Resources

Control

Cope with problems

Direct Project staff

Tracking the Project Schedule

Project is on schedule and within budget

Project Tracking

Problem diagnosed

Additional resources focussed on problem area

Staff may be redeployed

Project Schedule can be redefined

Team Structure

- Problems of different complexities and sizes require different team structures:
  - Chief-programmer team
  - Democratic team
  - Mixed organization

Democratic Teams

- **Suitable for:**
  - **small projects requiring less than five or six engineers**
  - **research-oriented projects**
- **A manager provides administrative leadership:**
  - **at different times different members of the group provide technical leadership.**

Democratic Teams

- **Democratic organization provides**
  - **higher morale and job satisfaction to the engineers**
  - **therefore leads to less employee turnover.**
- **Suitable for less understood problems,**
  - **a group of engineers can invent better solutions than a single individual.**

Democratic Teams

- Disadvantage:
  - team members may waste a lot time arguing about trivial points:
    - absence of any authority in the team.

Chief Programmer Team

- A senior engineer provides technical leadership:
  - partitions the task among the team members.
  - verifies and integrates the products developed by the members.

Chief Programmer Team

- Works well when
  - the task is well understood
    - also within the intellectual grasp of a single individual,
  - importance of early completion outweighs other factors
    - team morale, personal development, etc.

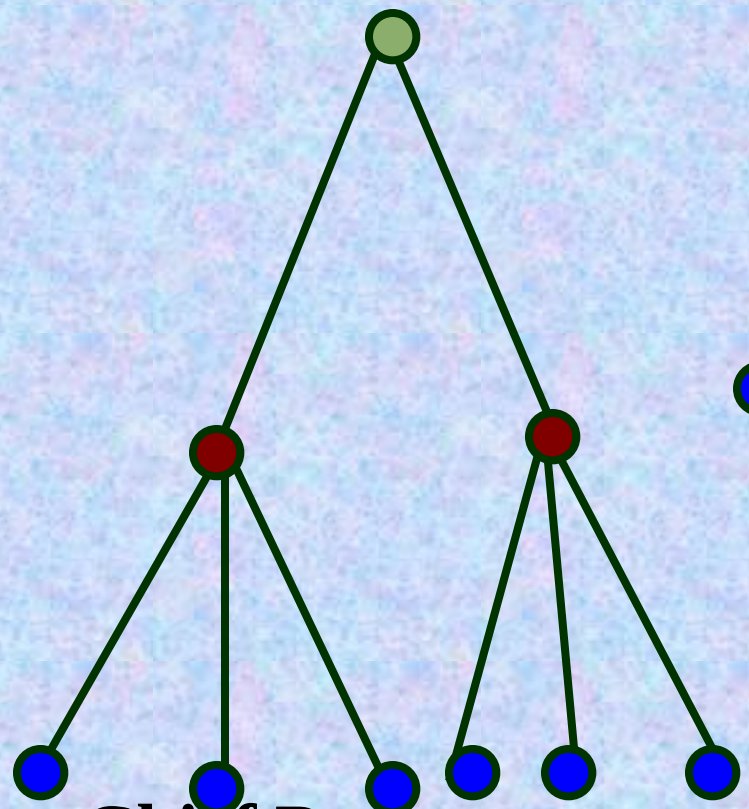
Chief Programmer Team

- Chief programmer team is subject to **single point failure**:
  - too much responsibility and authority is assigned to the chief programmer.

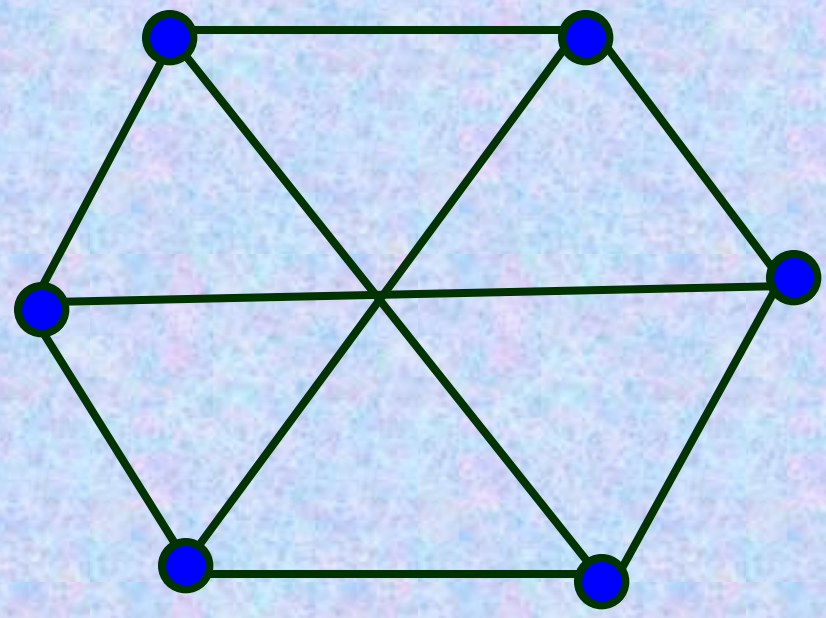
Mixed Control Team Organization

- Draws upon ideas from both:
  - democratic organization and
  - chief-programmer team organization.
- Communication is limited
  - to a small group that is most likely to benefit from it.
- Suitable for large organizations.

Team Organization



Chief Programmer team



Democratic Team

Mixed team organization