COMP201 – Software Engineering I
Lecture 30 – Project Management

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See Vital for all notes

Project Management

- Organising, planning and scheduling software projects

Objectives

- To introduce **software project management** and to describe its distinctive characteristics
- To discuss **project planning** and the **planning process**
- To show how **graphical schedule representations** are used by project management
- To discuss the notion of **risks** and the risk management process

Topics Covered

- Management activities
- Project planning
- Project scheduling
- Risk management

Software Project Management

- Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organisations developing and procuring the software
- **Project management** is needed because software development is always subject to budget and schedule constraints that are set by the organisation developing the software

Software Management Distinctions

- The product is **intangible**
- **Software engineering** is not recognized as an engineering discipline with the same status as mechanical, electrical engineering, etc.
- The software development process is **not standardised**
- Many software projects are '**one-off**' projects

Management Activities

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations

Management Commonalities

- These activities are not peculiar to software management
- Many techniques of engineering project management are **equally applicable** to software project management
- Technically complex engineering systems tend to suffer from the same problems as software systems

Project Staffing

- May not be possible to appoint the **ideal** people to work on a project
  - **Project budget** may not allow for the use of highly-paid staff
  - Staff with the **appropriate experience** may not be available
  - An organisation may wish to **develop employee skills** on a software project
- Managers have to **work within these constraints** especially when (as is currently the case) there is an international shortage of skilled IT staff

Project Planning

- Probably the **most time-consuming** project management activity
- **Continuous activity** from initial concept through to system delivery.
- Plans must be **regularly revised** as new information becomes available
- Various different types of plan may be developed to support the main project plan

Types of Project Plan

Plan	Description
Quality plan	Describes the quality procedures and standards that will be used in a project.
Validation plan	Describes the approach, resources and schedule used for system validation.
Configuration management plan	Describes the configuration management procedures and structures to be used.
Maintenance plan	Predicts the maintenance requirements of the system, maintenance costs and effort required.
Staff development plan.	Describes how the skills and experience of the project team members will be developed.

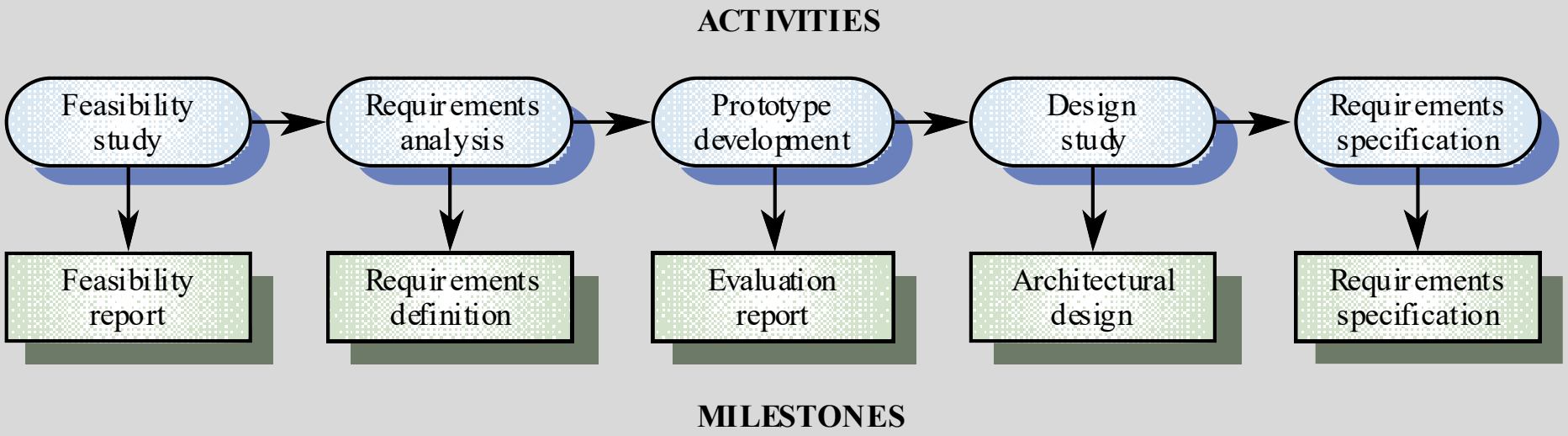
Project Plan Structure

- Introduction
- Project organisation
- Risk analysis
- Hardware and software resource requirements
- Work breakdown
- Project schedule
- Monitoring and reporting mechanisms

Activity Organization

- Activities in a project should be organised to produce ***tangible outputs*** for management to judge progress
- ***Milestones*** are the end-point of a process activity
- ***Deliverables*** are project results delivered to customers
- The waterfall process allows for the straightforward definition of progress milestones

Milestones in the Requirements Engineering Process



Project Scheduling

- Split project into tasks
- Estimate time and resources required for each task
- Organize tasks **concurrently** to make optimal use of workforce
- Minimize **task dependencies** to avoid delays
- Effectiveness is dependent on project managers intuition and experience

Scheduling Problems

- **Estimating the difficulty** of problems is hard to do
  - Therefore, **estimating cost** of developing a solution is hard
- Productivity is **not proportional** to the number of people working on a task
- Adding people to a late project can make it **even later** because of communication overheads
- The unexpected **always happens**.
- Always allow for **contingency** in planning

Bar Charts and Activity Networks

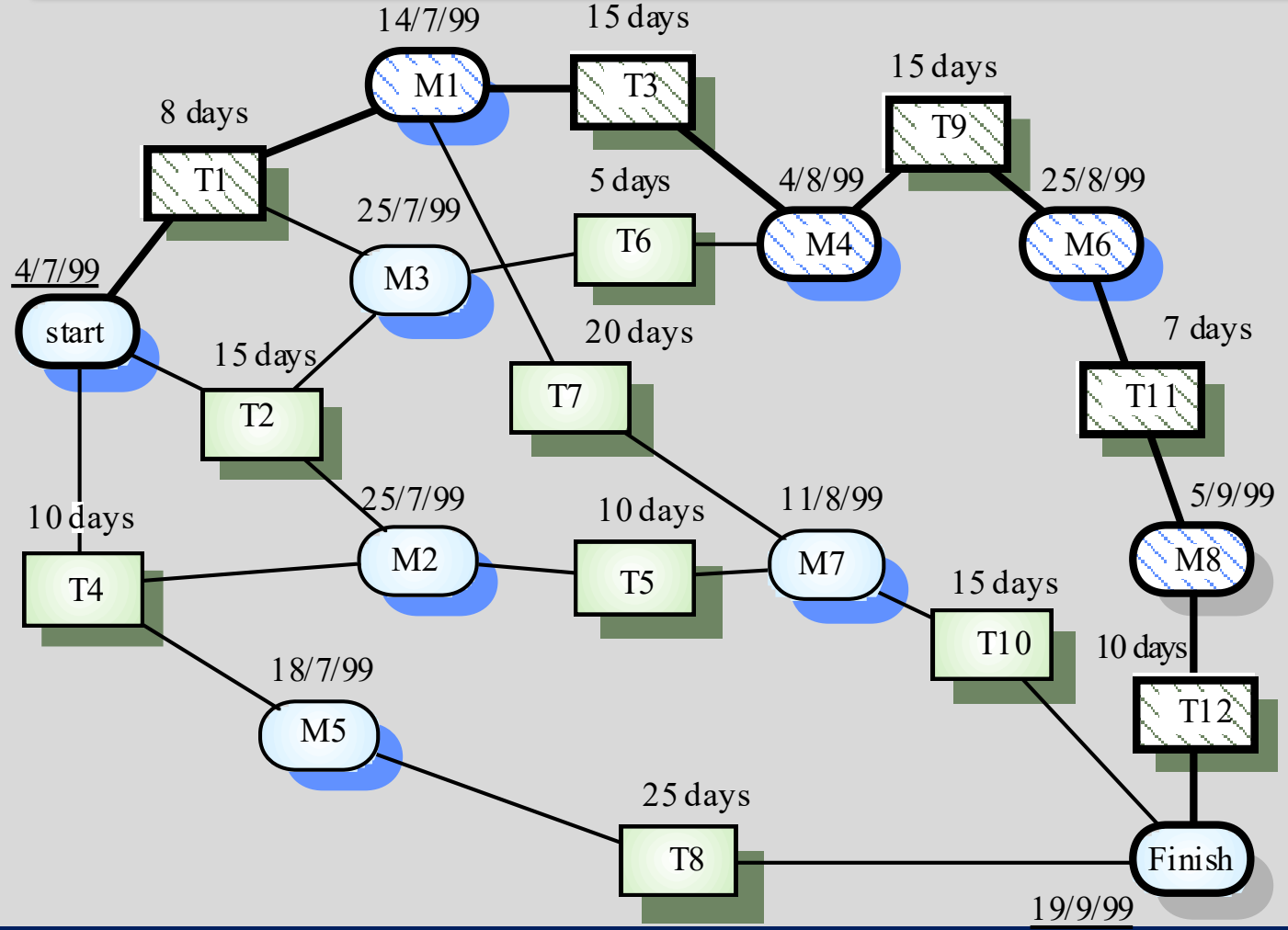
- Graphical notations used to **illustrate the project schedule**
- Show project **breakdown into tasks**.
  - Tasks should not be too small (1 week / 2weeks)
- **Activity charts** show task dependencies and the **critical path**
- **Bar charts** show schedule against calendar time

Task Durations and Dependencies

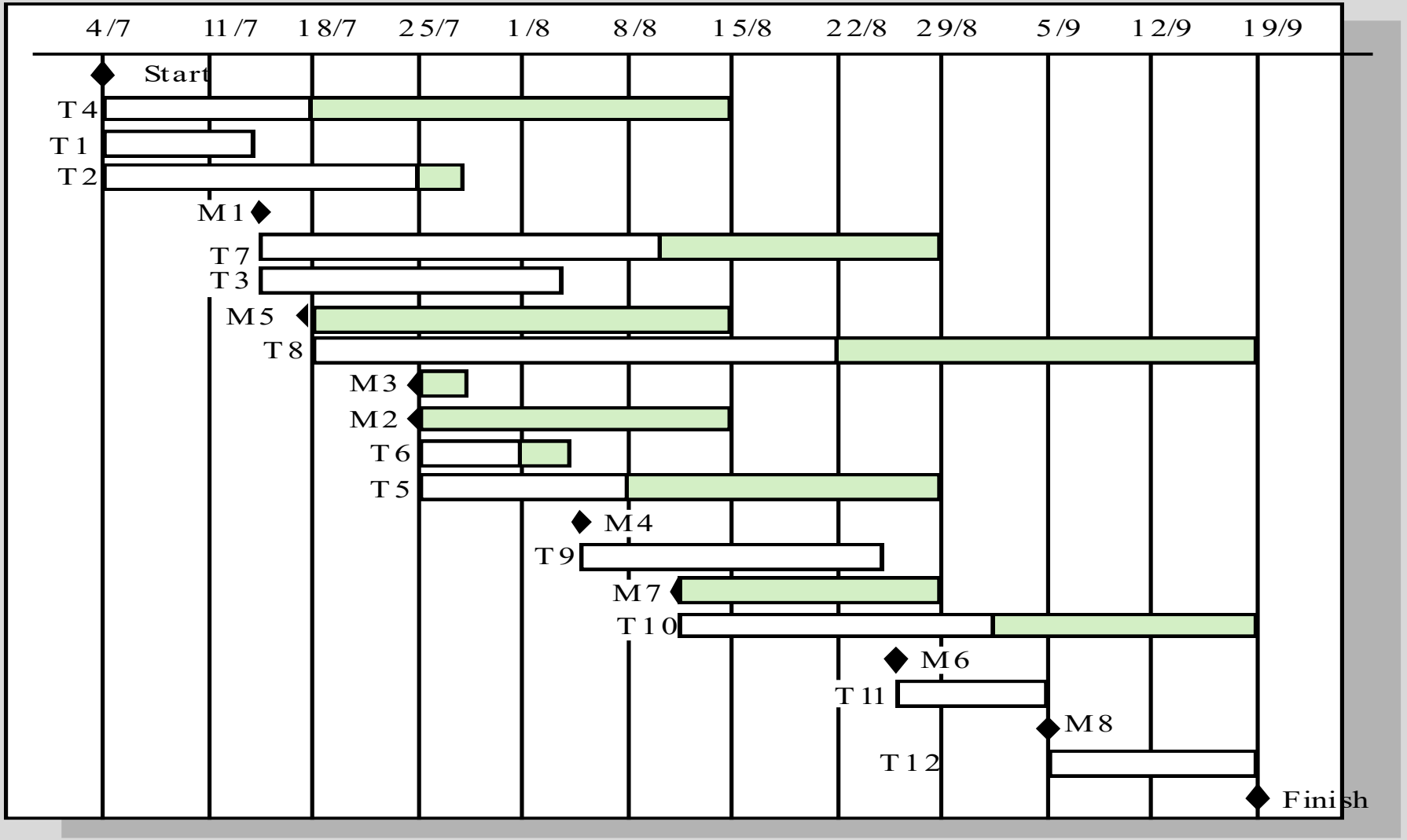
Task	Duration (days)	Dependencies
T1	8	
T2	15	
T3	15	T1(M1)
T4	10	
T5	10	T2,T4 (M2)
T6	5	T1,T2 (M3)
T7	20	T1 (M1)
T8	25	T4 (M5)
T9	15	T3,T6 (M4)
T10	15	T5,T7 (M7)
T11	7	T9(M6)
T12	10	T11(M8)

Activity Network

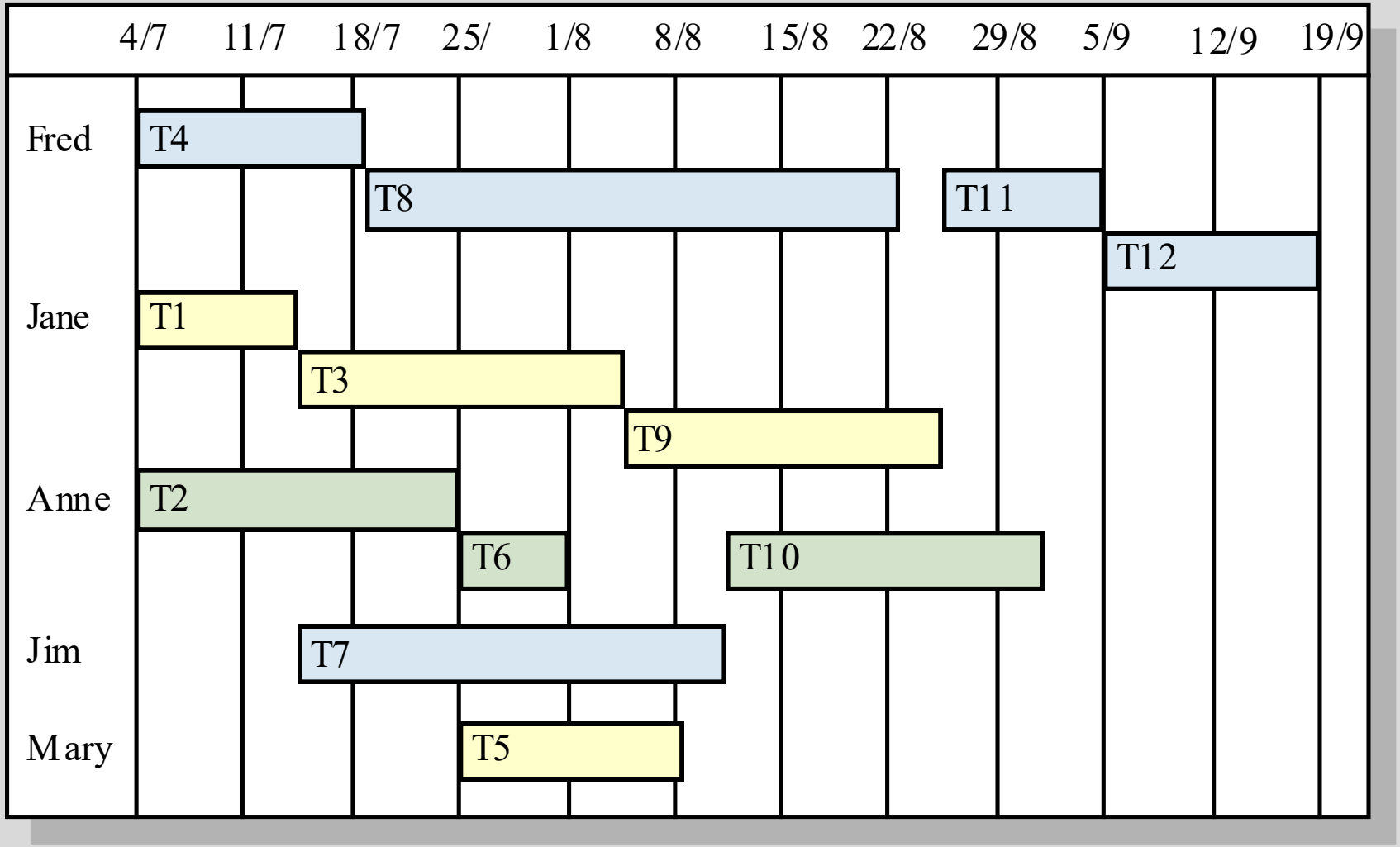
Minimal Time to finish = Length of longest (critical) path -> 55 days



Activity Timeline



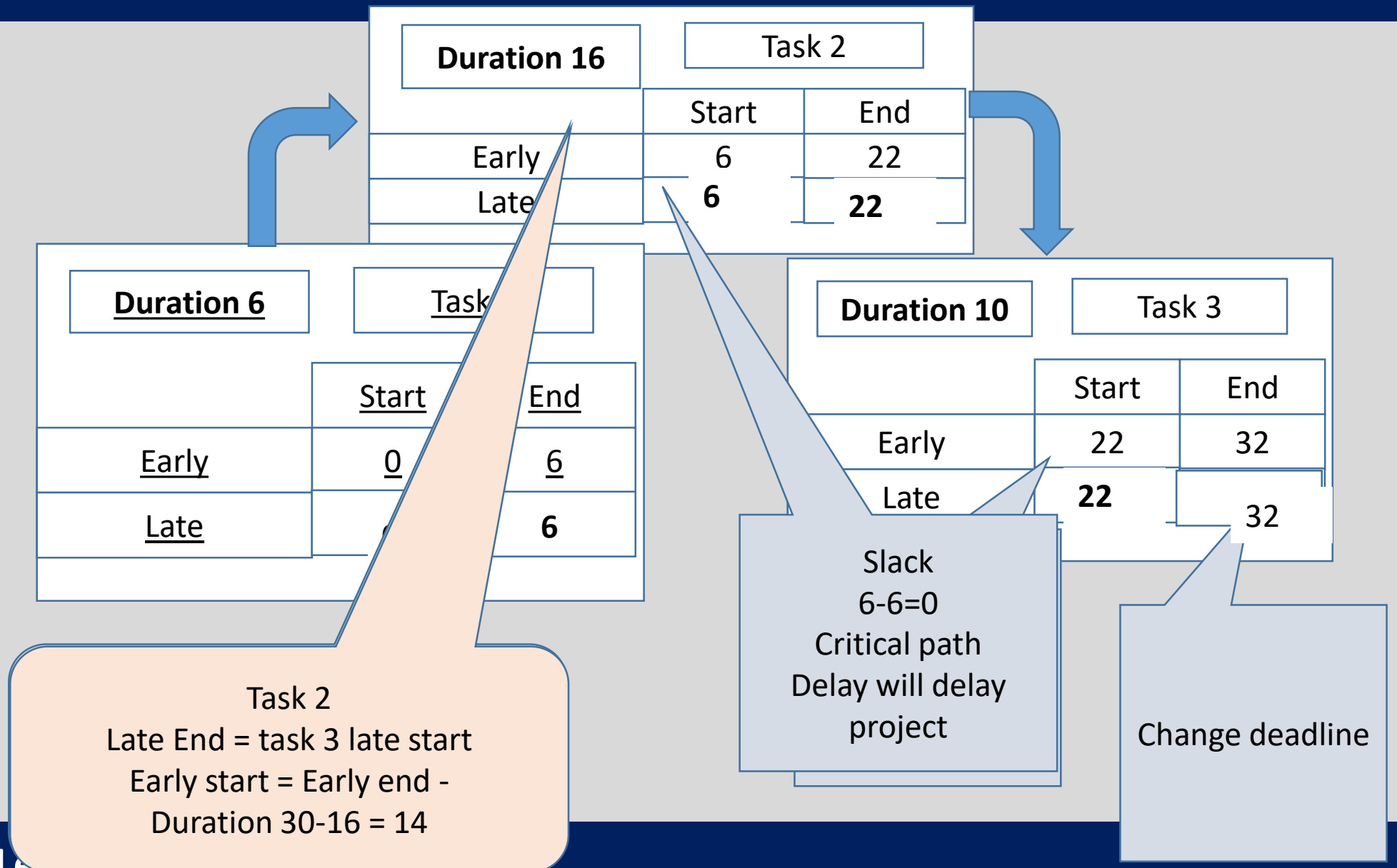
Staff Allocation



Pert charts

- Define for each task:
  - Dependencies
  - Early start
    - Earliest time the task can start (given its dependencies)
  - Early end
    - Earliest time the task can end (given its dependencies)
  - Late start
    - Latest time the task can start without delaying the deadline
  - Late end
    - Latest time the project can end without delaying the deadline
  - Slack
    - Amount task can be delayed without delaying the project
    - Slack = 0 task is CRITICAL

Pert charts


Duration 16
Task 2
Start
End
Early
6
22
Late
6
22
Duration 6
Task
Start
End
Early
0
6
Late
6
Duration 10
Task 3
Start
End
Early
22
32
Late
22
32
Task 2
Late End = task 3 late start
Early start = Early end -
Duration 30-16 = 14
Slack
6-6=0
Critical path
Delay will delay
project
Change deadline

Risk Management

- **Identifying** risks and planning to **minimise their effect** on a project.
- A risk is a probability that some adverse circumstance will occur.
  - Project risks affect **schedule** or **resources**
  - Product risks affect the **quality** or **performance** of the software being developed
  - Business risks affect the **organisation** developing or procuring the software

The Risk Management Process

- Risk identification
  - Identify project, product and business risks
- Risk analysis
  - Assess the likelihood and consequences of these risks
- Risk planning
  - Draw up plans to avoid or minimise the effects of the risk
- Risk monitoring
  - Monitor the risks throughout the project

Risk Identification

- Technology risks
- People risks
- Organisational risks
- Requirements risks
- Estimation risks

Risks and Risk Types

Risk type	Possible risks
Technology	The database used in the system cannot process as many transactions per second as expected. Software components which should be reused contain defects which limit their functionality.
People	It is impossible to recruit staff with the skills required. Key staff are ill and unavailable at critical times. Required training for staff is not available.
Organisational	The organisation is restructured so that different management are responsible for the project. Organisational financial problems force reductions in the project budget.
Tools	The code generated by CASE tools is inefficient. CASE tools cannot be integrated.
Requirements	Changes to requirements which require major design rework are proposed. Customers fail to understand the impact of requirements changes.
Estimation	The time required to develop the software is underestimated. The rate of defect repair is underestimated. The size of the software is underestimated.

Risk Analysis

- Assess probability and seriousness of each risk
- **Probability** may be very low, low, moderate, high or very high
- **Risk effects** might be catastrophic, serious, tolerable or insignificant

Risk Analysis

Risk	Probability	Effects
Organisational financial problems force reductions in the project budget.	Low	Catastrophic
It is impossible to recruit staff with the skills required for the project.	High	Catastrophic
Key staff are ill at critical times in the project.	Moderate	Serious
Software components which should be reused contain defects which limit their functionality.	Moderate	Serious
Changes to requirements which require major design rework are proposed.	Moderate	Serious
The organisation is restructured so that different management are responsible for the project.	High	Serious
The database used in the system cannot process as many transactions per second as expected.	Moderate	Serious
The time required to develop the software is underestimated.	High	Serious
CASE tools cannot be integrated.	High	Tolerable
Customers fail to understand the impact of requirements changes.	Moderate	Tolerable
Required training for staff is not available.	Moderate	Tolerable
The rate of defect repair is underestimated.	Moderate	Tolerable
The size of the software is underestimated.	High	Tolerable
The code generated by CASE tools is inefficient.	Moderate	Insignificant

Risk Planning

- Consider each risk and develop a strategy to manage that risk
- **Avoidance strategies**
  - The probability that the risk will arise is reduced
- **Minimisation strategies**
  - The impact of the risk on the project or product will be reduced
- **Contingency plans**
  - If the risk arises, contingency plans are plans to deal with that risk

Risk Factors

Risk type	Potential indicators
Technology	Late delivery of hardware or support software, many reported technology problems
People	Poor staff morale, poor relationships amongst team member, job availability
Organisational	organisational gossip, lack of action by senior management
Tools	reluctance by team members to use tools, complaints about CASE tools, demands for higher-powered workstations
Requirements	many requirements change requests, customer complaints
Estimation	failure to meet agreed schedule, failure to clear reported defects

Project management Tools

- The **best** tools are online
  - Easy to access anywhere
  - Don’t require you to set up any software
- Example: Zoho
  - Free
  - Online
  - Powerful
  - Task handling
  - Gannt charts
  - Milestones
  - Free for <10 Meg storage

Lecture Key Points

- Good project management is essential for project success
- The intangible nature of software causes problems for management
- Managers have diverse roles but their most significant activities are planning, estimating and scheduling
- Planning and estimating are iterative processes which continue throughout the course of a project

Lecture Key Points

- A project milestone is a predictable state where some formal report of progress is presented to management.
- Risks may be project risks, product risks or business risks
- Risk management is concerned with identifying risks which may affect the project and planning to ensure that these risks do not develop into major threats