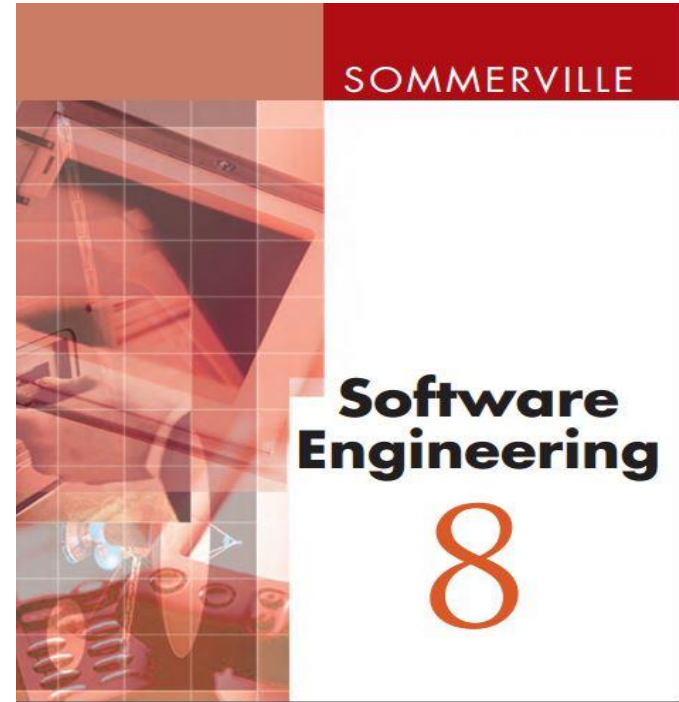


# Chapter 4

## Software Project management

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*By: Sultan J.*



*Adapted from Ian Sommerville 2006, Software Engineering, 8th edition. Chapter 5*

# Chapter 4: Objectives

- ❑ To explain the main tasks undertaken by project managers
- ❑ To introduce software project management
- ❑ 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

# Chapter 4: Roadmap

- 4.1. Management activities
- 4.2. Project planning
- 4.3. Project scheduling
- 4.4. 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 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**.
- ❑ The software development process is **not standardised**.
- ❑ Many software projects are 'one-off' projects (rapid technological changes). **Lessons learned from previous projects may not be transferable to new projects**

## 4.1. Management Activities

- ❑ Proposal writing.
- ❑ Project planning and scheduling.
- ❑ Project costing.
- ❑ Project monitoring and reviews.
- ❑ Personnel selection, supervision, and evaluation.
- ❑ Report writing and presentations.

# Cont...

- ❖ In other words, project management activities can be summed up as:
  - ✓ Ascertaining customer's requirement
  - ✓ Identifying the life cycle model for SW development
  - ✓ Selecting a team with appropriate skills
  - ✓ Identifying and allocating appropriate resources
  - ✓ Estimating the cost and effort required
  - ✓ Managing risks
  - ✓ Creating and tracking a project schedule
  - ✓ Managing the quality and configuration
  - ✓ Maintaining the SW product
  - ✓ Evaluating the project and deriving lessons for future projects

# Cont'd...

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❖ *Four P's* have a substantial influence on software project management- **people**, **product**, **process**, and **project**:

- ✓ **People** must be organized to perform SW work effectively.
  - ✓ Senior manager, project (technical) managers, practitioner, customers, end users.
- ✓ **Product** scope must be understood by effectively communicating with the customers.
- ✓ **Process** must be selected (most appropriate one).
- ✓ **Project** must be planned by estimating effort and time.



# The people (players)

1. Senior managers: who define the business issues
2. Project (technical) managers: who must plan, motivate, organize, and control the practitioners who do software work.
3. Practitioners who deliver the technical skills that are necessary to engineer a product or application.
4. Customers who specify the requirements for the software to be engineered.
5. End-users who interact with the software once it is released for production use.

# The people (players)

- ❖ There are almost as many human organizational structures for software development as there are organizations that develop software.

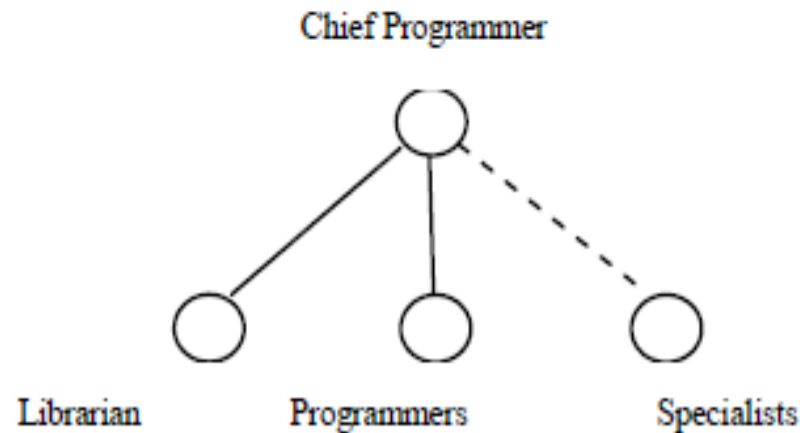
- 1. Centralized – Control Team Organization**
- 2. Decentralized – Control Team Organization**
- 3. Mixed – Control Team Organization**

## **I. Centralized – Control Team Organization**

- ✓ Standard management technique
- ✓ Workers report to supervisor – who directly controls and is responsible for their performance Specialists

# Cont'd...

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Patterns of control and communication in a chief programmer team

## ❖ Chief Programmer

- ✓ Project controller
- ✓ Hold the problem and its solution
- ✓ Responsible for the design and all technical details
- ✓ Initiates and controls all decisions

# Cont'd...



## **Advantages of centralized – control team organization**

- ✓ Works well when tasks well understood by the chief programmer

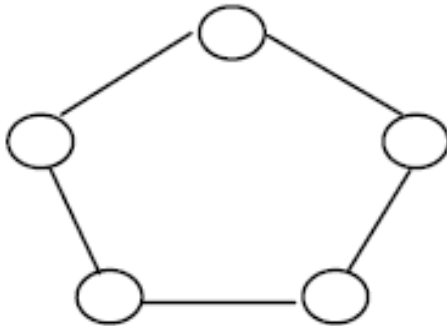
## **Disadvantages**

- ✓ Single point of failure
- ✓ Chief P- overloaded - all communication and decisions through him
- ✓ Success depends on skills and ability of CP, selection of CP
- ✓ Size and complexity of the problem

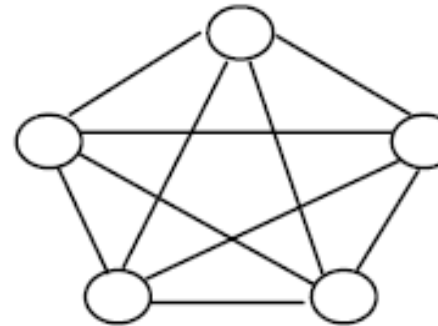
# Cont'd...

## 2. Decentralized – Control Team Organization

- Ring like management – lack of hierarchy
- Team members – same level, review each other's work and responsible as a group



(a) Management structure



(b) Communication Pattern

A decentralized-control team

# Cont'd...

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## **Advantages**

- ✓ Higher morale, job satisfaction, less turnover, higher quality,
- ✓ feel more ownership & responsible
- ✓ Suitable for less understood, more complicated problems

## **Disadvantages**

- ✓ Not suitable for large teams – communication leads to reduction of individual productivity
- ✓ Risk in searching a perfect solution that pleases all

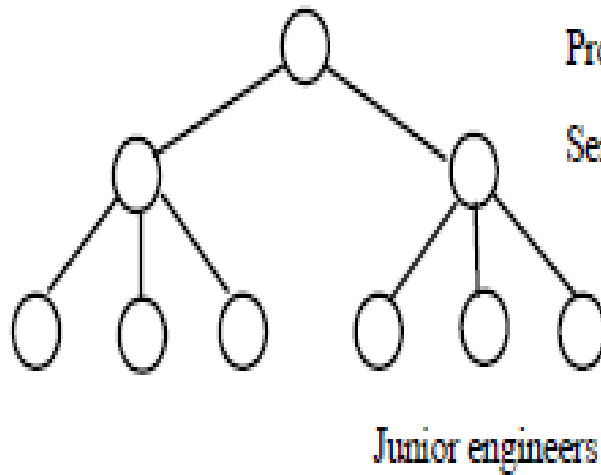
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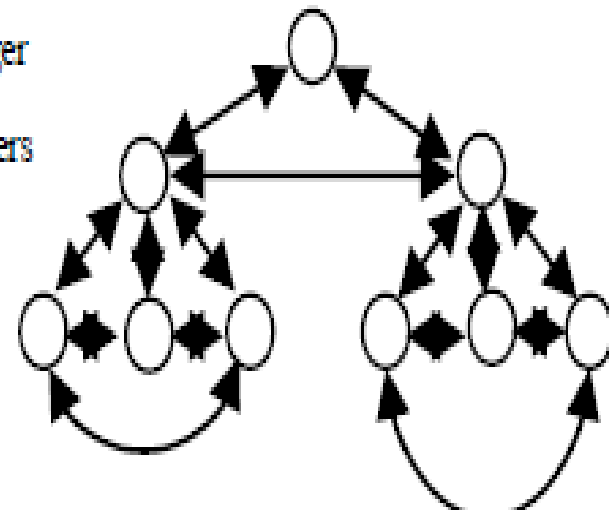
## 3. Mixed – Control Team Organization

- ✓ Combine the benefits of centralized and decentralized organization
- ✓ Minimizing / avoiding their disadvantages
- ✓ Distinguishes the engineers into senior and junior; senior leads a group of juniors; senior report to a project manager
- ✓ Communication is limited within a small group; Benefits from group decision by a group of senior engineers

# Cont'd...



(a) Management structure



(b) Communication Pattern

Mixed Control Organizations



# 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 there are shortages of trained staff.

# Causes of Success and Failure



causes of project success are:

- ✓ Formal governance and change approval guidelines
- ✓ Training in project management
- ✓ Measurement and feedback systems
- ✓ Formal priorities for requests and changes
- ✓ Regular communication with users
- ✓ Clear tracking of people, skills and time
- ✓ Inventory of skill-based competencies
- ✓ Decisions based on several inputs
- ✓ automated project management tools

# Cont'd...



## Causes of Failure

- ✓ inadequate planning and incomplete requirements;
- ✓ insufficient involvement of stakeholders;
- ✓ infrequent communication with the Business Owner;
- ✓ poor containment of the project's scope;
- ✓ poor management of expectations, roles and responsibilities;
- ✓ ineffective resource management;
- ✓ incomplete hand-offs between groups;
- ✓ no authority to overcome impairments;
- ✓ poor project estimations; and
- ✓ Unclear weighting criteria.

## 4.2. 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 plans may be developed to support the main software project plan that is concerned with schedule and budget.

# Types of project plan

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Plan	Description
Quality plan	Describes the quality procedures and standards that will be used in a project. See Chapter 27.
Validation plan	Describes the approach, resources and schedule used for system validation. See Chapter 22.
Configuration management plan	Describes the configuration management procedures and structures to be used. See Chapter 29.
Maintenance plan	Predicts the maintenance requirements of the system, maintenance costs and effort required. See Chapter 21.
Staff development plan.	Describes how the skills and experience of the project team members will be developed. See Chapter 25.

# Project planning process



```
Establish the project constraints
Make initial assessments of the project parameters
Define project milestones and deliverables
while project has not been completed or cancelled loop
    Draw up project schedule
    Initiate activities according to schedule
    Wait ( for a while )
    Review project progress
    Revise estimates of project parameters
    Update the project schedule
    Re-negotiate project constraints and deliverables
    if ( problems arise ) then
        Initiate technical review and possible revision
    end if
end loop
```

# The project plan



- ❑ The project plan sets out:
  - The resources available to the project;
  - The work breakdown;
  - A schedule for the work.

# project plan structure

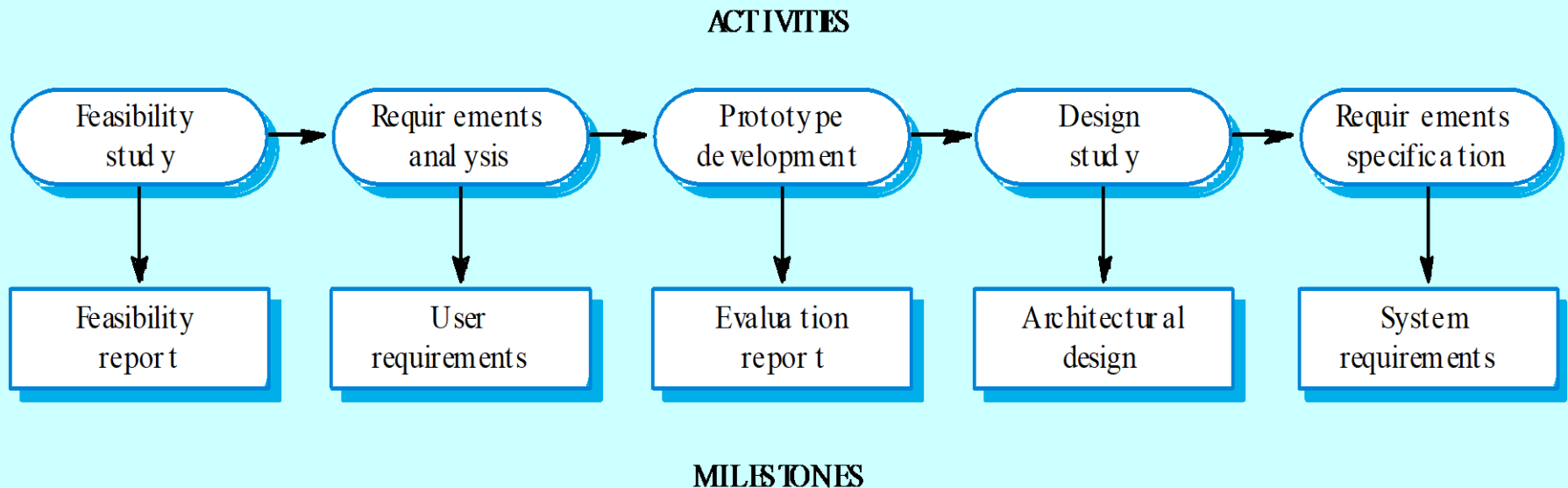
- ❑ Introduction.
- ❑ Project organisation.
- ❑ Risk analysis.
- ❑ Hardware and software resource requirements.
- ❑ Work breakdown.
- ❑ Project schedule.
- ❑ Monitoring and reporting mechanisms.



# 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.

# Milestone in requirement process

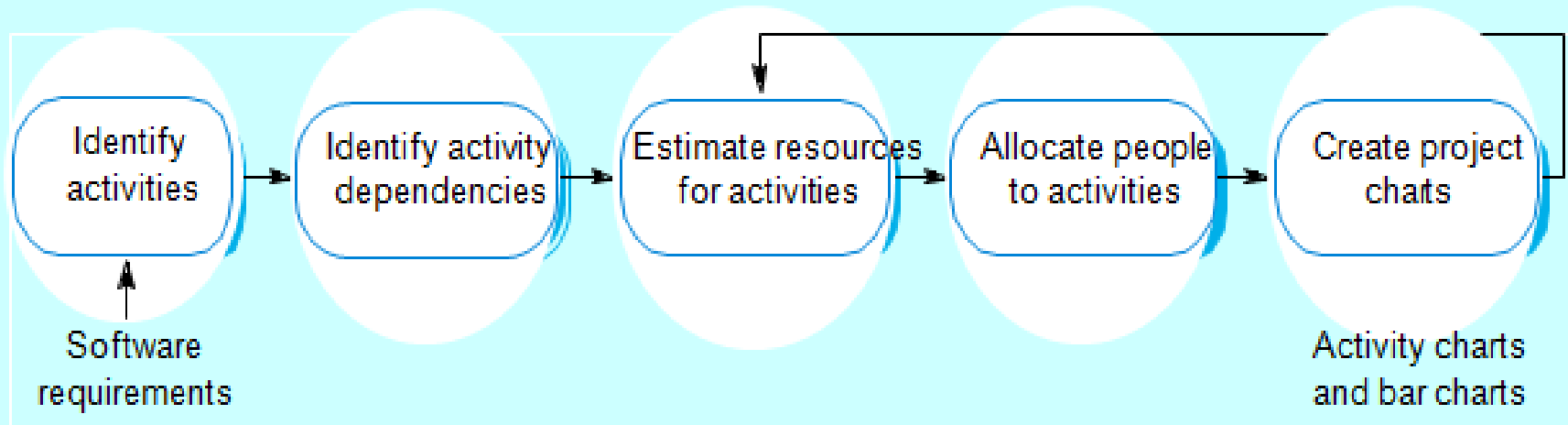


## 4.3. Project Scheduling

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- ❑ Split project into tasks and estimate time and resources required to complete each task.
- ❑ Minimize task dependencies to avoid delays caused by one task waiting for another to complete.
- ❑ Dependent on project managers intuition and experience.

# The project Scheduling process



# Scheduling problems



- ❑ Estimating the difficulty of problems and hence the 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 makes it later because of communication overheads.
- ❑ The unexpected always happens. Always allow contingency in planning. (+30% for anticipated possible problems, and +20% for unexpected)

# Bar chart and activity network

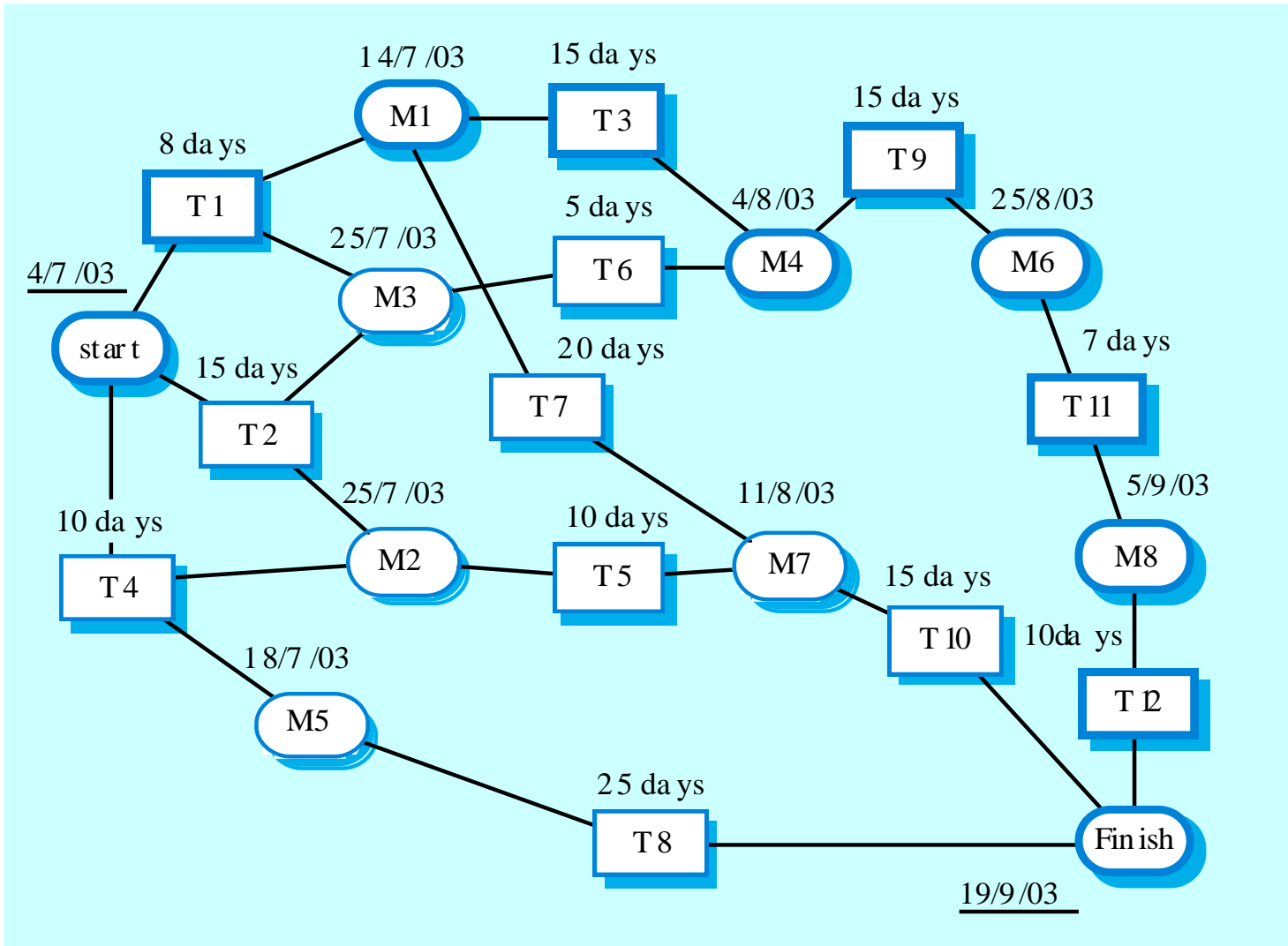


- ❑ Graphical notations used to illustrate the project schedule.
- ❑ Show project breakdown into tasks. Tasks should not be too small. They should take about a week or two.
- ❑ Activity charts show task dependencies and the critical path.
- ❑ Bar charts show schedule against calendar time.

# Task duration and activities

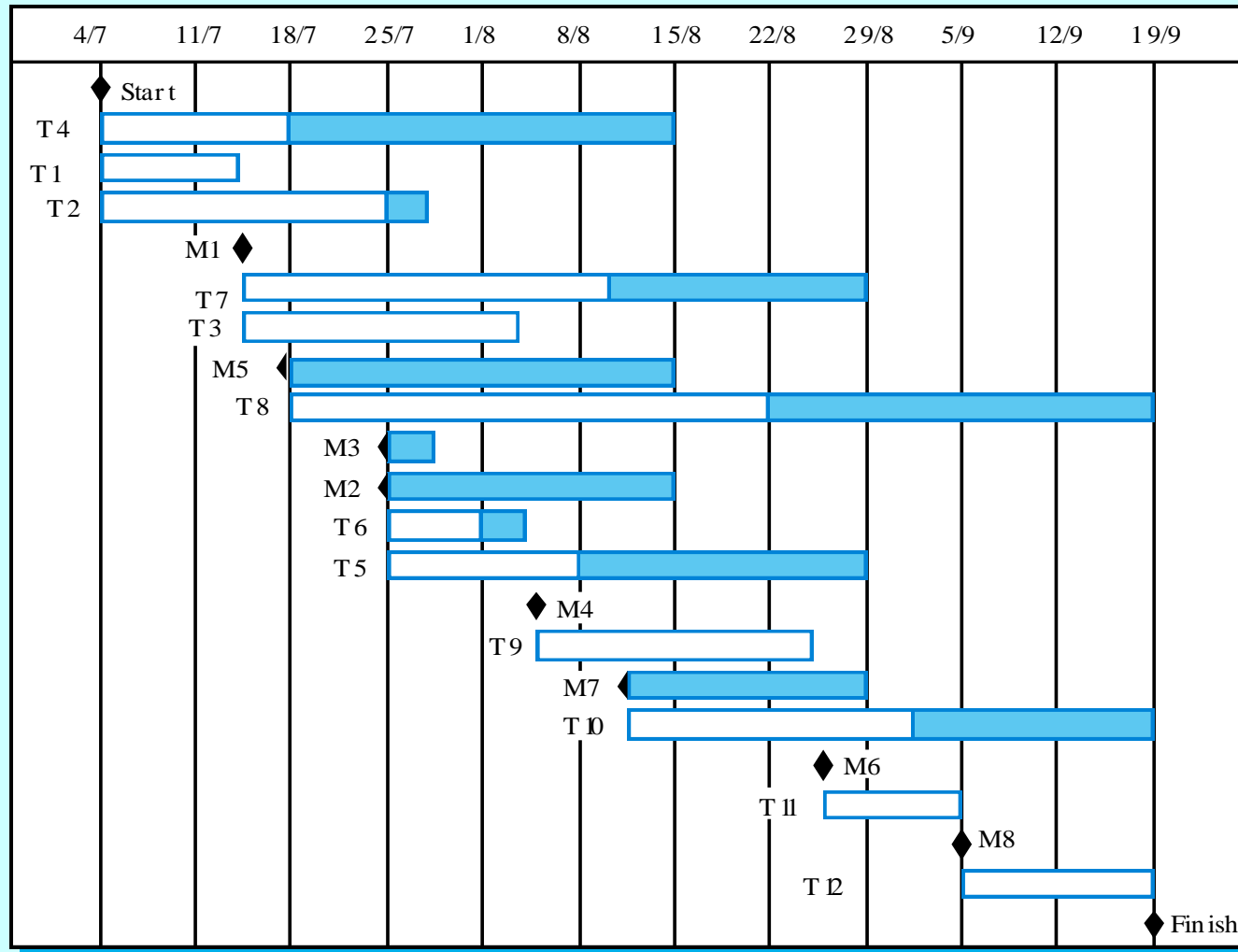
Activity	Duration (days)	Dependencies
T1	8	
T2	15	
T3	15	T1 (M1)
T4	10	
T5	10	T2, T4 (M2)
T6	5	T1, T2 (M3)
T7	20	T1 (M1)
T8	25	T4 (M5)
T9	15	T3, T6 (M4)
T10	15	T5, T7 (M7)
T11	7	T9 (M6)
T12	10	T11 (M8)

# Activity network

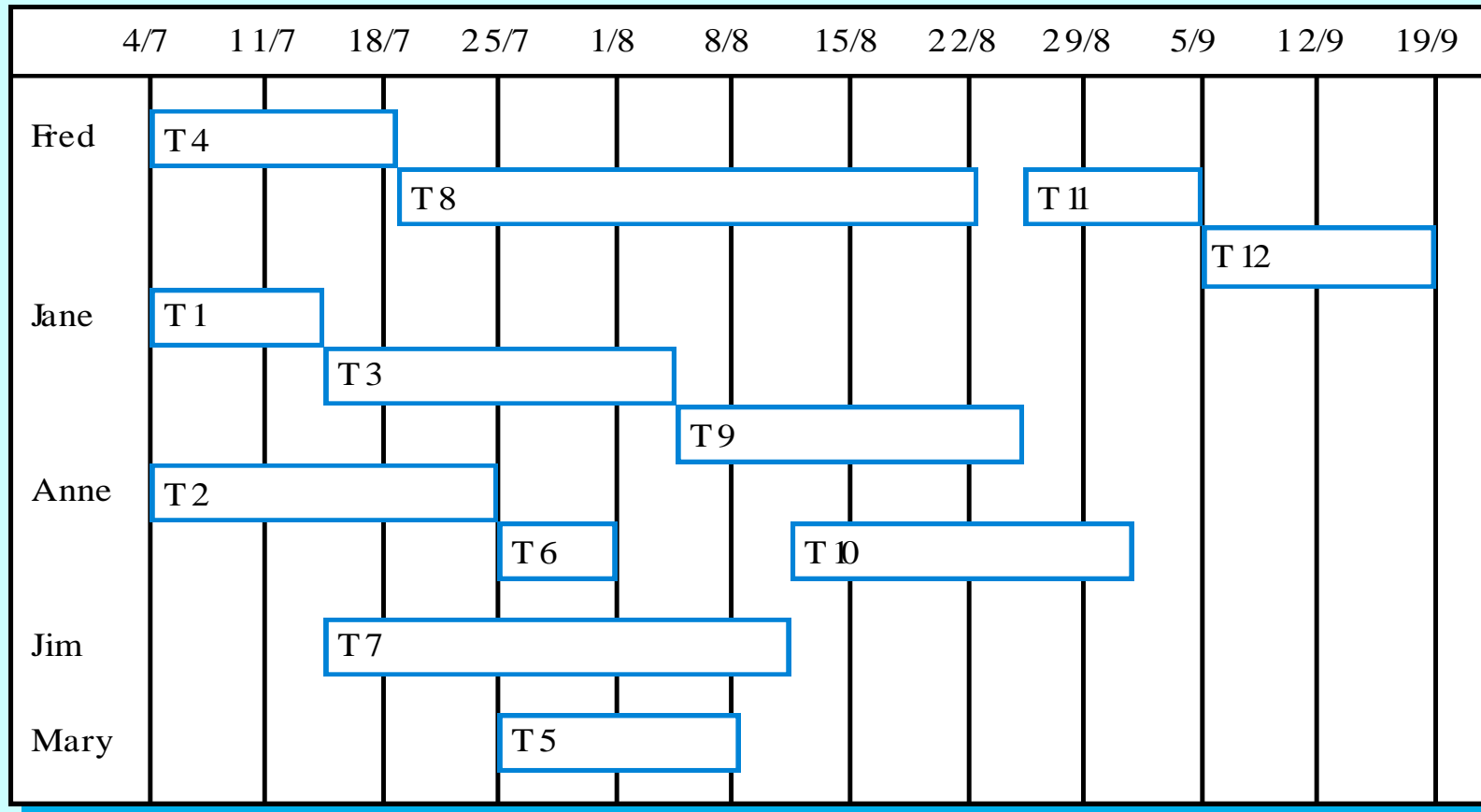




# Activity timeline (Grant chart)



# Staff allocation



Put dependable staff on critical tasks

## 4.4. Risk management



- ❑ Risk management is concerned with identifying risks and drawing up plans 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.

# Software risks



Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organisational management with different priorities.
Hardware unavailability	Project	Hardware that is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule
Size underestimate	Project and product	The size of the system has been underestimated.
CASE tool under-performance	Product	CASE tools which support the project do not perform as anticipated
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

# The risk management process



## ❑ Risk identification

- Identify project, product and business risks;

## ❑ Risk analysis

- Assess the likelihood and consequences of these risks;

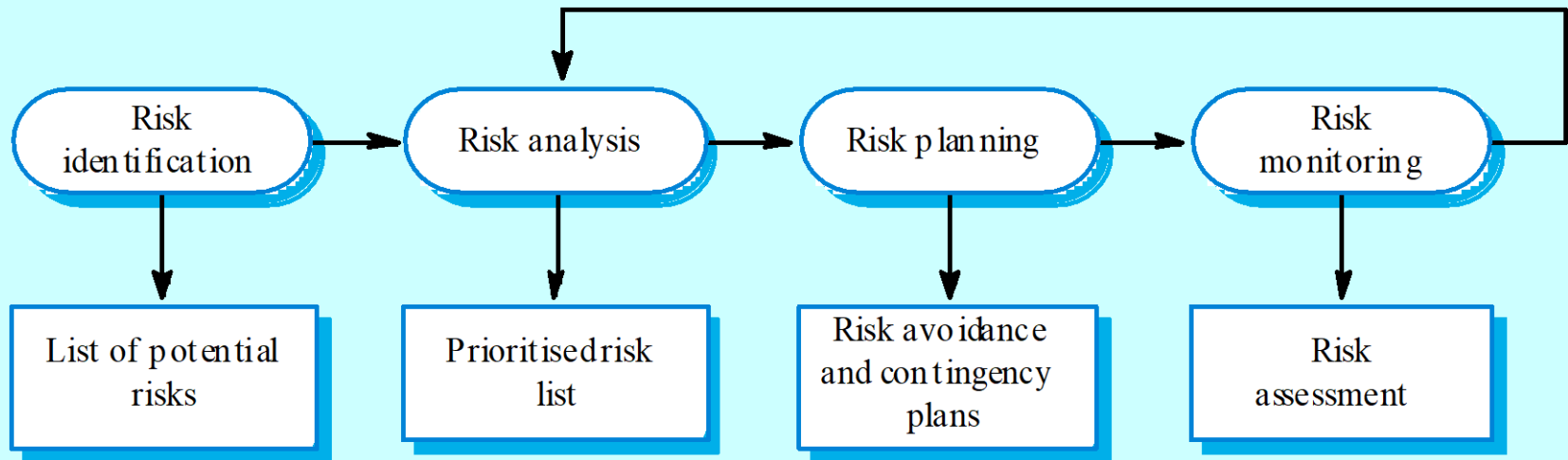
## ❑ Risk planning

- Draw up plans to avoid or minimise the effects of the risk;

## ❑ Risk monitoring

- Monitor the risks throughout the project.

# The risk management process



# Risk identification



- ❑ Technology risks.
- ❑ People risks.
- ❑ Organisational risks.
- ❑ Requirements risks.
- ❑ Estimation risks.

# Risk 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 that should be reused contain defects that 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 that 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

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- ❑ 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 (I)

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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 that should be reused contain defects which limit their functionality.	Moderate	Serious
Changes to requirements that require major design rework are proposed.	Moderate	Serious
The organisation is restructured so that different management are responsible for the project.	High	Serious

# Risk analysis (2)



Risk	Probability	Effects
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

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- ❖ 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 management strategies (I)

<b>Risk</b>	<b>Strategy</b>
Organisational financial problems	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business.
Recruitment problems	Alert customer of potential difficulties and the possibility of delays, investigate buying-in components.
Staff illness	Reorganise team so that there is more overlap of work and people therefore understand each other's jobs.
Defective components	Replace potentially defective components with bought-in components of known reliability.

# Risk management strategies (ii)

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Risk	Strategy
Requirements changes	Derive traceability information to assess requirements change impact, maximise information hiding in the design.
Organisational restructuring	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business.
Database performance	Investigate the possibility of buying a higher-performance database.
Underestimated development time	Investigate buying in components, investigate use of a program generator

# Risk monitoring

- ❑ Assess each identified risks regularly to decide whether or not it is becoming less or more probable.
- ❑ Also assess whether the effects of the risk have changed.
- ❑ Each key risk should be discussed at management progress meetings.

# Risk indicators



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<b>Risk type</b>	<b>Potential indicators</b>
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

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