Project Management

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with some slides adapted from Software Engineering, 8th Ed. by Ian Sommerville

Outline

- **Overview of software project management**
- Project planning
- Project scheduling
- Risk management

Software Project Management

- Goal of project management is to ensure software is developed and delivered
  - on time
  - within budget
  - in accordance with the requirements
  - high quality
  - satisfied customers
- Project management is crucial to the success of software projects
- Responsibility: project manager, program manager, team lead, test manager, …

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Common Management Activities

- Proposal writing and presentations
- Project estimating and costing
- Project planning and scheduling
- Team building
- Project monitoring, controlling, and reviews
- Customer relations, user relations
- Reporting and presentations

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Managing Software Projects

- **Most of management activities are common to other projects**

- **But, software projects have some differences**
  - Software is intangible
  - Software is flexible
  - Software processes are flexible
  - Software project depends on human factors

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- **Project planning**
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Project Planning

- Defining goals, what, who, when (and how) to do

- Planning is an continuous activity
    - Started early in project, lasted until the end of project
    - Plans are revised to reflect reality

- Activities and artifacts created dependent on processes followed
    - Agile projects require less planning than traditional projects

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Project Planning (cont'd)

- Many different plans
  - Software development plan (SDP)
    - Budget and schedule
    - Staffing plan
    - Training plan
    - Risk management plan
    - Schedule
    - Monitoring and controlling
  - Testing plan
  - Deployment plan
  - Configuration management plan
  - Quality management plan
  - Software acceptance plan
  - …

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Project Planning (cont'd)

- Main activities to form SDP
    - Estimate overall project effort, cost, and staff
    - Plan phases, iterations
    - Define and customize processes to use
    - Assign roles and responsibilities to staff
    - Plan training needs
    - Identify and assess risks

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Project Scheduling

- Goal: assigning right people to right tasks at right time

- Activities
  - Breakdown tasks, estimate time, resources for each task
  - Organize tasks concurrently to make optimal use of workforce
  - Minimize task dependencies, slack time, and waiting time
  - Balance workload

- Scheduling is a challenging activity
  - Requiring much intuition and experience of project managers

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Challenges in Project Scheduling

- Estimating each task is difficult
    - Productivity is not proportional to the number of people working on a task
    - Dependencies
    - Resource constraints

- Adding people to a late project makes it later
    - communication overheads
    - extra training
- Unexpected things always happen
    - allow contingency in planning

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Planning Poker - Exercise

- Estimate features in ideal hour for agile projects
- Estimators have cards with values 0, 1, 2, 3, 5, 8, ... (Fibonacci numbers)
- Estimators discuss each feature
- Estimators privately choose appropriate card from deck
- If having consensus, use the estimate for the feature.
  - ❑ Otherwise, estimators discuss their estimates
  - ❑ Repeat until having consensus

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Planning Poker – Exercise (cont'd)

- **Estimating a mobile app for taking notes**
  - ❑ Register an account
  - ❑ Create a note
  - ❑ Update a note
  - ❑ Delete a note
  - ❑ Send a note via SMS
  - ❑ Send a note via an account
  - ❑ Synch notes with other devices

- **Suppose that the following chosen feature has 3 ideal hours**
  - ❑ Create a note

Task Organization

- Organize tasks to produce tangible outputs

- *Milestones* are the end-point of a period
- *Deliverables* are results delivered to customers or users

- Each milestone is often marked by a set of deliverables
  - Build 1, Build 2, ...
  - Alpha release, beta release, GA release

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Activity Timeline

(Sommerville 2011)

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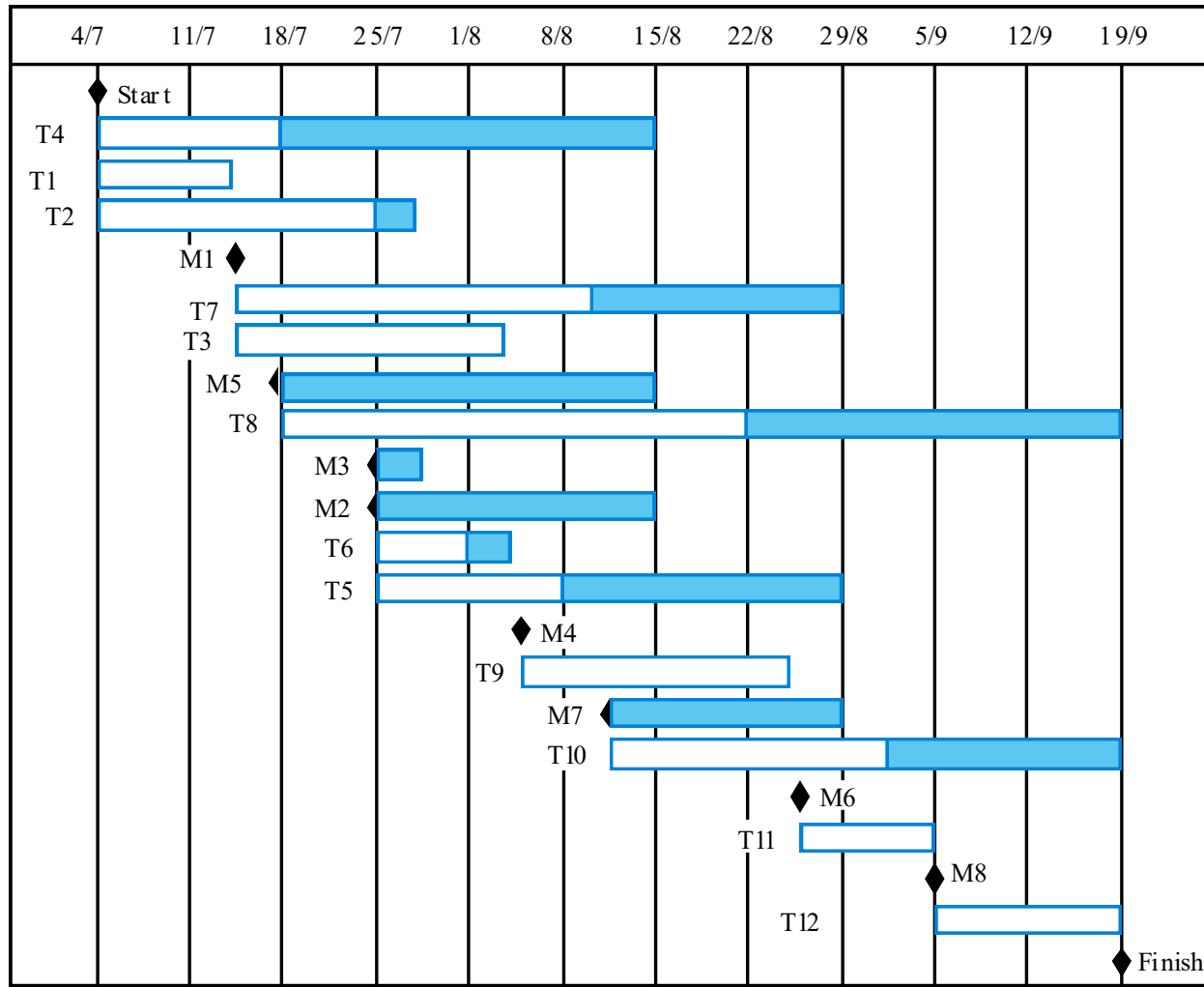
Staff Allocation

(Sommerville 2011)

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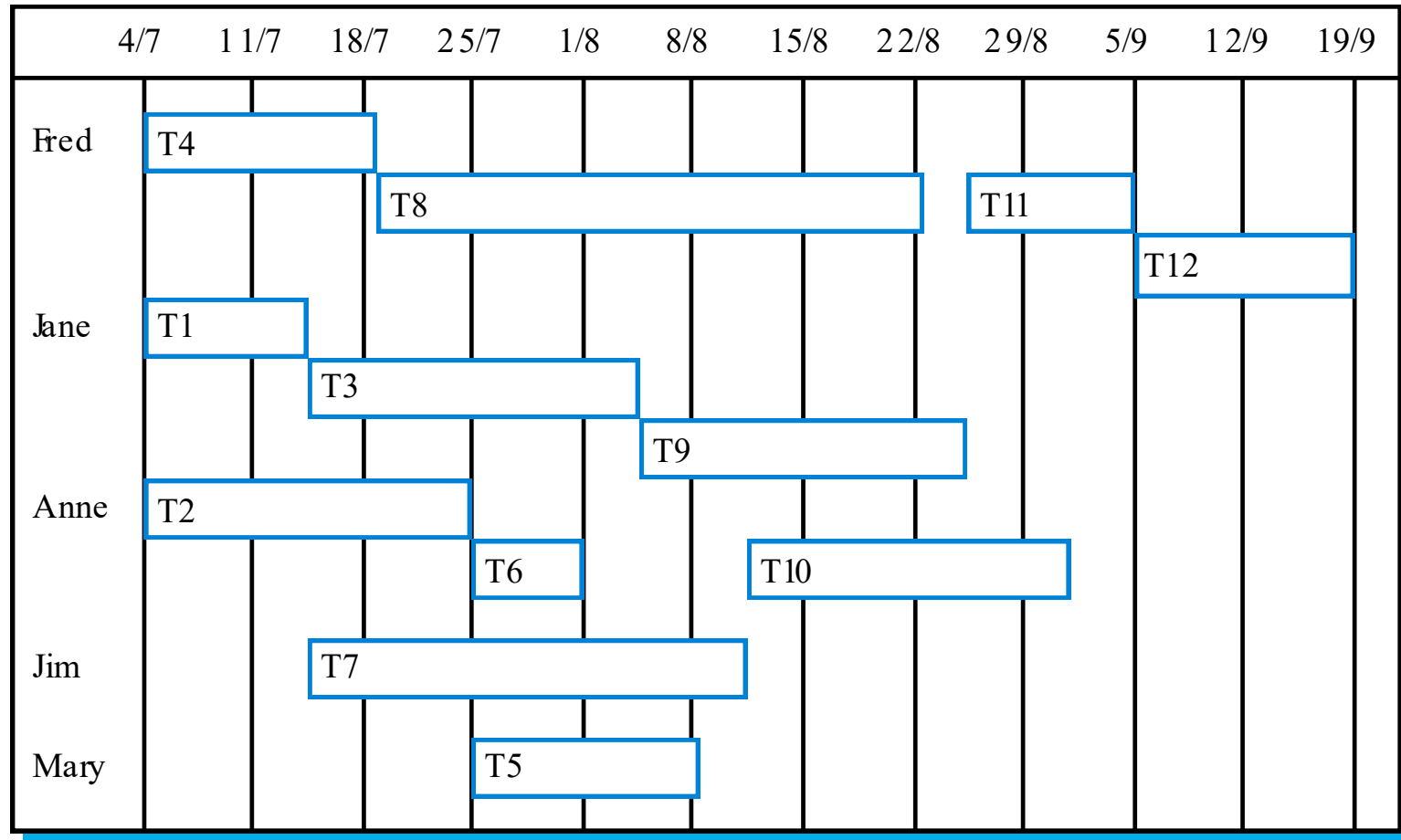
Exercise

- Suppose that your project develops an e-commerce system

- Your team has 5 people and works in 6 months

- Work in team of 5 people to detail your project plan as far as possible

- Report the result

Outline

- Overview of software project management
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- **Risk management**

Risk Management

- Goal: minimize effects of risks on project

- A risk is a probability that some adverse circumstance will occur
  - E.g., people may leave team

- Effects
  - schedule or resources
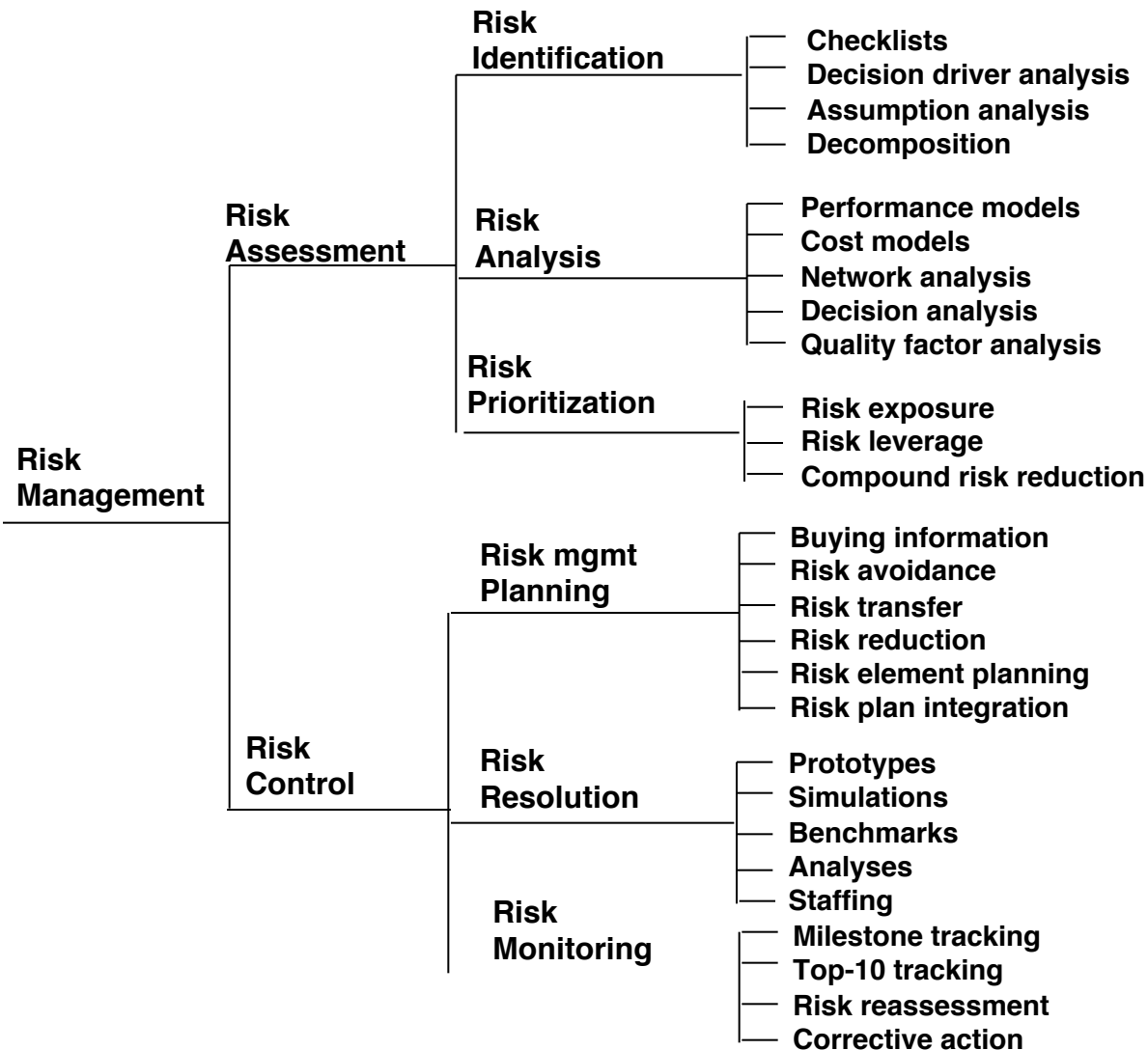 - quality or performance of software
  - cost
  - etc.

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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.

Risk Management Activities

- Risk Assessment
  - Risk identification
  - Risk analysis
  - Risk prioritization
- Risk Control
  - Risk management planning
  - Risk resolution
  - Risk monitoring

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Software Risk Management

```
                    Risk              ── Checklists
                    Identification    ── Decision driver analysis
                                      ── Assumption analysis
                                      ── Decomposition

        Risk                          ── Performance models
        Assessment  Risk             ── Cost models
                    Analysis          ── Network analysis
                                      ── Decision analysis
                                      ── Quality factor analysis
                    Risk
                    Prioritization    ── Risk exposure
Risk                                  ── Risk leverage
Management                            ── Compound risk reduction

                    Risk mgmt        ── Buying information
                    Planning          ── Risk avoidance
                                      ── Risk transfer
                                      ── Risk reduction
                                      ── Risk element planning
                                      ── Risk plan integration

        Risk        Risk             ── Prototypes
        Control     Resolution        ── Simulations
                                      ── Benchmarks
                                      ── Analyses
                                      ── Staffing
                    Risk             ── Milestone tracking
                    Monitoring        ── Top-10 tracking
                                      ── Risk reassessment
                                      ── Corrective action
```

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Risk Identification

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

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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 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.
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 size of the software is underestimated.

Risk Analysis and Prioritization

- **Assess probability and seriousness of each risk**
  - Probability
  - Loss
- **Risk exposure (RE) = Probability x Loss**
- **Probability can be**
  - Categorical: very low, low, moderate, high or very high
  - Numerical: from 0% to 100%
- **Loss can be**
  - Categorical: catastrophic, serious, tolerable or insignificant
  - Numerical: any number representing cost

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Risk Analysis and Prioritization (cont'd)

- **Risks are prioritized using Risk exposure (RE)**
  - Higher prioritized risk has higher RE

Rank	Risk	Prob (%)	Loss (PM)	RE
1	Underestimate staff	20	2	40
2	Experienced staff leaves	15	2	30
3	Unable to recruit experienced staff on time	10	2	20
4	Customers are not supportive	5	3	15
5				

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Risk Analysis and Prioritization (cont'd)

Risk	Probability	Loss
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

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Risk Planning

- Provide mitigation strategies to manage each risk
- Avoidance strategies
- Minimization strategies
- Contingency plans
    - If risks arise, contingency plans are followed
- Risk transfer
- Buying information

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Risk Management Strategies

Risk	Strategy
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 (cont'd)

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

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Risk Indicators

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
Requirements	Many requirements change requests, customer complaints
Estimation	Failure to meet agreed schedule, failure to clear reported defects

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Risk Monitoring and Controlling

- Assess each identified risks regularly
  - Some risks may become less, some more probable
  - Maintain a list of top-10 risks
  - Review and revise risks regularly
- High prioritized risks should be
  - reviewed and discussed at management progress meetings
  - reported weekly
- Taking appropriate actions when problems occur

Key points

- Project management is crucial to project success

- Managers' important activities
  - team building
  - planning, estimating and scheduling
  - monitoring and controlling

- Project management is an iterative process from the start to the end of project