Research Methods in Computer Science

Lecture 17: Presentations and Presentation Skills (4)

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Previously . . .

34 Slides
- Titles
- Content
- Fonts
- Colours
- Graphics

Today's questions

1. How should you behave during a presentation?
2. What kind of behaviour should you avoid during a presentation?

Consider

- Stance
- Hands
- Eye contact
- Voice

(12 minutes group discussion)

Gesture and Body Language: Stance and Movement

- Be aware where you stand (centre stage vs side stage)
- Do not obscure the screen
- Stand tall, keep your head up most of the time
- Move from stillness to stillness, walk slowly

Gesture and Body Language: Hands

- Use hand gestures to emphasise points
- Use open palm gestures, full arm gestures
- Avoid aggressive gestures
- Avoid hands in pockets, hands behind your back, hands clasped in front of your body

Gesture and Body Language: Eye Contact

- Maintain eye contact
  - lighthouse beam
  - treat everyone equal
  - do not look out of the window or on your watch
  - do not focus too long on a single individual
- Keep an eye on the audience's body language
  - does a point need further clarification?
  - can you proceed more quickly than anticipated?

Gesture and Body Language: Voice

- Be aware of the acoustics of the room
- Speak clearly (do not shout or whisper)
- Pause shortly at key points (adds emphasis)
- Emphasise the right words, control your breathing
- Facial gestures and tone of voice should match your message
- Do not rush, or talk deliberately slowly, but vary speed
- Do not talk to the screen
- Do not turn your back to the audience and talk at the same time
- Do not read from a script (cue cards are ok)

Seven Principles of Public Speaking

(Isa N. Engleberg: The Principles of Public Presentation.
Harper Collins, New York, 1994)

Purpose: Why are you speaking?
What do you want audience members to know, think, believe, or do as a result of your presentation?

People: Who is your audience?
How do the characteristics, skills, opinions, and behaviours of your audience affect your purpose?

Place: How can you plan and adapt to the logistics of this place?
How can you use visual aids to help you achieve your purpose?

Seven Principles of Public Speaking

(Isa N. Engleberg: The Principles of Public Presentation.
Harper Collins, New York, 1994)

Preparation: Where and how can you find good ideas and information for your speech?
How much and what kind of supporting materials do you need?

Planning: Is there a natural order to the ideas and information you will use?
What are the most effective ways to organise your speech in order to adapt it to the purpose, people, place, etc.?

Seven Principles of Public Speaking

(Isa N. Engleberg: The Principles of Public Presentation.
Harper Collins, New York, 1994)

Personality: How do you become associated with your message in a positive way?
What can you do to demonstrate your competence, charisma, and character to the audience?

Performance: What form of delivery is best suited to the purpose of your speech?
What delivery techniques will make your presentation more effective?
How should you practice?

Research Methods in Computer Science

Lecture 18: Choosing or proposing a project (1)

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35 Gesture and Body Language
- Stance
- Hands
- Eye Contact
- Voice

36 Principles of Public Speaking

Topics

Today's questions

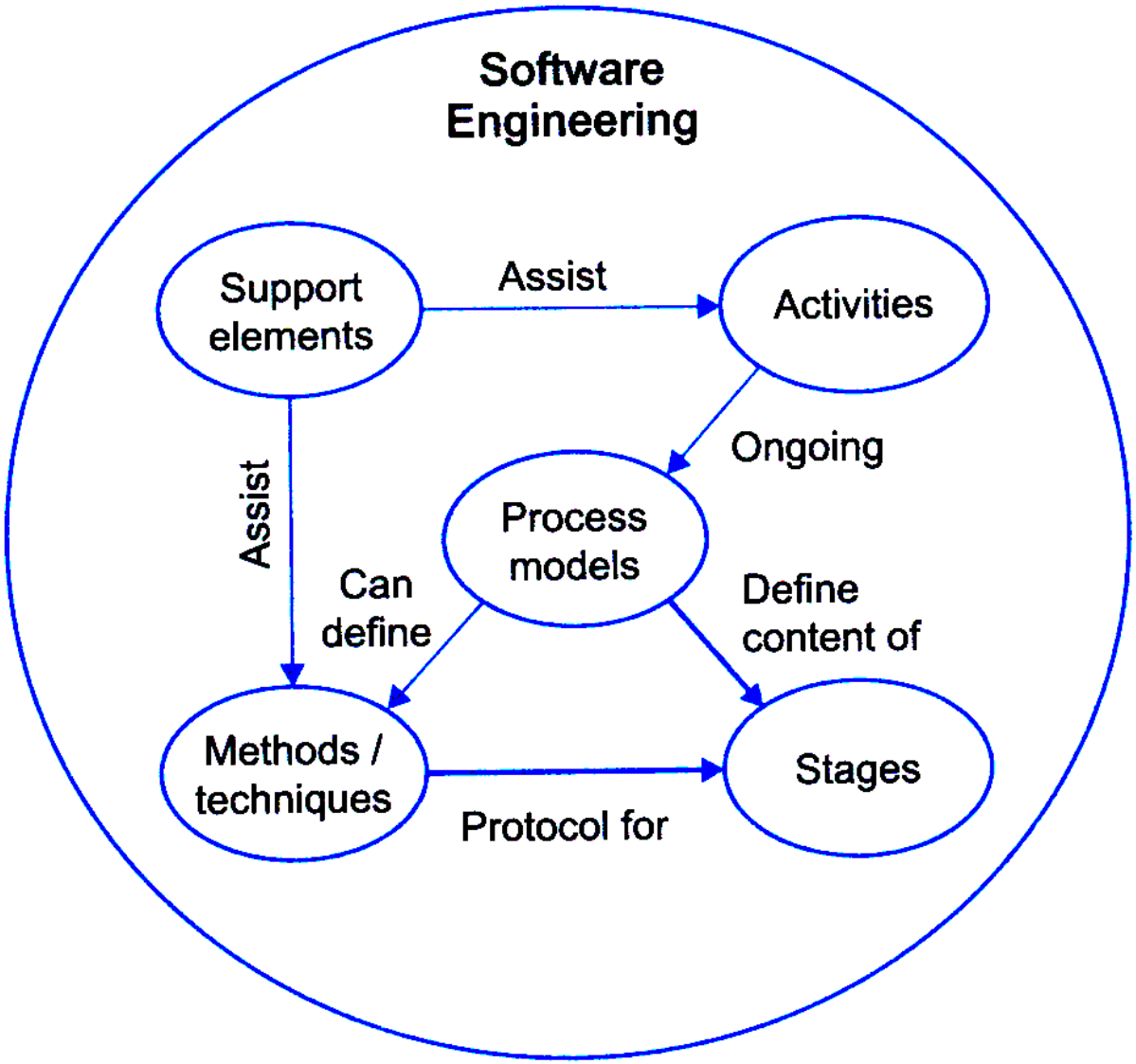
1. What sources of information could be used to devise a research-oriented project?
2. Given a collection of proposals for research-oriented projects, what criteria could you use to select the most suitable one?

(10 minutes group discussion)

Sources of information

- Proposals by academic staff or departments
- Past projects
- Brainstorming
- Your own goals and learning objectives
- Reading about / working in the subject area
- Systematic analysis of the subject area
  - Research Territory Maps
    Show how topics related to each other
  - Relevance Trees
    Break down a particular subject or research question into lower and lower levels of detail
  - Spider Diagrams
    Combines features of Research Territory Maps with those of Relevance Trees

Research Territory Maps: Example



Relevance Trees: Example

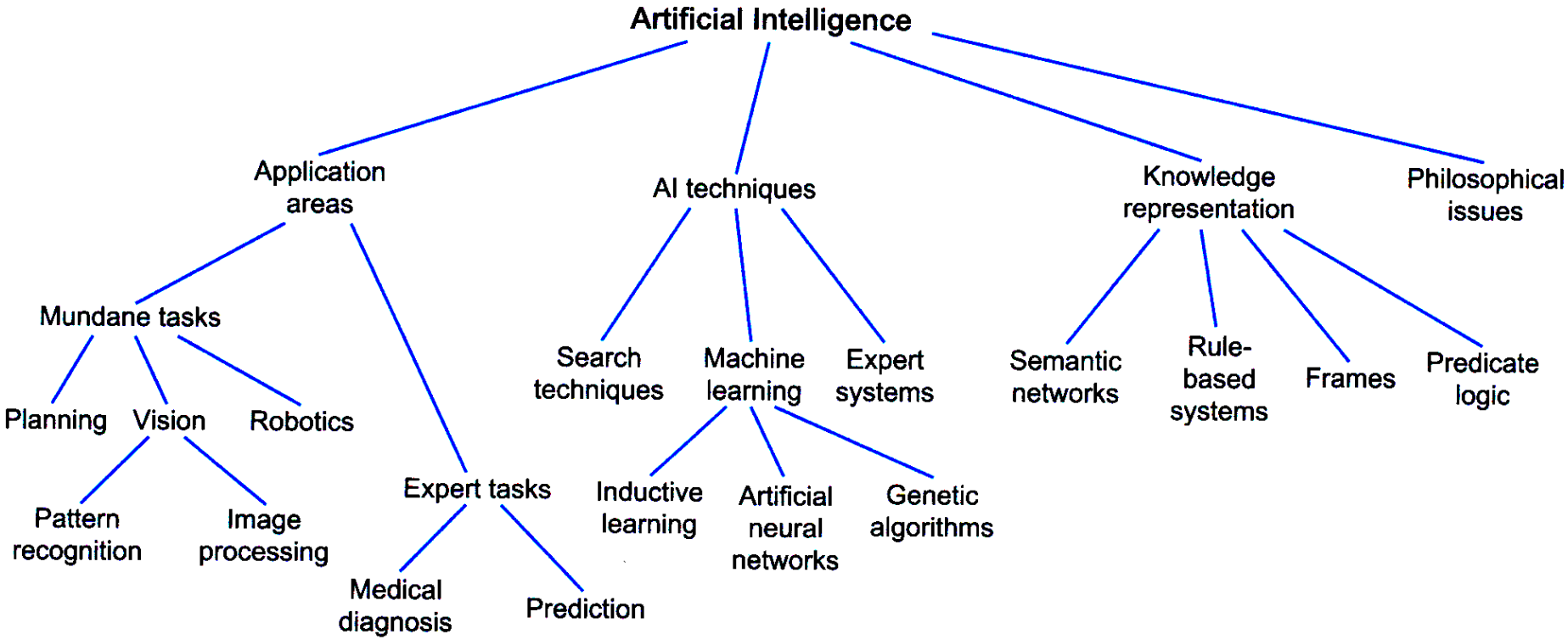


Figure 3.2 An example relevance tree for the field of *artificial intelligence*

Spider Diagrams: Example

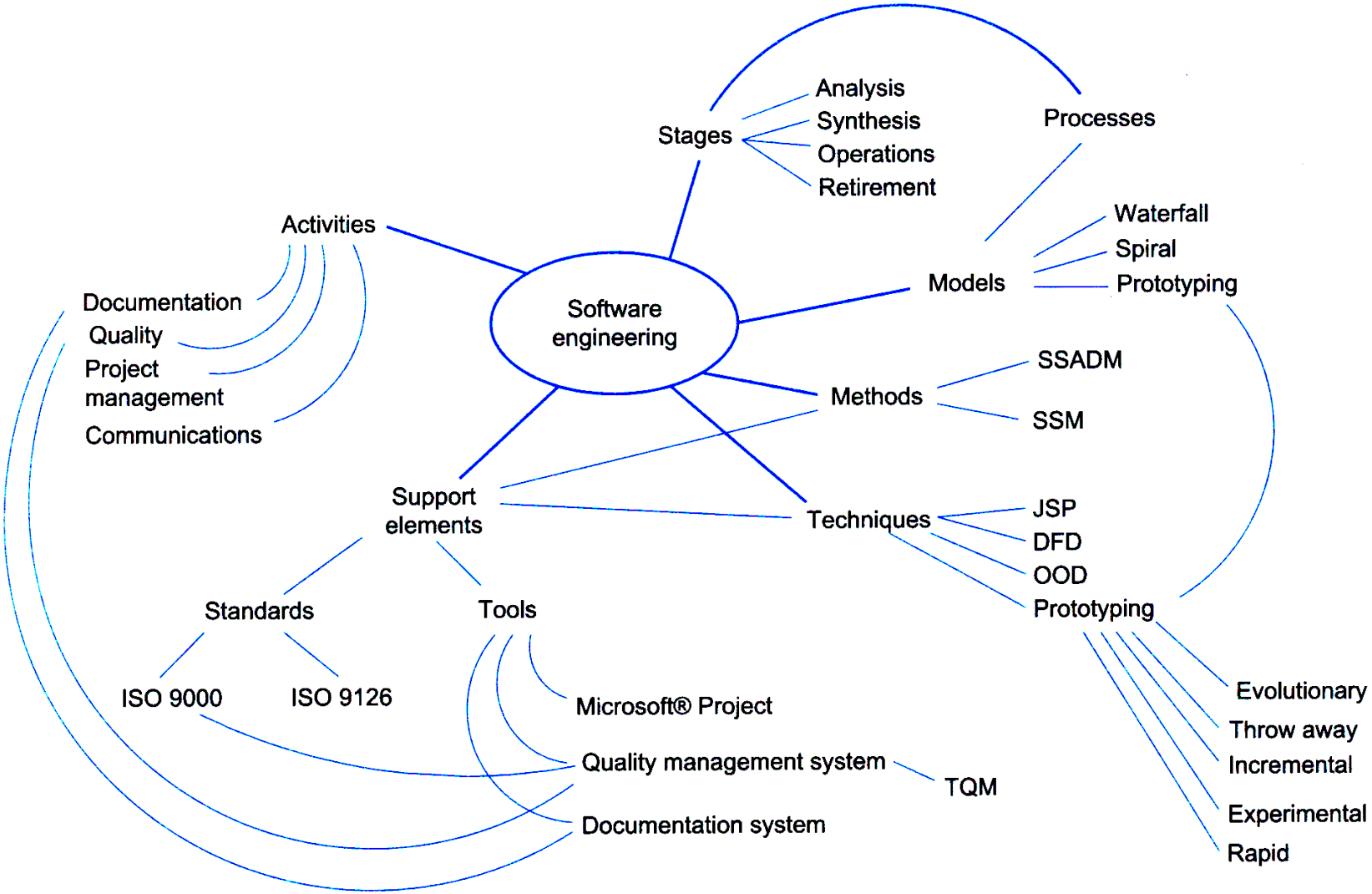


Figure 3.3 An example spider diagram for the field of *software engineering*

Choosing a project

- The project needs to be within your capabilities
- The project needs to have sufficient scope
- The project needs to interest you
- The project needs to have a serious purpose
- The project needs to have a clear outcome
- The project needs to be related to your degree programme
- The resources required for the project are available or can be obtained

Suitability tests for projects

- 'So what?' test
  Is the topic meaningful?
  Will it be of value for anyone?
  What contribution will it make?
- Justification
  Can you explain your project and justify it in simple terms?
- Estimating your understanding
  Can you put a figure on what you know about your chosen subject?
- Contacts
  Are the contacts you require for your project (including your supervisor) available, accessible, and willing to help?
- Project proposal
  Can you write a substantive proposal for your project?

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Lecture 19: Choosing or proposing a project (2)

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37 Choosing a project
- Sources of information
- Criteria
- Suitability criteria

Today's questions

Take the project proposal you were given last week as a reference to answer the following two questions:

1. What is the (implicit) content of a project proposal?
   What kind of questions does it need to address?
2. What is the explicit structure of a project proposal?
   What sections/parts are there? What is their purpose?

(10 minutes group discussion)

Preparing a project proposal: Implicit Content

- Introduction to the subject area
  - Sets the context for the project
  - Should motivate the relevance of the subject area
- Overview of current research in the area
  - Demonstrates current activities in the subject area
  - Shows your understanding of current research
- Identify a gap
  - Identify a need for further investigation or re-interpretation
- Identify how your work fills the gap
  - Explain how your project fills the gap
- Identify risks and solutions
  - Highlight the benefits that can be derived from your project
  - Account for the risks to your project

Preparing a project proposal: Explicit Structure (1)

- Title
  Clear, Concise, Preferably no acronyms
- Aims and Objectives

  Aims: Broad statement(s) of intent
  Identify the project's purpose

  Objectives: Identify specific, measurable achievements
  Quantitative and qualitative measures by which completion of the project can be judged
- Expected outcomes/deliverables
  Identify what will be produced/submitted in the project
- Keywords
  Identify the topic areas that the project draws on

Preparing a project proposal: Explicit Structure (2)

- Introduction/Background/Overview
  - Overview of the project (Identification of research questions and hypotheses, elaboration of aims)
  - Motivation for the project
  - Motivation for you conducting the project
- Related Research

  Identifies other work, publications, and related to the same/similar topic
- Methods

  Identifies the research methods and project methods that will be used (e.g. theoretical investigation, case study)

Preparing a project proposal: Explicit Structure (3)

- Research Requirements

  Identifies the resources that will be needed for the project (e.g. hardware, software, data, personnel)
- Project Plan
  - More or less detailed 'timetable' for the project
  - Deadlines for deliverables

Today's questions

Consider the proposal for an academic project taken from (Dawson 2005, p. 50).

1. What is wrong with it?
2. How could it be improved?

(10 minutes group discussion)

Conclusion

- Choosing the right project is an important stage in any project
- There are a number of techniques that can assist you with choosing the right project
- In a project proposal or project specification
  - stick to the required structure and
  - address all the guiding questions as precisely as possible

Further reading:
Sharp et al. (2002) proposes five questions that might help you to choose a project supervisor; see (Dawson 2005; p. 52).

Research Methods in Computer Science
Lecture 20: Project planning (1)

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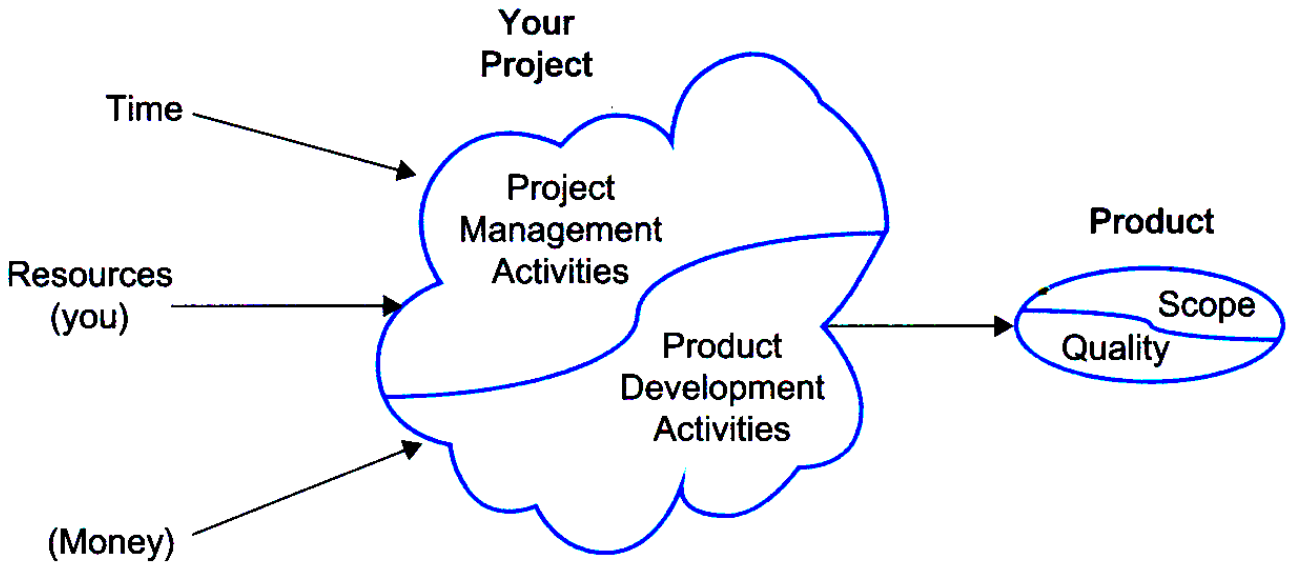
38 Project proposals
- Implicit content
- Explicit structure
- Reviewing your proposal

Topics

42 Project planning
- Time estimates
- Milestones
- Activity sequencing

Overview

- All projects consume resources including time and money in order to deliver a product of a particular scope and quality
- There is always a tension between the extent of resource input and the extend of product output
- There is also tension between project management activities and project development activities



Main project activities

Project management

Concerned with

- planning the conduct of the project
- controlling and checking project progress
- monitoring milestones and deliverables
- managing risk

Should account for not more than 10% of overall effort

$\rightsquigarrow$ not evenly distributed; spend most of it towards the start!

'Product' development

Concerned with

- achieving the aims and objectives of the project
- producing the deliverables in accordance with the project plan
- optimising scope and quality of the deliverables relative to the resources available

Project stages

From a project management perspective, projects proceed in five stages:

1. **Definition**
   Deciding on a project; making a project proposal
2. **Planning**
   Detailed planning of the project
3. **Initiation**
   Organising work (in particular, group work); literature survey
4. **Control**
   Monitoring the progress of the project
5. **Closure**
   Delivering/deploying result of the project; preparing final presentation; writing up reports

Project definition: Aims and Objectives (1)

Clear specification of what the project is to achieve

$\rightsquigarrow$ definition of aims and objectives

Aims: Broad statement(s) of intent
Identify the project's purpose

Examples:

- Design a methodology for GUI development of technical courseware material
- Develop and evaluate an Artificial Neural Network to predict stock market indices

Project definition: Aims and Objectives (2)

Clear specification of what the project is to achieve

$\rightsquigarrow$ definition of aims and objectives

Example aim:

- Develop and evaluate an Artificial Neural Network to predict stock market indices

Objectives: Identify specific, measurable achievements
Quantitative and qualitative measures by which completion of the project can be judged

Example:

1. Complete a literature search and literature review of existing stock market prediction techniques
2. Develop a suitable Artificial Neural Network model
3. Identify and collect suitable data for analyses and evaluation
4. Evaluate the model using appropriate statistical techniques
5. Complete final report

Project definition: SMART objectives

Each objective should be

- Specific
- Measurable
- Appropriate
- Realistic
- Time-related

Example:

1. Complete a literature search and literature review of existing stock market prediction techniques

- Is it specific? Does it tells us what will be done?
- Is it measurable? How will we know to what extend and to what quality the objective has been completed?
- Is it appropriate? Does is related to and in support of our aims?

Project definition: SMART objectives

Each objective should be

- Specific
- Measurable
- Appropriate
- Realistic
- Time-related

Example:

1. Complete a literature search and literature review of existing stock market prediction techniques

- Is it realistic? Can we realistically expect to achieve this objective?
- Is it time-related? Have we identified how long the task will take and when we will complete it?

Project planning

Objectives of project planning

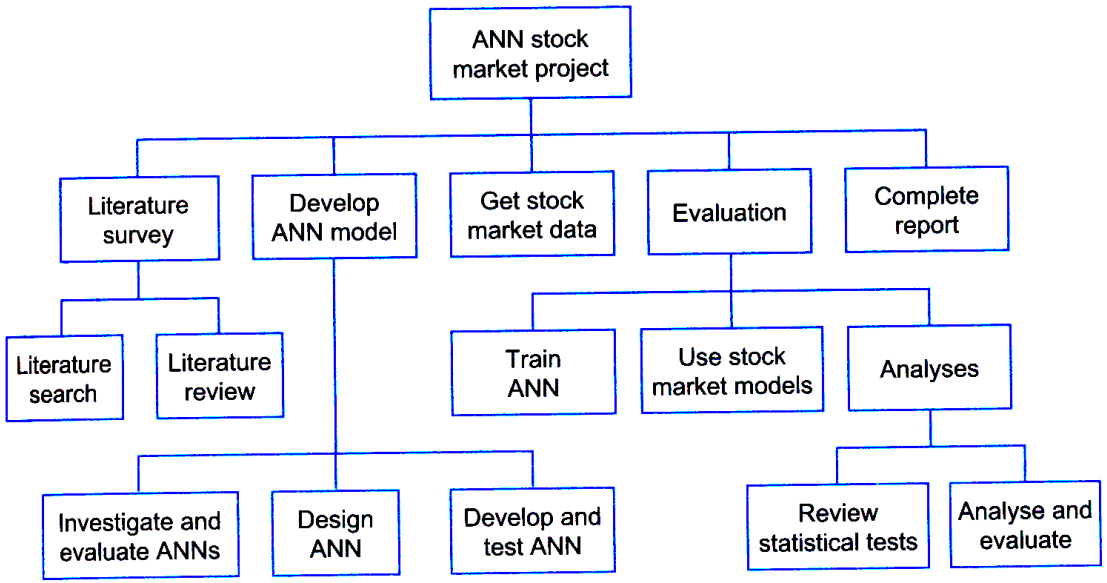
- Identifying the tasks that need to be done
- Clarifying the order in which tasks need to be done
- Determining how long each task will take
- (Redefining the project if there are problems)

Steps of project planning

1. Work breakdown
2. Time estimates
3. Milestone identification
4. Activity sequencing
5. Scheduling
6. Replanning

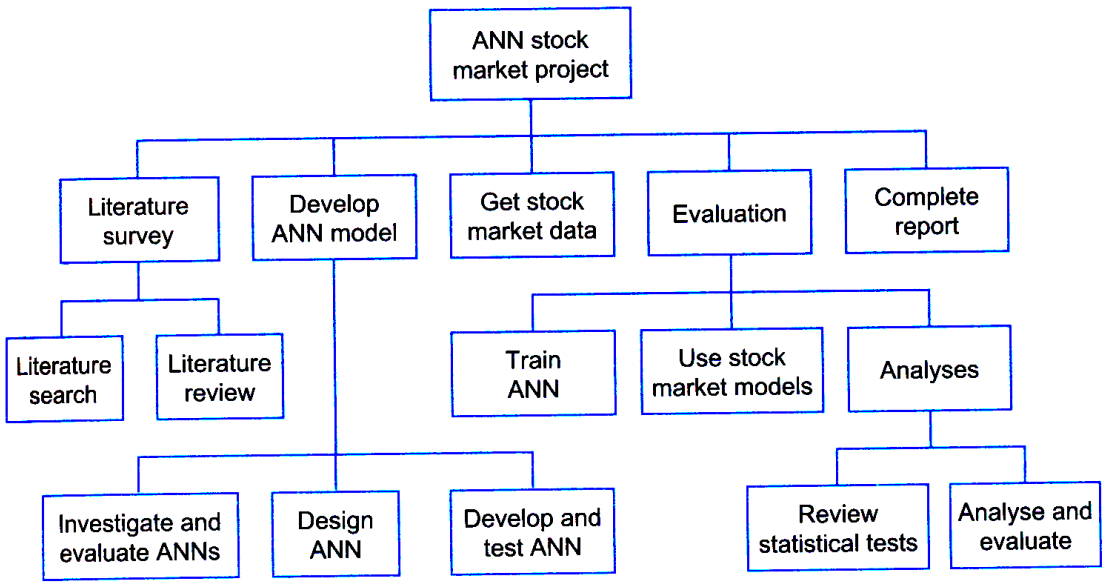
Work breakdown (1)

- First step of project planning: Identifying the tasks that need to be done
- Starting point(s) should be the objectives of the project;
  Then break your objectives down into lower and lower levels of detail
- Work breakdown structures are used to visualise the process of breaking down the project



Work breakdown (2)

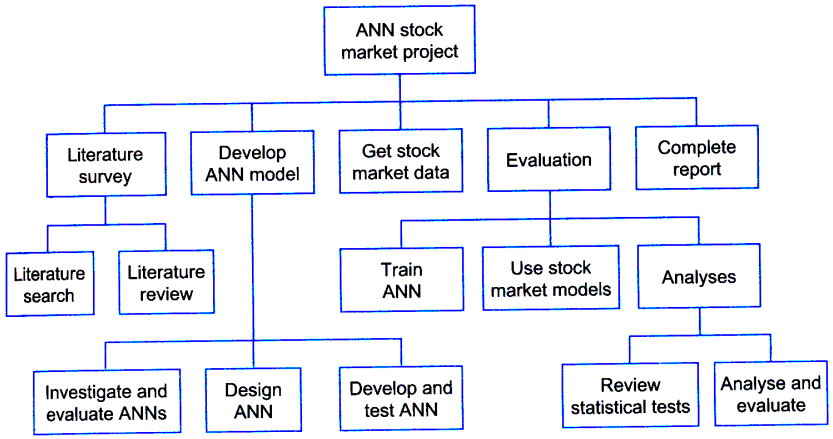
- Tasks at all levels need to be separate from one another
- Continue to break down your project into smaller tasks until each task takes up no less than 5% of the total effort



Time estimates

- Make reasonably accurate predictions of
  - the effort needed for completion and
  - the duration until completion

  of each leaf node of the work breakdown structure
- If the estimate exceeds the total time available for the project, then either modify the objectives and work breakdown or reduce and reallocate time between tasks



Activity	Effort	Duration
Literature search	2 weeks	8 weeks
Literature review	2 weeks	4 weeks
Investigate and evaluate ANNs	2 weeks	4 weeks
Design ANN	2 weeks	4 weeks
Develop and test ANN	2 weeks	2 weeks
Get stock market data	1 week	1 week
Train ANN	1 week	1 week
Use stock market models	1 week	2 weeks
Review statistical tests	1 week	2 weeks
Analyse and evaluate	4 weeks	4 weeks
Complete report	8 weeks	8 weeks
Total	26 weeks	40 weeks

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Lecture 20: Project planning (2)

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36 Introduction

37 Project definition
- Aims and objectives

38 Project planning
- Steps
- Work breakdown
- Time estimates

Steps of project planning

1. Work breakdown
2. Time estimates
3. Milestone identification
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5. Scheduling
6. Replanning

Topics

39 Project planning
- Time estimates
- Milestones
- Activity sequencing

Running example

Example aim:

Develop and evaluate an Artificial Neural Network to predict stock market indices

Example objectives:

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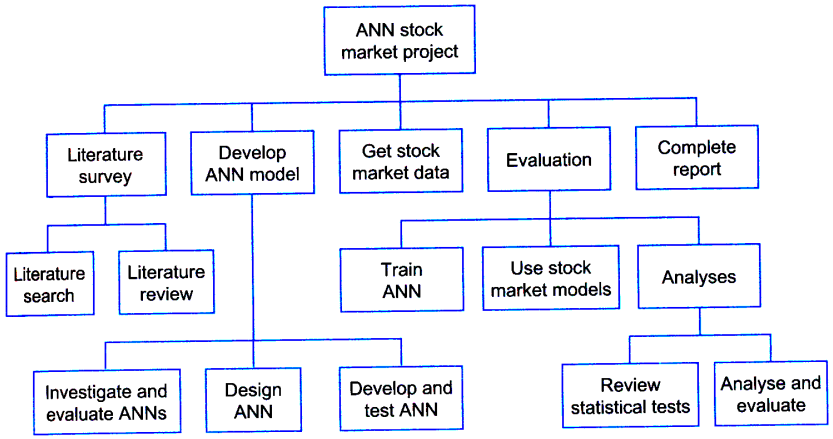

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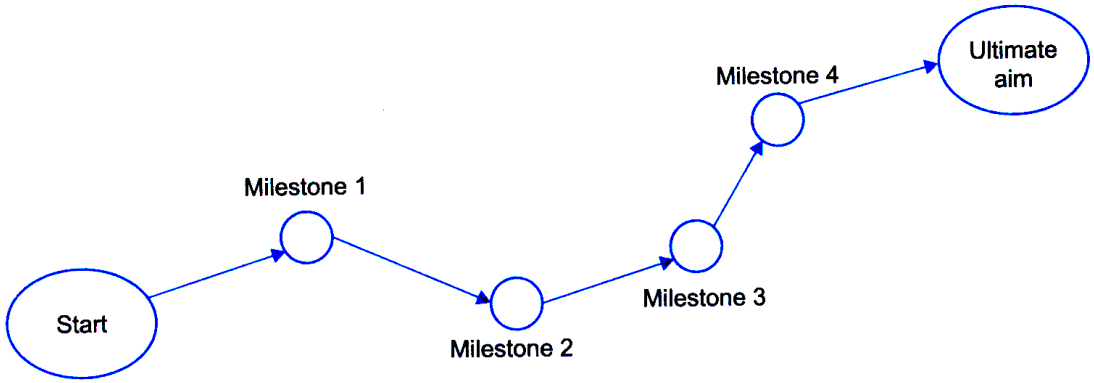
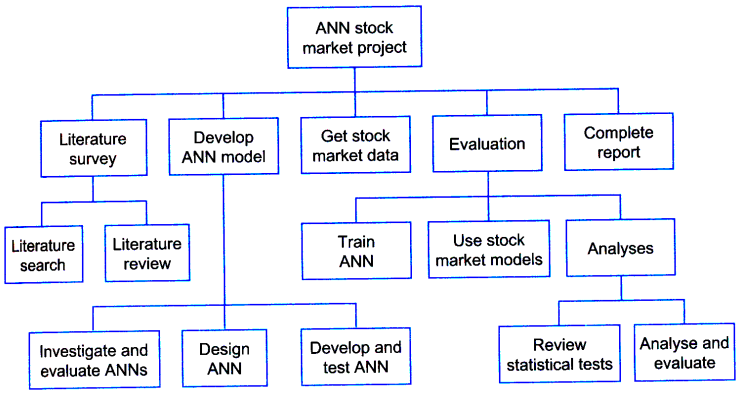
Milestone identification

- Milestones are significant steps towards the completion of the project
  - ⇝ intermediate goals at which to aim

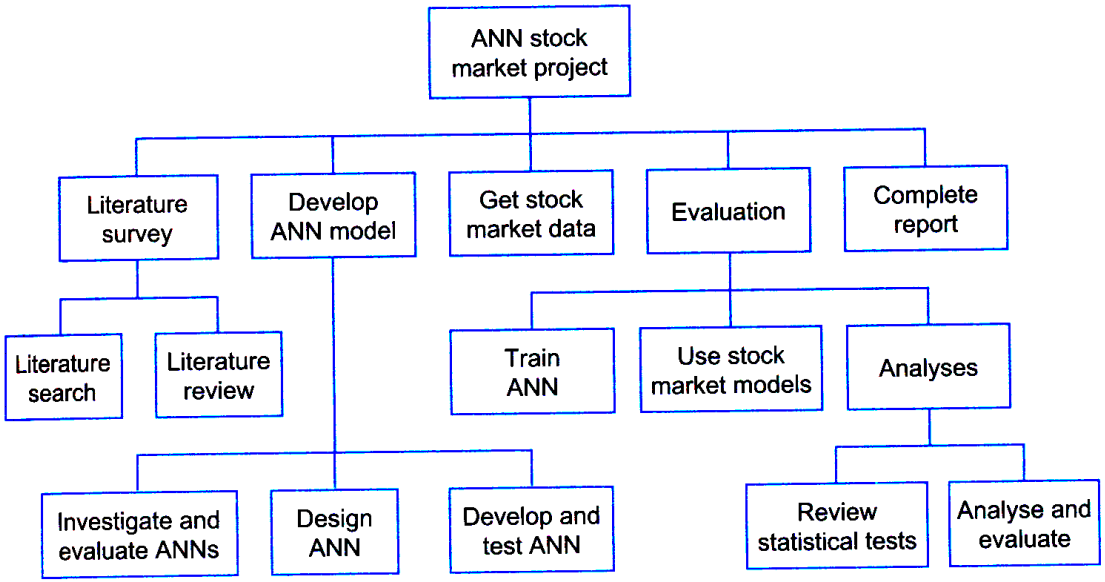




M1 Completion of literature review
(M2 Completion of ANN development)
(M3 Completion of evaluation)
M4 Completion of project/report

Activity sequencing

- The work breakdown structure does not state in which order tasks are performed

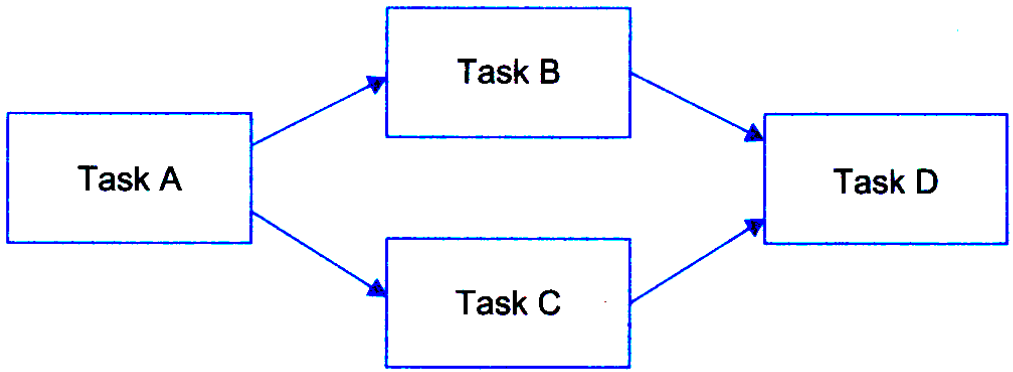


- To represent the order and inter-dependency of tasks we can use activity networks
  - Activity-on-the-node diagrams
  - Activity-on-the-arrow diagrams

Activity-on-the-node diagrams

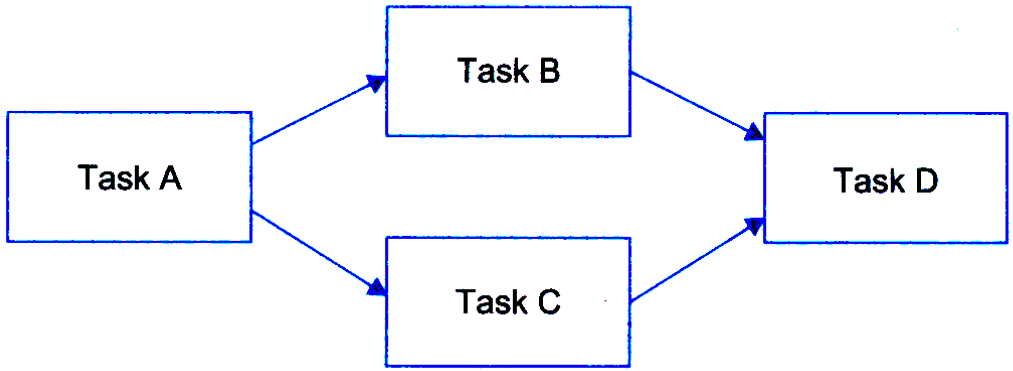
- Tasks are represented by rectangular nodes
- Milestones are represented by diamond-shape nodes
- Arrows indicate the order in which they need to be performed

Example:



- Task A has to be completed before tasks B and C can start
- Task B and C can be done independently (in parallel)
- Task D can only start once both tasks B and C have been completed

Activity-on-the-node diagrams: Start and end dates



- Assume we estimate effort and duration for the four tasks as follows

Activity	Effort	Duration
Task A	2 weeks	4 weeks
Task B	3 weeks	4 weeks
Task C	2 weeks	4 weeks
Task D	2 weeks	3 weeks

- Also assume
  - the project starts on 1 January
  - each month has four weeks
  - there are no breaks, holidays, etc
- What is the start date for each of the tasks?

Activity-on-the-node diagrams: Critical path

- Critical path: Longest-duration path through a network
  $\rightsquigarrow$ identifies the tasks in the project that must not be delayed
- Determination of critical paths:
  - Work backwards from the end to the start
  - As long as there is only one preceding task, this task must be on the critical path
  - If there is more than one preceding tasks, only the task(s) which force the start time of the next task are on the critical path

  $\rightsquigarrow$ there can be more than one critical path

Research Methods in Computer Science
Lecture 22: Project planning (3)

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42 Project planning
- Time estimates
- Milestones
- Activity sequencing

Steps of project planning

1. Work breakdown
2. Time estimates
3. Milestone identification
4. Activity sequencing
5. Scheduling
6. Replanning

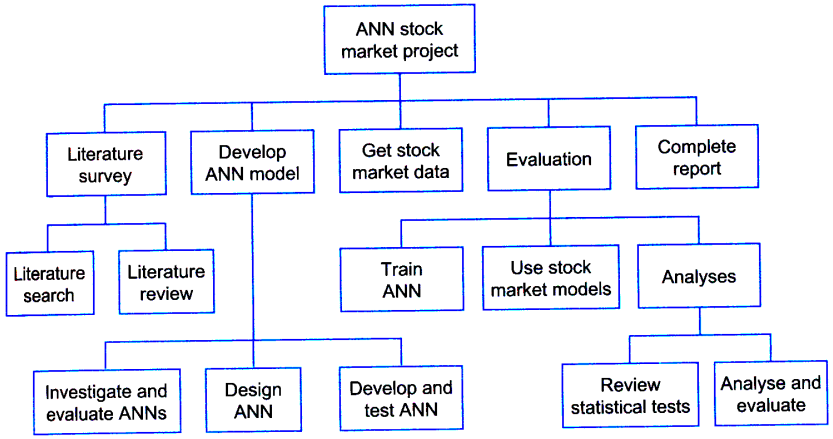
Topics

43 Developing an activity diagram

44 Project planning
- Problems with ADs
- Scheduling
- Replanning
- Rolling wave planning

Group work

- Working in groups, construct an activity-on-the-node diagram for the example stock market project based on our example project



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7 Train ANN	1 week	1 week
8 Use stock market models	1 week	2 weeks
9 Review statistical tests	1 week	2 weeks
10 Analyse and evaluate	4 weeks	4 weeks
11 Complete report	8 weeks	8 weeks
Total	26 weeks	40 weeks

Dependencies

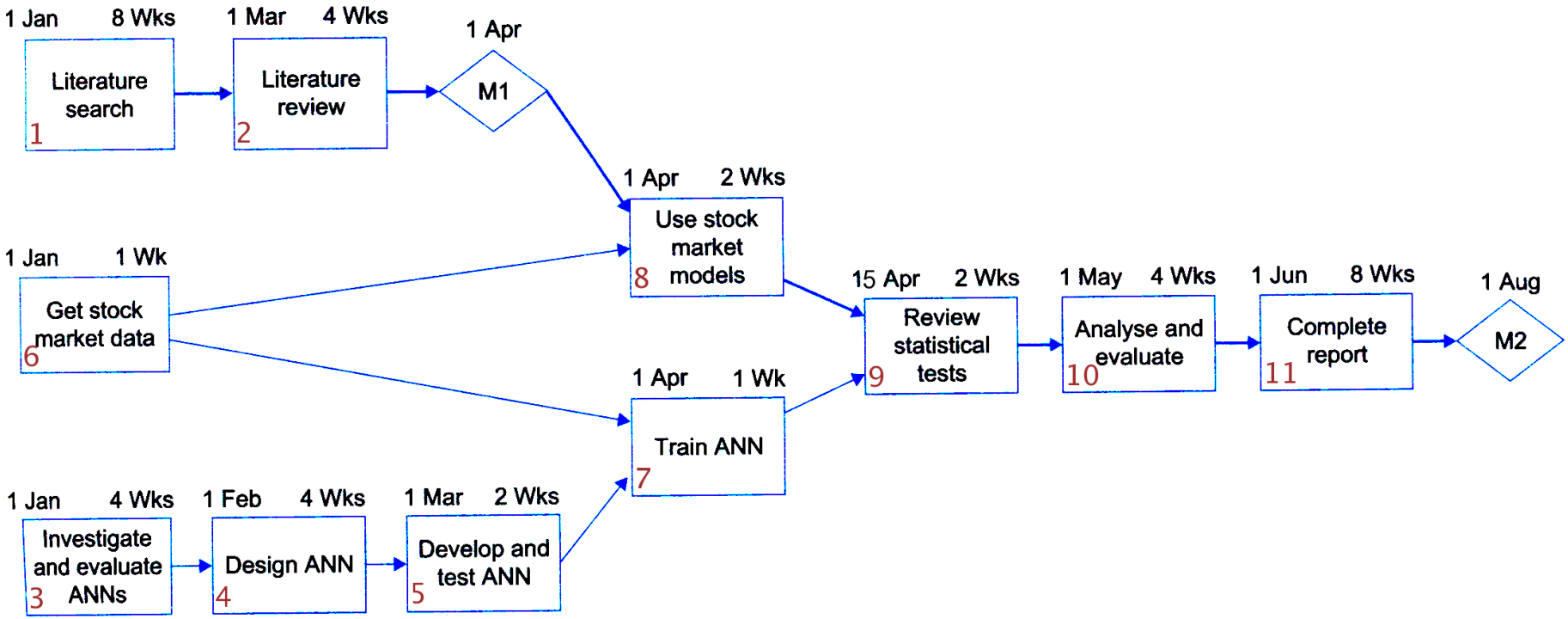
$2 \longrightarrow 1$	$7 \longrightarrow 5 \longrightarrow 4 \longrightarrow 3$	$8 \longrightarrow 6$
$11 \longrightarrow 10 \longrightarrow 9 \longrightarrow 8$	$9 \longrightarrow 7 \longrightarrow 6$	$8 \longrightarrow 2$

Milestones

M1	Completion of literature review
M4	Completion of project/report

- Determine start dates for each task
- Determine the critical path(s) for this project

Solution


1 Jan
8 Wks
Literature search
1
1 Mar
4 Wks
Literature review
2
1 Apr
M1
1 Jan
1 Wk
Get stock market data
6
1 Apr
2 Wks
Use stock market models
8
1 Apr
1 Wk
Train ANN
7
1 Jan
4 Wks
Investigate and evaluate ANNs
3
1 Feb
4 Wks
Design ANN
4
1 Mar
2 Wks
Develop and test ANN
5
15 Apr
2 Wks
Review statistical tests
9
1 May
4 Wks
Analyse and evaluate
10
1 Jun
8 Wks
Complete report
11
1 Aug
M2

Problems with activity diagrams

- Correctness of activity diagrams is difficult to check

  Example:

Activity	Effort	Duration
Task A	1 week	4 weeks
Task B	1 week	4 weeks

  Question: Can tasks A and B done in parallel and both be finished within 4 weeks?

  Answer: Information is insufficient to tell

- Do not allow to express distribution of effort within a task
- Do not reflect the duration/effort of each task well (all nodes are of equal size)
- Do not allow to indicate slack
- Simplistic view of activities/tasks: No loops, no conditions

Scheduling

Activity	Effort	Duration
Literature search	2 weeks	8 weeks
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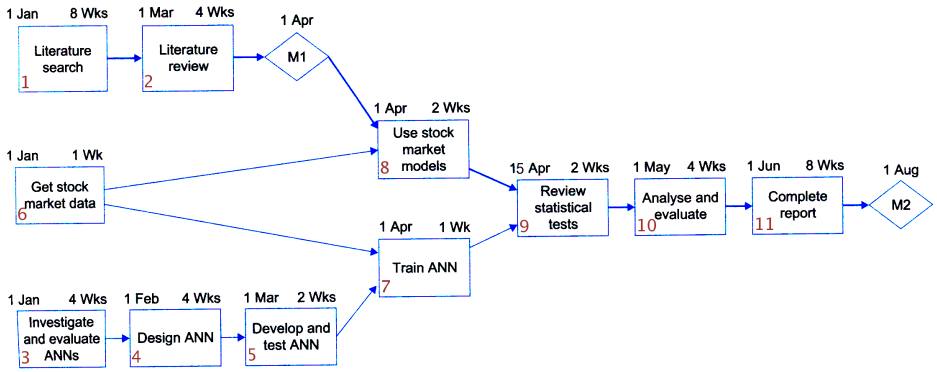
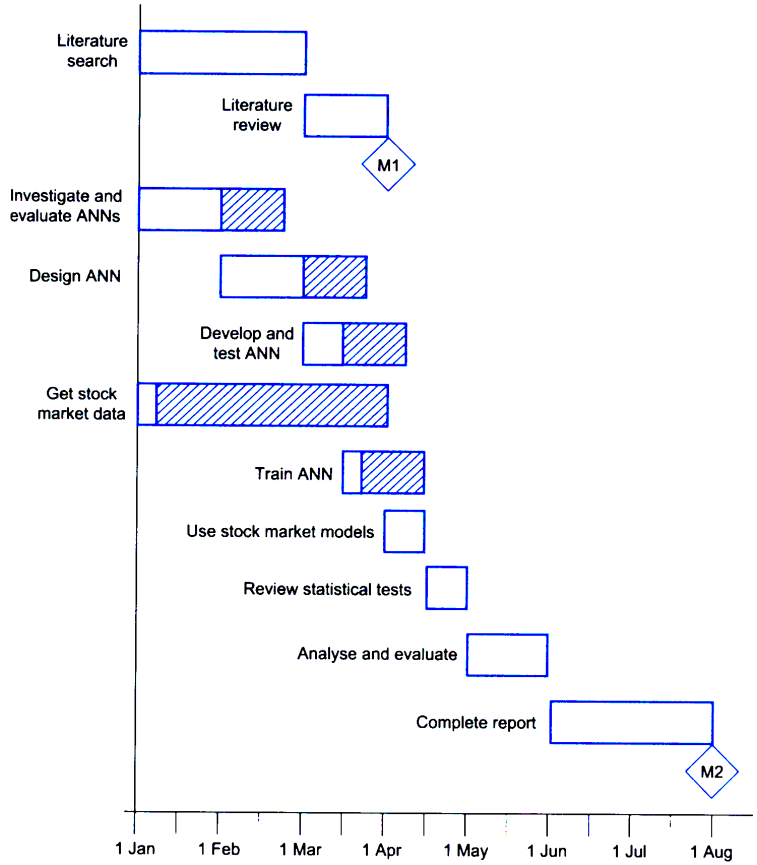
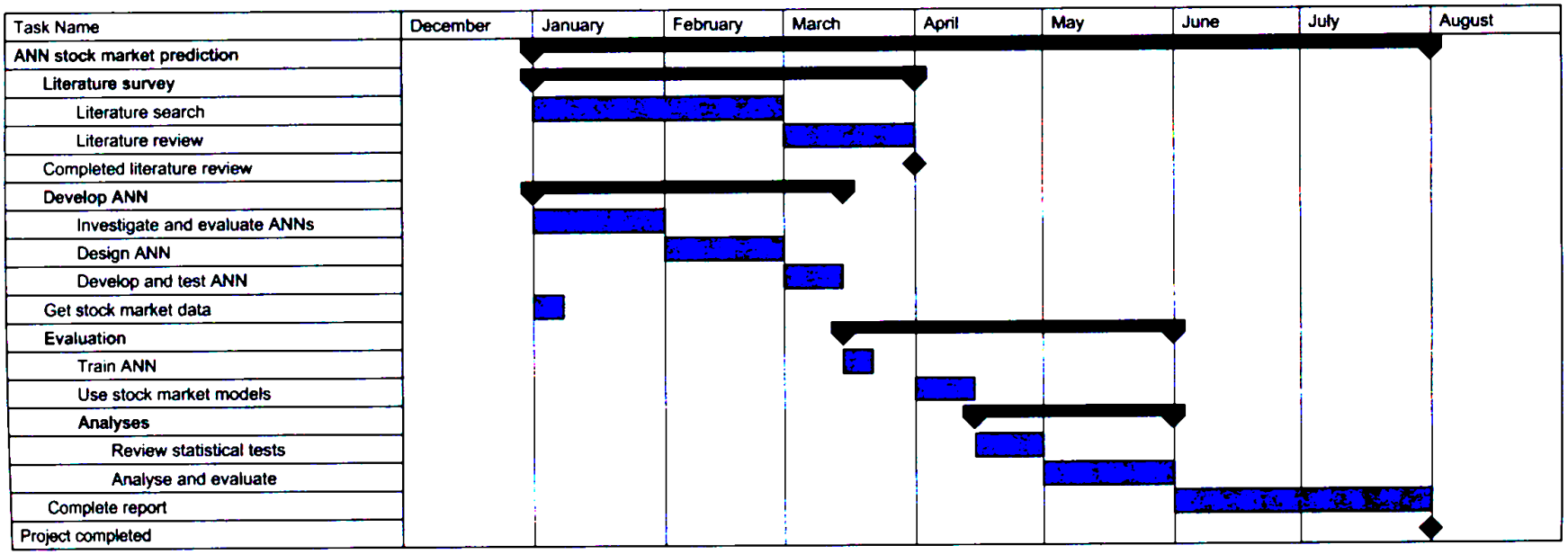


Gantt Chart



- Activities are represented by rectangles
- Milestones are represented by diamonds
- Size indicates duration relative to the timeline
- Shaded areas indicate slack

MS Project Gantt Chart



- MS Project allows to represent the hierarchy of the work breakdown structure
- MS Project allows to represent activities and milestones (in the expected way)
- MS Project does not allow to represent slack
- MS Project does not allow to represent interdependencies across high-level tasks

Replanning

- Needs to be done if you try to achieve too much in too little time
- Approach:
  Iterate the following steps until you get a correct schedule
  - Rethink the interdependencies between activities
  - Redo estimates for effort and duration of each tasks
  - Reschedule tasks
  - Rethink the aims and objectives of your project
  - Redo work breakdown structure
- No plan is perfect; no plan is set in stone

Rolling wave planning

- Phased iterative approach to project planning
  $\rightsquigarrow$ fits well for incremental development
- Approach:
  1. Define planning packages for your project with
     - resource requirements
     - macro level deliverables
     - macro level dependencies
  2. Execute the following loop
     1. Determine which planning package has to be done next (first)
     2. Make a detailed plan for this planning package
     3. Execute the plan
     4. Re-adjust the remaining planning packages based on what happened

Research Methods in Computer Science

Lecture 23: Risk management

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43 Developing an activity diagram

44 Project planning
- Problems with ADs
- Scheduling
- Replanning
- Rolling wave planning

Steps of project planning
1. Work breakdown
2. Time estimates
3. Milestone identification
4. Activity sequencing
5. Scheduling
6. Replanning

Topics

Risk management: Introduction

Risk management

- involves the identification of risks at the project's outset
- control of those risks as the project progresses

$\rightsquigarrow$ risk management process

Four main stages of the risk management process

1. Identify risks
2. Assess impact of risks
3. Alleviate critical risks
4. Control risks

Identifying risks: Types of risk

	Event-driven	Evolving
Technical	Project requirements change; Hard disk crashing	Project beyond your technical capability; Problem dependent on developing a complex algorithm
Non-Technical	Supervisor leaving; Illness	Underestimating effort required for a task; Literature not arriving on time

Identifying risks

Risk triggers (risk symptoms)

Events happening during the course of a project that might indicate problems or that one of the identified risks is increasingly likely to occur

Examples:

- Missing preliminary milestones in your project
- Struggling with a straightforward implementation of a component
- Problems with arranging a meeting a client

Assessing the impact of risks (1)

Risk impact = Likelihood × Consequence

Example: Severe earthquakes in Britain

- Likelihood is low
- Residential building → Consequences are low
  Nuclear power plant → Consequences are catastrophic

⇝ Nuclear power plants are earthquake proof,
residential buildings are not

Assessing the impact of risks (2)

1. Assess each risk according to the following scales:

Risk Likelihood	Score
Low	1
Medium	2
High	3

Risk Consequence	Score
Very low	1
Low	2
Medium	3
High	4
Very high	5

2. Compute risk impact for each risk using the formula

$$\text{Risk impact} = \text{Likelihood} \times \text{Consequence}$$

3. Rank all risks according to their risk impact

Assessing the impact of risks (3)

4. Determine critical risks

   (a) 80/20 rule:

   20% of your risks cause 80% of your problems
   $\rightsquigarrow$ 20% top ranking risks are critical

   (b) RAG grading:

Red	Risks with impact greater than 10 $\rightsquigarrow$ critical risks
Amber	Risks with impact between 6 and 10 $\rightsquigarrow$ deserve some attention
Green	Risks with impact smaller than 6 $\rightsquigarrow$ can be ignored

Alleviating critical risks (1)

- **Contingency**
  Accepting that the risk is going to occur and putting something in place to deal with it when it does

  Examples:

  - Hard disk crash → have a backup
  - Time over-run → allow slack for each task

- **Deflection**
  Passing the risk on to someone or something else

  Example:

  - Required software → use of existing software instead of developing it yourself

Alleviating critical risks (2)

- Avoidance

  Reducing the likelihood that the risk will occur at all

  Examples:

  - Use of programming languages
    $\longrightarrow$ use one that you know instead of one that you don't
  - Development of a complex algorithm
    $\longrightarrow$ modify an existing algorithm

Risk assessment report

Project: Introduction of IT-assisted teaching at a college

Risk	Likelihood	Consequence	Risk management approach	Risk symptoms
Infrastructure				
IT infrastructure cannot cope with requirements	Med(2)	High(4)	Equip sufficiently and involve IT Dept	Speed of equipment response
Data projector failing during teaching	Low(1)	Very High(5)	Have a stand-by data projector	None
Staff				
Lack of commitment by staff	Med(2)	High(4)	Clear communication plan; staff development events	Non- or variable attendance of events
Loss of key staff	Med(2)	Med(3)	Succession planning; critical procedures should be documented in a manual	Notice period / Request to attend interview
Delivery				
Staff not available at times training is delivered	High(3)	High(4)	Flexible delivery and session on different days and at different times	Timetables

Controlling risks

Planning a risk strategy

- How will you go about managing/controlling the risks identified?

  E.g. how and when would you notice a time over-run?

  Checkpoints: Checking critical risks
  - at regular intervals (e.g. weekly)
  - at the end of particular project stages
  - at meetings with your supervisor

- How and when will you check the risk triggers identified?
- How and when will you invoke your contingency plans?
- How and when will you update your critical risk list?

  Risk likelihood and risk consequences change over time

Today's question

Consider our running example, that is, the project with the aim to

> *Develop and evaluate an Artificial Neural Network to predict stock market indices*

which is conducted by undertaking the following tasks

Activity	Effort	Duration
Literature search	2 weeks	8 weeks
Literature review	2 weeks	4 weeks
Investigate and evaluate ANNs	2 weeks	4 weeks
Design ANN	2 weeks	4 weeks
Develop and test ANN	2 weeks	2 weeks
Get stock market data	1 week	1 week
Train ANN	1 week	1 week
Use stock market models	1 week	2 weeks
Review statistical tests	1 week	2 weeks
Analyse and evaluate	4 weeks	4 weeks
Complete report	8 weeks	8 weeks
Total	26 weeks	40 weeks

What might a risk assessment report look like for this project?

(10 minutes group discussion)

Project planning: Summary

- Project planning consists of two stages:
  1. Defining what it is you want to achieve
  2. Planning how you will achieve it
- Project planning proceeds in six steps
  1. Work breakdown
  2. Time estimates
  3. Milestone identification
  4. Activity sequencing
  5. Scheduling
  6. Replanning
- Risk management is performed in parallel with project management and involves four stages:
  1. Risk identification
  2. Risk quantification
  3. Risk alleviation
  4. Risk control