COMP 516
Research Methods in Computer Science

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Lecture 13: Project planning (1)

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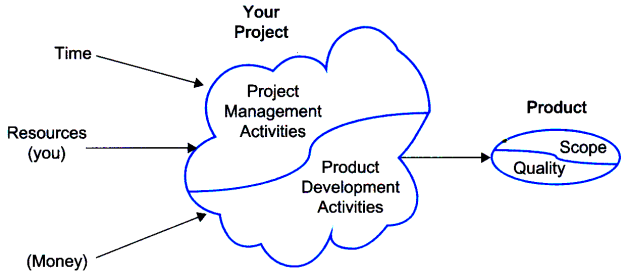
Overview

- 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 extent 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
⇝ 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 extent and to what quality the objective has been completed?
- Is it appropriate? Is it related to and in support of our aims?
- 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

Running Example

Example aim:

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

Example objectives:

1. Complete a literature search and literature review of existing stock market prediction techniques
2. Develop a suitable Artificial Neural Network model
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Steps of project planning

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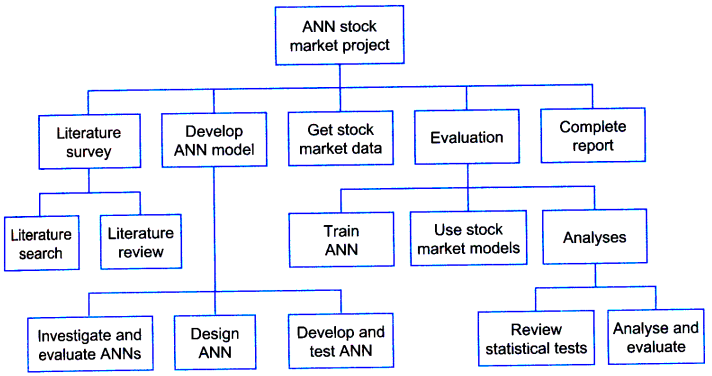
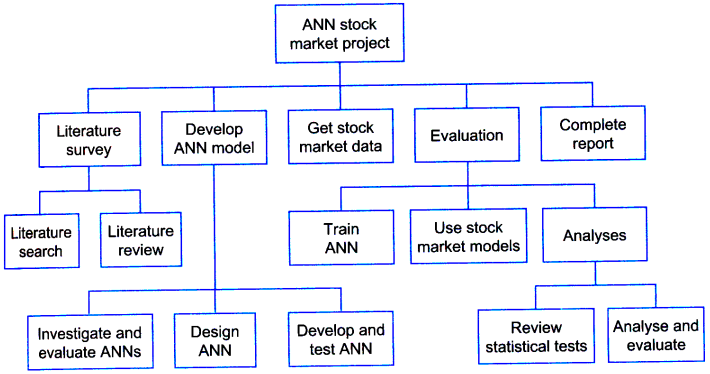
Work Breakdown (1)

- First step of project planning: Identify 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



Steps of project planning

1. Work breakdown
2. Time estimates
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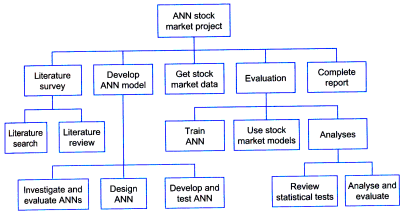
Time Estimates

- 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

Steps of project planning

1. Work breakdown
2. Time estimates
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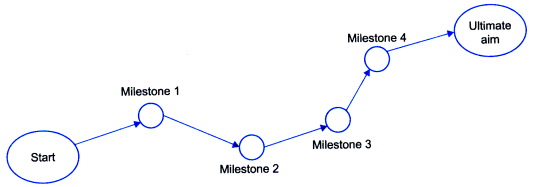
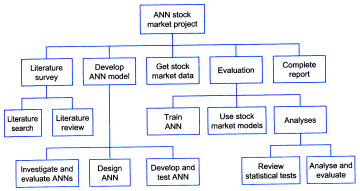
Milestone Identification

- 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

Steps of project planning

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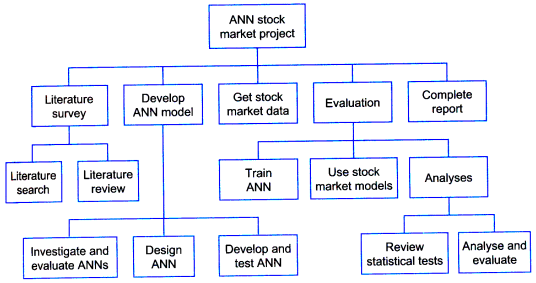
Activity Sequencing

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

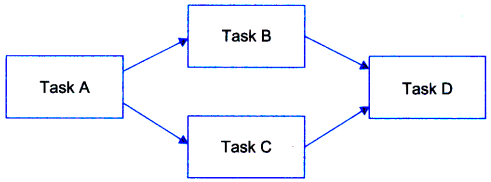


- To represent the order and inter-dependency of tasks we can use activity networks
  - Activity-on-the-node diagrams
  - Activity-on-the-arrow diagrams

Activity-on-the-node Diagrams

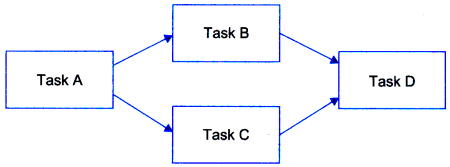
- Tasks are represented by rectangular nodes
- Milestones are represented by diamond-shape nodes
- Arrows indicate the order in which they need to be performed

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

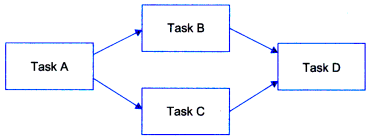
Activity-on-the-node Diagrams: Start and End Dates



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

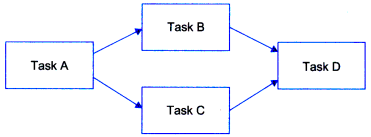
Activity	Effort	Duration
Task A	2 weeks	4 weeks
Task B	2 weeks	4 weeks
Task C	2 weeks	4 weeks
Task D	2 weeks	3 weeks

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

Activity	Start Date
Task A	Jan 1
Task B	Feb 1
Task C	Feb 1
Task D	Mar 1



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

Activity	Start Date
Task A	Jan 1
Task B	Feb 1
Task C	Feb 1
Task D	Mar 1 or Mar 8?

We need to consider our ability to do activities in parallel

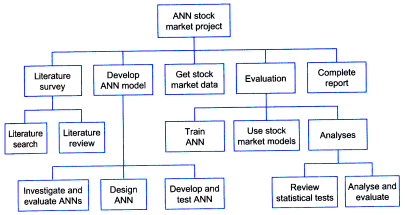
Activity-on-the-node diagrams: Critical Path

- Critical path: Longest-duration path through a network
  ⇝ identifies the tasks in the project that must not be delayed
- Determination of critical paths:
  - Determine earliest start dates for activities
  - 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

  ⇝ there can be more than one critical path

Example

- Our goal is to construct an activity-on-the-node diagram for the example stock market project based on our example project



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Total	26 weeks	40 weeks

Dependencies

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

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

Activity	Effort	Duration
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Milestones

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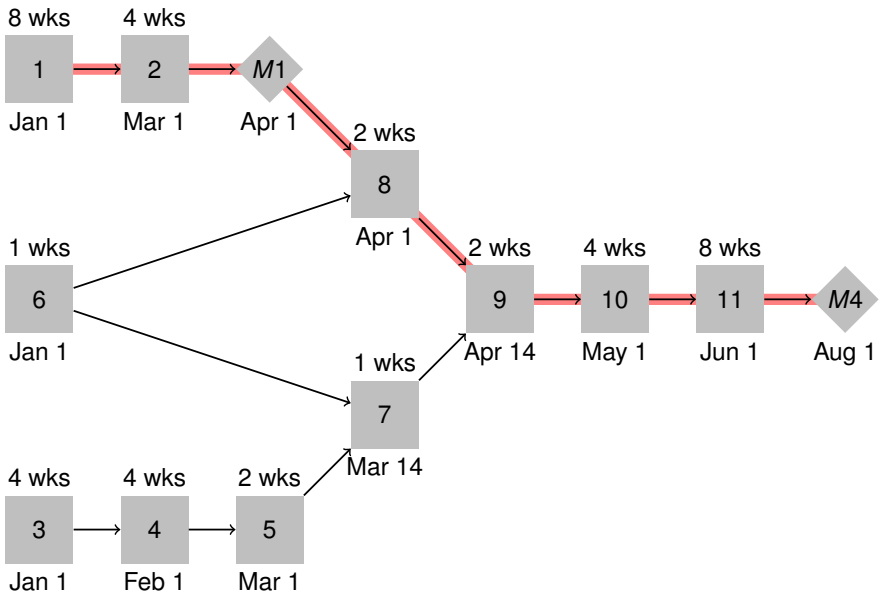
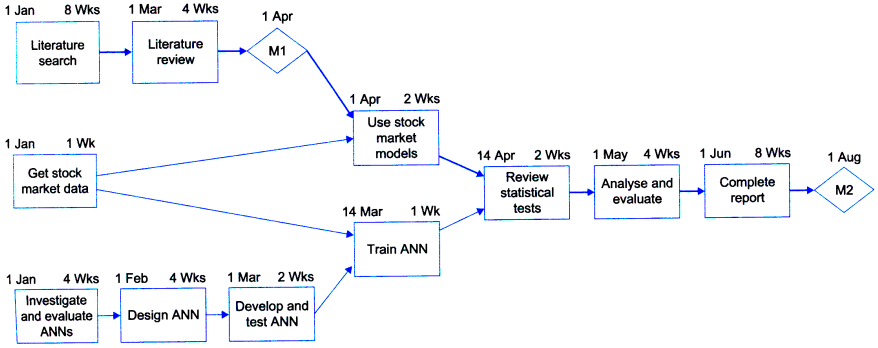


Solution



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 be 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

Next time

Finish Project Planning:

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

. . . and then Risk Management

Announcements

- No lectures next Monday (29th Oct) and Tuesday (30th Oct)
- you should spend that time working on your presentations
- we resume on Thursday (1st Nov at 10am)
- 2nd Nov (Friday) at 6pm: the deadline for submitting your presentation and preliminary bibliography for your essay