Part 5

- *Project planning*
  - o *Time estimates*
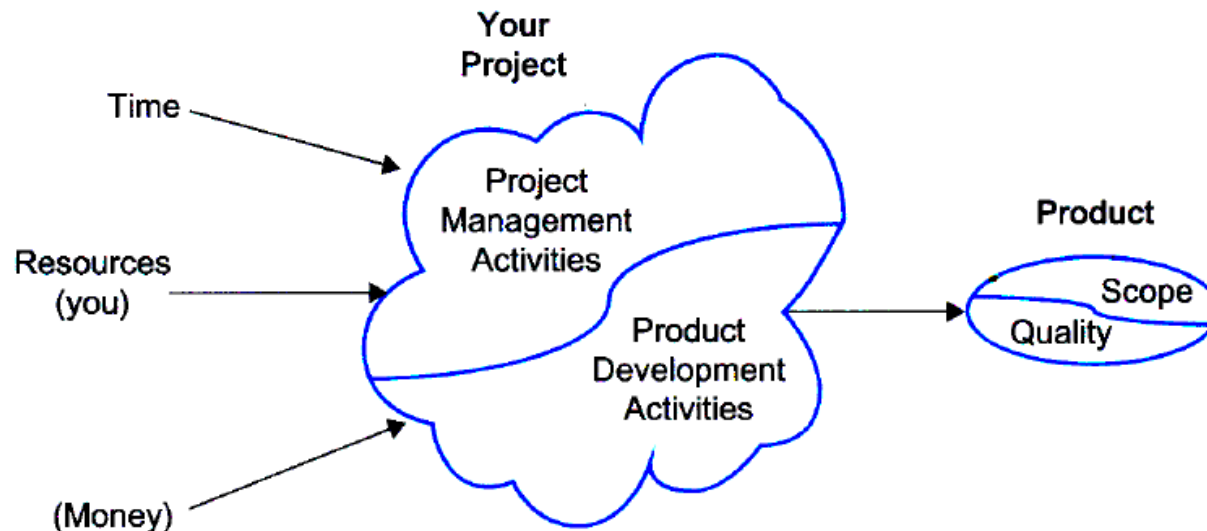 - o *Milestones*
  - o *Activity sequencing*

Research Methods in Computer Science

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Project planning

- 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 activites

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

1. Project definition: aims and objectives

Clear specification of what the project is to achieve
↝ 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

1. Project definition: 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

1. 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?
- 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?

2. 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
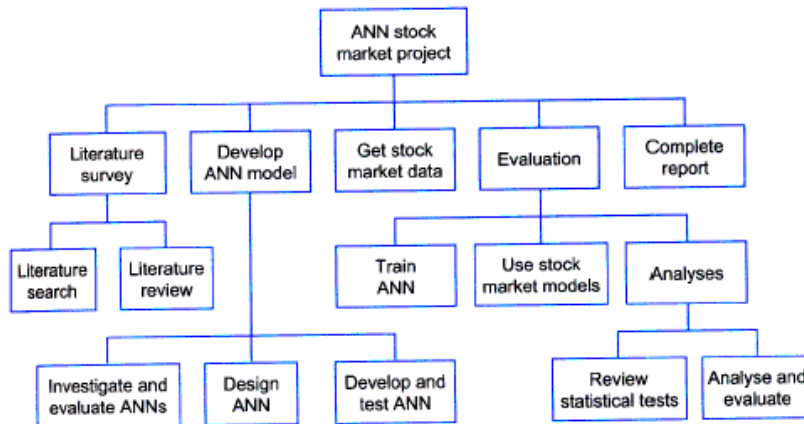6. Replanning

2. Project planning: work breakdown

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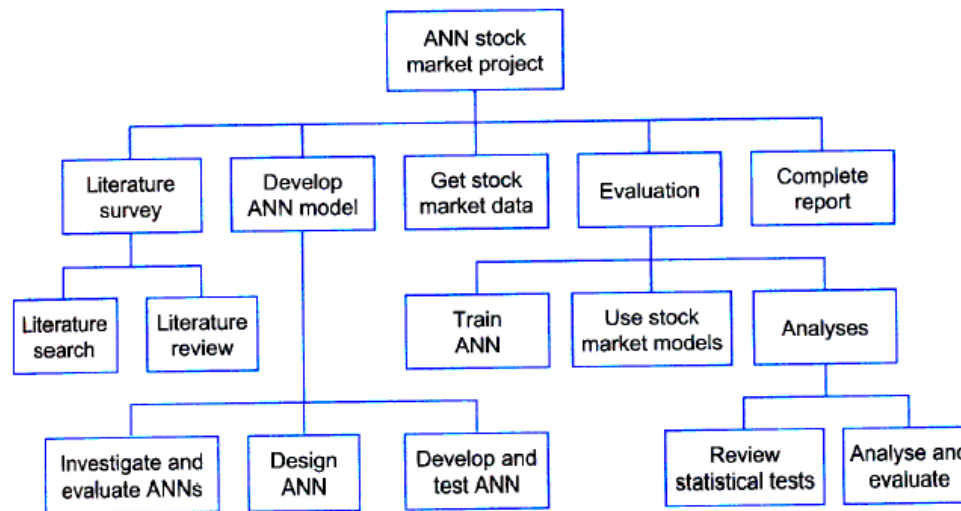
- Tasks at all levels need to be separate from one another
- Continue to break down your project into smaller tasks until each task takes up no less than 5% of the total effort

2. Project planning: 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

2. Project planning: milestone identification

- Milestones are significant steps towards the completion of the project
  - ↝ intermediate goals at which to aim
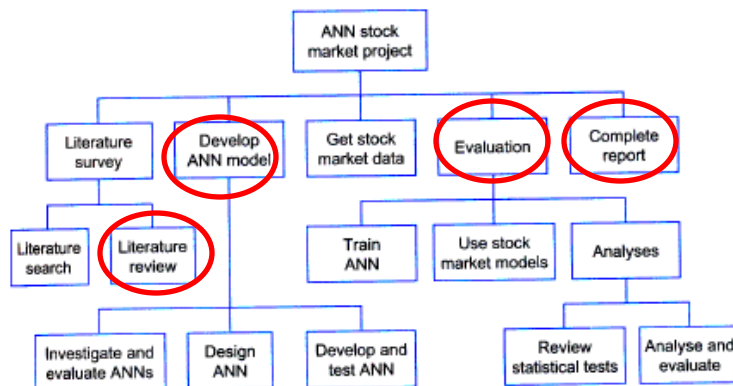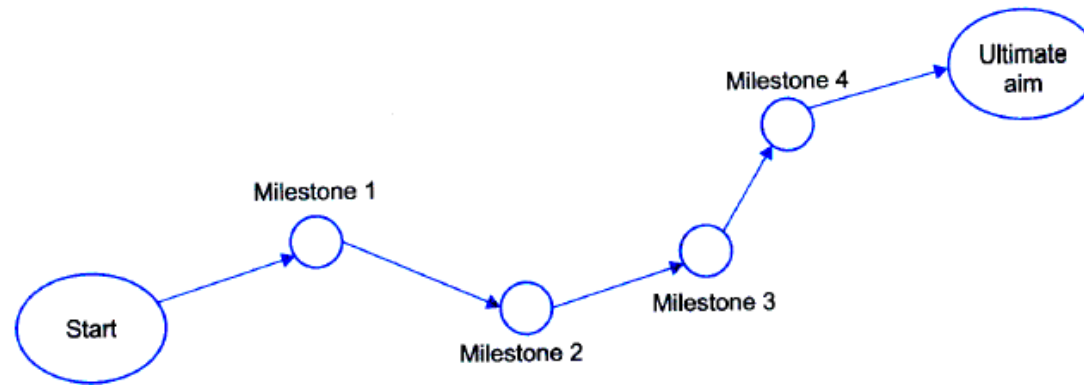
M1   Completion of literature review
(M2   Completion of ANN development)
(M3   Completion of evaluation)
M4   Completion of project/report

2. Project planning: activity sequencing

- The work breakdown structure does not state in which order tasks are performed
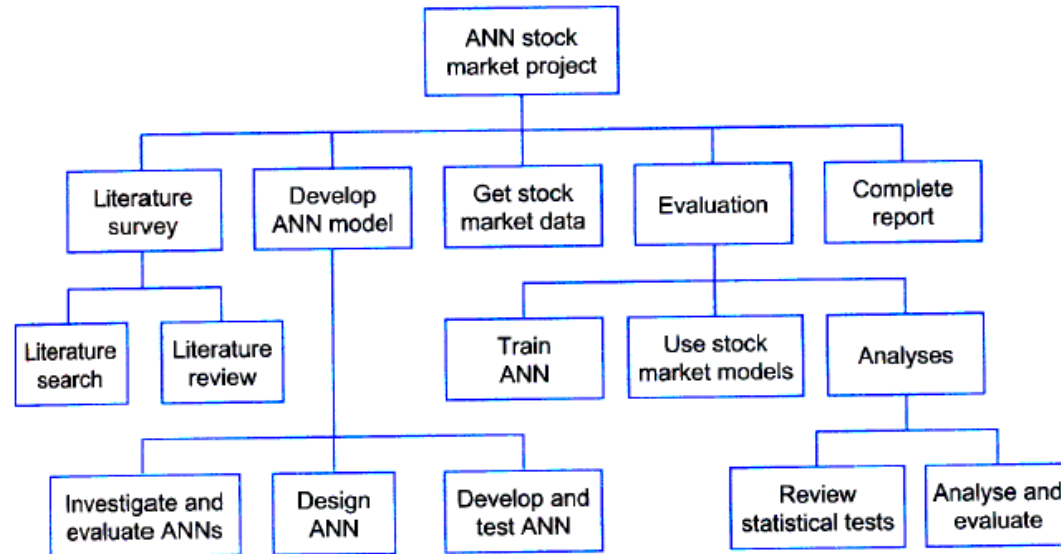
- To represent the order and inter-dependency of tasks we can use activity networks
  - Activity-on-the-node diagrams
 - Activity-on-the-arrow diagrams

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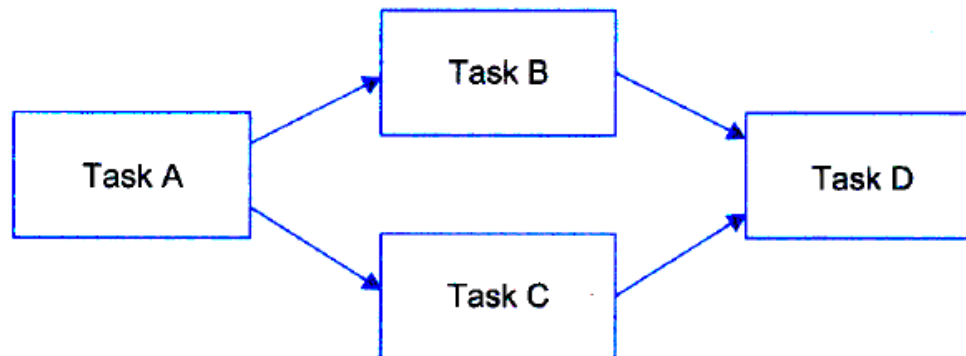
- Task A has to be completed before tasks B and C can start
- Task B and C can be done independently (in parallel)
- Task D can only start once both tasks B and C have been completed

Activity-on-the-node diagrams: start and end dates
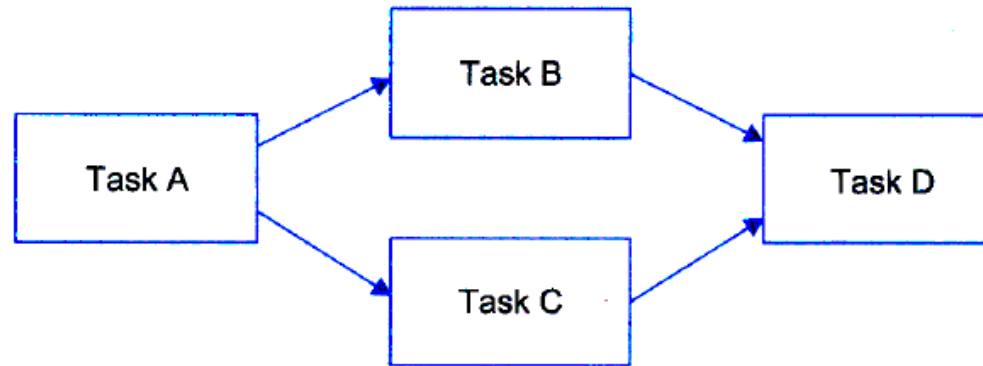
- Assume we estimate effort and duration for the four tasks as follows

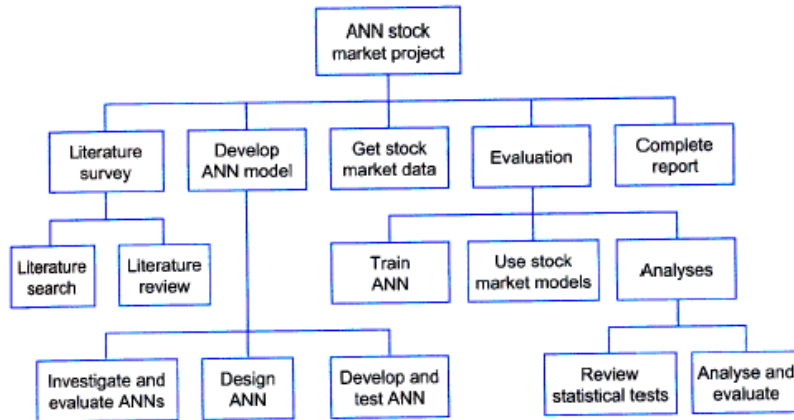| Activity	Effort	Duration
Task A	2 weeks	4 weeks
Task B	3 weeks	4 weeks
Task C	2 weeks	4 weeks
Task D	2 weeks	3 weeks

- 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
  ⤳ 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

  ⤳ there can be more than one critical path

3. Project initiation: group work

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

Activity	Effort	Duration
1 Literature search	2 weeks	8 weeks
2 Literature review	2 weeks	4 weeks
3 Investigate and evaluate ANNs	2 weeks	4 weeks
4 Design ANN	2 weeks	4 weeks
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6 Get stock market data	1 week	1 week
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
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Dependencies

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

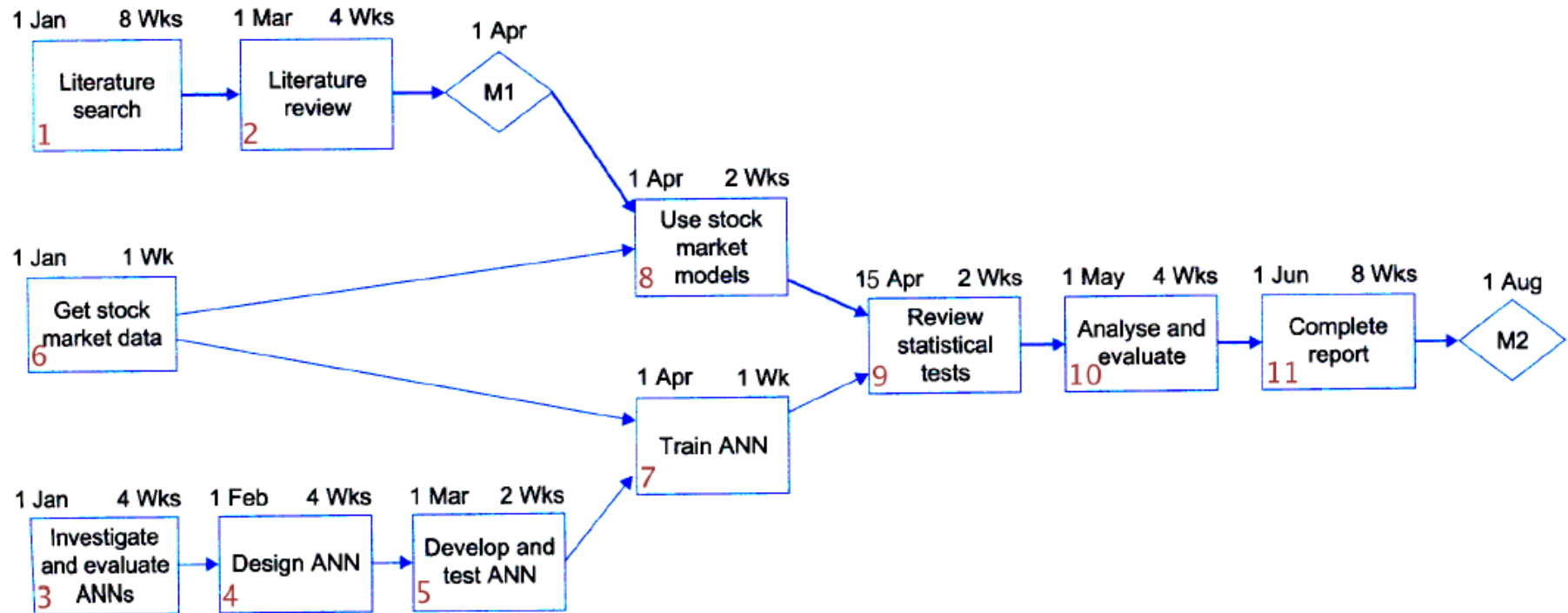**Milestones**

M1	Completion of literature review
M2	Completion of project/report

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

3. Project initiation: group work

3. Project initiation: problems with activity diagrams

- Correctness of activity diagrams is difficult to check

  Example:

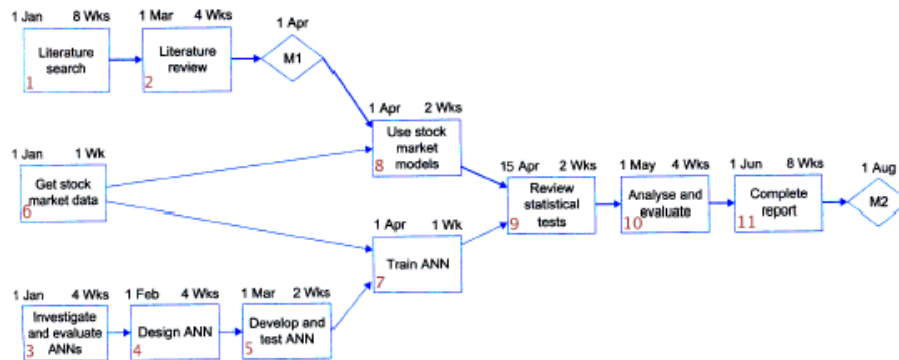 | Activity | Effort | Duration |
  |----------|--------|----------|
  | Task A | 1 week | 4 weeks |
  | Task B | 1 week | 4 weeks |

  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

3. Project initiation: scheduling

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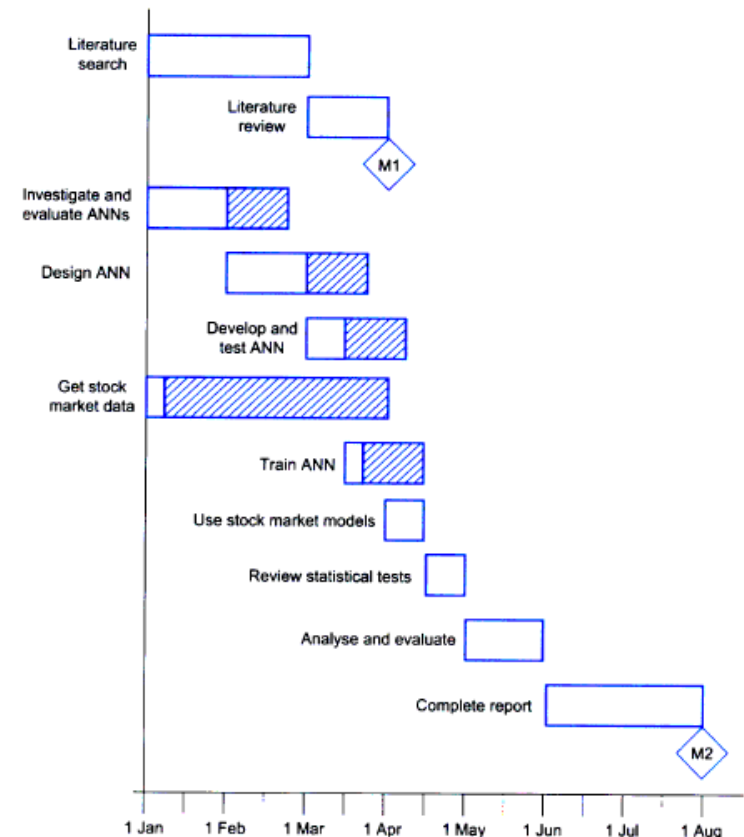
- Activities are represented by rectangles
- Milestones are represented by diamonds
- Size indicates duration relative to the timeline
- Shaded areas indicate slack

3. Project initiation: 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

End of part 5

- *Project planning*
  - o *Time estimates*
  - o *Milestones*
  - o *Activity sequencing*

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