COMP 516
Research Methods in Computer Science

Dominik Wojtczak

Department of Computer Science
University of Liverpool

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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

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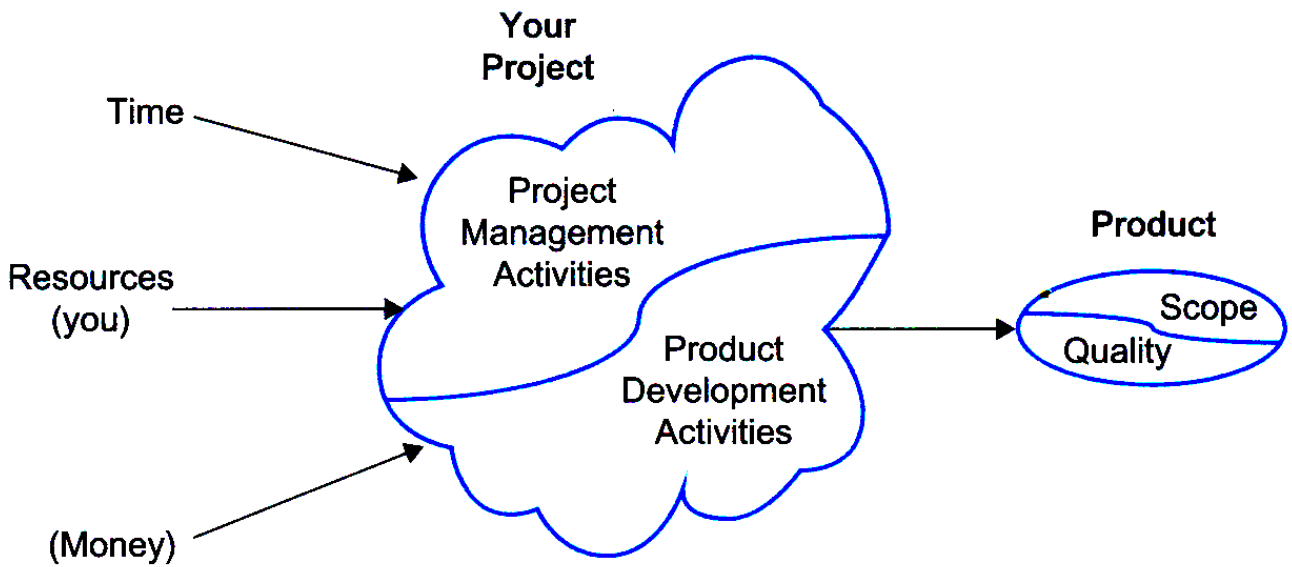

Main Project Activities

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

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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

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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

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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
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Each objective should be

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

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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?

Project Definition: SMART Objectives

Each objective should be

- Specific
- Measurable
- Appropriate
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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
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Running Example

Example aim:

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

Example objectives:

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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 (1)

- First step of project planning: Identify the tasks that need to be done
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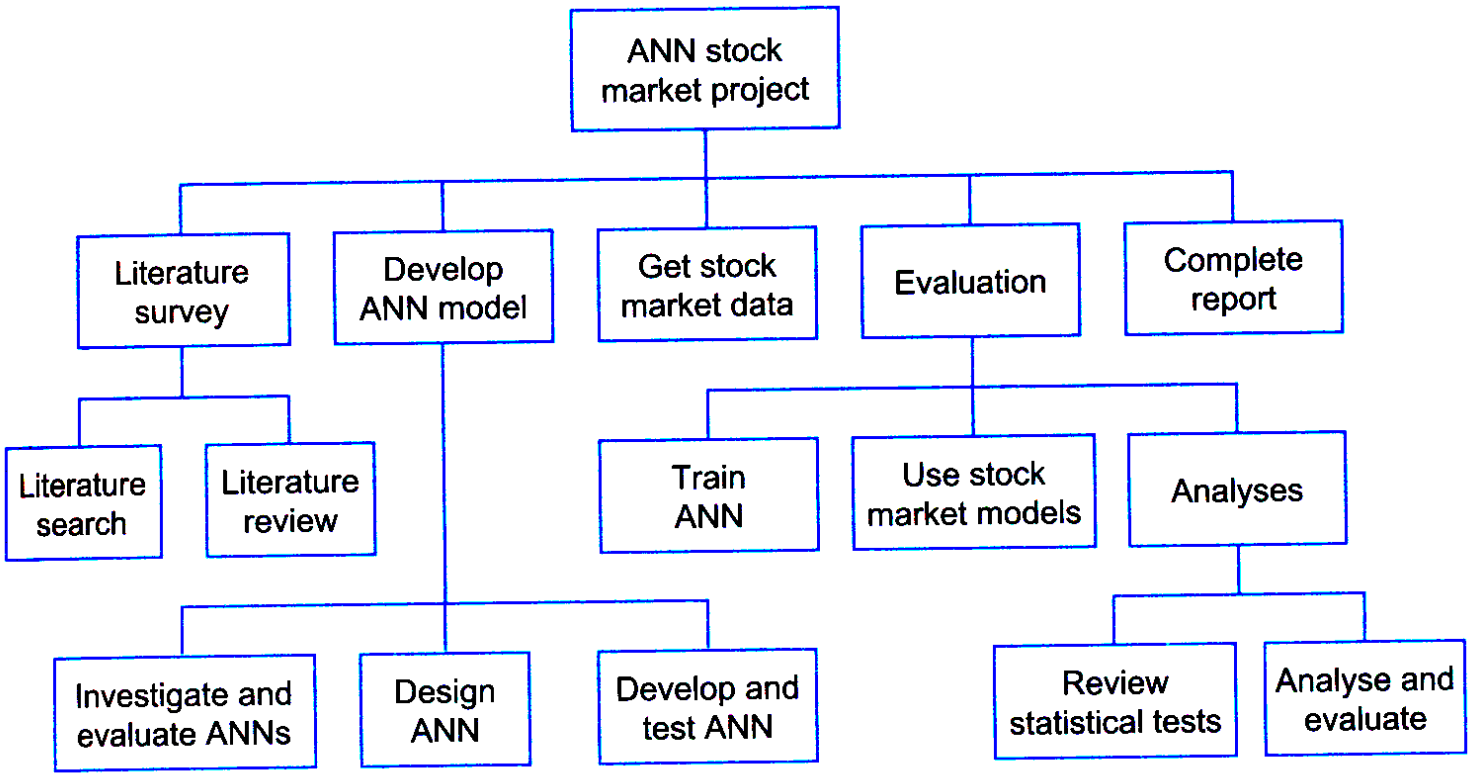
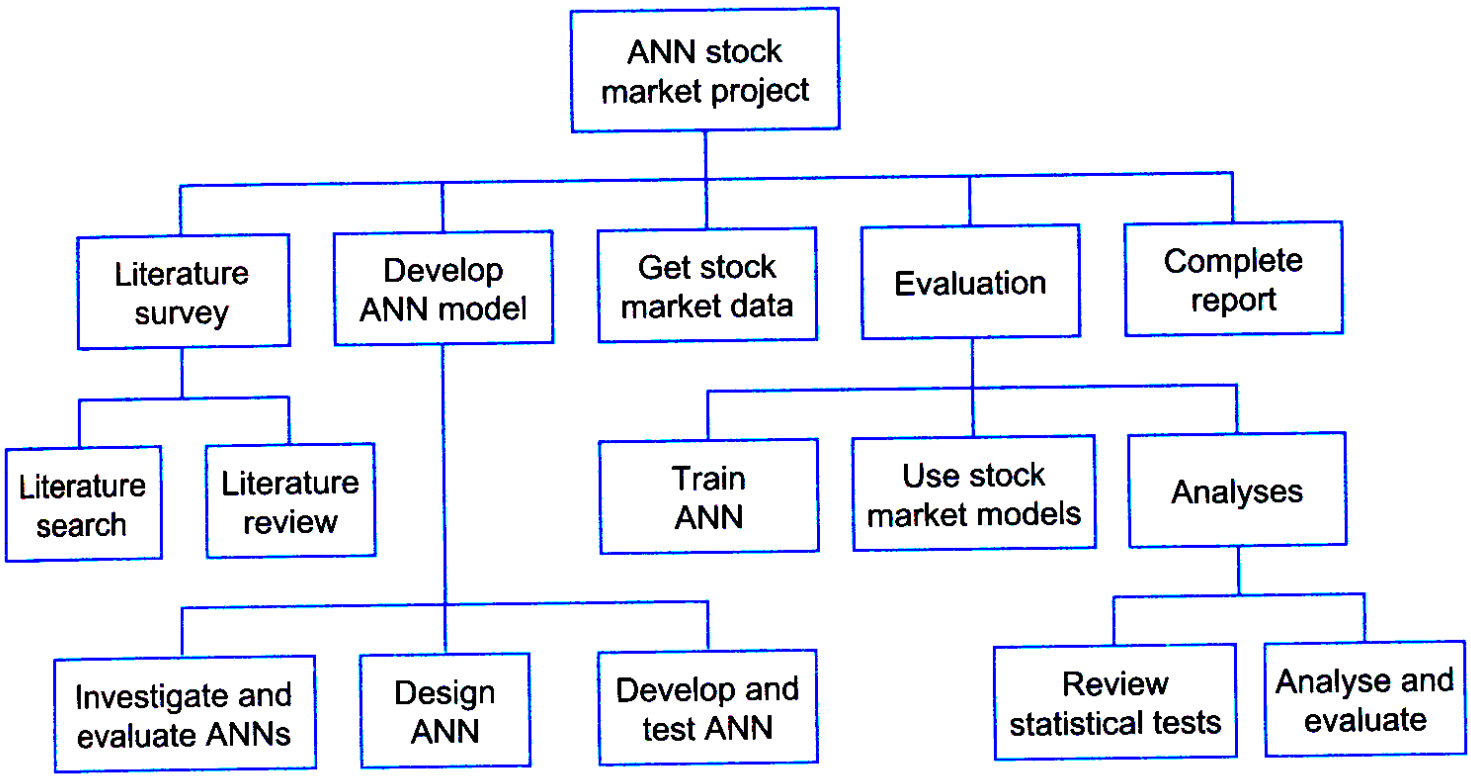
- Work breakdown structures are used to visualise the process of breaking down the project



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

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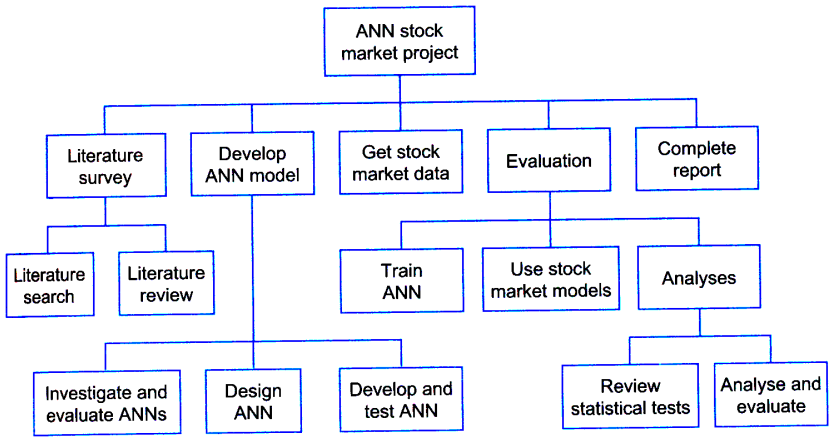
Time Estimates

- 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
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Complete report	8 weeks	8 weeks
Total	26 weeks	40 weeks

Steps of project planning

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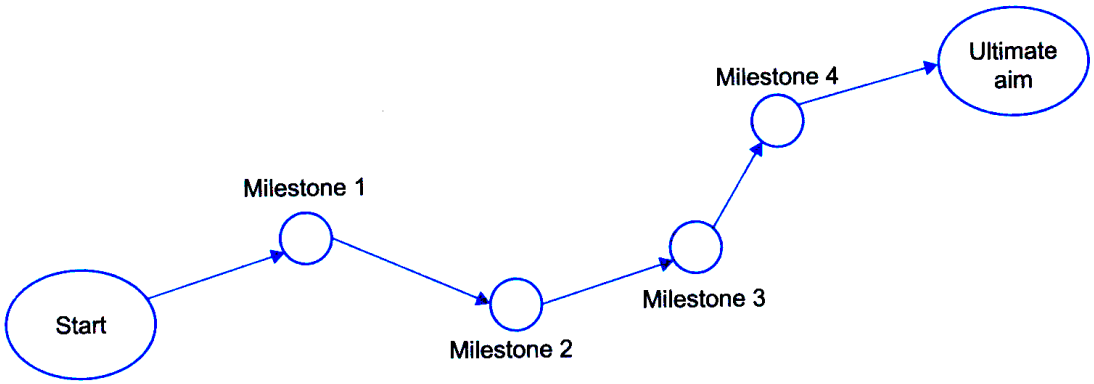
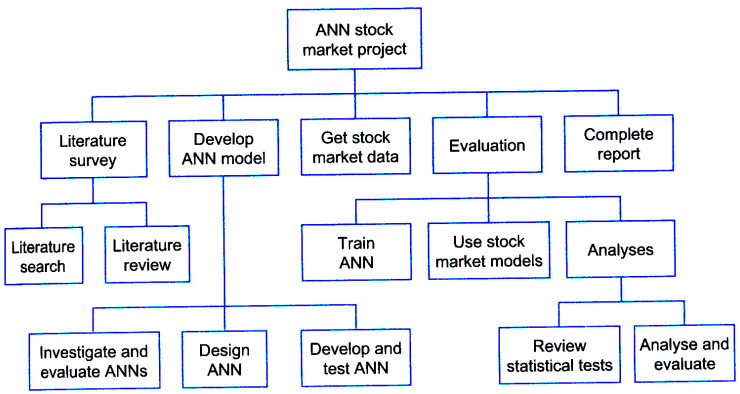
Milestone Identification

- 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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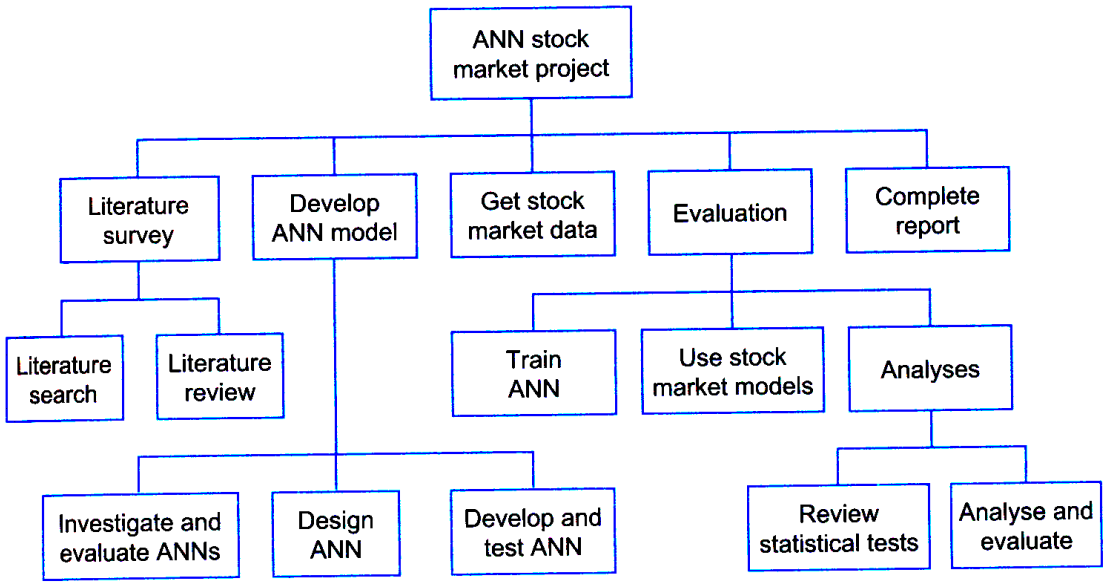
Activity Sequencing

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

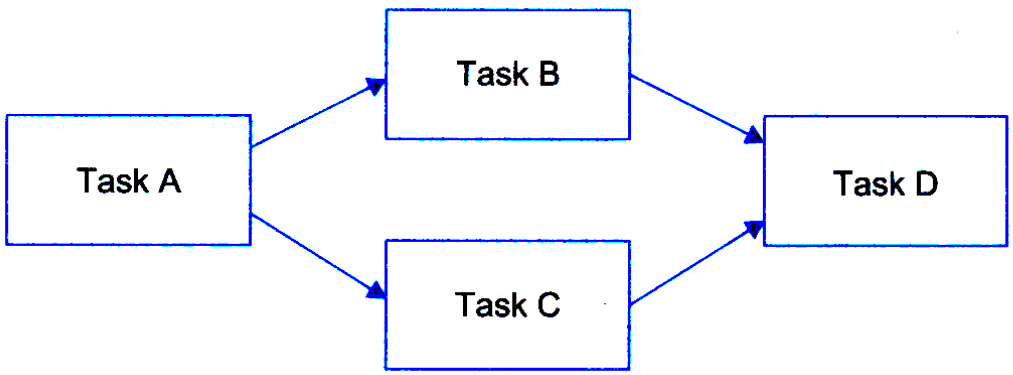


- To represent the order and inter-dependency of tasks we can use activity networks
  - Activity-on-the-node diagrams
  - Activity-on-the-arrow diagrams

Activity-on-the-node Diagrams

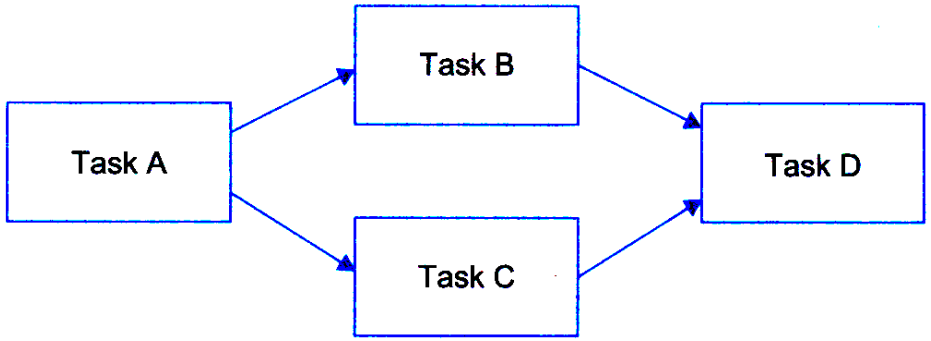
- Tasks are represented by rectangular nodes
- Milestones are represented by diamond-shape nodes
- Arrows indicate the order in which they need to be performed

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

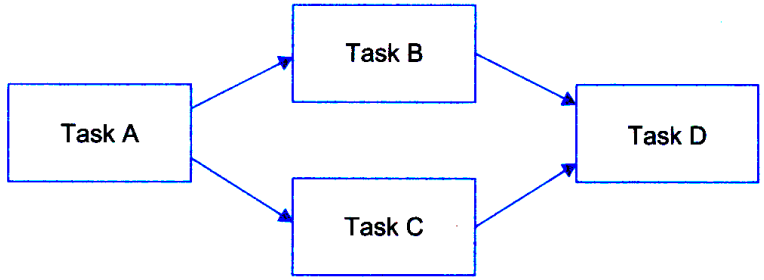
Activity-on-the-node Diagrams: Start and End Dates



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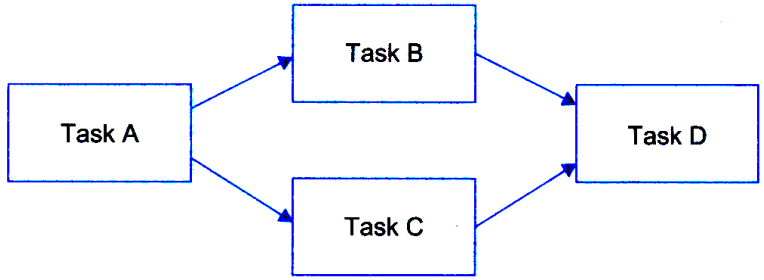
Activity	Start Date
Task A	Jan 1
Task B	Feb 1
Task C	Feb 1
Task D	Mar 1



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Task A	2 weeks	4 weeks
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Task C	2 weeks	4 weeks
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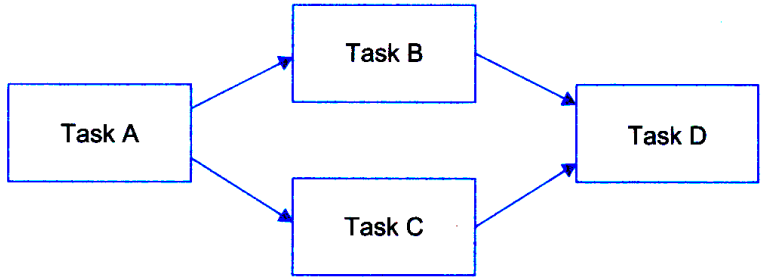
Activity	Start Date
Task A	Jan 1
Task B	Feb 1
Task C	Feb 1
Task D	Mar 1 or Mar 8?

We need to consider our ability to do activities in parallel



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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:
  - 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
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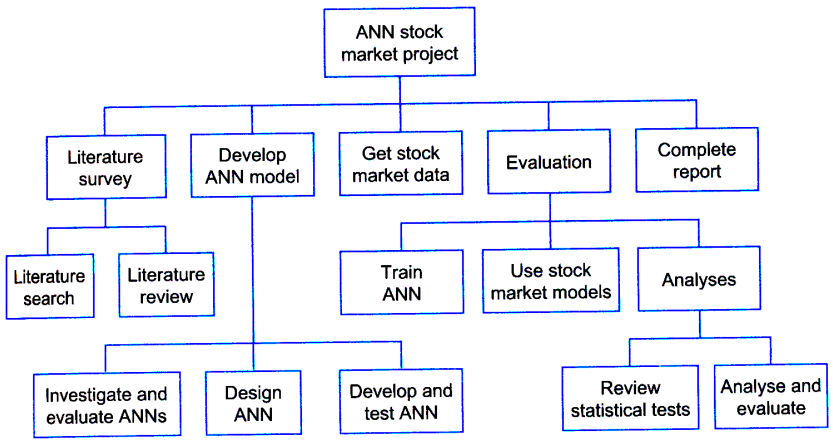
Example

- 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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$11 \rightarrow 10 \rightarrow 9 \rightarrow 8$	$9 \rightarrow 7 \rightarrow 6$	$8 \rightarrow 2$

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

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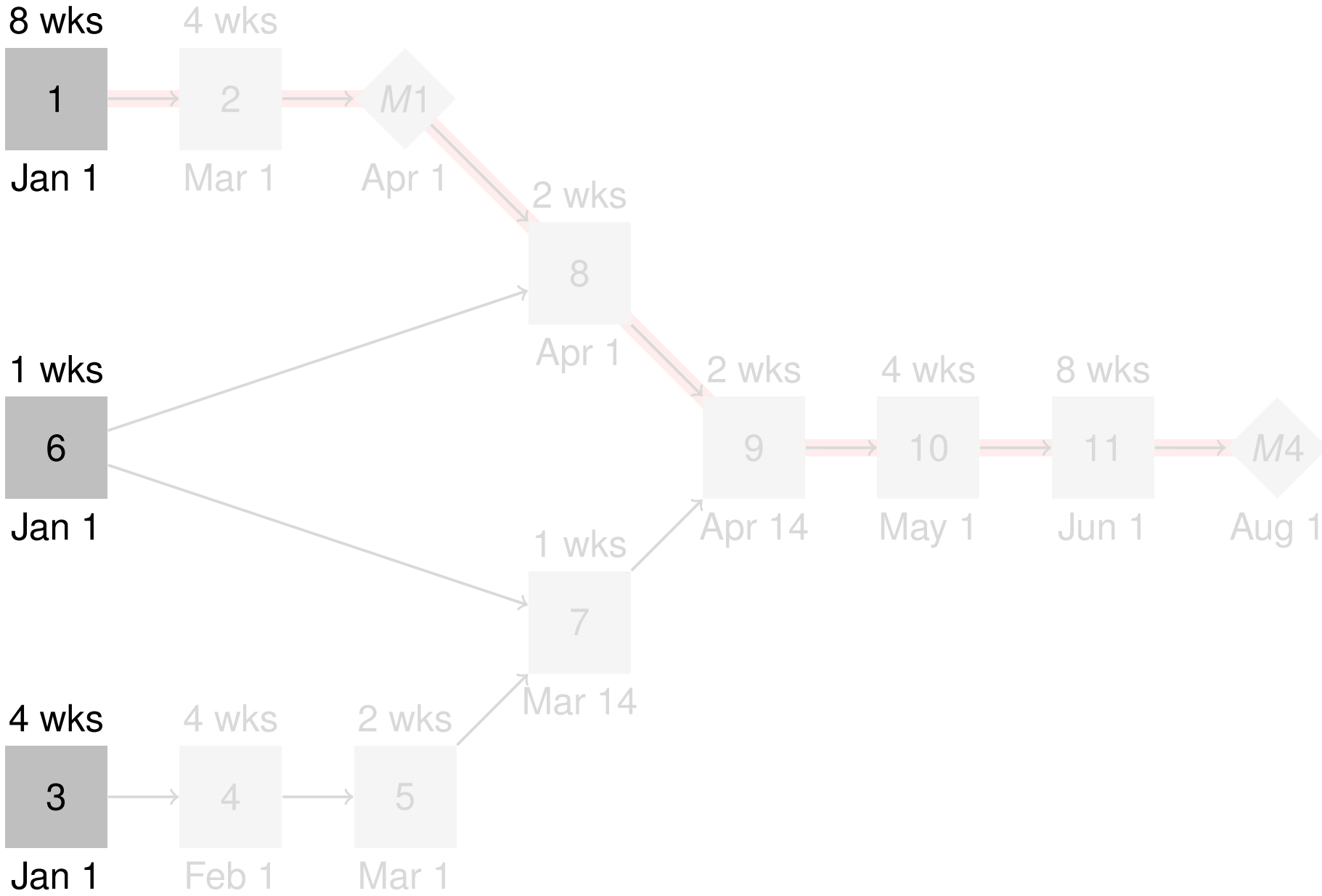
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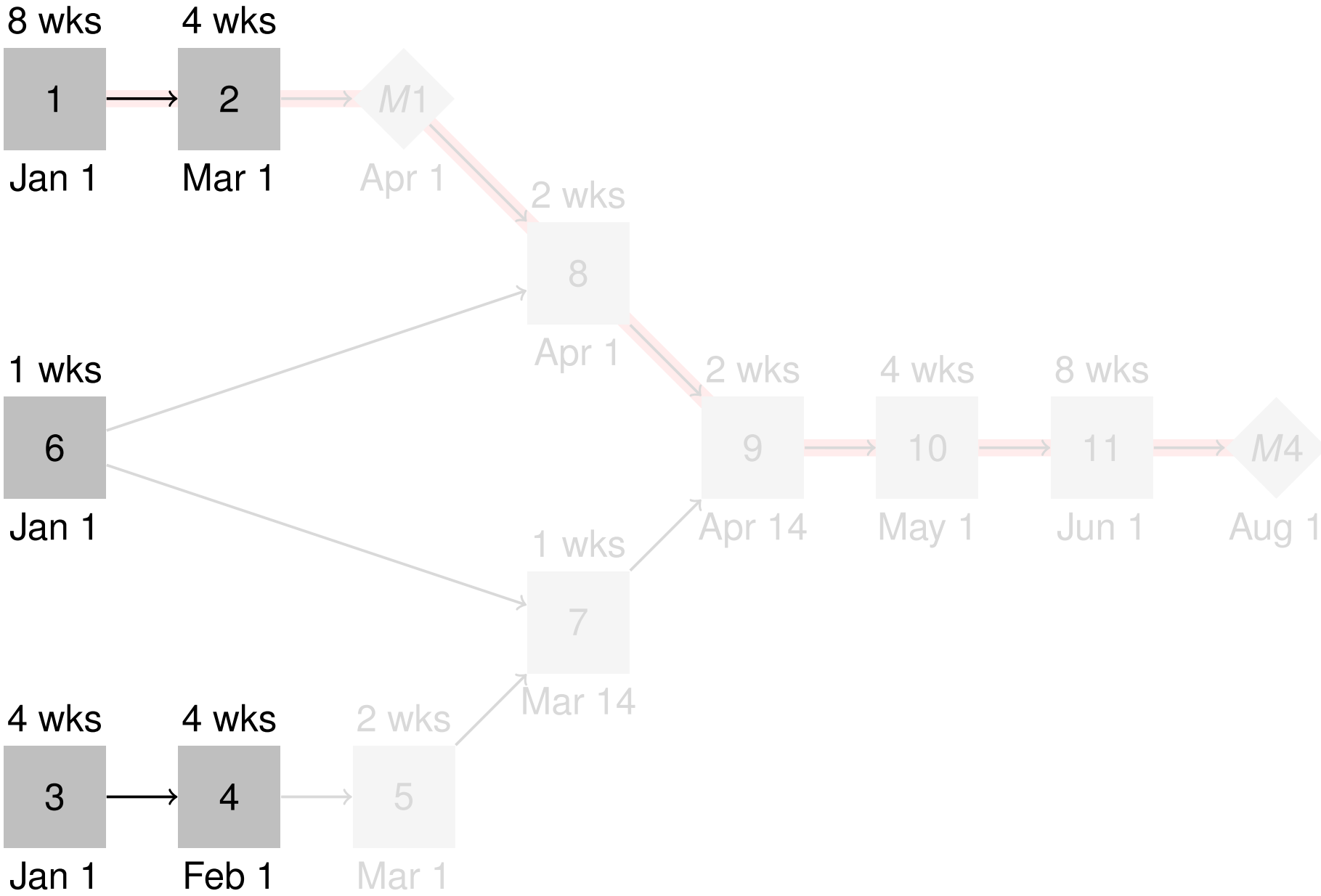
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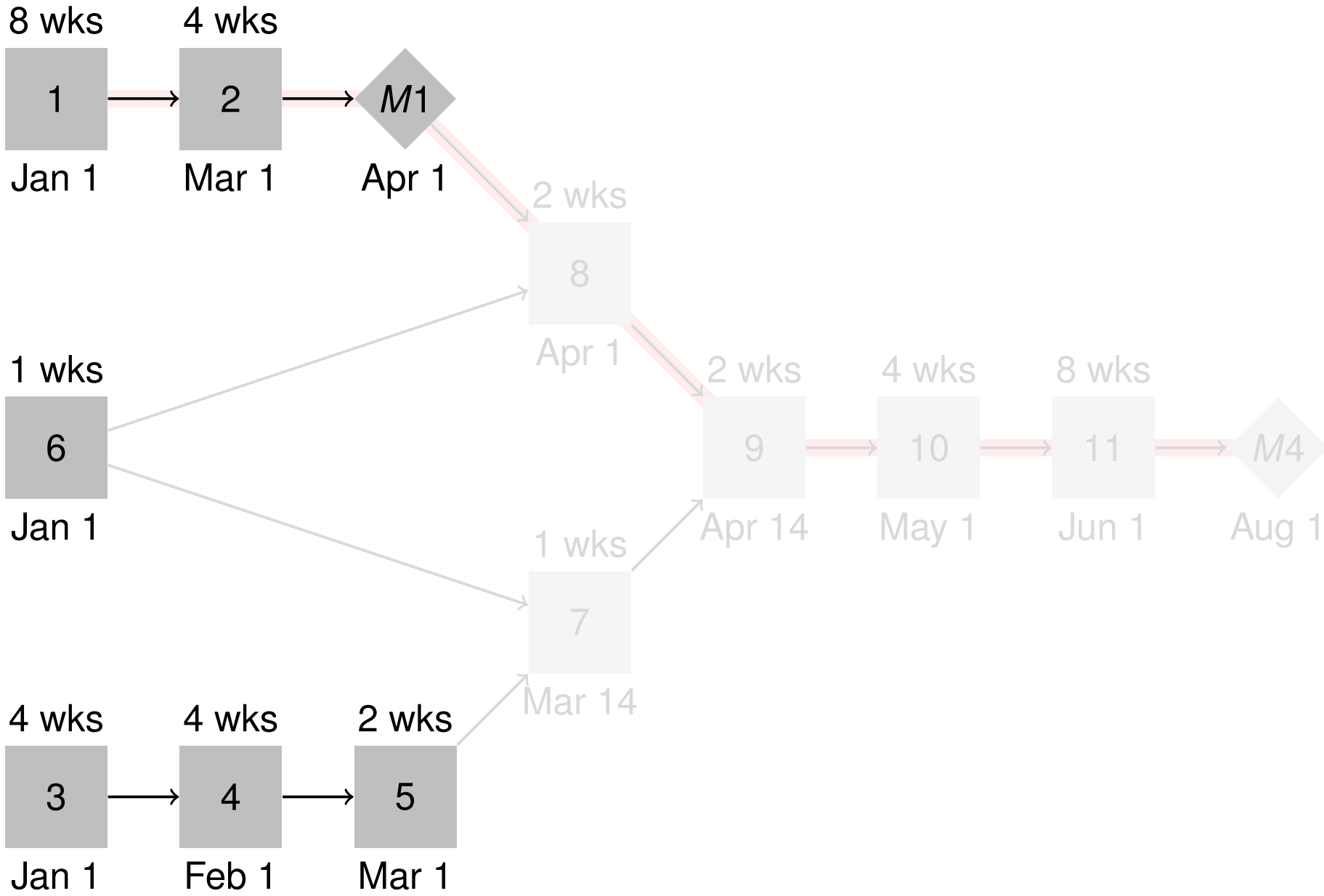
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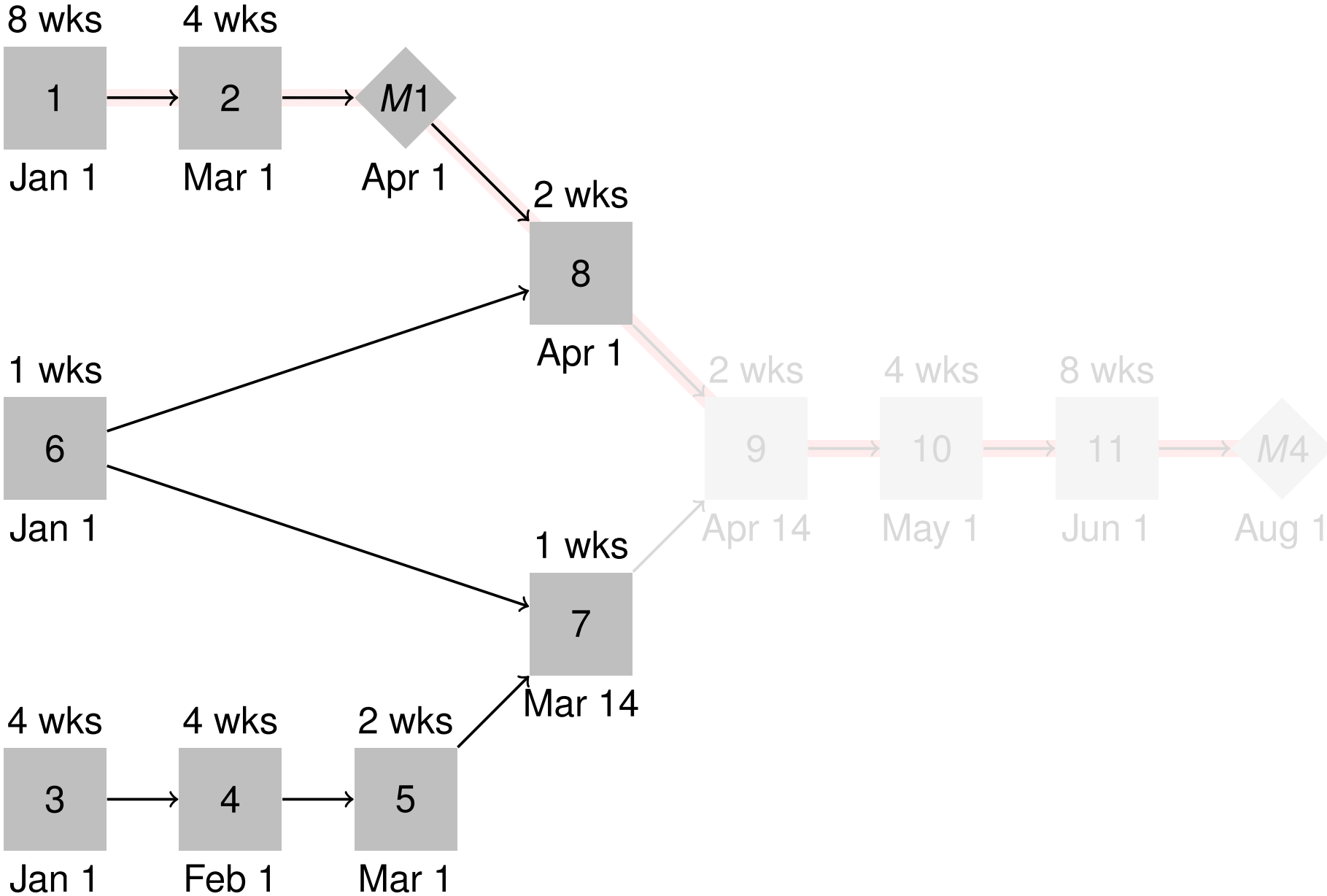
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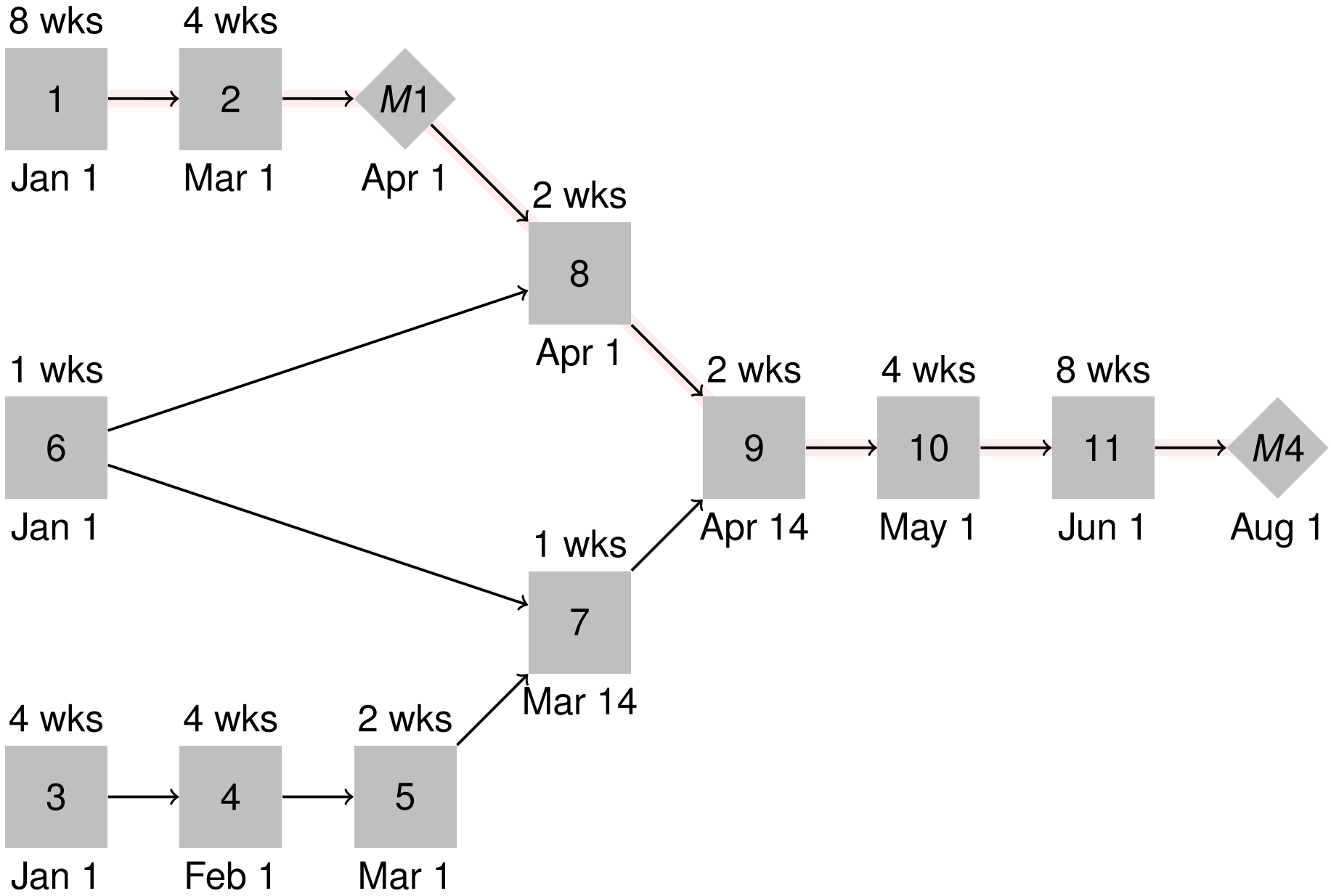
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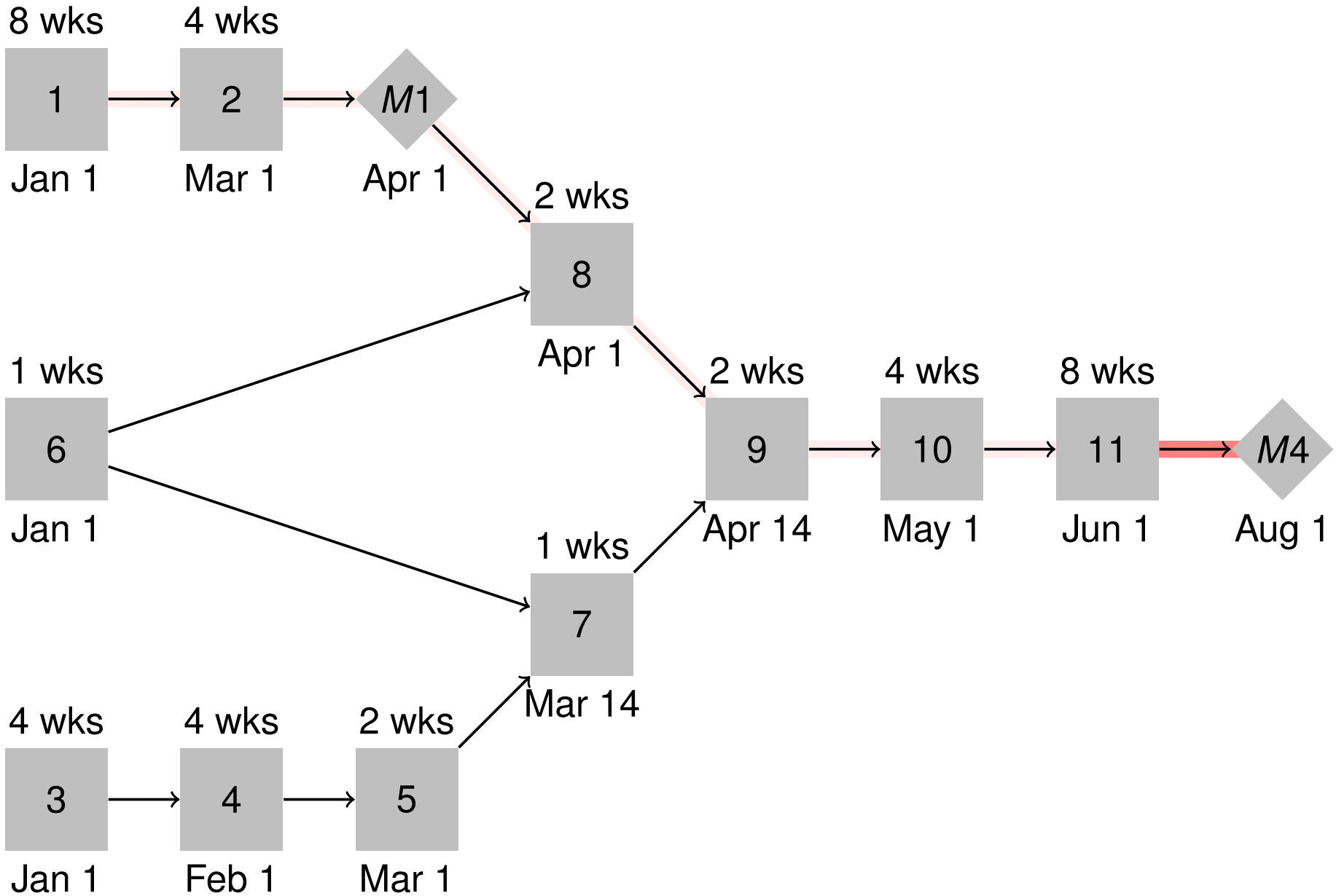
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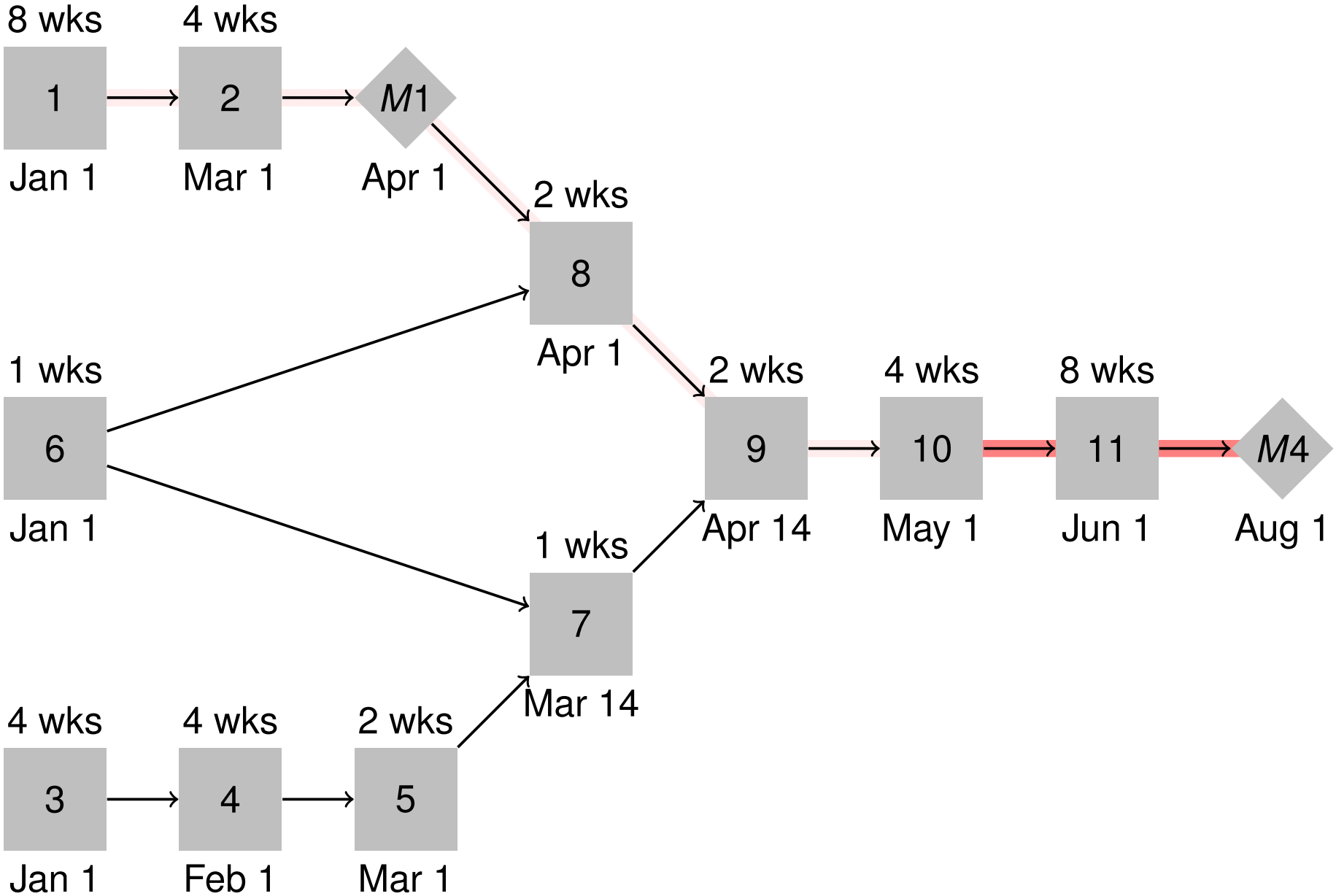
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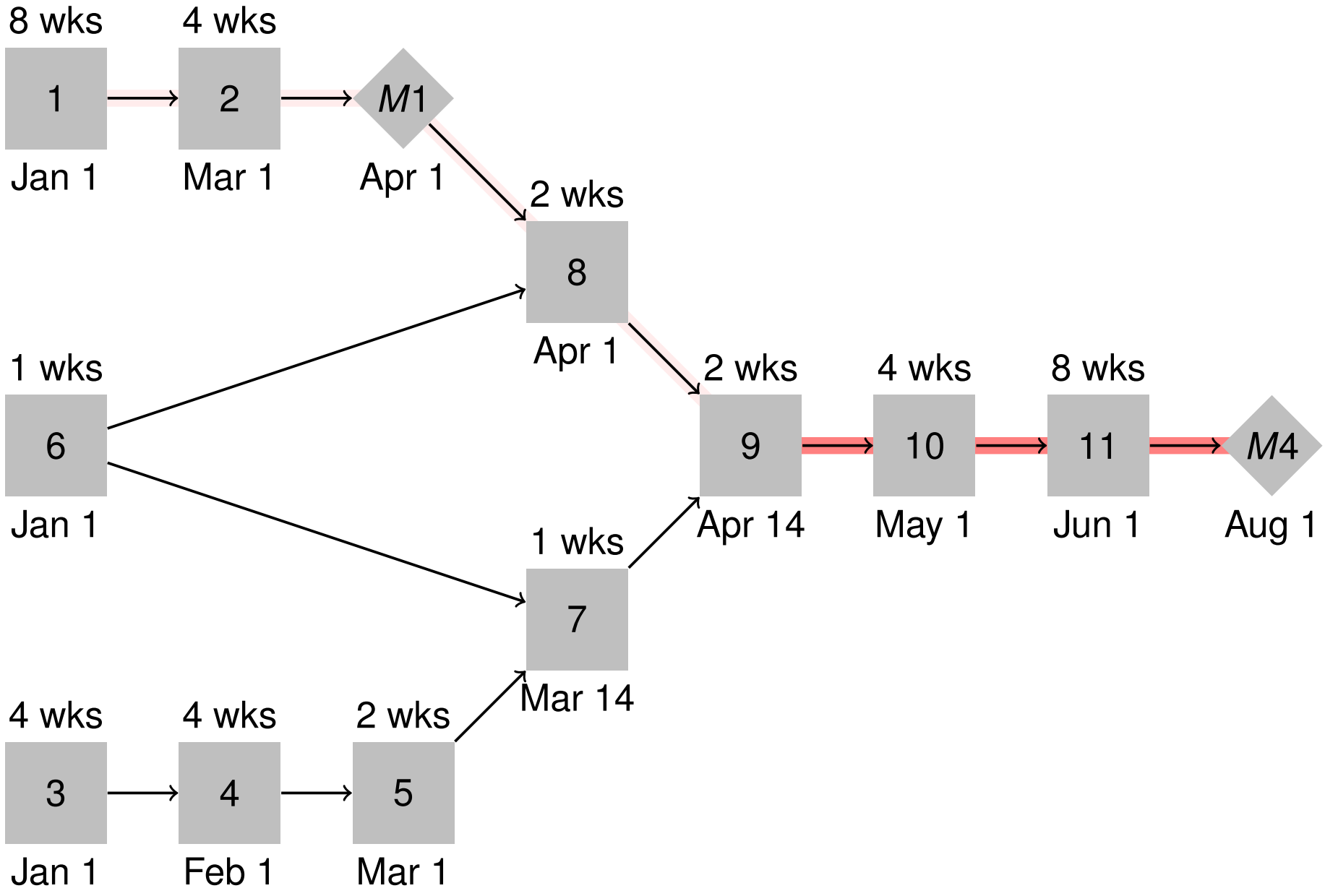
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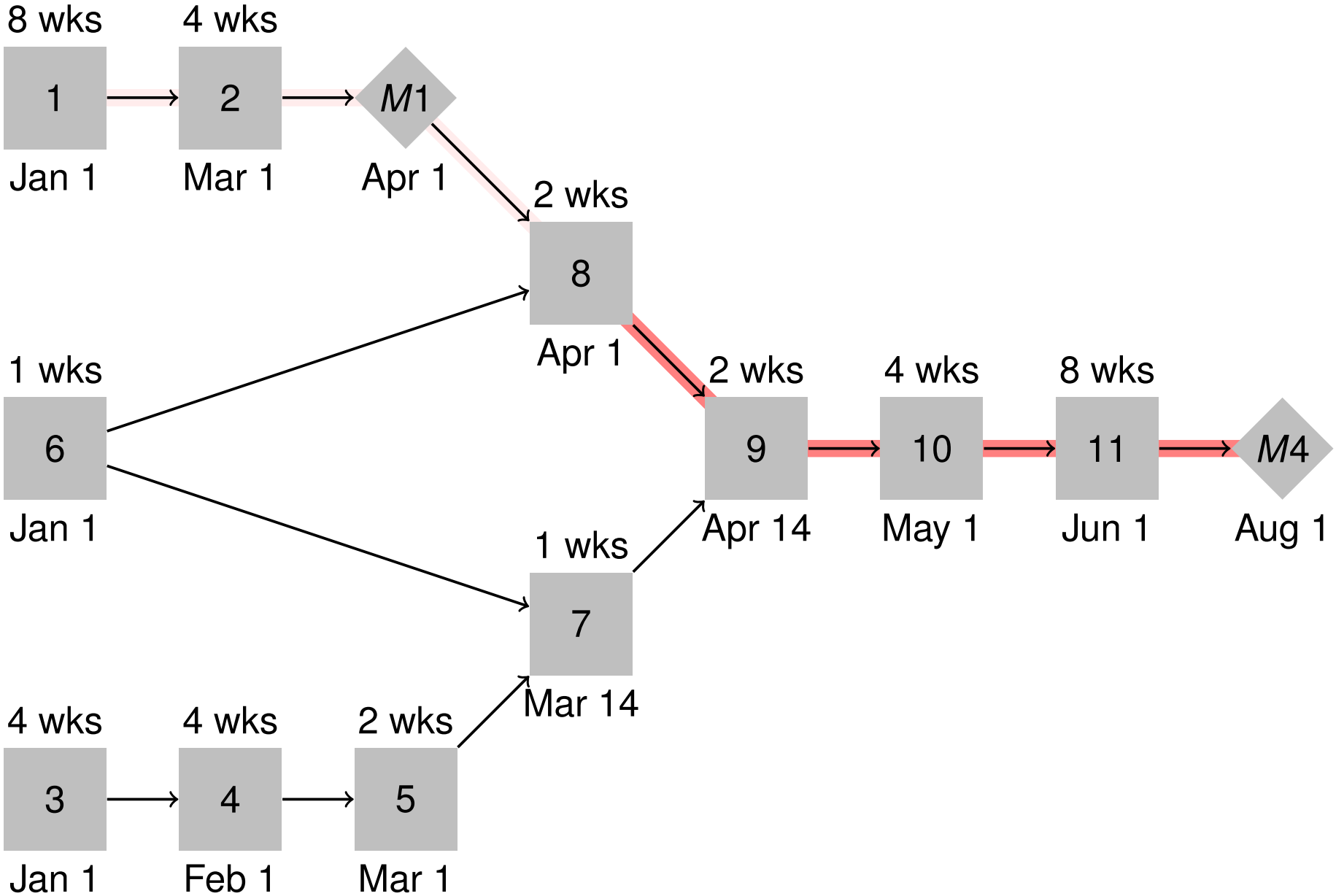
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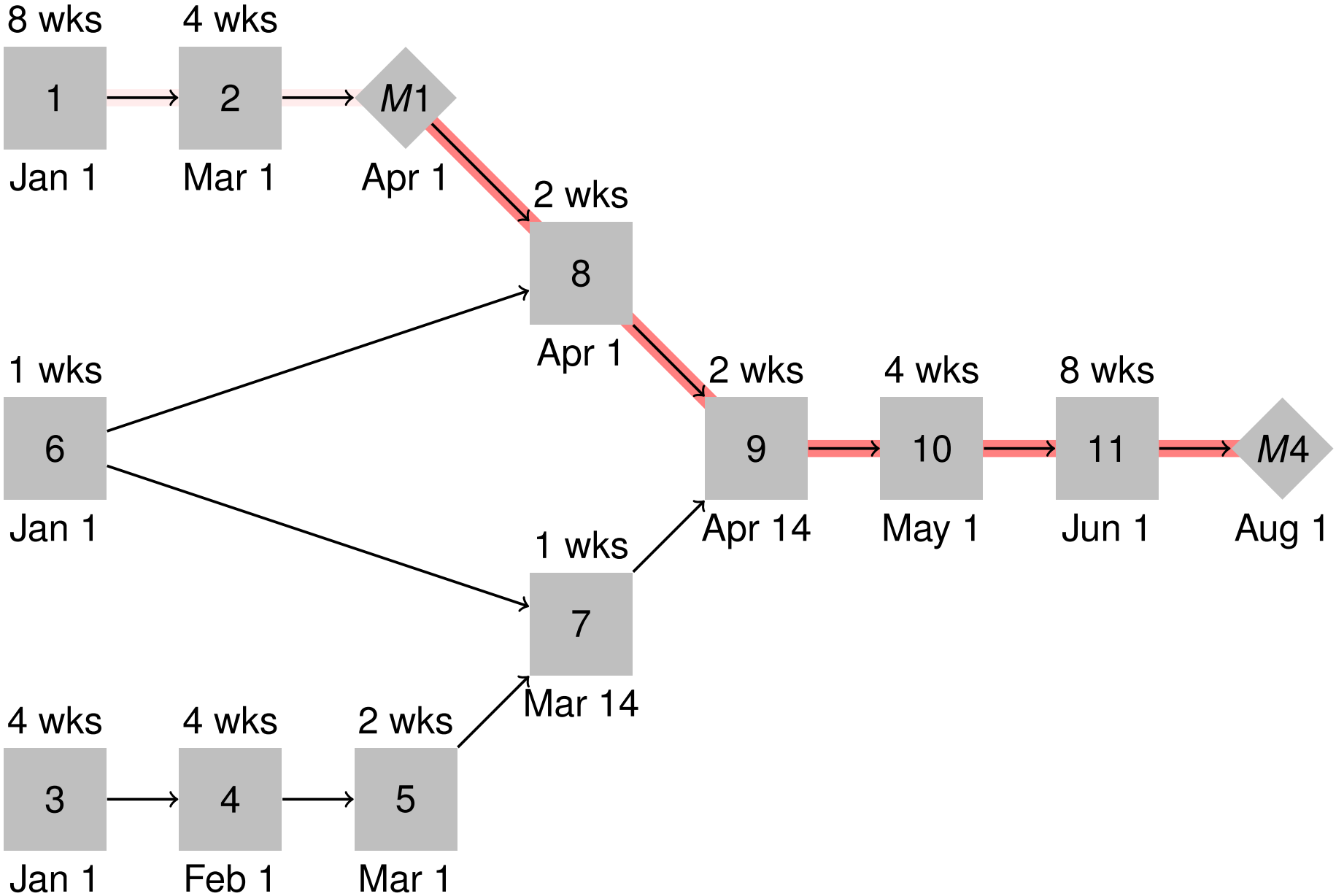
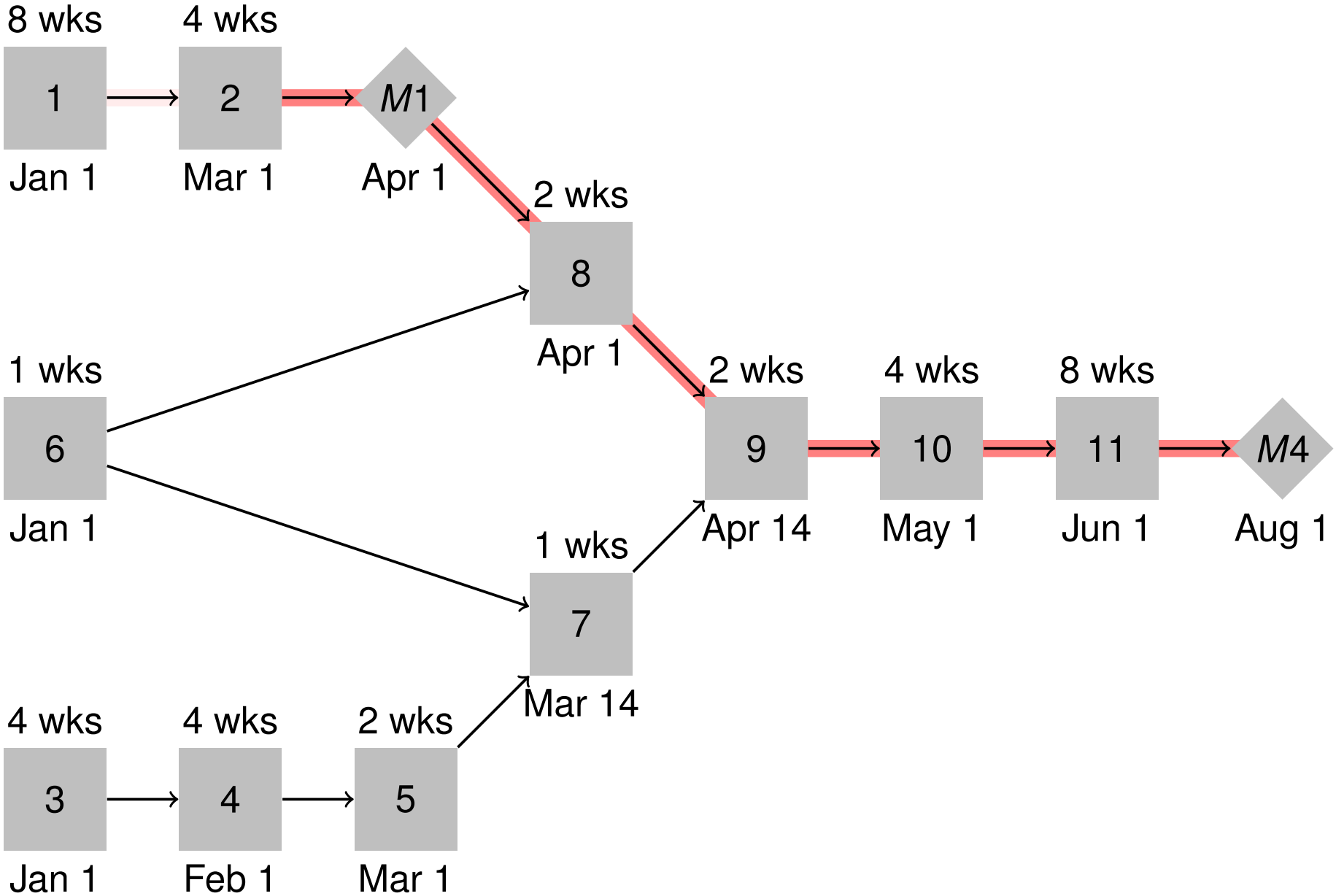
Jan 1
Feb 1
Mar 1


8 wks
4 wks
1
2
M1
Jan 1
Mar 1
Apr 1
2 wks
8
Apr 1
1 wks
6
Jan 1
2 wks
4 wks
8 wks
9
10
11
M4
Apr 14
May 1
Jun 1
Aug 1
1 wks
7
Mar 14
4 wks
4 wks
2 wks
3
4
5
Jan 1
Feb 1
Mar 1


8 wks
4 wks
1
2
M1
Jan 1
Mar 1
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8
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Jan 1
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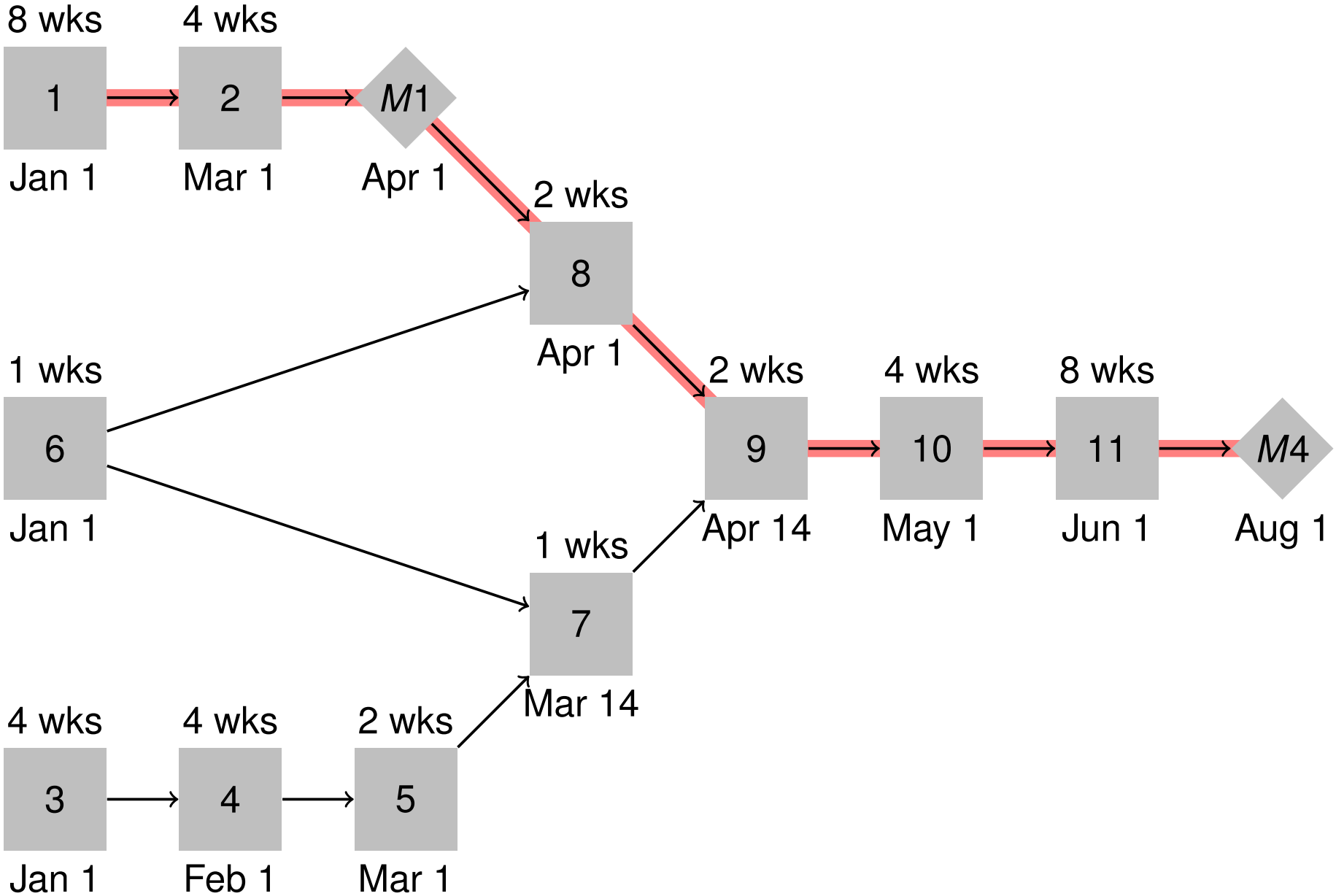
8 wks
4 wks
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M1
Jan 1
Mar 1
Apr 1
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Apr 14
May 1
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Aug 1
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7
Mar 14
4 wks
4 wks
2 wks
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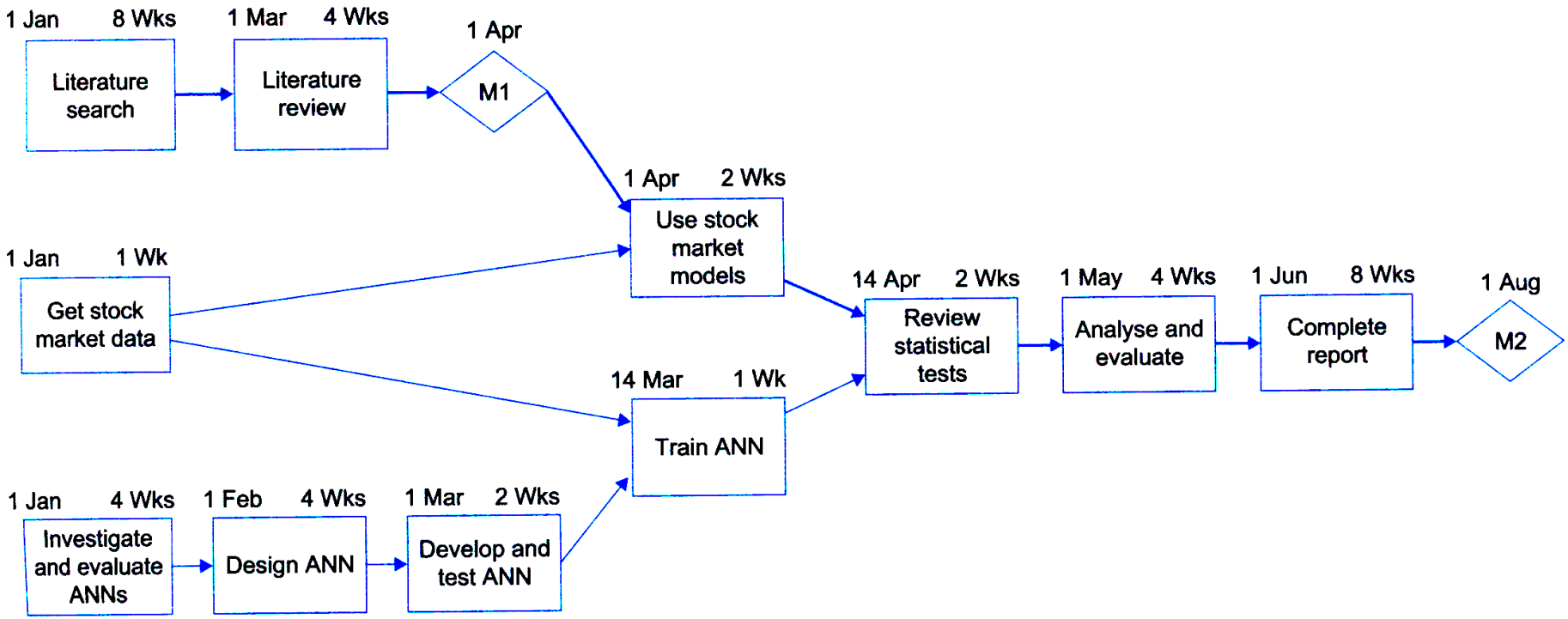
4
5
Jan 1
Feb 1
Mar 1

Solution


1 Jan
8 Wks
Literature search
1 Mar
4 Wks
Literature review
1 Apr
M1
1 Jan
1 Wk
Get stock market data
1 Apr
2 Wks
Use stock market models
14 Mar
1 Wk
Train ANN
1 Jan
4 Wks
Investigate and evaluate ANNs
1 Feb
4 Wks
Design ANN
1 Mar
2 Wks
Develop and test ANN
14 Apr
2 Wks
Review statistical tests
1 May
4 Wks
Analyse and evaluate
1 Jun
8 Wks
Complete report
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 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

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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

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