Resource Allocation

Lecture 10 by Professor Vladimir Geroimenko

Module “Software Project Management“

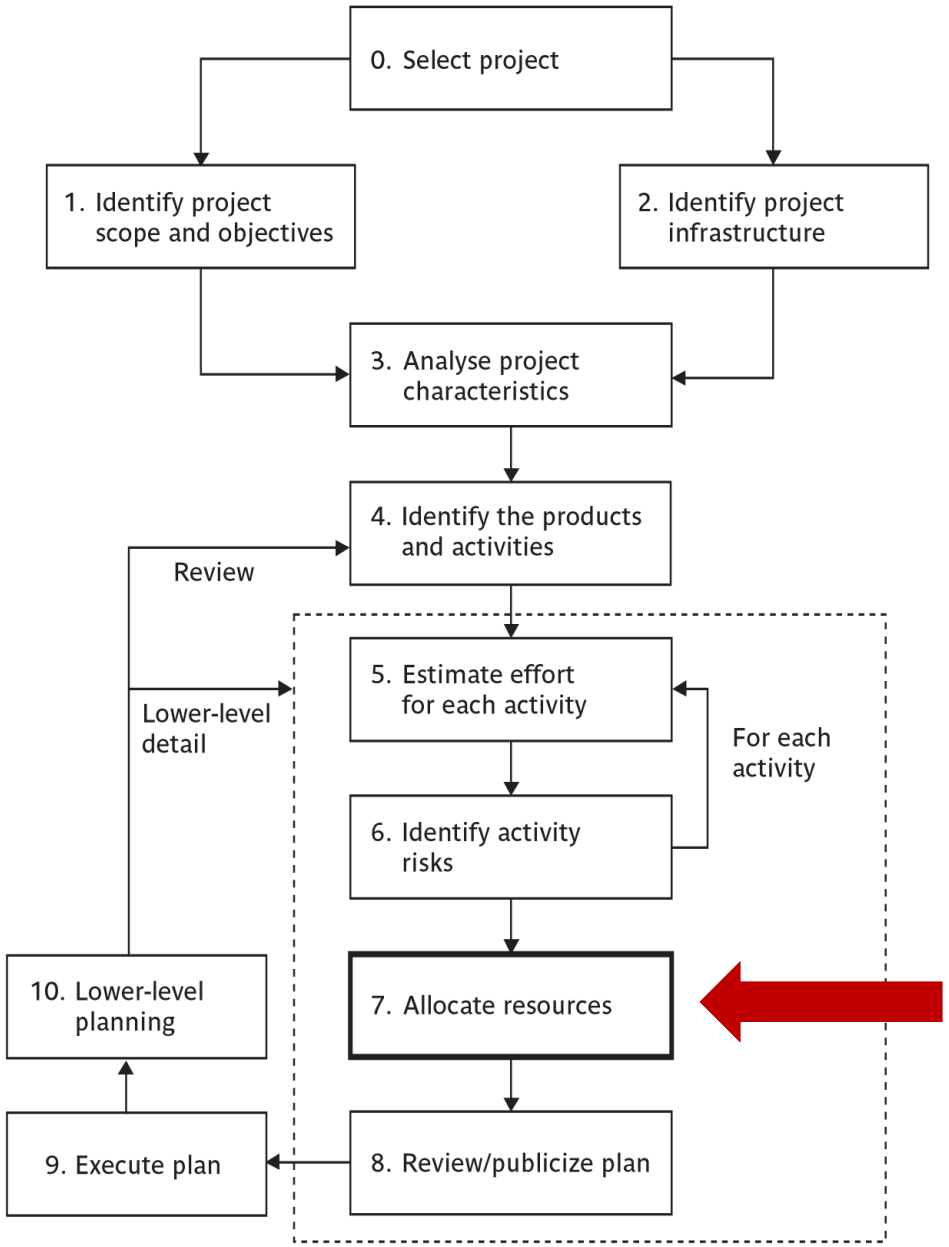
27 November 2016 - Teaching Week 10

Textbook reference: Chapter 8

Lecture Outline

- The nature and categories of resources
- Identifying the resources required
- Prioritizing activities
- Resource scheduling
- Cost scheduling

Resource allocation in the Step Wise framework – **Step 7**



Resource Allocation Problem

- A shortcoming of most scheduling procedures is that they do not address the issues of **resource utilization and availability**.
- Typically the durations are set with **“normal”** resources, and the schedule is calculated with **no assumed resource limit**.
- Scheduling procedures tend to **focus on time** rather than physical resources.

Resource Allocation Problem (cont.)

- The extremes that the PM may be confronted with are:

  Time Limited: The project must be finished by a certain time, using as few resources as possible. But it is time, not resource usage, that is critical

  Resource Limited: The project must be finished as soon as possible, but without exceeding some specific level of resource usage or some general resource constraint

- *Please note:* It is the PM's job to ensure that the required resources, in the required amounts, are available when and where they are needed

Time and Money

Time and cost are interrelated:

- The faster an activity is completed, the more it costs
- Change the schedule and you change the budget
- Many activities can be speeded up by spending more money

From the Ideal Plan to Resource Allocation

- In general, the allocation of resources to activities will lead us to review and modify *the ideal activity plan.*
- It may cause us to revise stage or project completion dates.
- It is likely to lead to a narrowing of the time spans within which activities may be scheduled.

The Results of Resource Allocation

The final results of resource allocation will normally be a number of schedules, including:

- ***An activity schedule*** - indicating the planned start and completion dates for each activity
- ***A resource schedule*** – showing the dates when resources needed and the level of the requirement
- ***A cost schedule*** - showing the planned cumulative expenditure incurred by the use of resources over time

The Nature of Resources

- A resource is any item or person required for the execution of the project.
- This covers many things – from key programmers to paper clips
- The project manager must concentrate on those resources which, without planning, might not be available when required.
- In general, resources will fall into one of seven categories (see next slide)

Resource Categories

1. Labour (project manager, software developers, support staff, …)
2. Equipment (workstations , …., coffee machine – Java :)
3. Materials (= items that are consumed: CDs, cartridges, paper, …)
4. Space (rooms, cubicles, especially for any additional staff)
5. Services (telecommunications, …)
6. Time
7. Money (money is a secondary resource – it is used to buy other resources and will be consumed as other resources are used. It is similar to other resources – it is available at a cost (interest %)

A note about money

- A key point is that money (by definition) is the means by which one resource can be converted to another.
- However in practice this may be problematic because of resource constraints.
- For example, staff need time to become expert in a new technology regardless of the amount of money that might be available to buy expertise.

Resource allocation

1. Identify the resources needed for each activity and create a ***resource requirement list***
2. Identify ***resource types*** – individuals are interchangeable within the group (e.g. ‘VB programmers’ as opposed to ‘software developers’)
3. Allocate resource types to activities and examine the ***resource histogram***

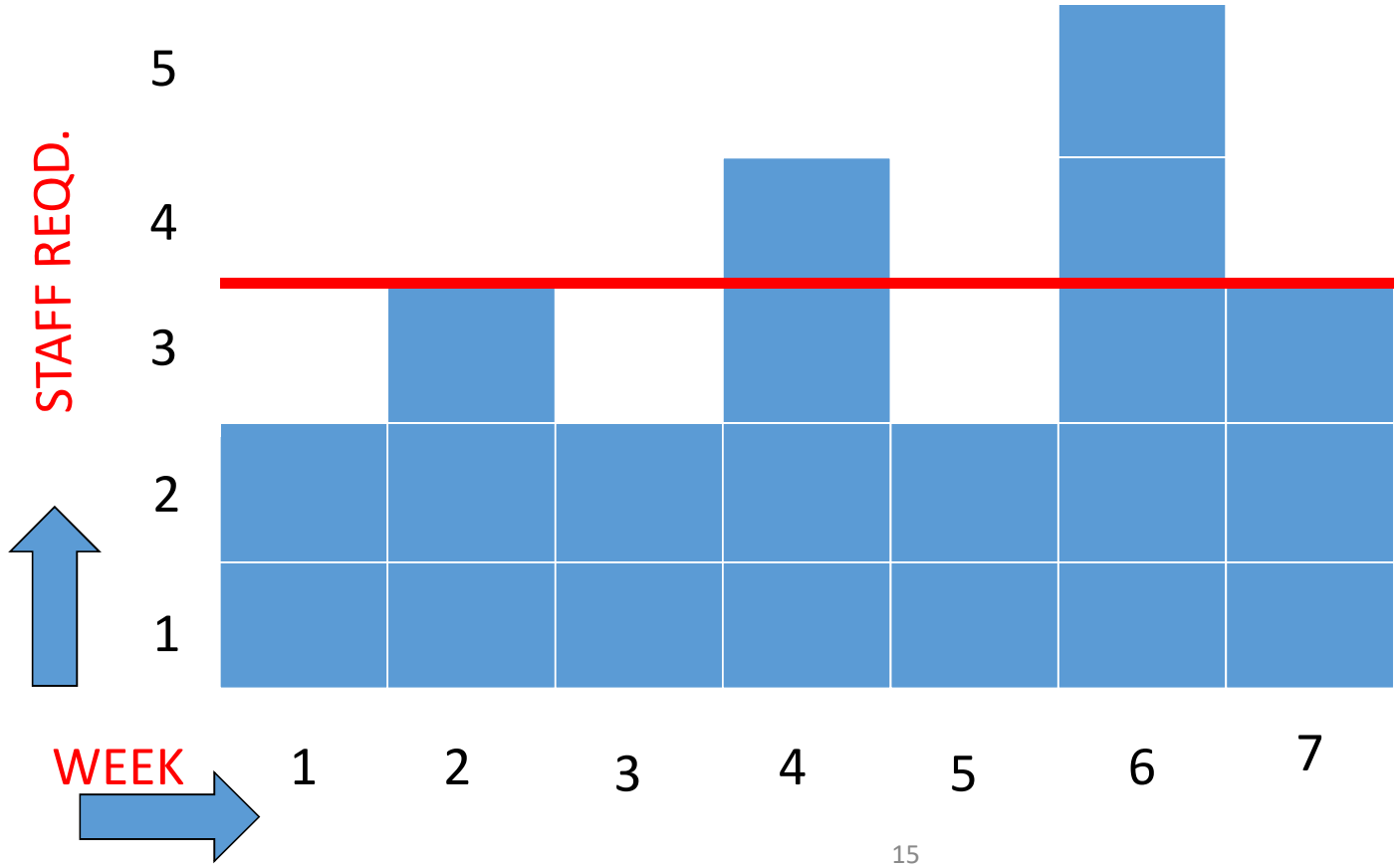
A note about staff

- Note that at this point we have to assume that we are dealing with, for example, **‘standard’** software developers who have an average productivity.
- When we allocate actual people we may find that we have a trainee or a super-expert and this will affect productivity.
- A short-coming in productivity in an individual might be compensated for by a lower cost (as would be expected with trainees).

Resource Histograms

- Commonly used during planning to indicate possible problem areas.
- **People (by category) vs Week Number**
- For each individual – estimated number of tasks over weeks.
- This helps in reducing work load and helps the individual recover from any heavy load.

Resource histogram: systems analysts



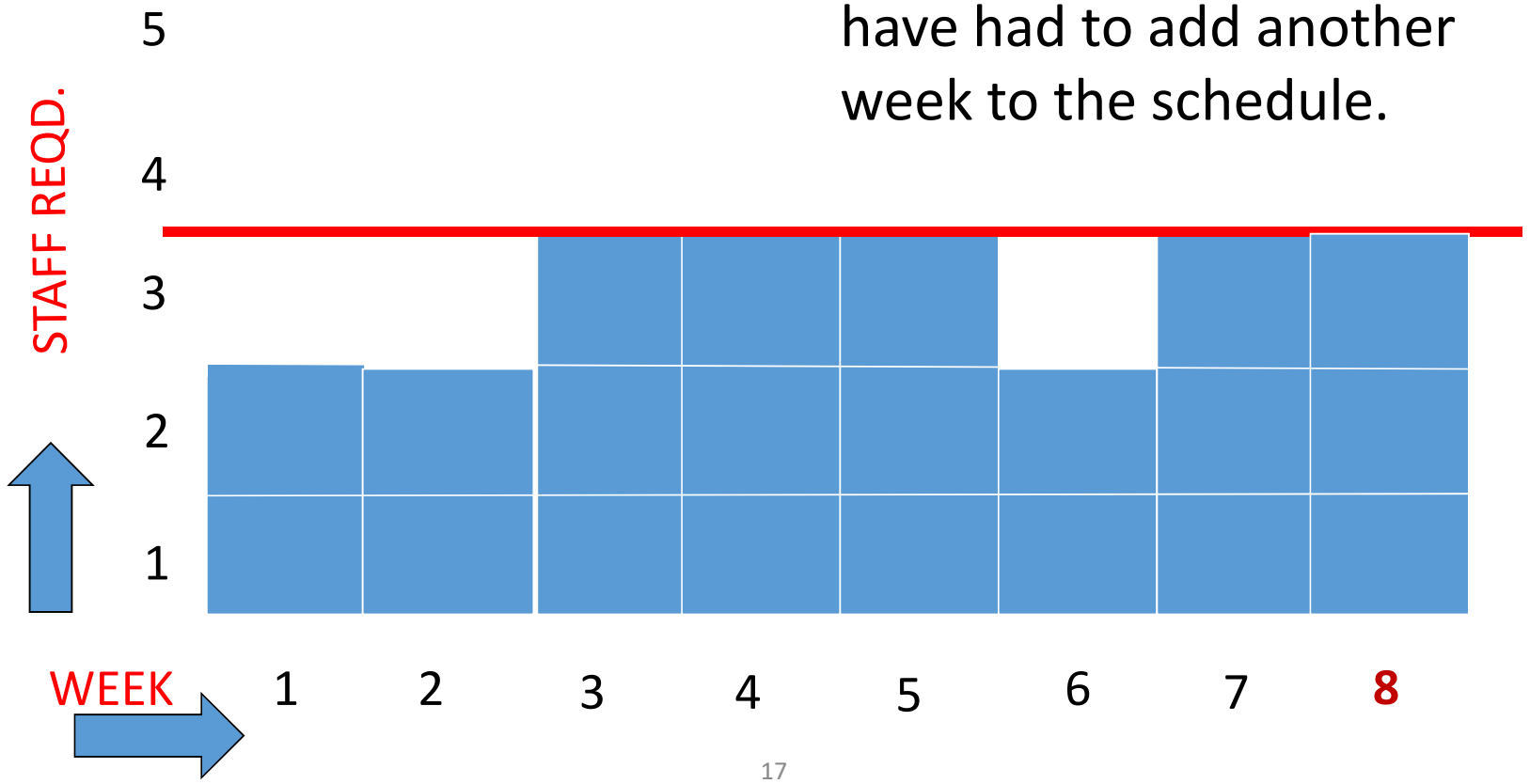
The resource histogram helps us identify where the demand for a resource exceeds the supply.

Resource smoothing

- It is usually difficult to get specialist staff who will work odd days to fill in gaps – need for staff to learn about application etc
- Staff often have to be employed for a continuous block of time
- Therefore desirable to employ a constant number of staff on a project – who as far as possible are fully employed
- Hence need for **resource smoothing**

Resource smoothing

Please note that in order to smooth the previous resource histogram, we have had to add another week to the schedule.



Resource clashes

Where same resource needed in more than one place at the same time.

It can be resolved by:

- delaying one of the activities
  - taking advantage of float to change start date
  - delaying start of one activity until finish of the other activity that resource is being used on - *puts back project completion*
- moving resource from a non-critical activity
- bringing in additional resource - *increases costs*

Prioritizing activities

Where more than one activity is competing for the same limited resource at the same time then those activities need to be prioritized.

There are two main ways of doing this:

- *Total float priority* – those with the smallest float have the highest priority
- *Ordered list priority* – this takes account of the duration of the activity as well as the float (for example, Burman's priority list – see next slide).

Burman's priority list

Give priority to:

1. Shortest critical activities
2. Other critical activities
3. Shortest non-critical activities
4. Non-critical activities with least float
5. Non-critical activities

Resource usage

- A need to maximize % usage of resources i.e. reduce idle periods between tasks
- A need to balance costs against early completion date
- A need to allow for contingency

Critical path

- Scheduling resources can create new dependencies between activities and new critical paths.
- It is best not to add dependencies to the activity network to reflect resource constraints
  - Makes network very messy
  - A resource constraint may disappear during the project, but link remains on network
- Amend dates on **schedule** to reflect resource constraints

Allocating individuals to activities

The initial ‘resource types’ for a task have to be replaced by actual individuals.

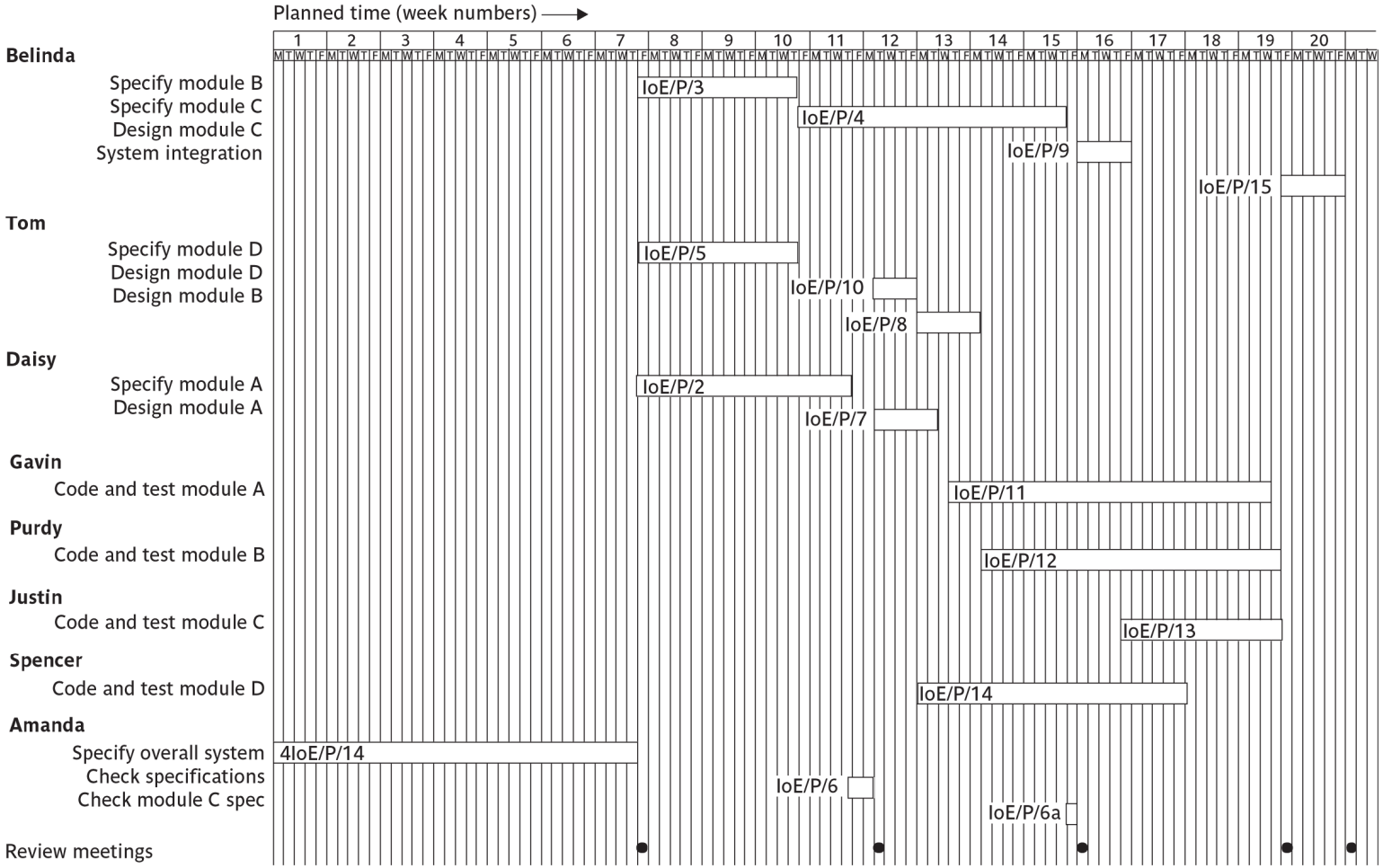
5 Factors to be considered:

1. Availability: Who is free? Note that this will change during the course of the project as some tasks are completed earlier or later than planned.
2. Criticality: You would want to put your more experienced, ‘safer’, staff on the critical activities

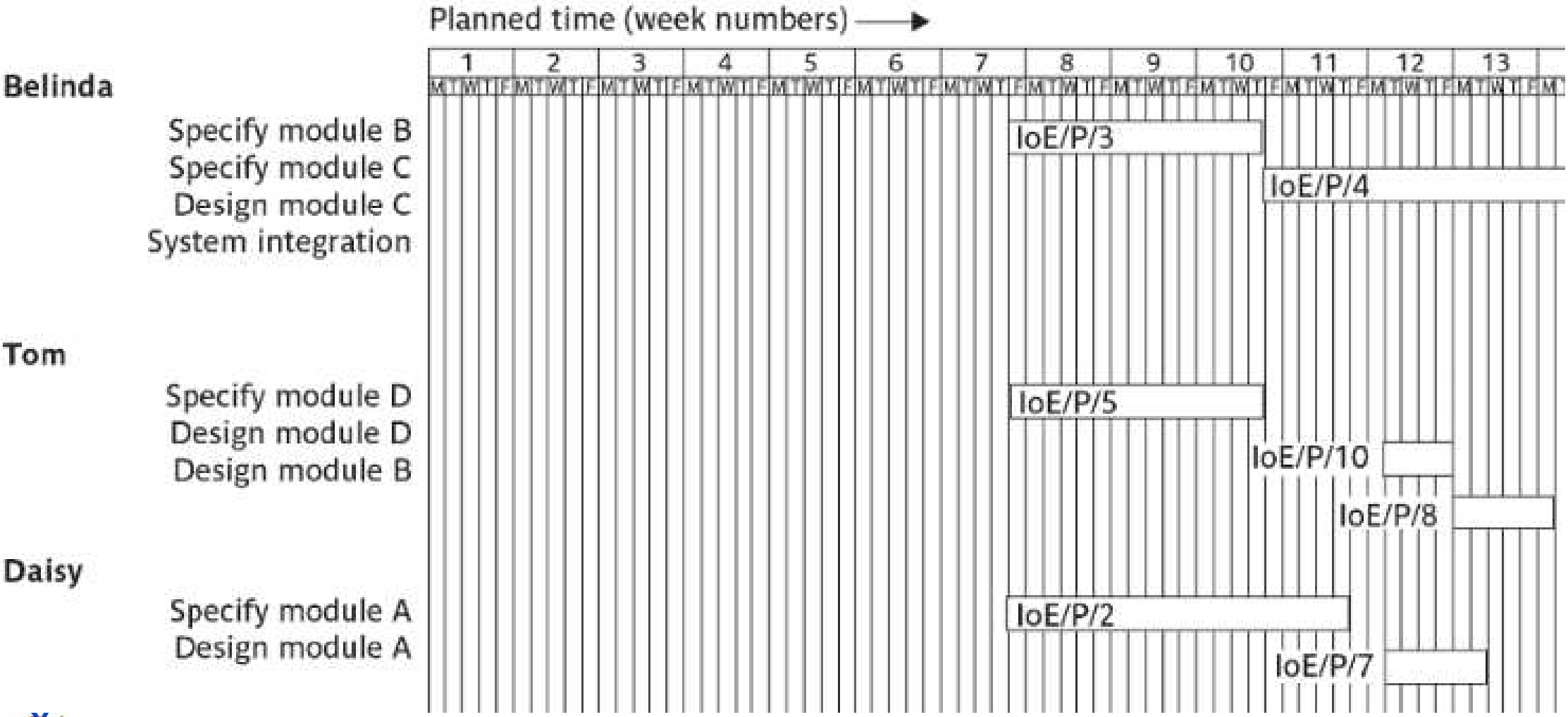
Allocating individuals to activities (cont.)

3. Risk: This is similar to the point above, but some activities could be off the critical path but still have risks e.g. to the quality of subsequent products
4. Training: Despite concerns about minimizing risk, it is healthy to take some risks in order to develop staff capabilities by allocating challenging tasks to relatively inexperienced staff
5. Team-building: Identifying people who work well together can pay dividends

Publishing the resource schedule as a work plan



A closer look …



Cost schedules

Cost schedules can now be produced.

Costs include:

- Staff costs
- Overheads
- Usage charges

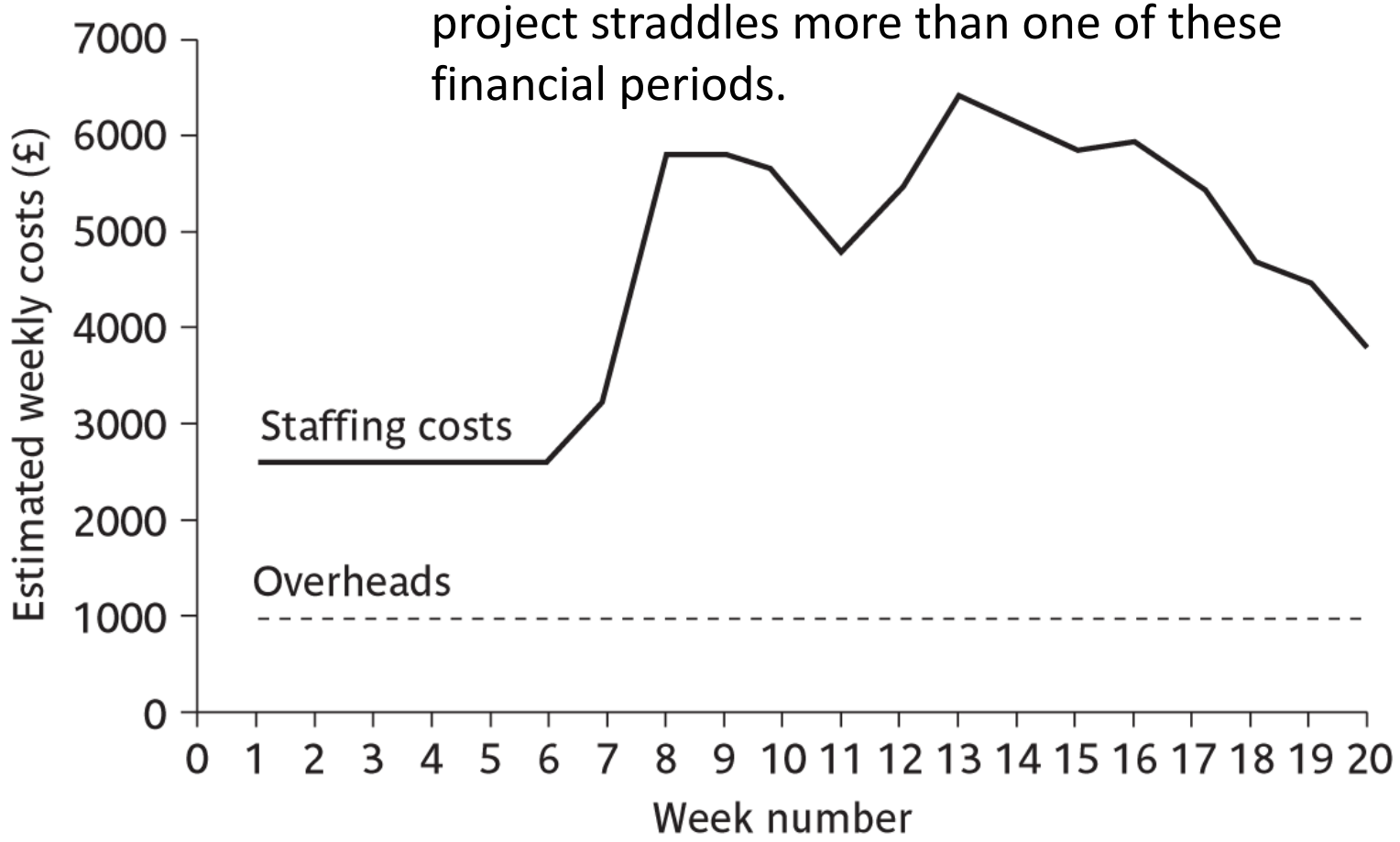
See next slide for details

Costs explained

- **Staff costs** – includes not just salary, but also social security contributions by the employer, holiday pay etc. Timesheets are often used to record actual hours spent on each project by an individual.
- **Overheads** e.g. space rental, service charges etc. Some overheads might be directly attributable to the project; in other cases a percentage of departmental overheads may be allocated to project costs.
- **Usage charges** – some charges can be on a 'pay as you go' basis e.g. telephone charges, postage, car mileage – at the planning stage an estimate of these may have to be made.

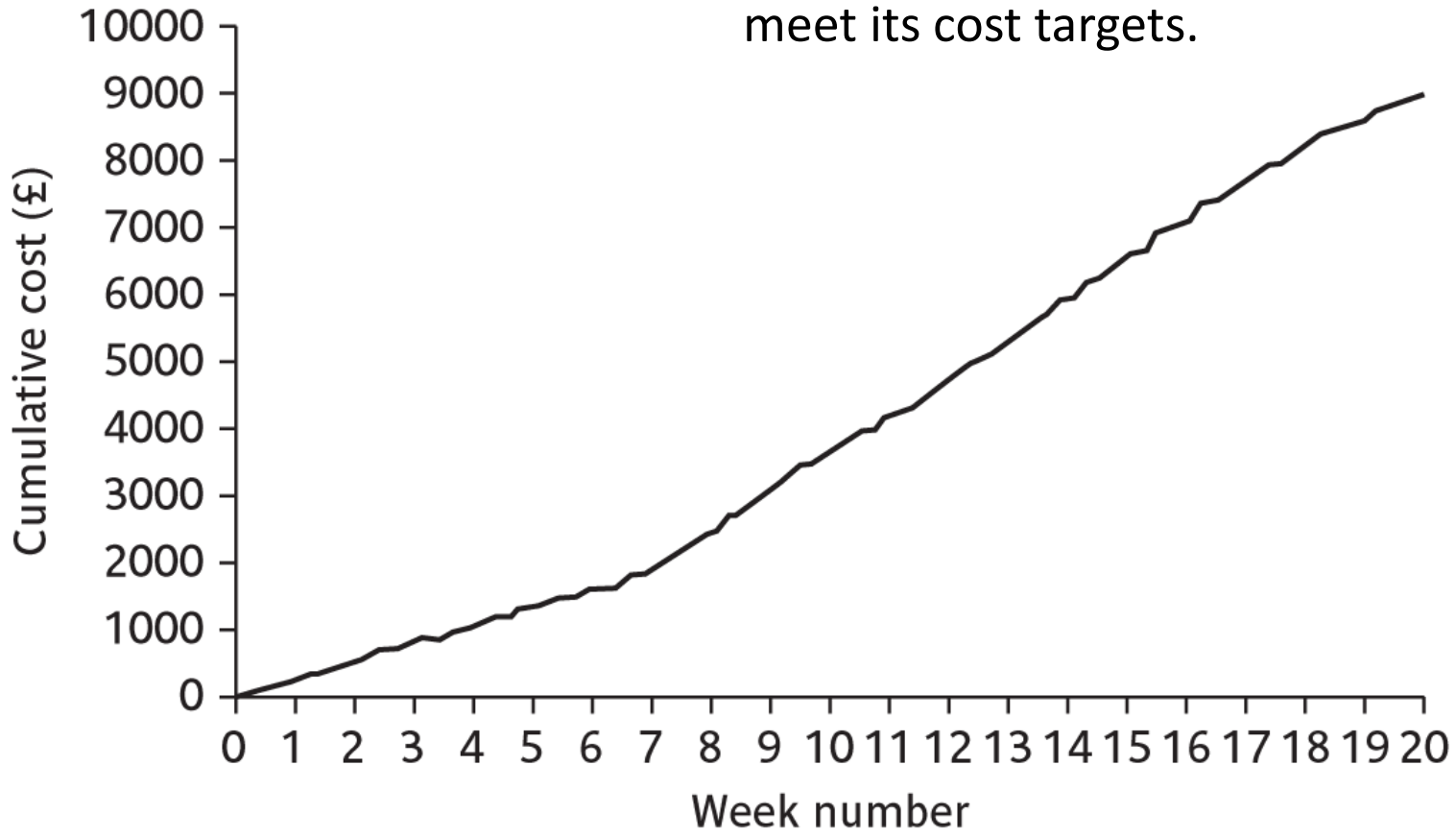
Cost profile

Please note: This shows how much is going to be spent in each week. This could be important where an organization allocates project budgets by financial year or quarter and the project straddles more than one of these financial periods.



Accumulative costs

Please note: This chart can be compared to the actual accumulative costs when controlling the project to assess whether the project is likely to meet its cost targets.



An example: Staff Costs

Staff member	Daily cost (£)
Amanda	300
Belinda	250
Tom	175
Daisy	225
Gavin	150
Purdy	150
Justin	150
Spencer	150

TABLE 8.2 Staff costs (including on-costs) for Amanda's project team

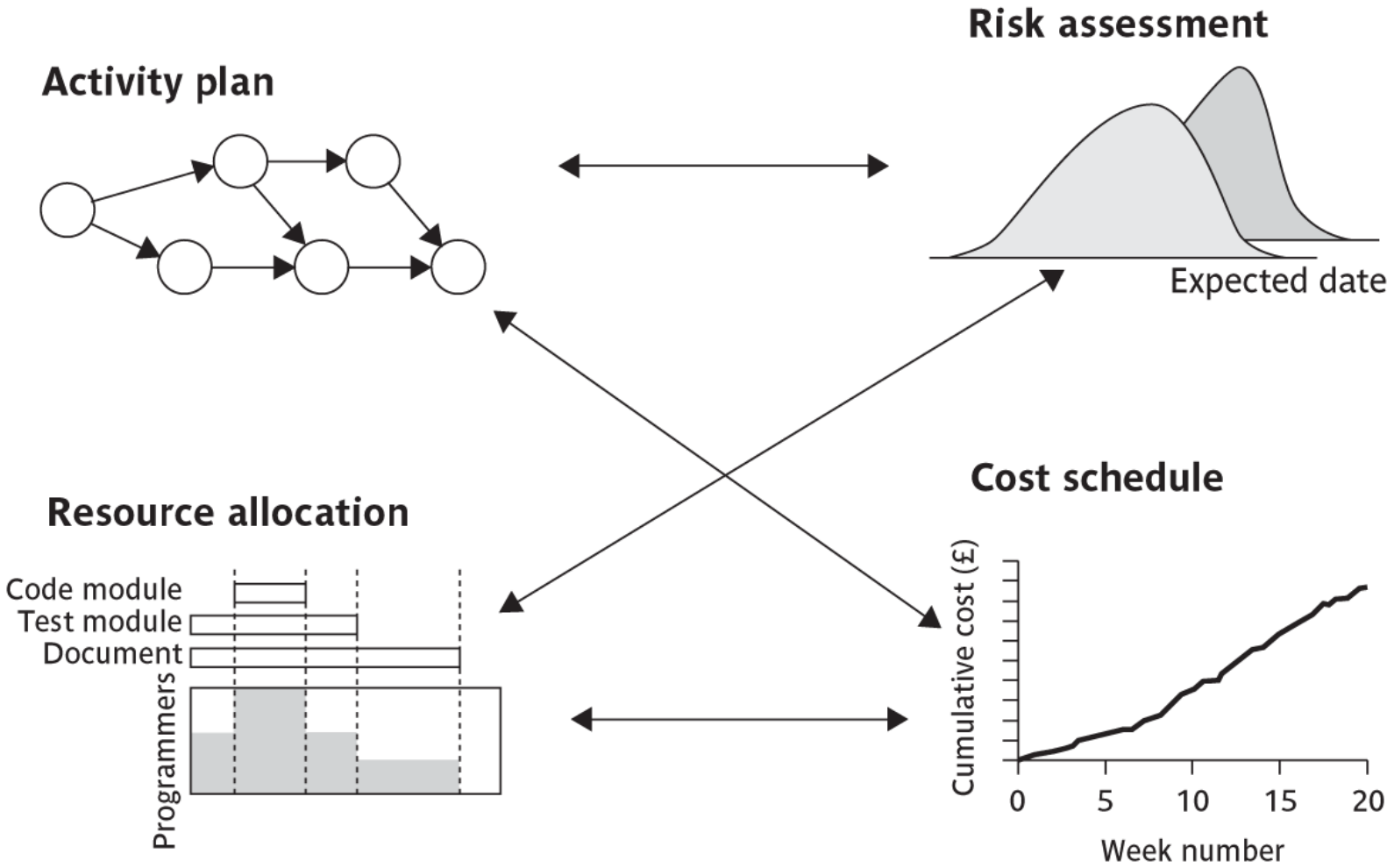
An Example: Total Project Costs

Analyst	Daily cost (£)	Days required	Cost (£)
Amanda	300	110[2]	33,000
Belinda	250	50	12,500
Tom	175	25	4,375
Daisy	225	27	6,075
Gavin	150	30	4,500
Purdy	150	28	4,200
Justin	150	15	2,250
Spencer	150	25	3,750
Daily on-cost	200	100	20,000
Total			90,650

TABLE B.11 Calculating the cost of Amanda's project

[2] This includes 10 days for pre-project planning and post-project review.

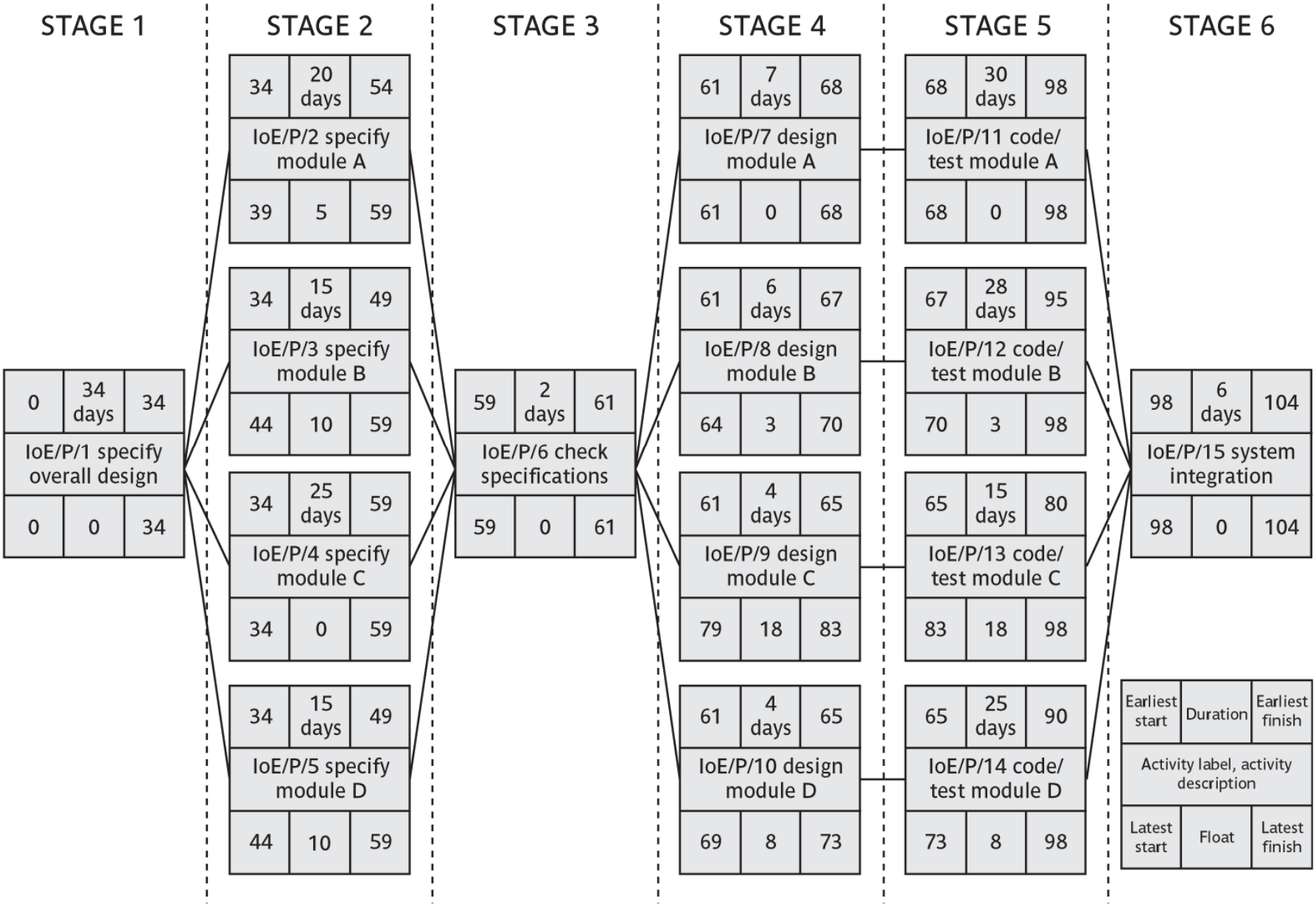
Successfully project scheduling is not a simple sequence!



Amanda’s IOE Project

An example from our textbook

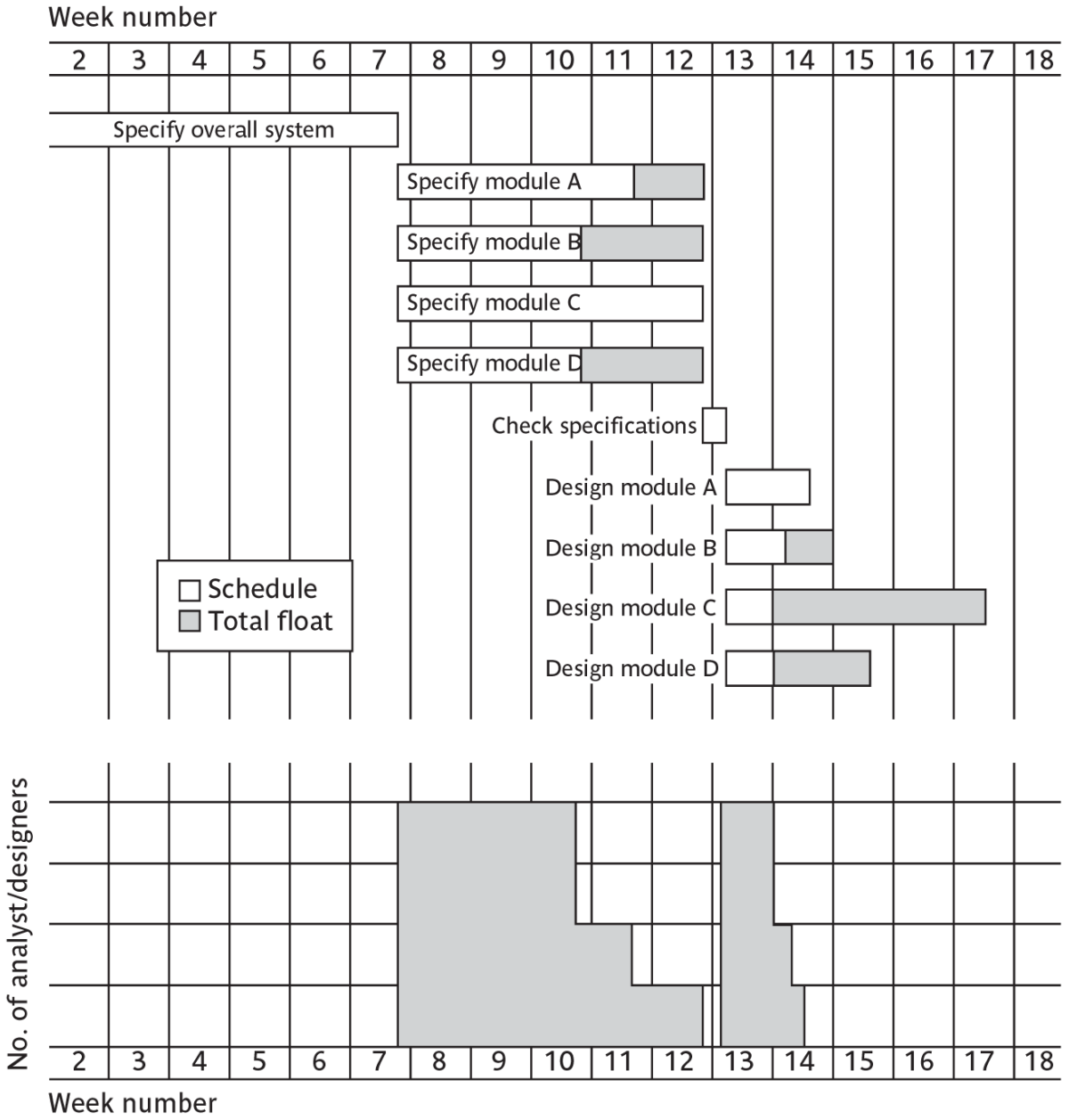
1.
A precedence network for the IOE project



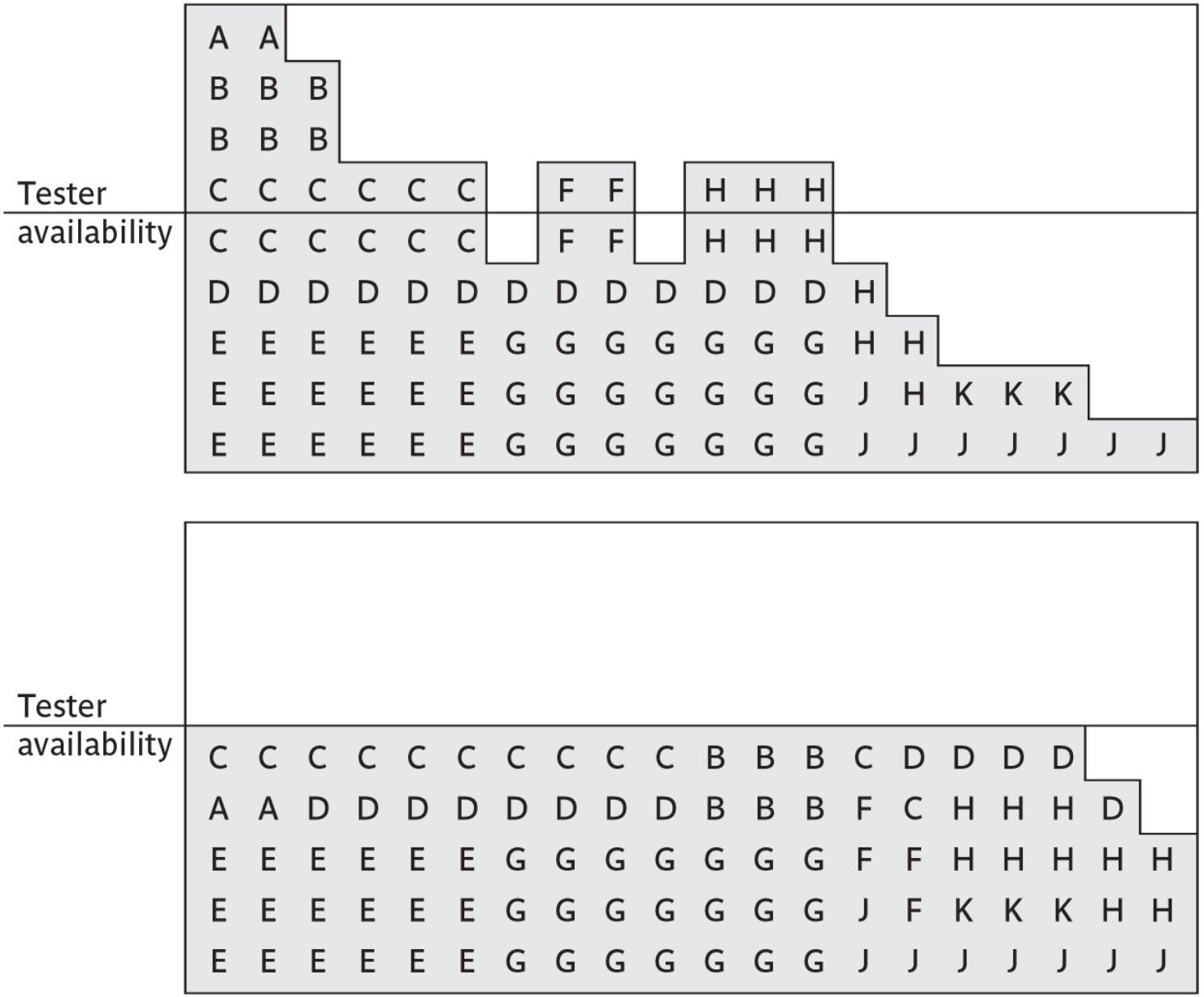
2. Resource requirements list (fragment)

Stage	Activity	Resource	Days	Quantity	Notes
ALL		Project manager	104 F/T		
1	All	Workstation	–	34	Check software availability
	IoE/P/1	Senior analyst	34 F/T		
2	All	Workstation	–	3	One per person essential
	IoE/P/2	Analyst/designer	20 F/T		
	IoE/P/3	Analyst/designer	15 F/T		
	IoE/P/4	Analyst/designer	25 F/T		
	IoE/P/5	Analyst/designer	15 F/T		Could use analyst/programmer
3	All	Workstation	–	2	
	IoE/P/6	Senior analyst*	2 F/T		
4	All	Workstation	–	3	As stage 2
	IoE/P/7	Analyst/designer	7 F/T		
	IoE/P/8	Analyst/designer	6 F/T		
	IoE/P/9	Analyst/designer	4 F/T		
	IoE/P/10	Analyst/designer	4 F/T		

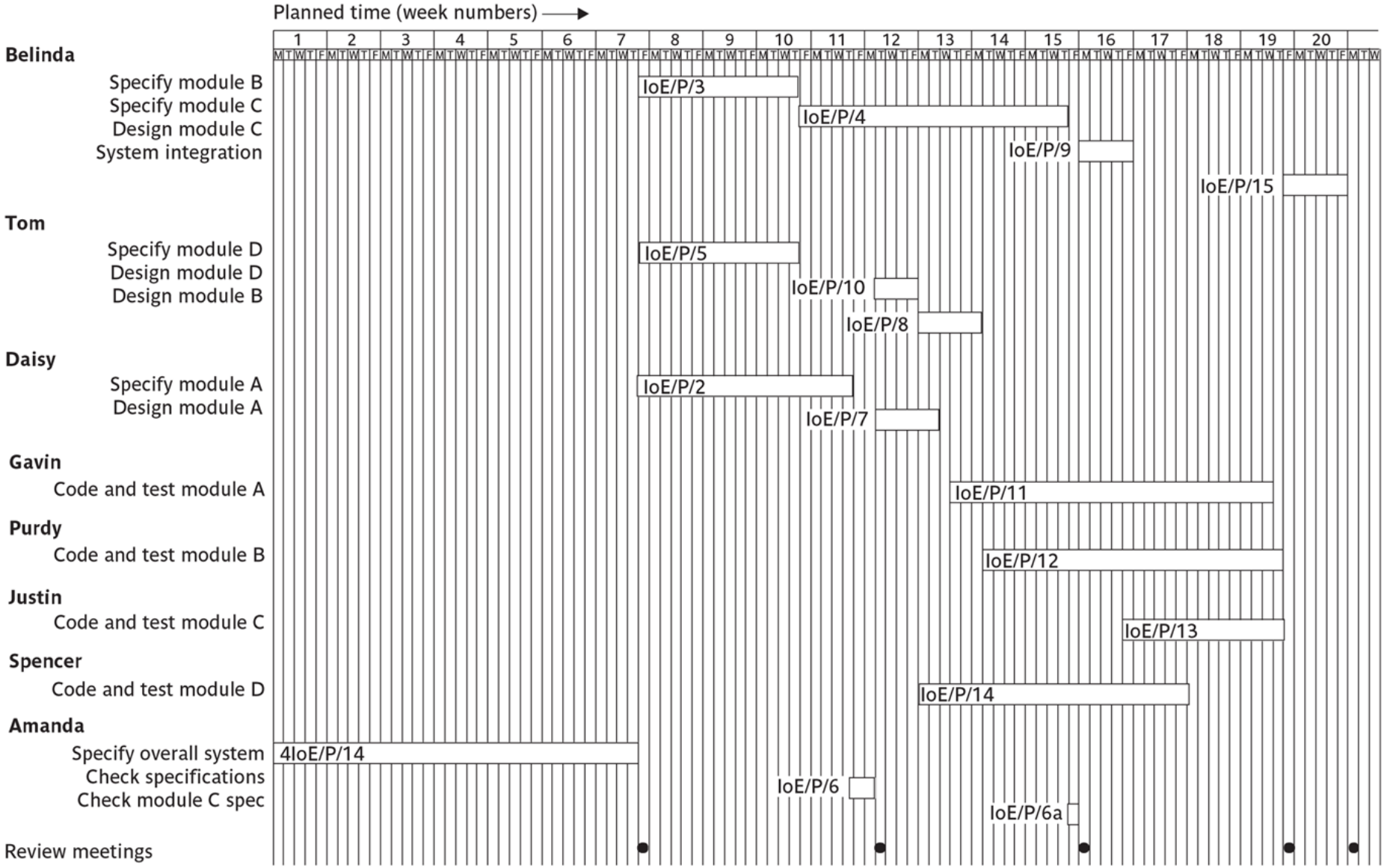
3 & 4.
The activity plan as a bar chart & A resource histogram for each resource



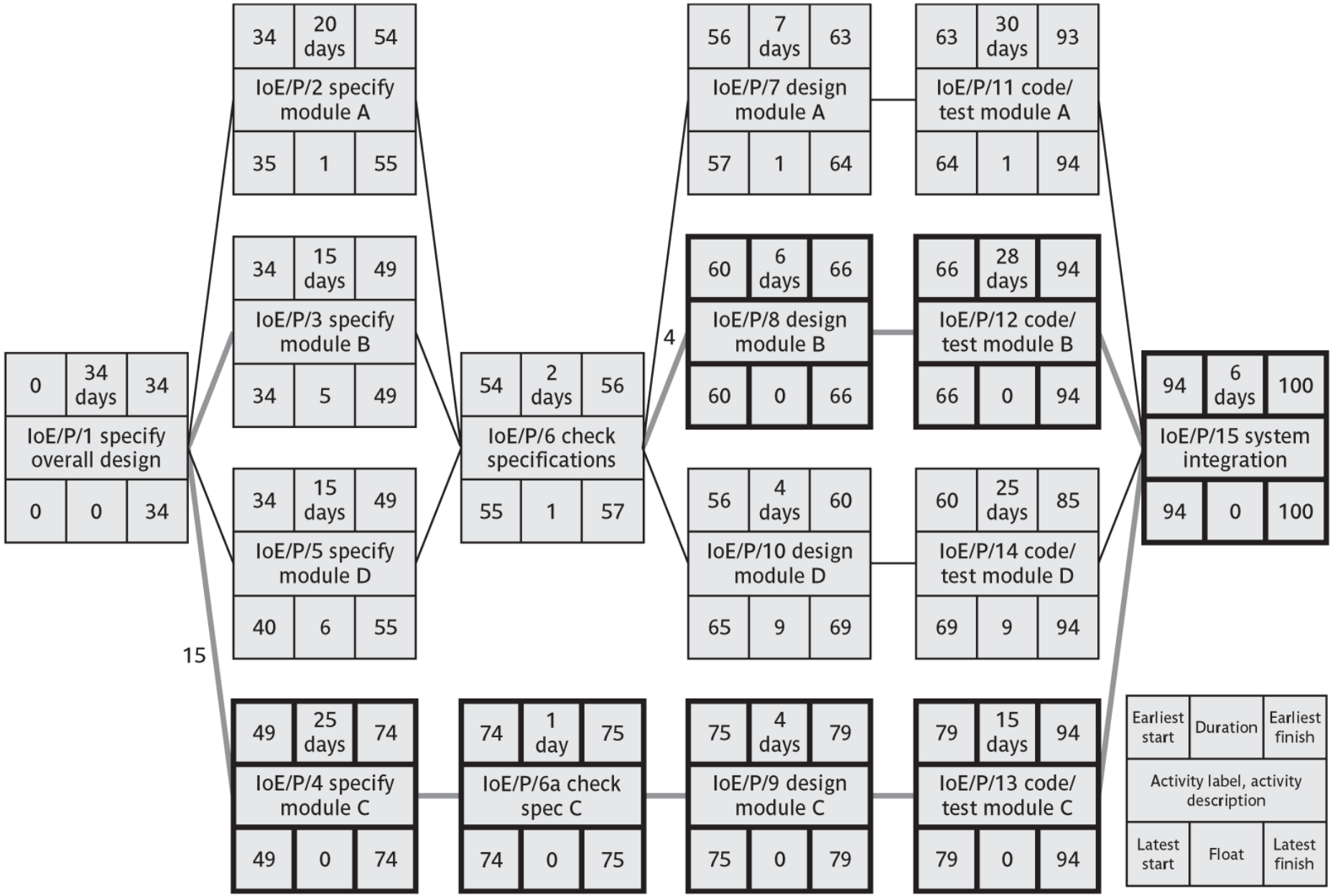
5.
A resource histogram before and after smoothing



6. Work plan / schedule



7.
A revised precedence network for the IOE project



Summary

In this lecture, we have discussed the problems of allocating resources to project activities and the conversion of an activity plan to a work schedule.

In particular, we have seen the importance of

- identifying all the resources needed;
- allocating resources to completing activities in a rational order of priority;
- taking care in allocating the right staff to critical activities.

Thank you for your attention

Any questions, please?