

Chapter 8: Resource Allocation

NET481: Project Management

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What is Resource Allocation

Up till now, the activities have been identified using various techniques.

1. Using activity network analysis, we were able to identify when the activities should take place: Activity span (LF - LS).

2. Using PERT technique, we were able to forecast a range of expected dates by which activities would be completed.

- In both cases, the availability of resources was not taken into consideration.
- When we allocate resources to the identified activities . This process is considered resource allocation.

What is Resource Allocation

- **The allocation of resources to activities will lead to:**
 - the review and
 - modification of the ideal activity plan.
- **Resource allocation may lead to:**
 - Revising a stage.
 - Revising project completion dates.
 - Narrowing activity time spans.

Resource Allocation Schedules

- **An activity schedule (revised):**
 - Start and completion dates.
 - **A resource schedule:**
 - When each resource will be required.
 - Level of its requirement.
 - **A cost schedule:**
 - Showing the planned cumulative expenditure incurred by the use of resources over time.
- These schedules will be used on daily basis for the control and management of the project.**

Resource Nature

- **Resources can be:**

- Item required for the execution of the project.
- Person required for the execution of the project.

Some resources will be required for a specific period and some will be required for the whole duration of the project.

Which type of resources need to be the concern of the project manager?

- stationary and other office supplies (paper clips....)

office Manager should be concerned.

- system analysts, software developers.

project manager should be concerned.

Resource Nature

Resources will fall into one of seven categories:

Labour (the project manager, system analysts, software developers.....).

Equipment: used items (workstations, office equipment, desks, chairs...).

Materials (Consumed items – floppy disks, paper, printer ink.....).

Space : for additional staff recruited or contracted (Rooms, Cubicles).

Services (Telecommunication services, Cleaning services.....).

Time (The most rigid item of all).

- Extended if other resources are reduced and
- Reduced if other resources are increased.

Money (Secondary resource).

- Used to buy other resources,
- Is consumed while other resources are being used.

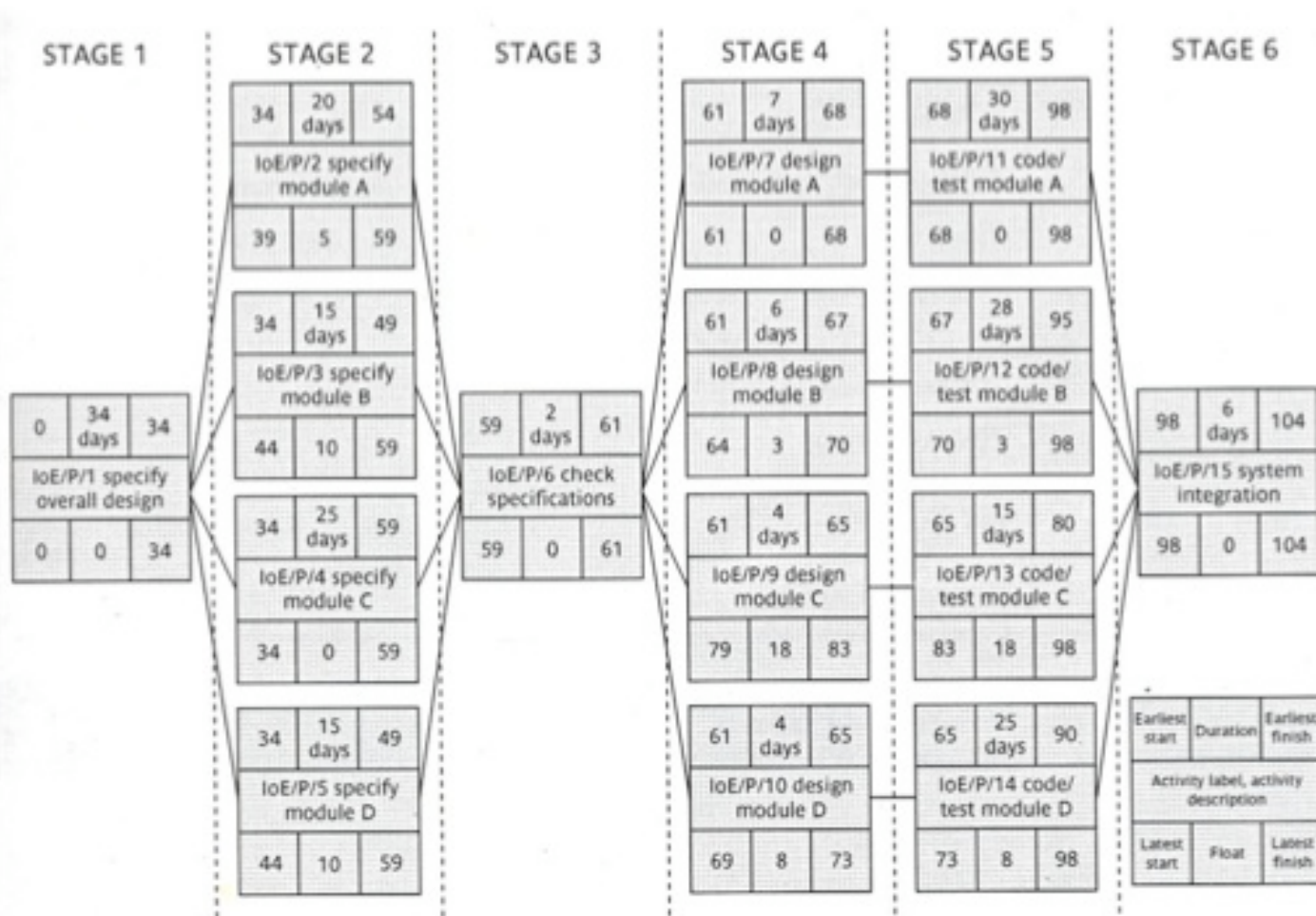
Identifying Resource Requirements

- **Resource allocation plan:**
 - **The first step is to prepare the resource requirement list:**
 - A list of the resources that will be required.
 - Along with the expected level of demand.
 - **Normally this will be done by considering each activity in turn.**
 - **But there could be resources that are not activity specific.**
 - **Resources that are part of the project infrastructure:**
 - Project manager.
 - **Resources required to support other resources.**
 - Office space required to house contract software developers.

Example

Activity	Estimated duration (days)	Activity	Estimated duration (days)
Specify overall system	34	Design module C	4
Specify module A	20	Design module D	4
Specify module B	15	Code/test module A	30
Specify module C	25	Code/test module B	28
Specify module D	15	Code/test module C	15
Check specification	2	Code/test module D	25
Design module A	7	System integration	6
Design module B	6		

Precedence Network



Resource Requirement List

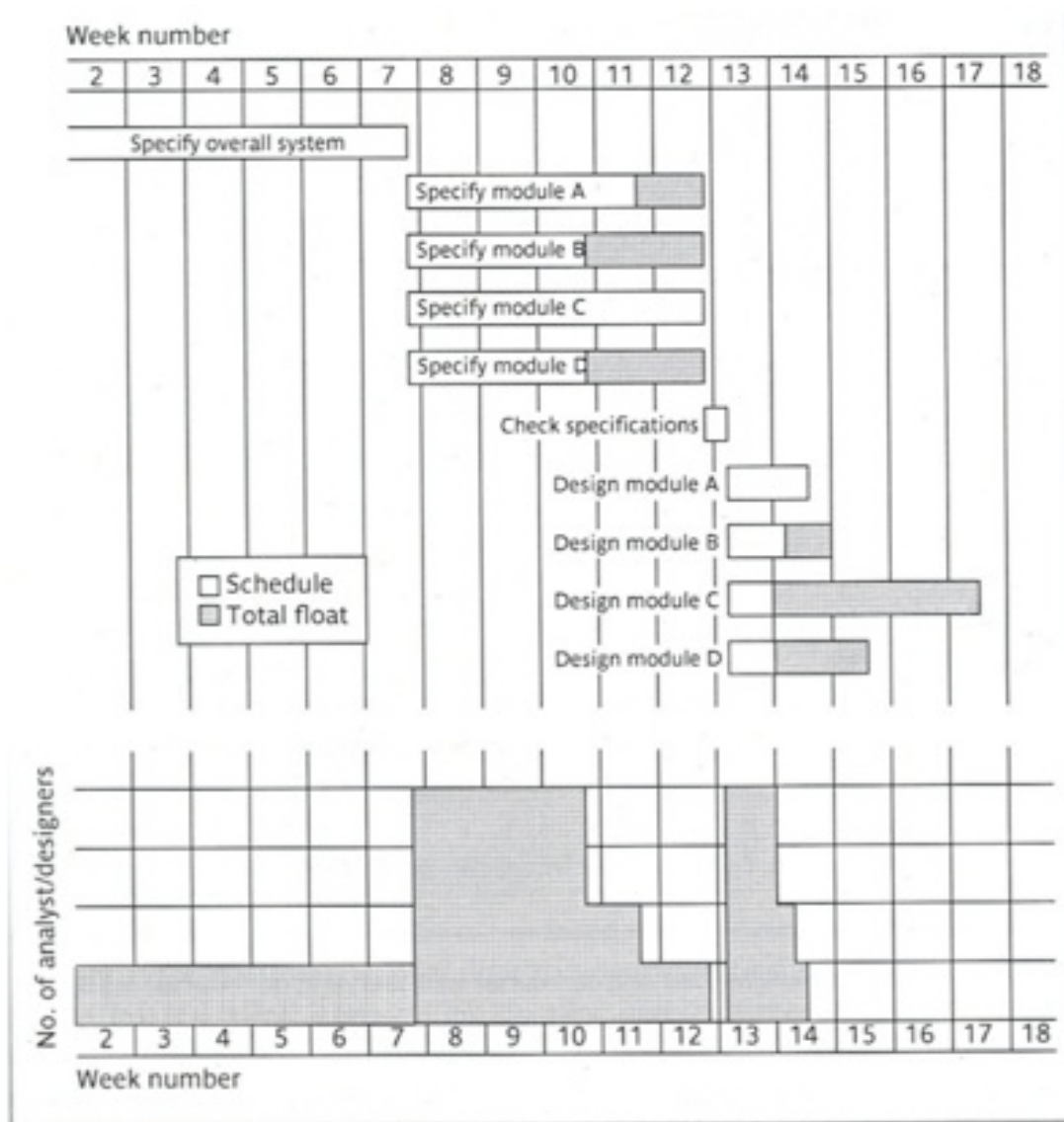
Example

Stage	Activity	Resource	Days	Quantity	Notes
ALL		Project manager	104 F/T		
1	All	Workstation	-	1	Check software availability
	IoE/P/1	Senior analyst	34 F/T		
2	All	Workstation	-	4	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	-	4	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		
5	All	Workstation	-	4	One per programmer
	All	Office space	-		If contract programmers used
	IoE/P/11	Programmer	30 F/T		
	IoE/P/12	Programmer	28 F/T		
	IoE/P/13	Programmer	15 F/T		
	IoE/P/14	Programmer	25 F/T		
6	All	Full system access	-		Approx. 16 hours for full system test
	IoE/P/15	Analyst/designer	6 F/T		

Resource Scheduling

- After all the **required resources** have been **identified**, they need to be **scheduled** effectively.
- So we need to **map the resources to the activity plan** to assess the distribution of the resources over the duration of the project.
- This mapping is best done by representing the activity plan as a bar chart and using a **resource histogram** for each resource.

Bar chart and resource histogram for analyst/designers



- From the previous histogram is there any ideal time for an analyst/designer between the specification and design time?

You can also look at the precedence network **in slide 9**

- Two of the analyst/designers stay idle for 12 days.

- From 49 to 61.

- one stays idle for 7 days.

- 54 to 61.

- One stays idle for 2 days.

- 59 to 61.

Resource Scheduling

- Allocating a resource (a member of the project team) to an activity limits the flexibility for resource allocation and scheduling of other activities.
 - Since each activity has a start and an end date this team member will not be available for the other activities for that period.
- Due to the above it is a good idea to prioritize the activities so that resources can be allocated to competing activities in a rational order.

Prioritizing Activities

- **Total Float Priority**

- Activities with the smallest total float are given highest priority.
- Thus Activities are allocated resources in ascending order of total float.
- It is desirable to recalculate floats as the scheduling proceeds. Why?

Prioritizing Activities (cont'd)

- **Ordered List Priority**

Activities that can proceed at the same time are ordered according to a set of simple criteria such as:

Burman's priority list :

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

Critical Paths

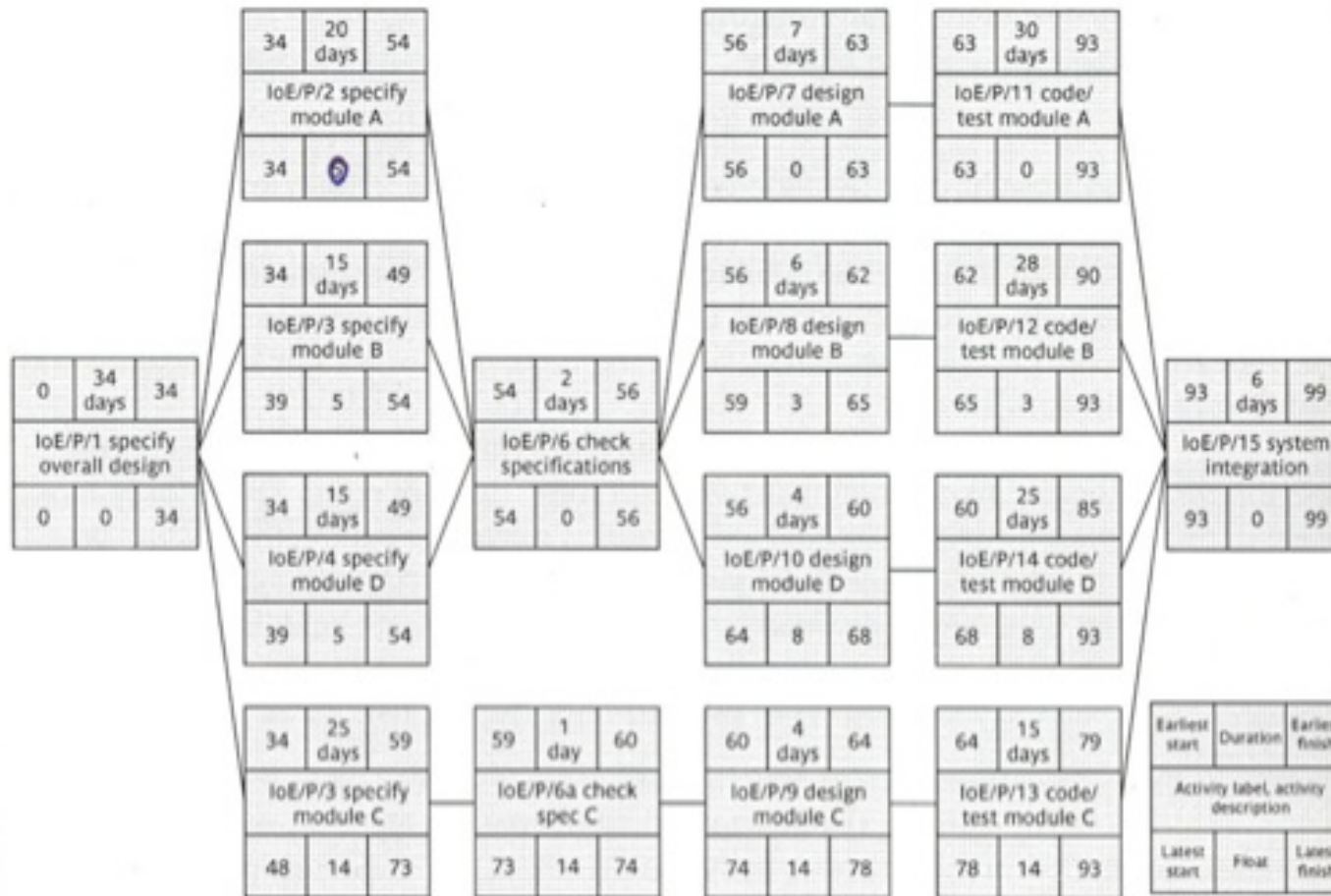
- Resource scheduling will almost always change the activity network.
- The changes often result in changes to the critical path.
 - Delaying an activity due to lack of resources will cause that activity to become critical after it uses up all its float.

Exercise

Consider the following:

- We need to revise the precedence network in order to proceed with checking the specifications of module's A, B, D without waiting for module C specification activity to finish. In this case we will check the specification of module C against the others in a separate activity.
- What will be the impact on the project completion date?
- The revised activity network is in the following slide.

Precedence Network



Exercise

Consider the following:

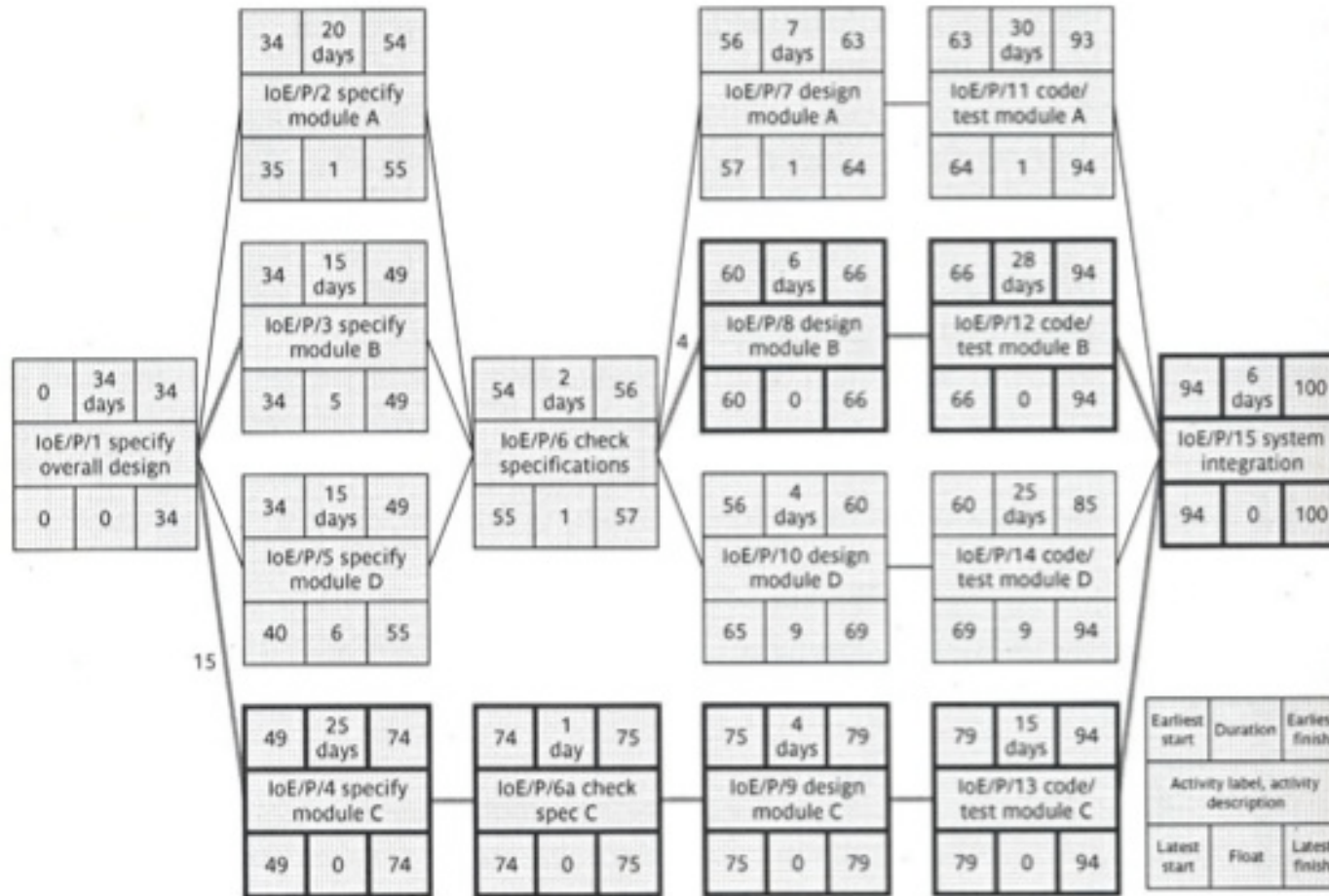
- Instead of having 4 (analyst/designer), we have only 3. We need to revise the precedence network in slide 20 according to the resource availability.
- The revised activity network is in the following slide.

Exercise

Consider that , where possible whoever writes the specifications for a module should also produce the design, as this is believed to improve the commitment and motivation of the three analyst/designers: Belinda, Tom, and Daisy.

- Tom a new trainee will be used for the specifications and design of module D.
- Belinda an experienced staff member is assigned to the specifications and design of module C.
- Work out whom she will assign to the other specification and design activities. Will Belinda be capable of doing the “design of module B” or she will be busy doing something else? If busy who could take her place?

Precedence Network



Staff Allocation Issues

- **Availability**

- Whether a particular individual will be available when needed.
- Investigate the risks that can prevent that from happening.

- **Criticality**

- Allocating more experienced personnel to critical activities often:
 - Shortens the project duration
 - Or at least reduces the risk of overrun.

- **Risk**

- Allocating the most experienced staff to the highest-risk activities is likely to have the greatest effect in reducing overall project uncertainties.

Staff Allocation Issues

- **Training**

Allocate junior staff to appropriate non critical activities, so there will be enough slack for them to train and develop skills.

- **Team Building**

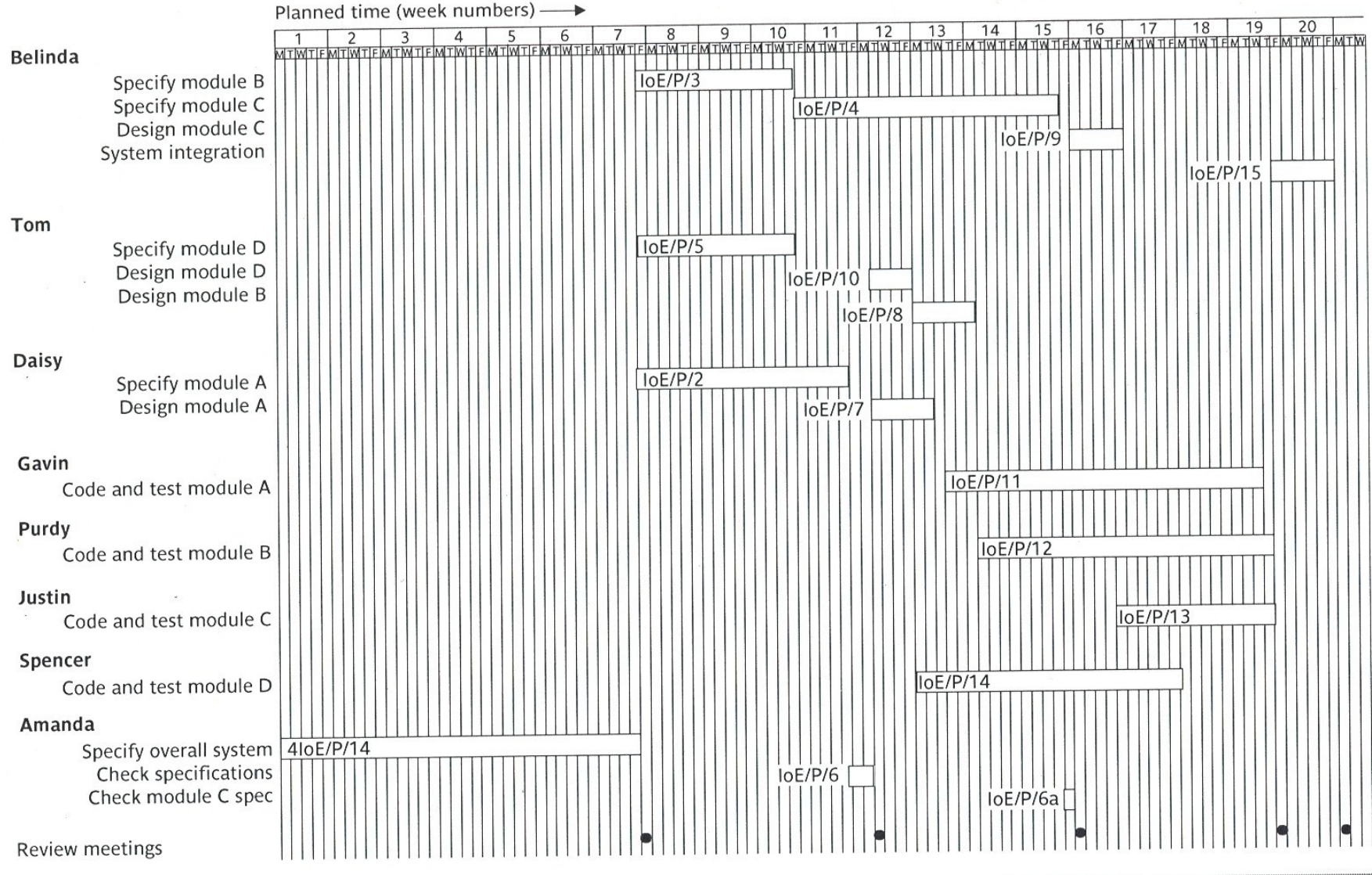
The selection of individuals in the project team must take account of :

- the final shape of the project team,
- the way they will work together.

Cost Scheduling

- **A detailed cost schedule will be created:**
 - Showing weekly or monthly costs over the life of the project.
- **Broad Categories**
 - Staff.
 - Overheads (Office Space, Interest charges, Travel Costs, Insurance and so on).
 - Usage charges (for external resources or contractors, leased/rental equipment).

Work Schedule



Exercise

Using the work schedule in slide 27, the precedence network in slide 23 and the hourly rates in the following table, calculate the total cost for the project. Consider that the project manager will require to work 10 extra days before the project starts to plan for the project and carry out post-project review.

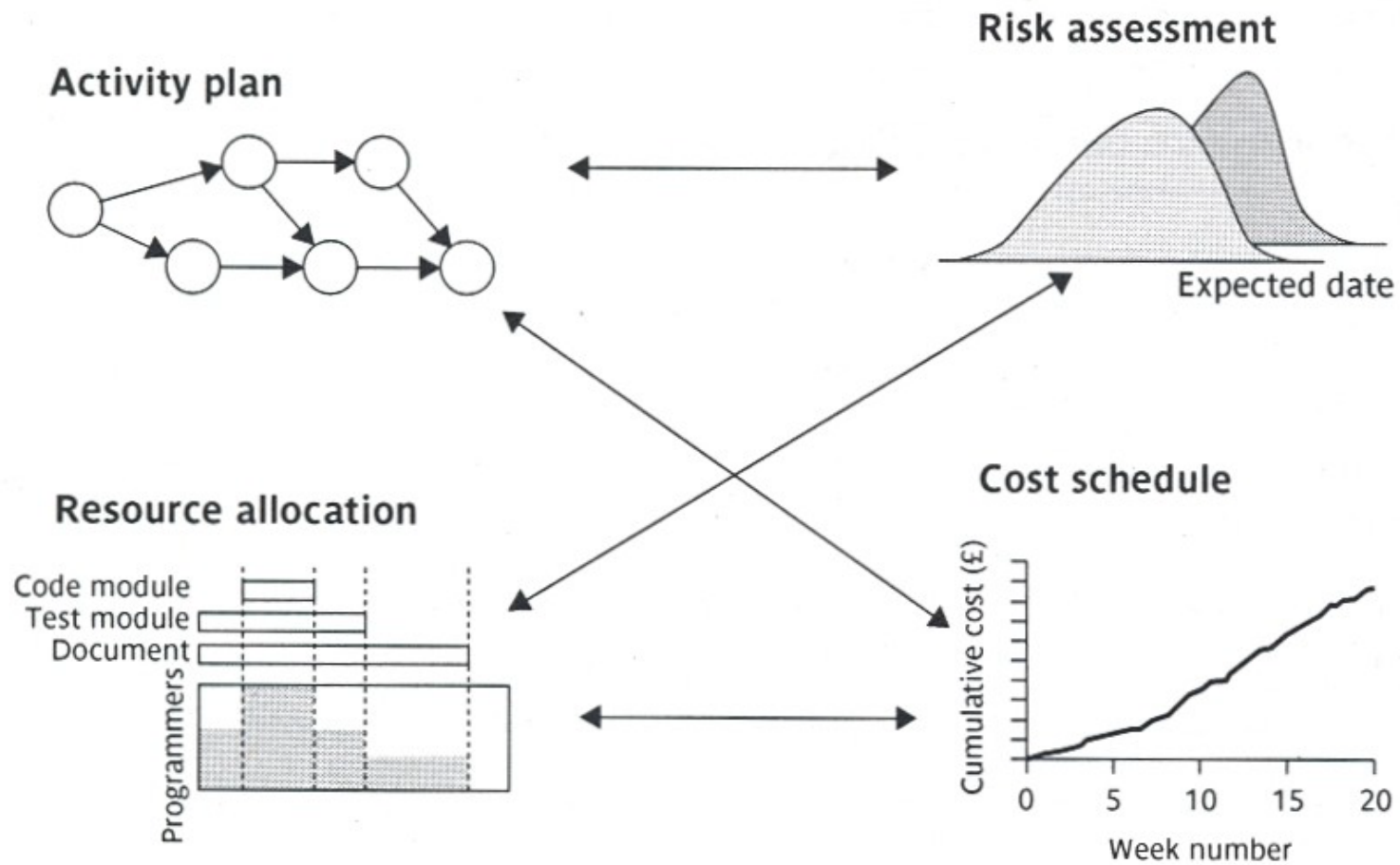
Staff member	Daily cost (\$)
Amanda	300
Belinda	250
Tom	175
Daisy	225
Gavin	150
Purdy	150
Justin	150
Spencer	150

Project Cost Table

Analyst	Daily cost \$	Days required	Cost \$
Amanda	300	110	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

Amanda, the project manager spends 10 extra days, for per project planning and post-project review.

Project Scheduling



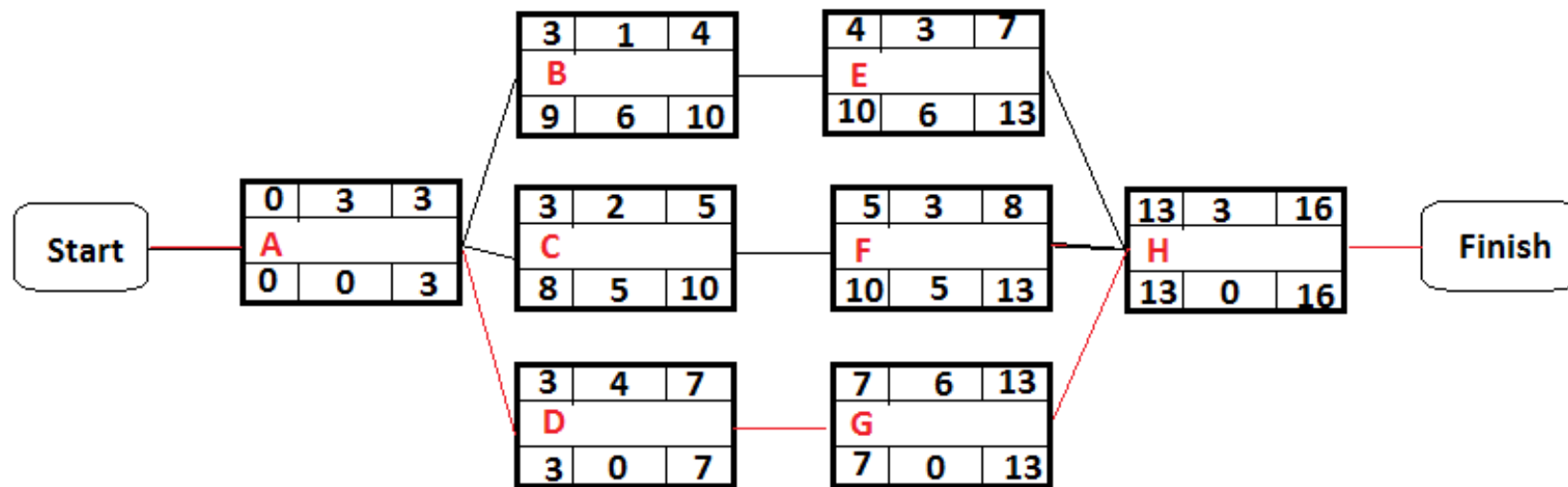
Exercise

Activity	Duration	Depends on	Resource type
A	3 days		SA
B	1 day	A	SD
C	2 days	A	SD
D	4 days	A	SD
E	3 days	B	SC
F	3 days	C	SC
G	6 days	D	SC
H	3 days	E,F,G	SA

SA = systems analyst; SD = systems designer; SC = software coder

Precedence Network

(1) Draw the precedence network by performing the forward and backward passes.



Exercise (cont'd)

- (1) Produce a table showing the number of specialists of each type needed on each day of the project if every activity was started as soon as possible.
- (2) How many of each type of resource (minimum) will need to be recruited for the project as a whole if the earliest finish date is to be preserved? (1 SA, 3 SD, 2 SC)

Exercise (cont'd)

- **What impact would there be on the project in slide 32 if there were only two system designers?**

Solution

- So if there were only two system designers, **the completion date of the project still will be 16 weeks and the critical path is still the same.**
- But now we have **5 staff members (1 SA, 2 SD, 2 SC) instead of 6 as before (1 SA, 3 SD, 2 SC) , which could result in reducing the project expenditure (cost).**

Exercise (cont'd)

- **What impact would there be on the project in slide 32 if there were only one system designer but you had three software coders?**

Solution

- So if there were only one system designer but you had three software coders, the completion date of the project still will be **16 weeks**.
- But now we have **5 staff** members (1 SA, 1 SD, 3 SC) instead of 6 as before (1 SA, 3 SD, 2 SC) , which could result in reducing the project expenditure (cost).
- Also now we have **2 critical paths** start **A- D- G-H-finish** and “start **A- D- G-H-finish**”, instead of only one critical path as before “start A- C- F-H-finish”.