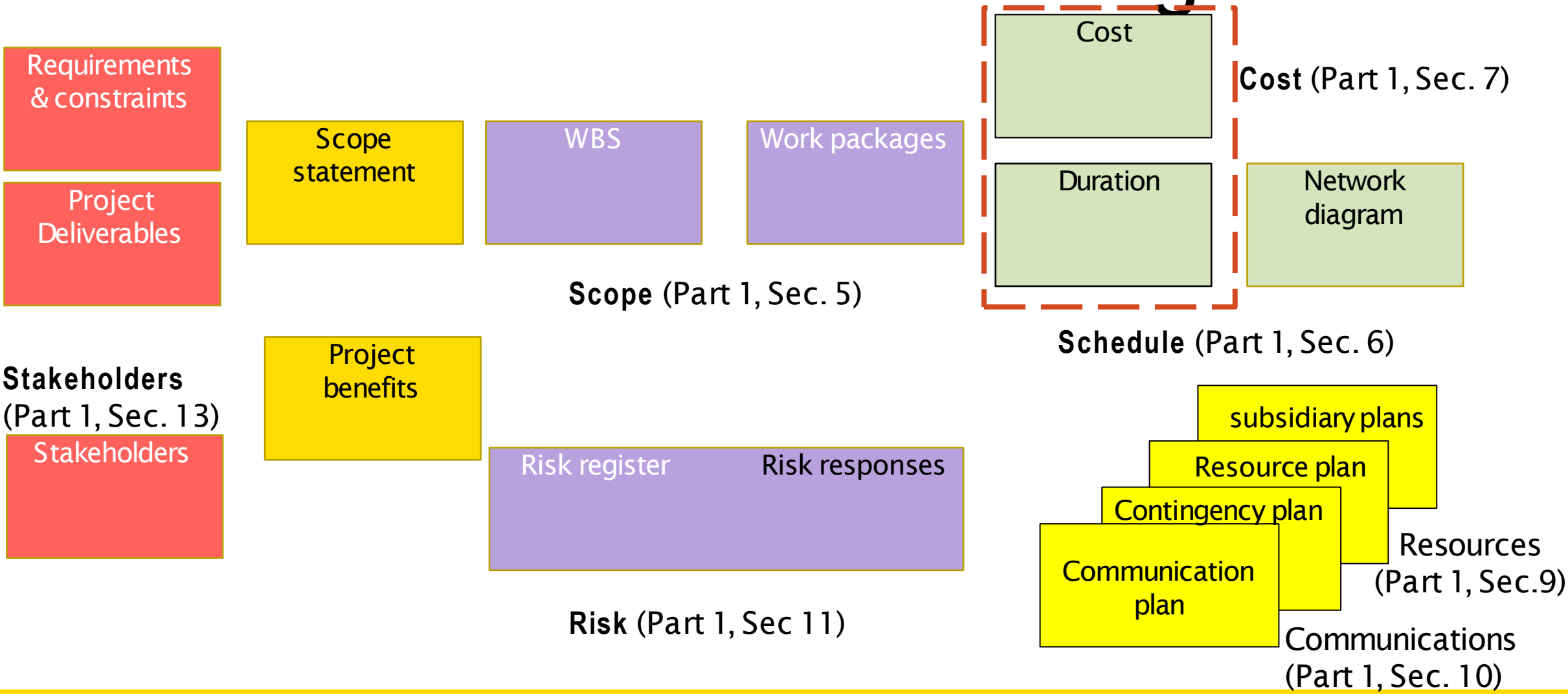
Week 5

GSOE9820 Engineering Project Management
Term 3 2021

UNSW SYDNEY

C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

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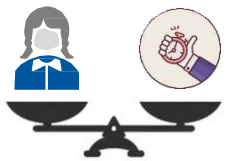
Part 5A: Estimating cost Management

What is Estimating?

The process of **forecasting** or approximating the **time** and **cost** of completing project deliverables.

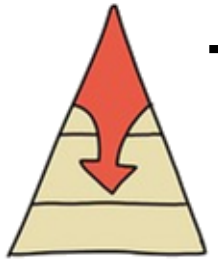


The task of **balancing expectations** of stakeholders and **need for control** while the project is implemented.

Some reasons for estimating:

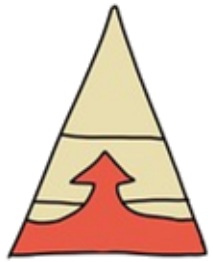
- To support **good decisions**
- To **schedule work**
- To determine **how long** the project should take and its **cost**
- To determine whether the **project is worth doing**
- To develop **cash flow needs**
- To determine how well the project is **progress**ing
- To develop time-phased **budgets** and establish **project baseline**

Types of Estimates



Top-down (macro)

- Analogy/previous experience
- Group consensus
- Mathematical relationships



Bottom-up (micro)

- Estimates of elements of the work breakdown structure

Conditions for selecting estimating method

Top-down (macro)	Bottom-up (micro)
Strategic decision making	Cost and time important
High uncertainty	Fixed-price contract
Internal, small project	Customer wants details
Unstable scope	

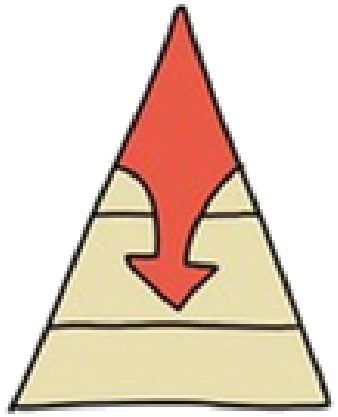
Top Down Approaches

Consensus methods

Ratio methods

Apportionment methods

Function point methods



PMBOK Guide (6th Ed.) 2017 Part 1 Sec.
6.4.2.2 Analogous estimating & 6.4.2.3 Parametric estimating

Consensus Method

- Typically involves a meeting where **experts** discuss, argue and reach a decision as to their **best guess** estimate
- Accuracy of the estimate can be improved by the use of “Delphi method”
- Helpful in determining whether the project warrants more formal planning

“The Delphi technique is a structured, anonymous and iterative survey of a panel of ‘experts’ or participants.”

“All those in favor say ‘Aye.’”
“Aye.” *“Aye.”* *“Aye.”* *“Aye.”* *“Aye.”*

Ratio Method

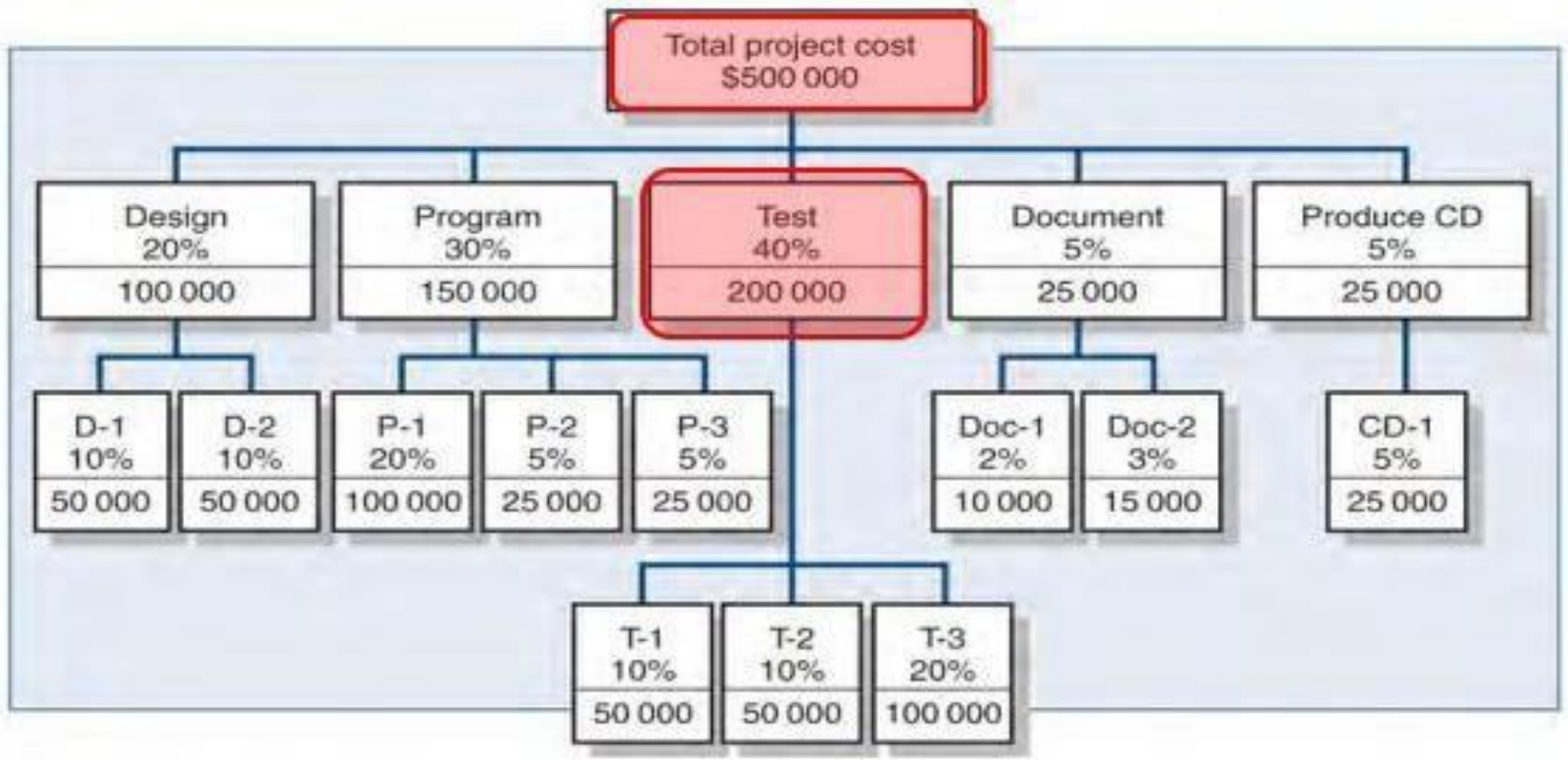
- Also known as “parametric method”
- Usually use **ratios or surrogates** to estimate project times or costs
- Often obtain initial estimates based on **prior experience**

Example

The cost of building a house in a particular suburb is $150 per square metre. If a house of 1,000 square metres is to be build, how much would it approximately cost?

Apportionment Method

- Is an extension of the Ratio Method
- Is used when projects closely follow **past projects** in features and costs
- Useful for projects that are relatively **standard**, but have some **small variation** or customisation



Function Point Method

- Is often used for **software** and **systems projects**
- Uses weighted macro variables called **"function points"**
- A function point is a **unit** of measurement to express **functionality** an information system provides to a user.
- Function points are used to measure **software size**.

Software project 13: Patient admitting and billing			
15	Inputs	Rated complexity as low	(2)
5	Outputs	Rated complexity as average	(6)
10	Inquiries	Rated complexity as average	(4)
30	Files	Rated complexity as high	(12)
20	Interfaces	Rated complexity as average	(10)

Application of complexity factor					
Element	**Count**	**Low**	**Average**	**High**	**Total**
Inputs	15	× 2			= 30
Outputs	5		× 6		= 30
Inquiries	10		× 4		= 40
Files	30			× 12	= 360
Interfaces	20		× 10		= 200
				Total	660

This is another type of relative estimating, See:

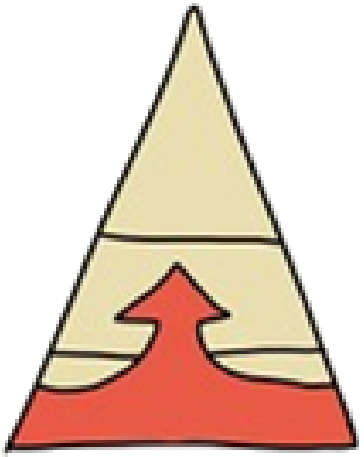
O'Connell, K. "Sizing and estimating techniques" video in course Cert. Prep: PMI Agile Certified Practitioner accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Bottom-up Approaches

Template methods

Range Estimating

Parametric procedures applied to specific tasks



PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 6.4.2.5 bottom up estimating

Template Method

- If the project is **similar to past projects**, the cost and time estimates from these past projects can be used as a starting point for the new project.
- Differences are noted and estimates adjusted.
- Enables development of a budget in a very **short time**.

Parametric procedures applied to specific tasks

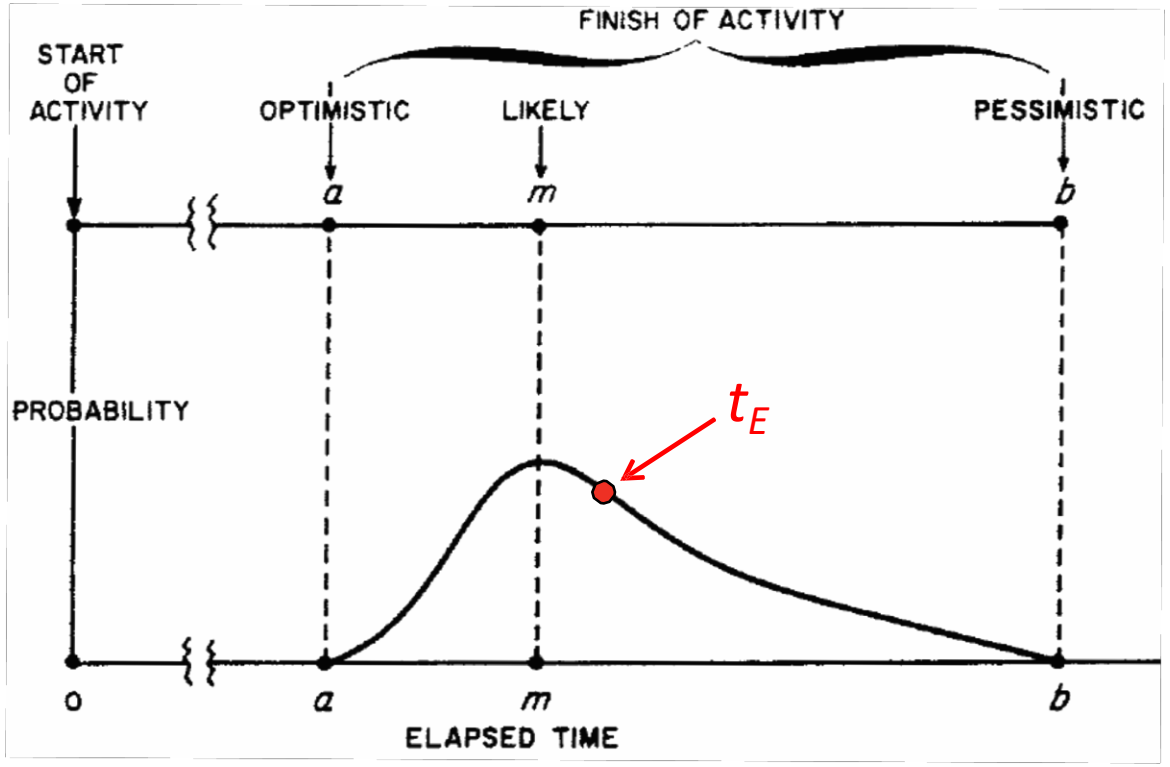
- In parametric estimating, an **algorithm** is used to calculate cost or duration based on **historical data** and project parameters (e.g., build rate of road/cable/wall/lines of code)
- Similar to the ratio and apportion methods from top-down estimation
- This method **begins** with ratio at the **lowest** possible **level of WBS**

Example

An IT workstation conversion project requires 30 computers to be upgraded. From past experience, one person could convert 5 computers per day. If there are 2 technicians available, how long will it take to complete the project?

Range Estimating

- Range estimating usually use three estimates
  - Low/ Average/ high
  - Pessimistic/ Most likely/ Optimistic
- Work best when the work package have **significant uncertainty** with time and cost



- 3 point estimate $t_E = (t_o + t_m + t_p) / 3$
- PERT estimate $t_E = (t_o + 4t_m + t_p) / 6$

*PERT = Programme Evaluation Review Technique

PMBOK Guide (6th Ed.) 2017 Part 1 Sec 6.4.2.4 Three-point estimating

Harrington, R. "Using a time estimation formula" video in course Project Management for Creative Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Types of Costs

Direct cost

- Costs chargeable to a specific work package
- e.g., labour, materials, equipment and other

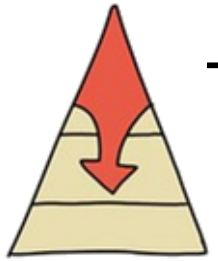
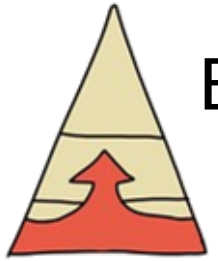
Direct overhead costs

- Costs incurred directly tied to an identifiable project deliverable or work package
- e.g., salary, rent, supplies, specialised machinery

Indirect overhead costs

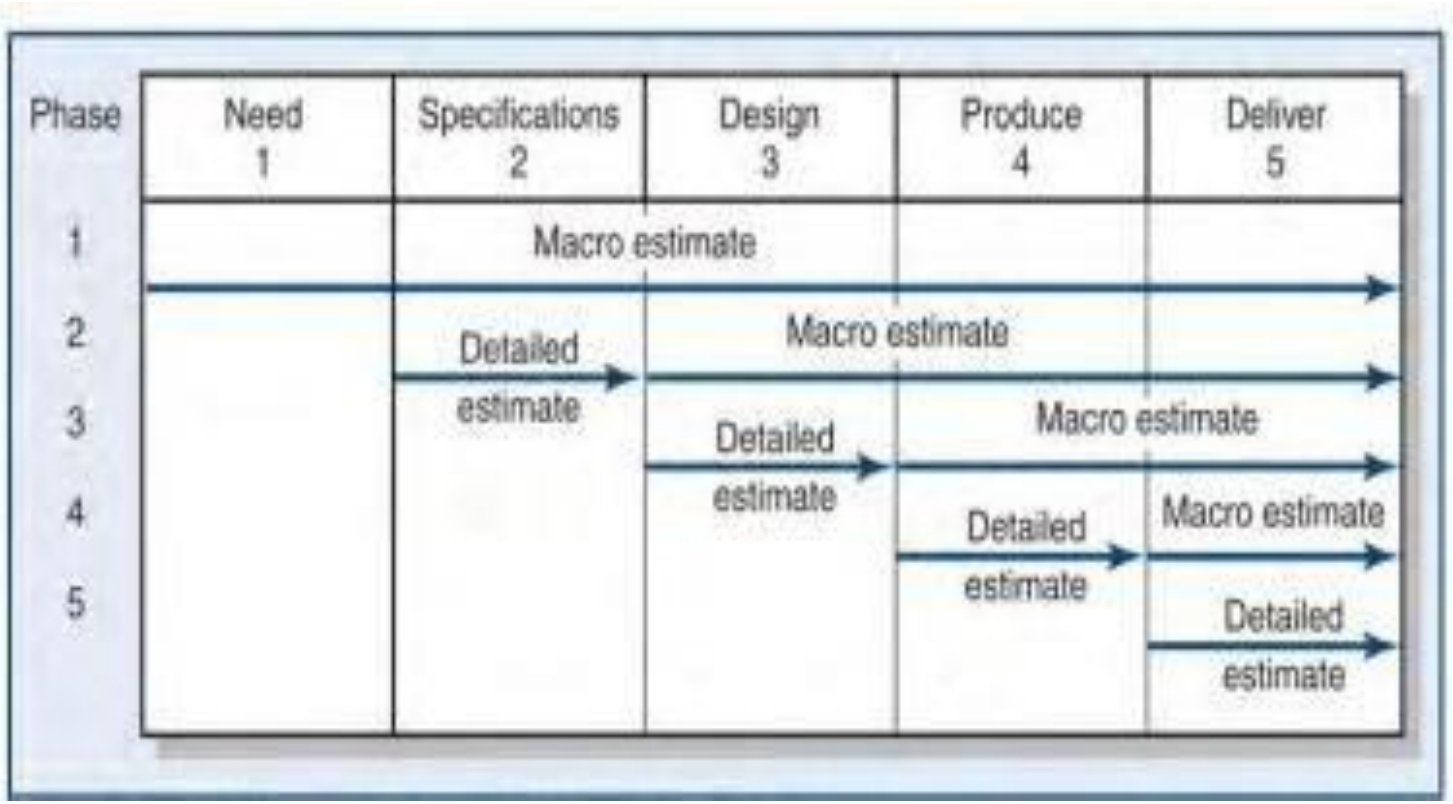
- Organisational costs indirectly linked to a specific package that are apportioned to the project
- e.g., marketing

Bottom-up vs Top Down

	Intended Use	Preparation Cost	Accuracy	Method
 Top-down (macro)	• Feasibility/conceptual phase • Rough time/cost estimate • Fund requirements • Resource capacity planning	• 1/10 to 3/10 of a percent of total project cost	• Minus 20% to plus 60%	• Consensus • Ratio • Apportion • Function point
 Bottom-up (micro)	• Budgeting • Scheduling • Resource requirements • Fund timing	• 3/10 of a percent to 1.0 percent of total project cost	• Minus 10% to plus 30%	• Template • Parametric • Range

A Hybrid | Phase Estimating

- Uses a **two-estimate system** over the life of the project.
- A **detailed** (micro) estimate is developed for the **immediate phase**
- A **macro** estimate is made for the **remaining phases** of the project



Estimating Projects | A preferred approach

Step 1	Make rough top-down estimates
Step 2	Develop the WBS/OBS
Step 3	Make bottom-up estimates
Step 4	Develop schedules and budgets
Step 5	Reconcile differences between top-down and bottom-up estimates

Estimating Guidelines

- Have **people familiar** with the tasks make the **estimate**
- Encourage **accountability** and **responsibility**
- Use **several people** to **make** the **estimate**
- Treat each task as independent, **don’t aggregate**
- Base **estimates** on **normal conditions**, efficient methods, and a normal level of resources
- Do not make allowance for contingencies
- Adding a **risk assessment** helps **avoid surprises** to stakeholders

A Typical Bottom-up Estimating Rules used in Power Industry

- Base estimate on a preliminary design sufficient to provide quantities and preliminary schedule
- For in-house activities, base manhours on ratio'd 'actuals' from recent previous similar projects
- For 'buy-in' materials for in-house processes, base quantities on preliminary design and unit costs on current or recent supply contracts
- For 'buy-in' equipment and services, especially complex electro-mechanical equipment, preferably use firm quotes; if not, budget quotes; if not, ratio'd estimates off recent actual purchase of similar equipment
- For labour, base manhours on ratio'd 'actuals' from recent previous similar projects; and labour rates from actual industrial agreements inflated for life of project
- Base direct overheads on ratio'd estimates from recent projects and the preliminary schedule
- Add in indirect overheads, contingencies and profit as percentages to the overall estimate based on previous experience and with full approval of Management
- Develop a "Top Down" estimate from a ratio'd recent similar project(s) as a point of reference to check bottom-up estimate

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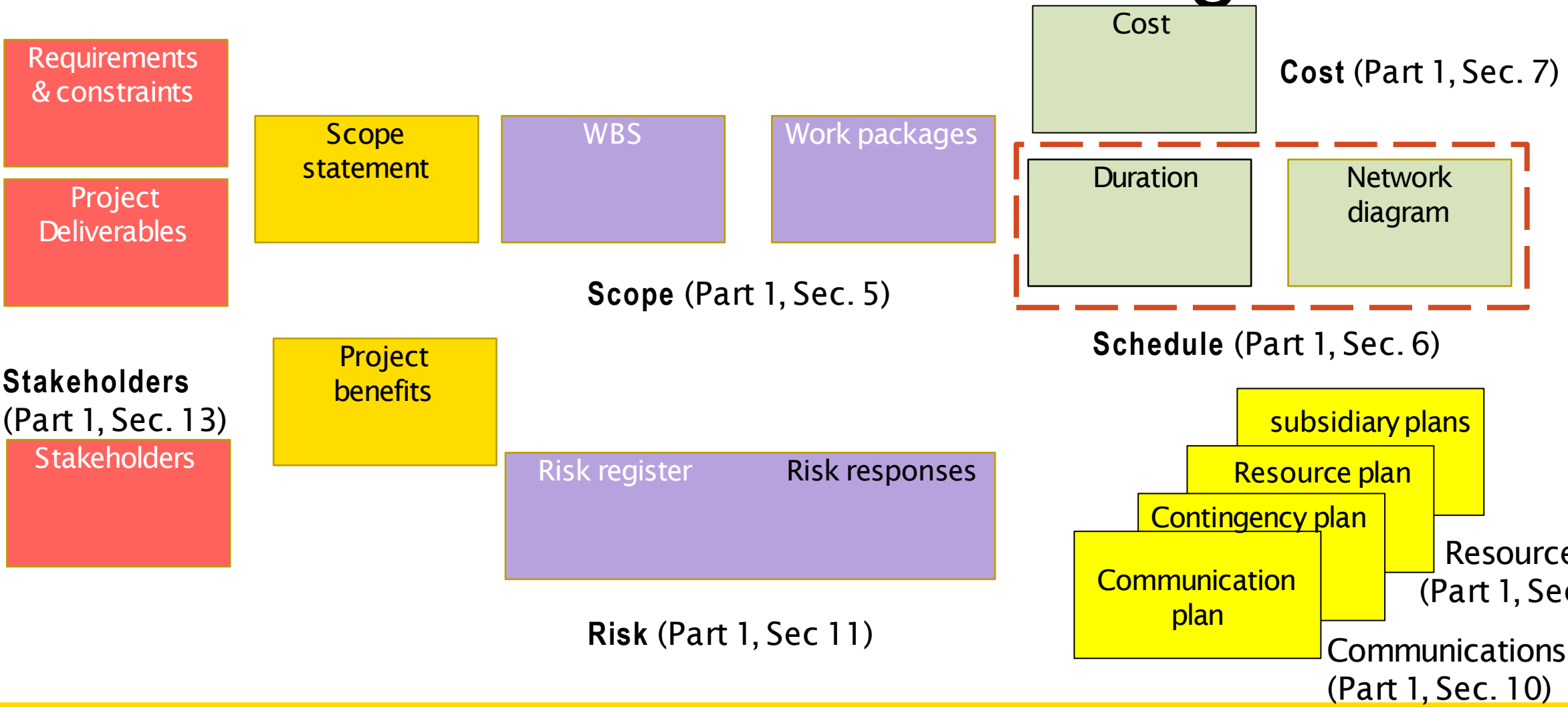
Part 5B: Schedule Management

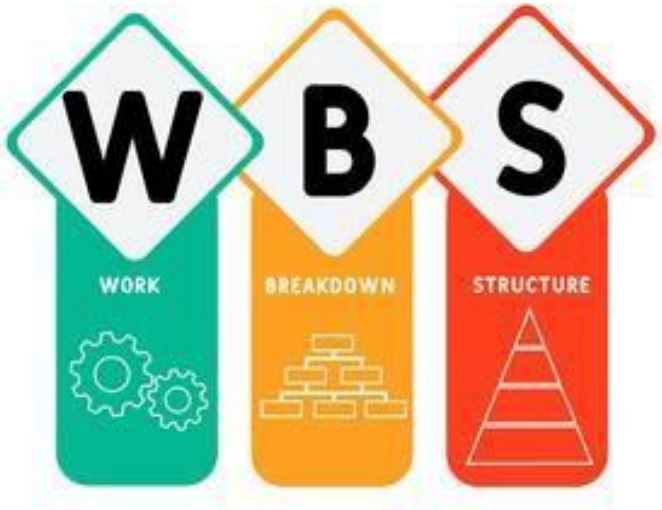
C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

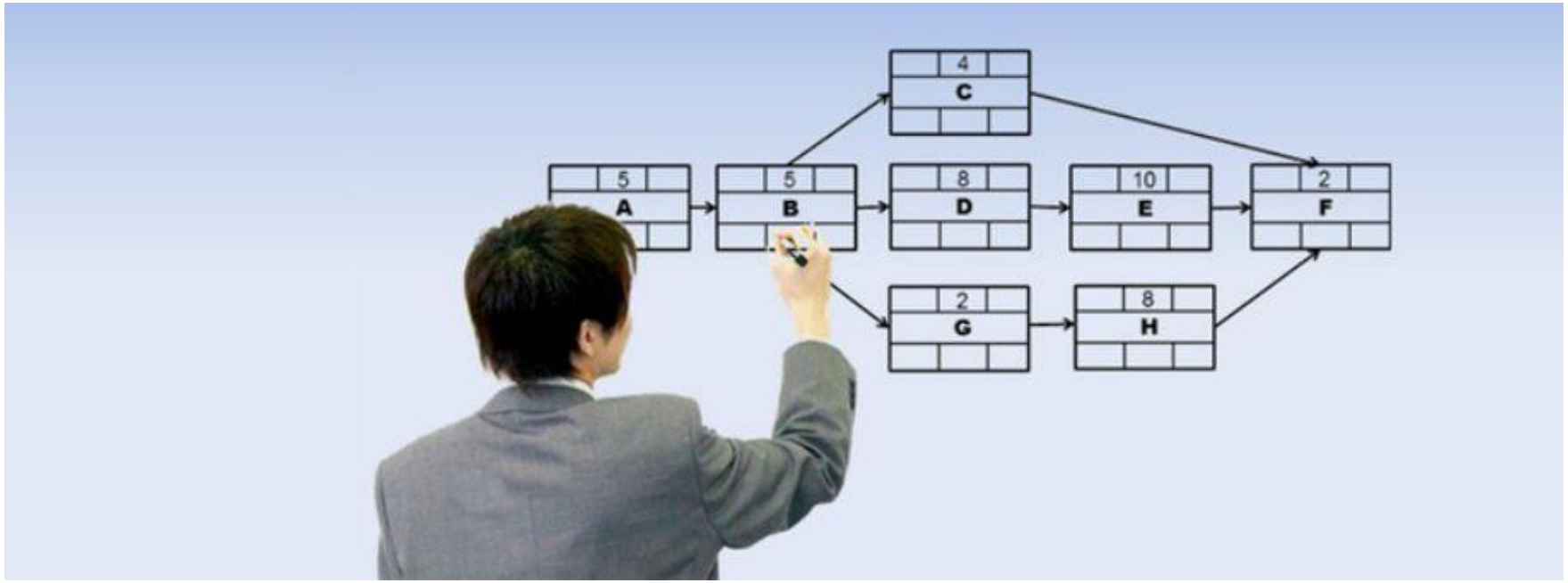
Scheduling limitations of the WBS

- Do not show all the activities that consume **time** (e.g. waiting periods)
- **Dependencies** and **interrelationships** between activities are not shown
- Do not **sequence** of activities (e.g. work flow)
- **Timing** of activities (e.g. how long the project will take) are not shown.
- Do not show the most important (e.g. **critical**) activities.



The project network diagram

Is a **flow chart** that graphically depicts using nodes and arrows the **sequence**, **interdependencies,** and **start and finish times** of the project job plan of activities.



Project scheduling questions

About the project

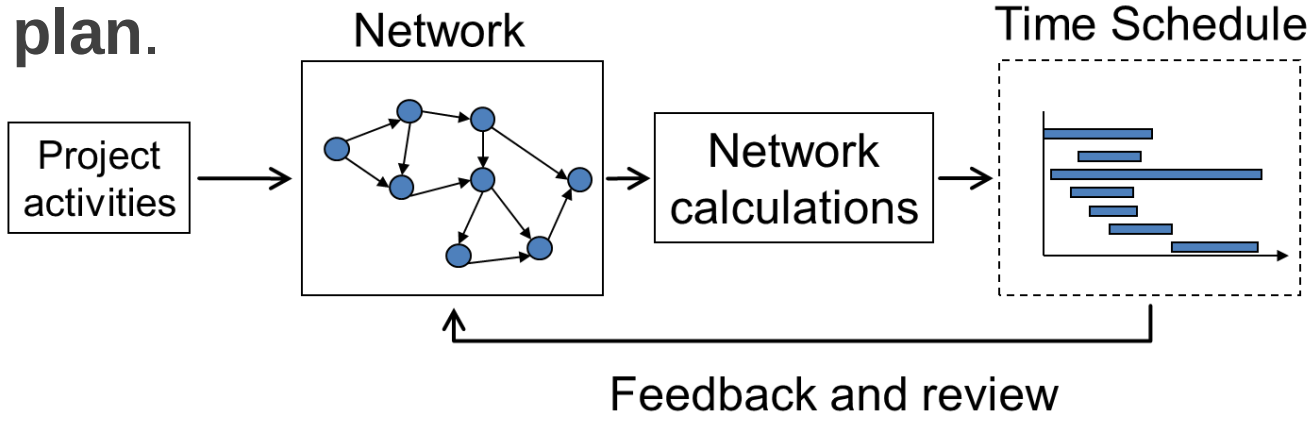
- How soon can the **project finish**?
- Which activities represent the **critical path**?

About the activities

- How soon can the activity start?
- How soon can the activity finish?
- How late can the activity start?
- How late can the activity finish?
- How long can an activity be delayed?

Benefits of developing the project network

- Provides the basis for **scheduling** labour and equipment;
- Enhances **communication** among project participants;
- Provides an **estimate** of the project's duration;
- Provides a basis for **budgeting** cash flow;
- Highlights activities that are **'critical'** and cannot be delayed;
- Highlights **activities** that can be **compressed** to meet a deadline;
- Help managers get and **stay on plan**.



Time elements of a project network

Activity

- Is some action which **requires time**

Event

- It does **not consume time**
- Is a point in time when an activity is started or completed
- May also be known as a “**milestone**”

Project network work flow

Path

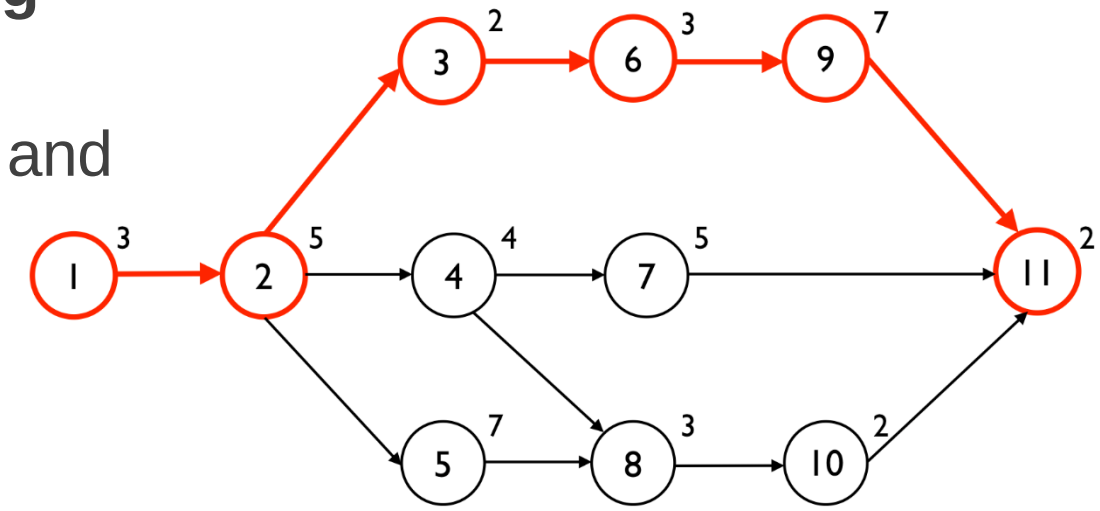
- a **sequence** of connected, dependent **activities**.

Critical path

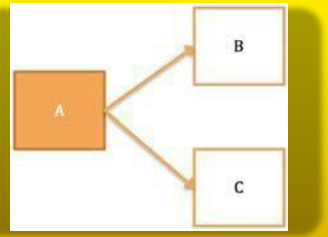
- the **longest path** through the activity network that allows for the completion of all activities;
- the **shortest expected time** in which the entire project can be completed.

Rules for developing a project network (activity on node)

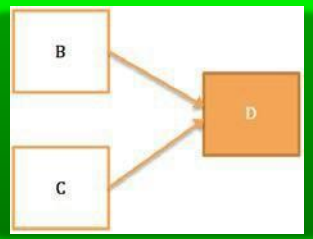
- Networks flow from **left to right**
- An activity cannot begin until **all preceding** connected activities are **complete**
- **Arrows** on networks indicate precedence and **flow**
- Each activity should have an **unique** identification **number** or label
- An activity identification **number** must be **larger** than that of any **preceding activities**
- **Looping** is **not allowed**
- **Conditional statements** are **not allowed**



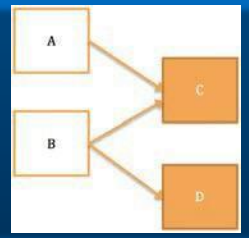
Types of activities in a network diagram



Burst - an activity that has more than one activity immediately following it



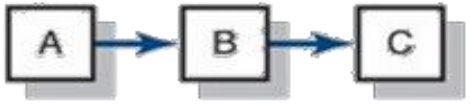
Merge - an activity that has two or more preceding activities on which it depends



Parallel - activities that can occur independently and, if desired, not at the same time.

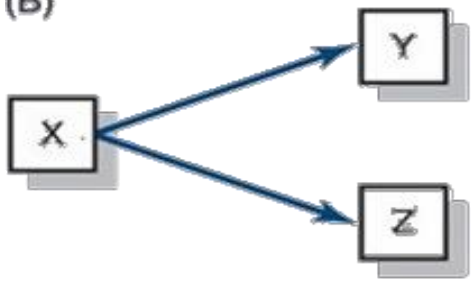
Activity-on-node networks

(A)



A is preceded by nothing
B is preceded by A
C is preceded by B

(B)

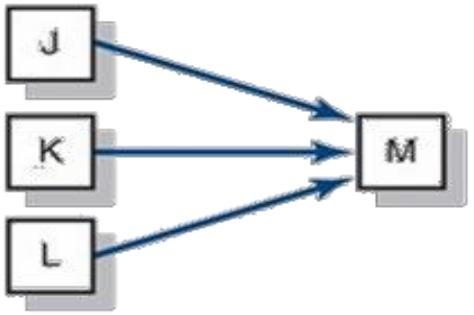


Y and Z are preceded by X

Y and Z can begin at the same time, if you wish

X is a burst activity

(C)



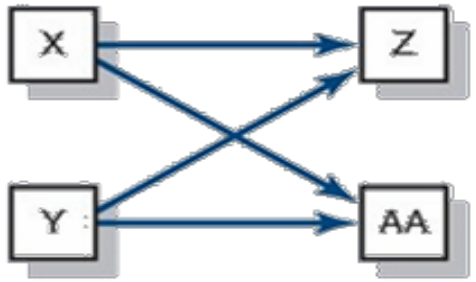
J, K and L can all begin at the same time, if you wish (they need not occur simultaneously)

but

All (J, K, L) must be completed before M can begin

M is a merge activity

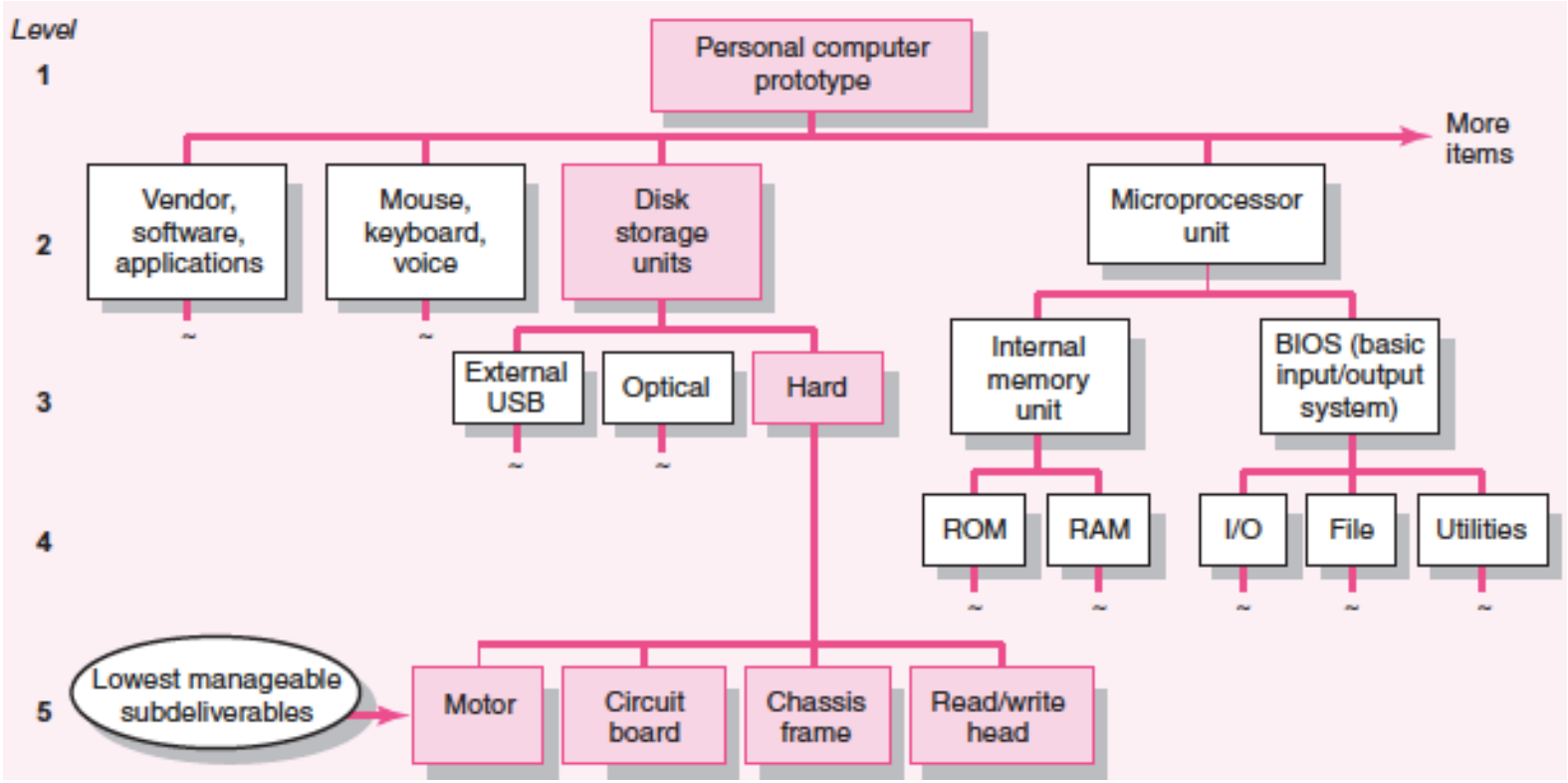
(D)



Z is preceded by X and Y

AA is preceded by X and Y

From WBS to project network



Circuit board

Activity 3.3.2.1 | Designing (specifications; documentation)

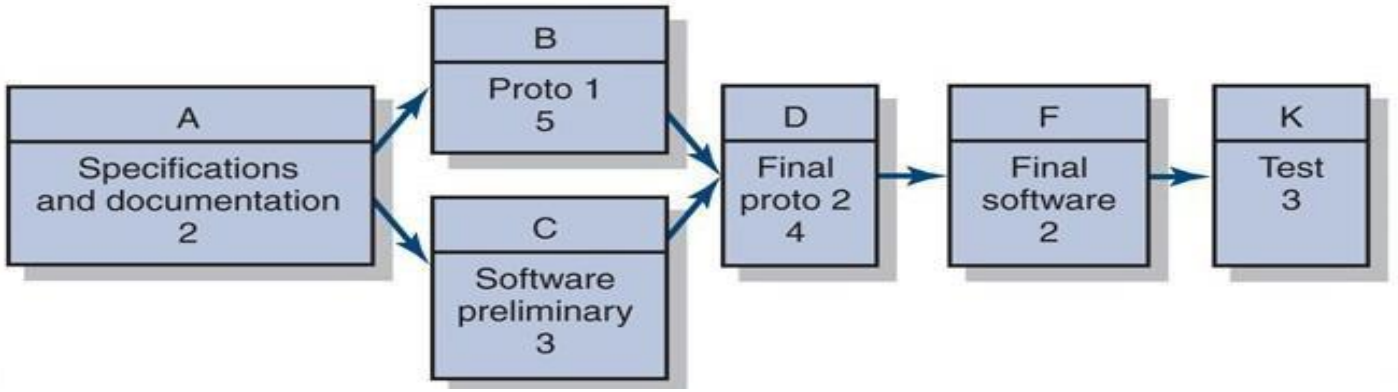
Activity 3.3.2.2 | Building prototype 1

Activity 3.3.2.3 | Coding preliminary software

Activity 3.3.2.4 | Building prototype 2

Activity 3.3.2.5 | Finalising software

Activity 3.3.2.6 | Testing



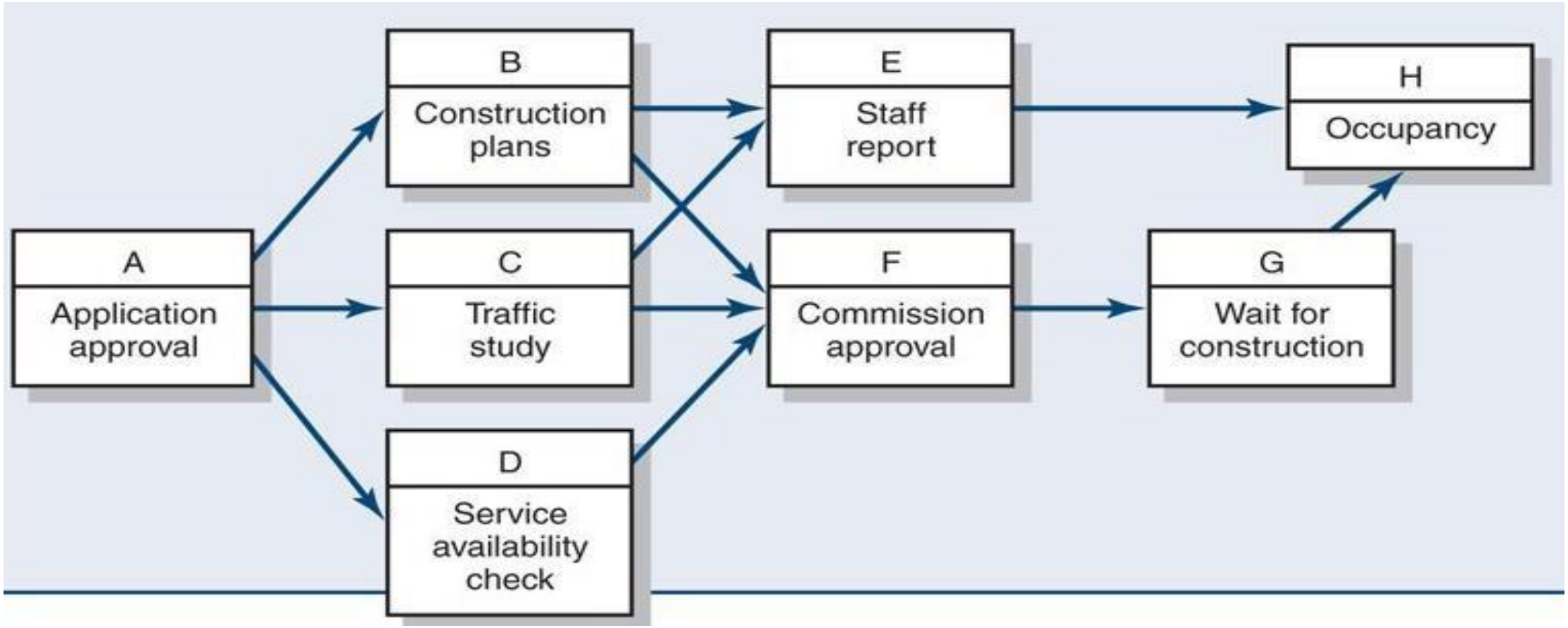
Example | Koll Business Centre

Step 1 Defining Network information

Activity	Description	Preceding activity
A	Application approval	None
B	Construction plans	A
C	Traffic study	A
D	Service availability check	A
E	Staff report	B, C
F	Commission approval	B, C, D
G	Wait for construction	F
H	Occupancy	E, G

Example | Koll Business Centre

Step 2 Drawing the Network diagram



Example | Koll Business Centre

Step 3 Estimating duration

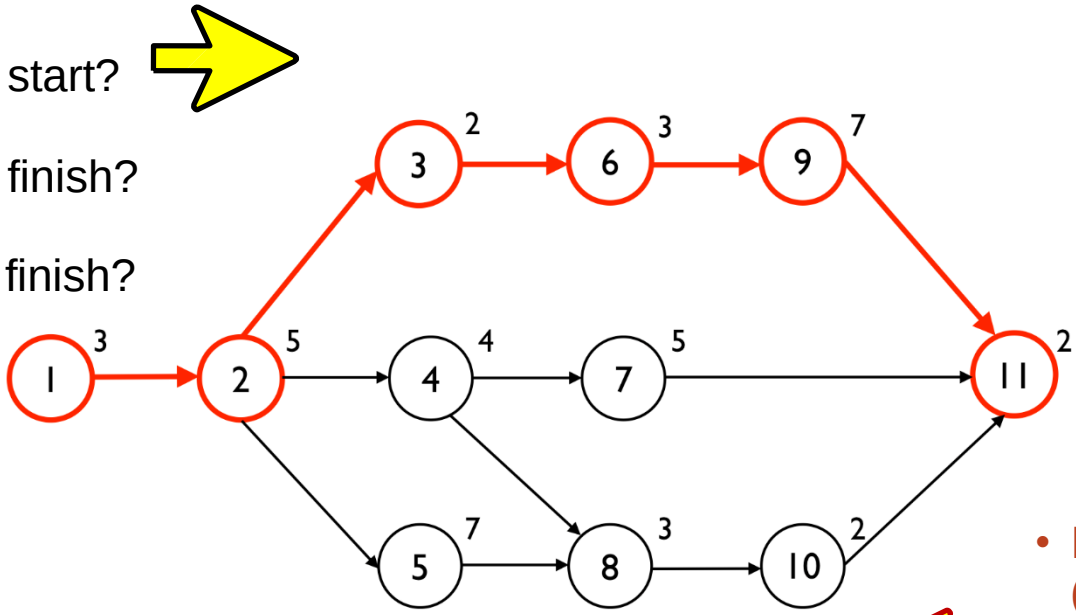
Activity	Description	Preceding activity	Activity time
A	Application approval	None	5
B	Construction plans	A	15
C	Traffic study	A	10
D	Service availability check	A	5
E	Staff report	B, C	15
F	Commission approval	B, C, D	10
G	Wait for construction	F	170
H	Occupancy	E, G	35

Example | Koll Business Centre

Step 4 | Network computation process

Forward pass

- How soon can the activity start? (Early Start—ES)
- How soon can the activity finish? (Early Finish—EF)
- How soon can the project finish? (Expected Time—ET)



Backward pass

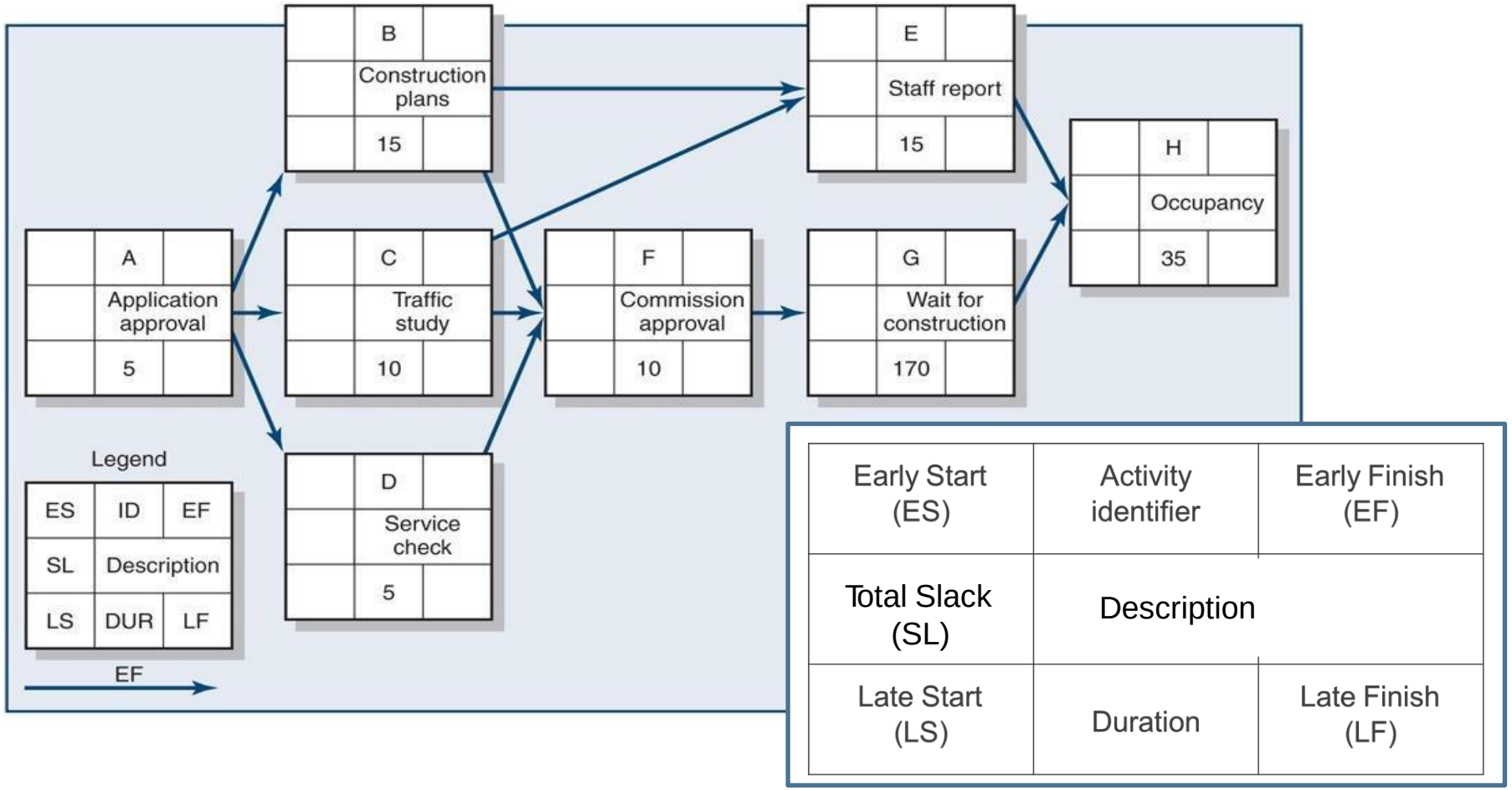
- How late can the activity start? (Late Start—LS)
- How late can the activity finish? (Late Finish—LF)

Network Computation | Key Activity Times

Term	Acronym	Description	Formula
Late finish	LF	The latest an activity can finish and not delay a following activity	LF = LS + DUR
Late start	LS	The latest an activity can start and not delay a following activity	LS = LF – DUR
Early finish	EF	The earliest an activity can finish if all preceding activities are finished by their early finish times	EF = ES + DUR
Early start	ES	The earliest an activity can start. It is the largest early finish of all its immediate predecessors	ES = EF – DUR

Example | Koll Business Centre

Step 4a | Forward Pass



Forward pass computation process

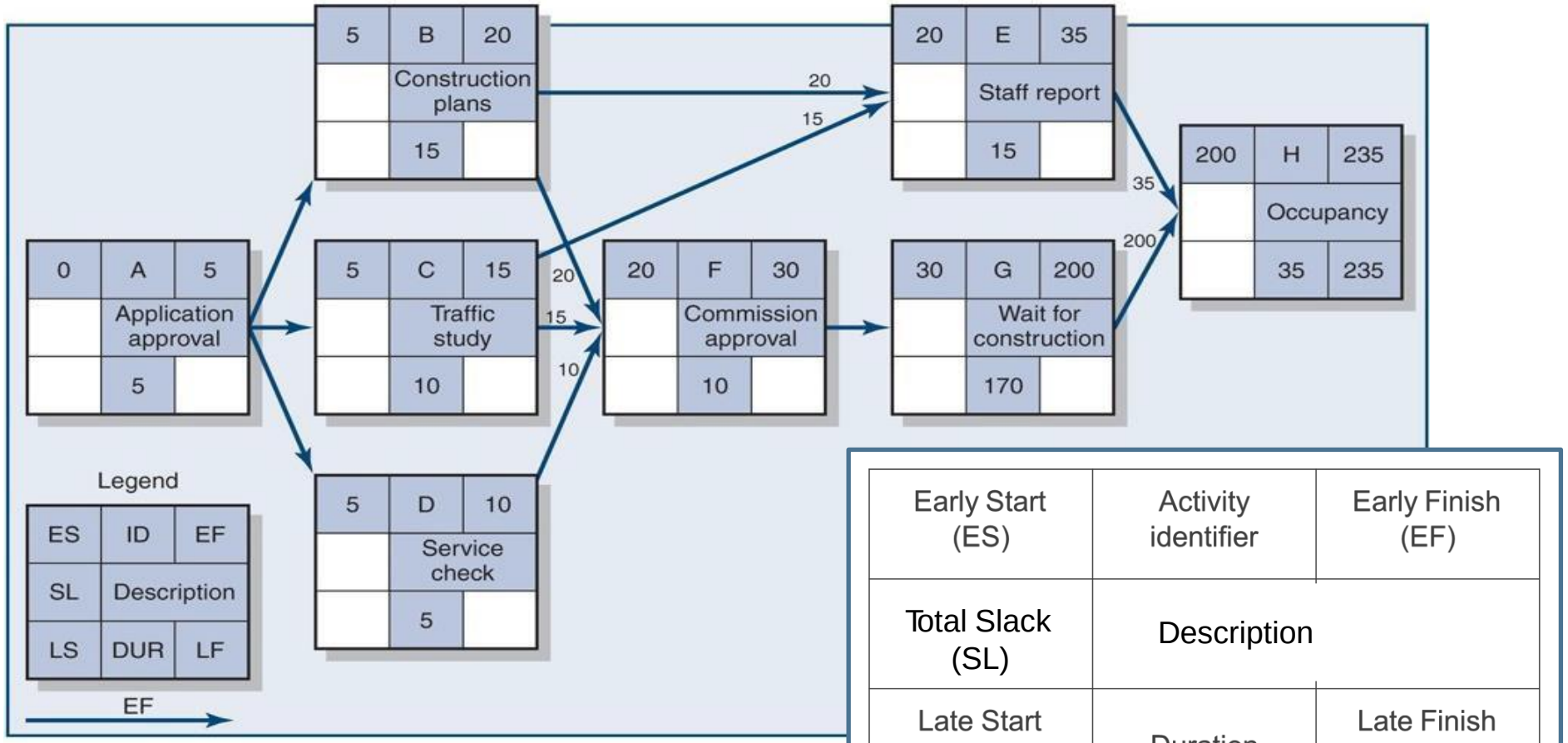
1. Add activity times along each path in the network (ES + Duration = EF).

2. Carry the early finish (EF) to the next activity where it becomes its early start (ES) ……. ***unless***

3. the succeeding activity is a merge activity, in which case select the largest EF of all preceding activities

Example | Koll Business Centre

Step 4b | Backward Pass



Backward pass computation process

1. Subtract activity times along each path in the network (LF – Duration = LS).

2. Carry the late start (LS) to the next activity where it becomes its late finish (LF) ……. ***Unless***

3. the succeeding activity is a burst activity, in which case select the smallest LF of all preceding activities.

Types of Slack

Total slack

- Shared by activities along a path
- Affects project completion date

Free slack

- Owned by theactivity
- Affects subsequent tasks

Determining total slack

- The amount of time an activity can be delayed and not delay the overall project
- The amount of time an activity can exceed its early finish date without affecting the project end date or an imposed completion date

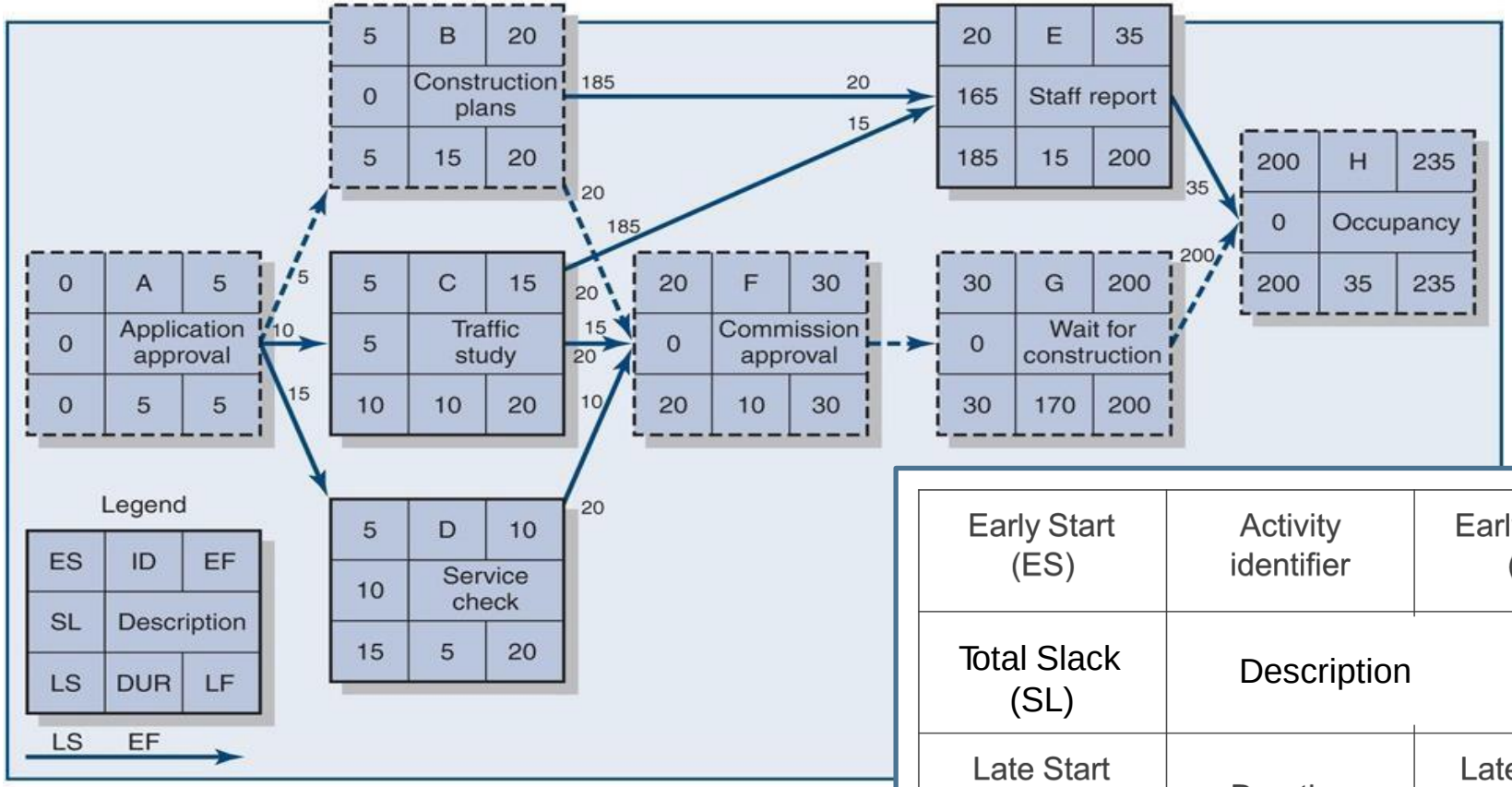
Total Slack = LS – ES

- Total slack can change as the project progresses

  Total slack is **shared by ALL** activities in a path

Example | Koll Business Centre

Step 5 | Calculating total slack and identifying the critical path



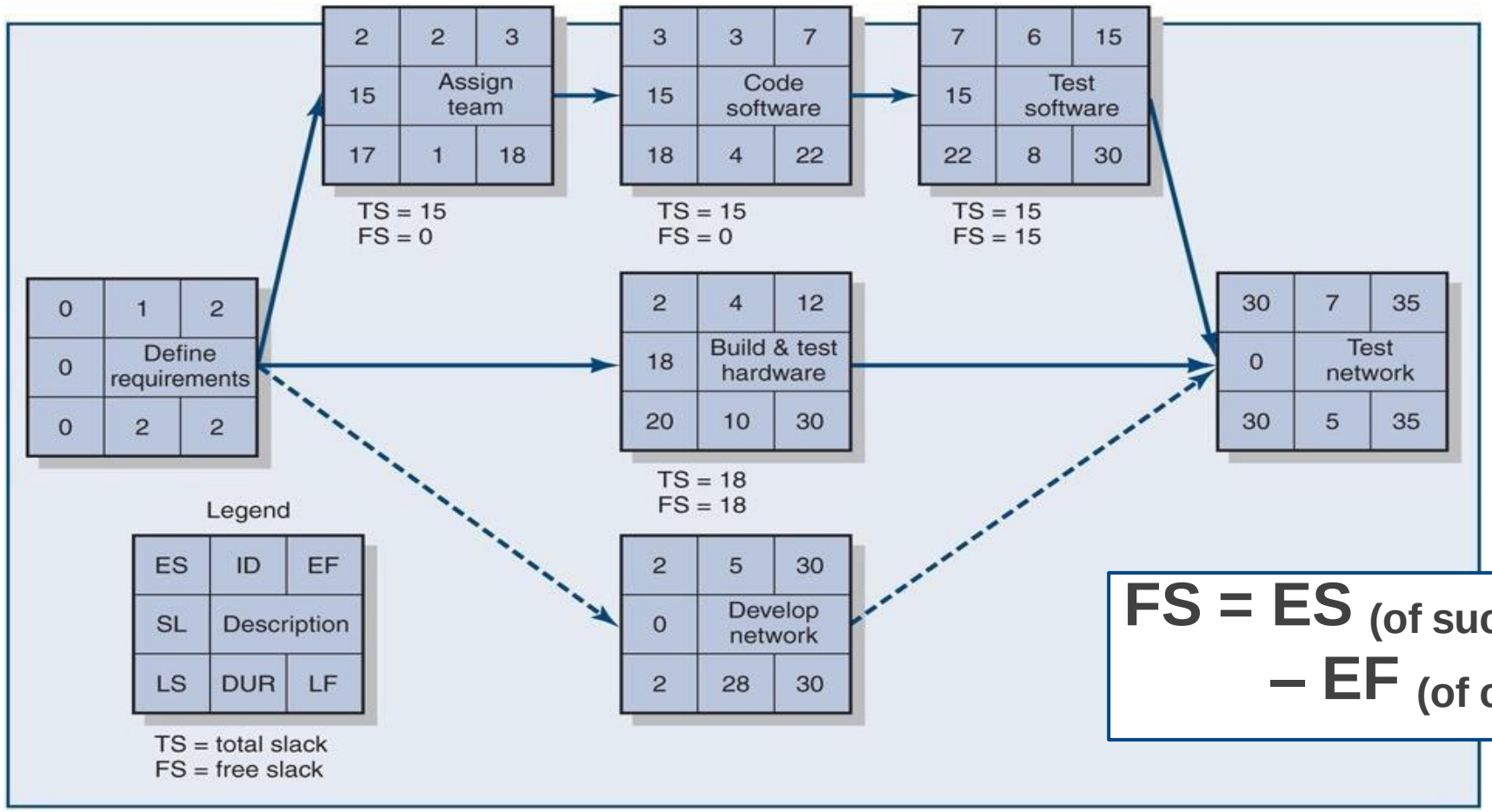
Total Slack = LS – ES

Total Slack values

Total Slack value	Interpretation
TS > 0	Activity delay is possible without delaying the project completion
TS = 0	**Critical situation.** Any delay in zero float activities will cause the project completion date to slip. Identifies the critical path.
TS < 0	You are behind schedule. You can get negative slack if you put a constraint on your completion date

Determining free slack (or float)

Is the amount of **time** that an activity can be **delayed** without delaying the early start (ES) of any successive activities



FS = ES (of successor activity) – EF (of current activity)

Schedule tools summary

- Critical path method (this is what I just showed)
- Further work with float (or slack):
  - Negative float analysis - to find possible ways of bringing a delayed schedule back on track.
  - Resource leveling – adjusting tasks within slack to optimize resource usage (e.g. programmers, excavators, engineers…) and CAN change critical path
  - Resource smoothing – like resource levelling, but does NOT modify critical path
- Crashing – Adding more resources to reduce duration for same work
- Fast-tracking – doing work in parallel

Sensitivity

Is the likelihood the original critical path(s) will change once the project is initiated.

Typical rules of thumb:

Very **little slack** and **lots of critical paths**

→ MORE sensitive

Lots of slack and only **one critical path**

→ LESS sensitive

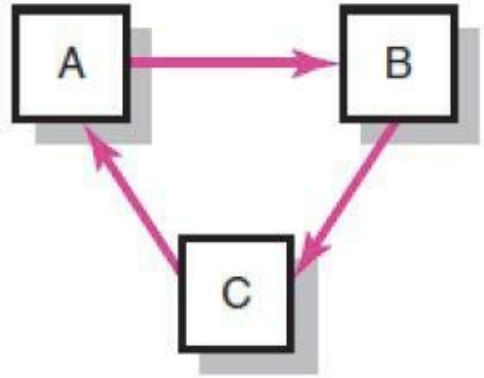
Tips from experience

- Always **avoid** the temptation to **fast-track** unless you have a very good reason – it looks good in theory but adds a new level of complexity and risk to engineering projects – and to your work as PM! If you fast-track, then communication between teams has to be exceptional.
- Continuously **review** and **update** the schedule. So often the baseline schedule is done once and not looked at again, whereas it is a living document and needs constant attention to have any value.

Practical considerations

Network logic errors

- Looping
- Conditional statements (e.g. if-then) are invalid



Activity numbering

- Each activity to have an unique identifier
- Number in ascending order
- Leave gaps to add missing or new activities

Calendar dates

- Assign actual dates (include non-workdays)

Multiple starts and multiple projects

- Use a common start and finish event to ensure project has a clear beginning and end

Note: ▪Detail → ▪Accuracy → ▪**Overhead/Costs**

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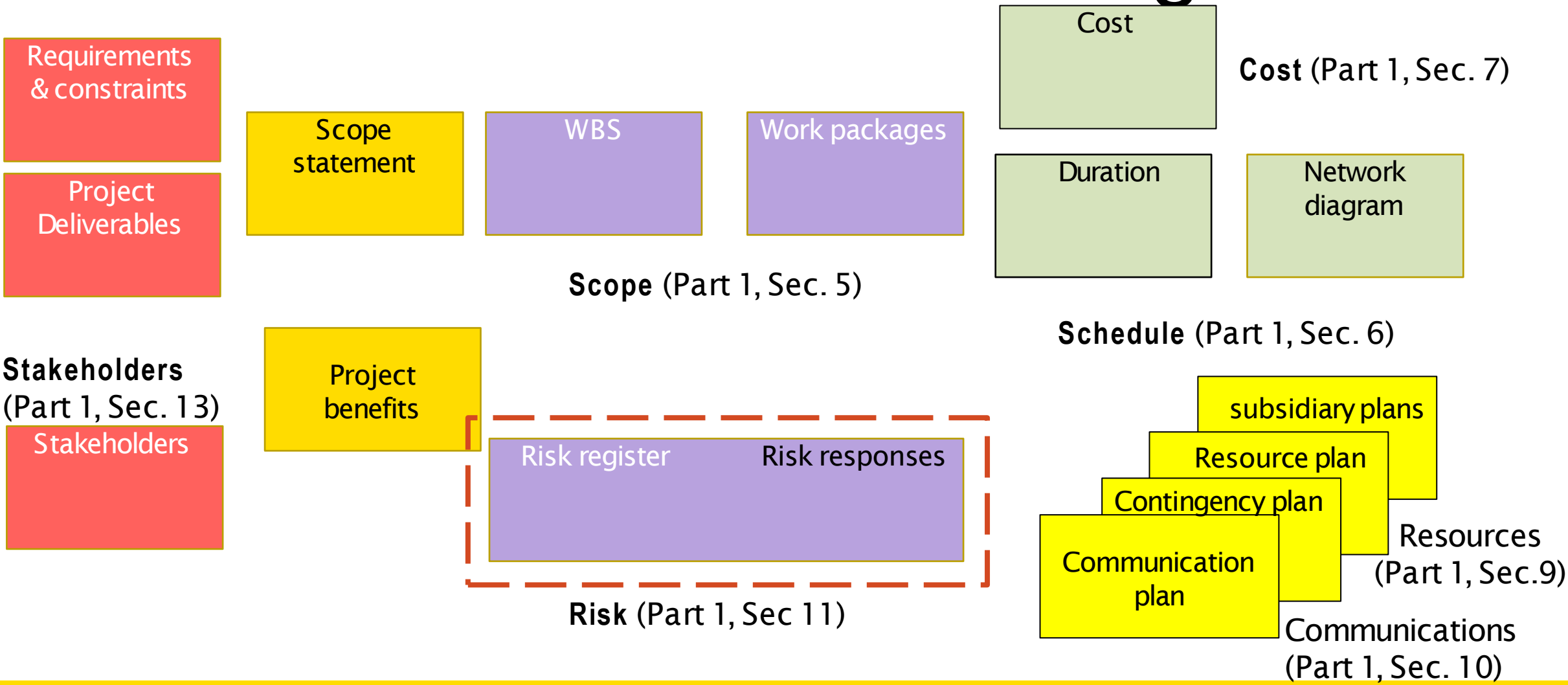
Part 5C: Risk Management

C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

What is Risk Management?

A **proactive** attempt to recognize and manage internal events and external threats that affect the likelihood of a project's success.

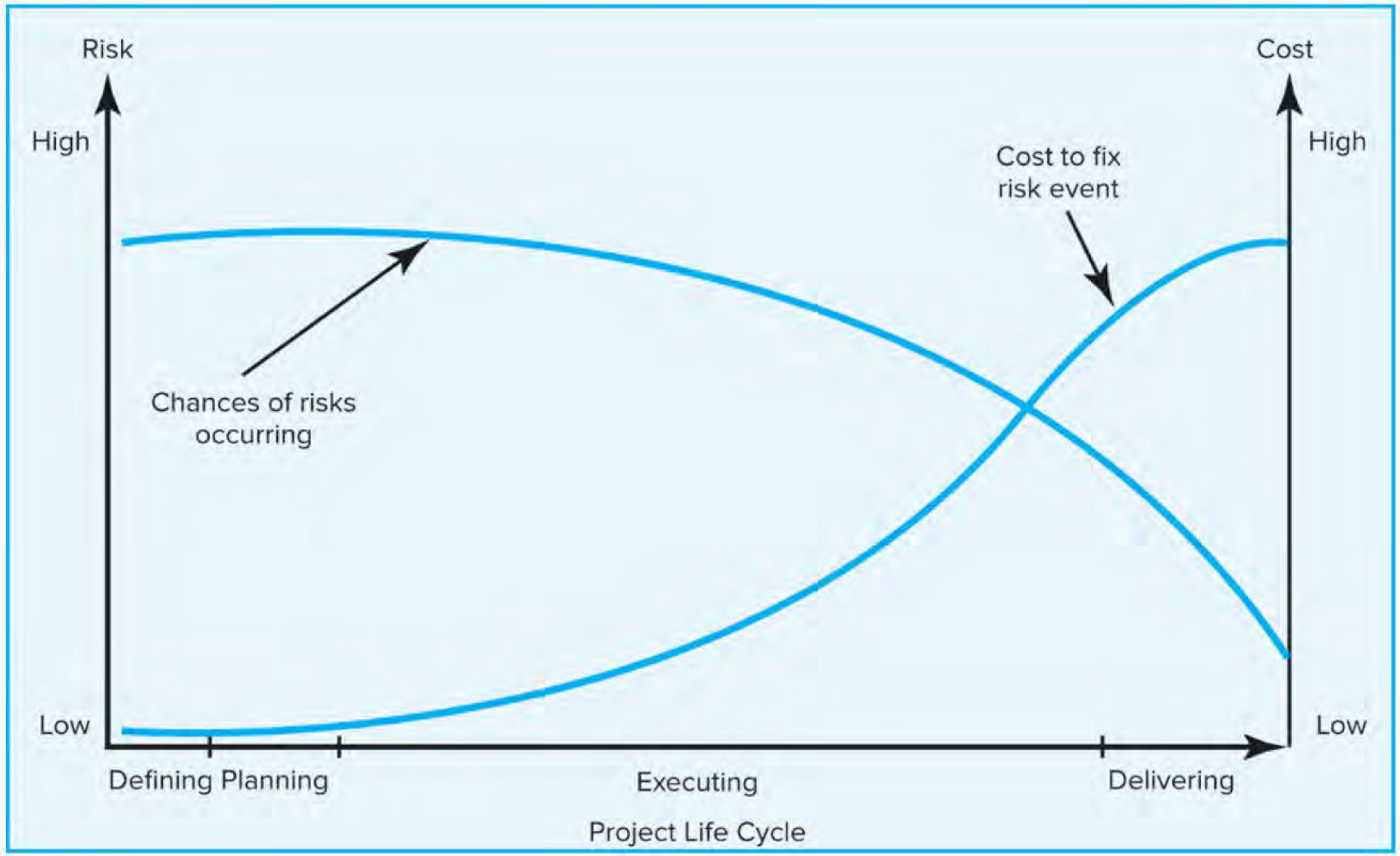
Incorporates an understanding of:

- What can go wrong (risk event)
- How to minimize the risk event's impact (consequences/effects)
- What can be done before a risk event occurs (anticipation)
- What to do when a risk event occurs (contingency plans)

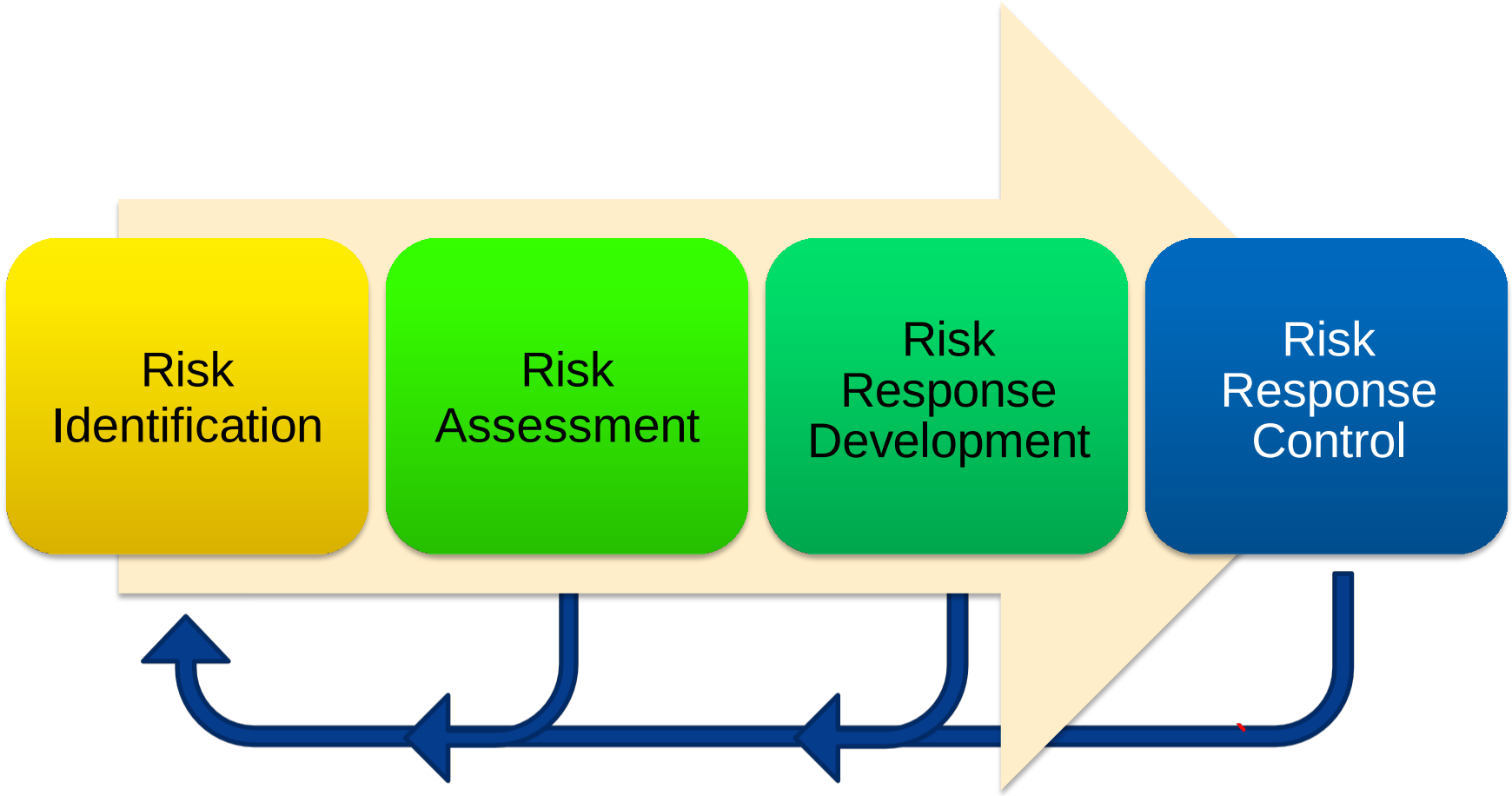
Benefits of Risk Management

- Aproactive rather than reactive approach.
- Reduces surprises and negative consequences.
- Prepares the project manager to take advantage of appropriate risks.
- Provides better control over the future.
- Improves the chances of reaching project performance objectives within budget and on time.

The risk management challenge



4-Step Risk Management Process



Step 1 | Risk Identification

The process of generating a list of possible risks that could affect the project.

A common mistake is to identify **project objectives** rather than **events**
as risks.

- E.g. Failure to meet schedule is a project objective, whereas adverse weather is an event which will effect the schedule.

Common risk identification tools

- Personal experience
- Individual pondering
- Group processes
  - Brainstorming
  - Nominal group (PMBOK Sec. 5.2.2.6)
  - Delphi method
- SWOT
- Root cause analysis
- Past Project information
- Checklists and Risk Profiles
- Risk breakdown structure (RBS)

PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 11.2.2.
Identify Risks: Tools & Techniques

Sample risk profiling questions

Technical Requirements

Are the requirements stable?

Design

Does the design depend on unrealistic or optimistic assumptions?

Testing

Will testing equipment be available when needed?

Development

Is the development process supported by a compatible set of procedures, methods, and tools?

Schedule

Is the schedule dependent upon the completion of other projects?

Budget

How reliable are the cost estimates?

Quality

Are quality considerations built into the design?

Management

Do people know who has authority for what?

Work Environment

Do people work cooperatively across functional boundaries?

Staffing

Is staff inexperienced or understaffed?

Customer

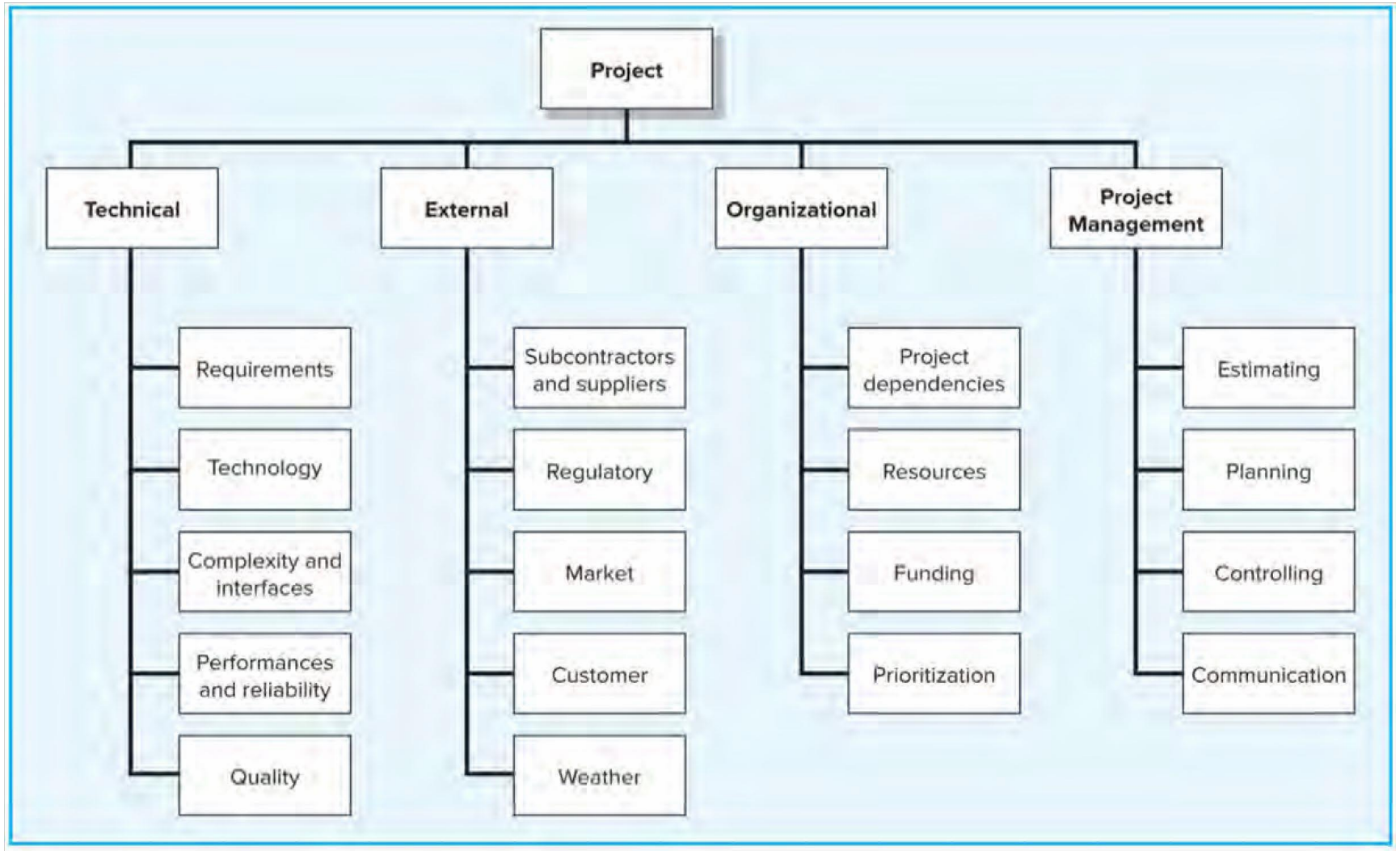
Does the customer understand what it will take to complete the project?

Contractors

Are there any ambiguities in contractor task definitions?

Sample risk breakdown structure (RBS)

Macro risks



Step 2 | Risk Assessment

Takes the list of risks identified and filters out and prioritize them.

We typically evaluate each risk in terms of:

- Probability / Likelihood
- Impact / Severity
- Ease / Difficulty of Detection

PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 11.3.2 Perform Qualitative Risk assessment

Stanton, D. "Manage project risks" video in course Leading Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Risk Assessment Tools

Scenario analysis

PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 6.5.2.4 Scenario analysis

Impact Scales – (Simple (e.g. low/moderate/high))/Numerical e.g. 1-5)

Risk severity matrix – (Probability & Impact)

Failure Mode and Effects Analysis (FMEA) – (Probability, Impact & Ease of Detection)

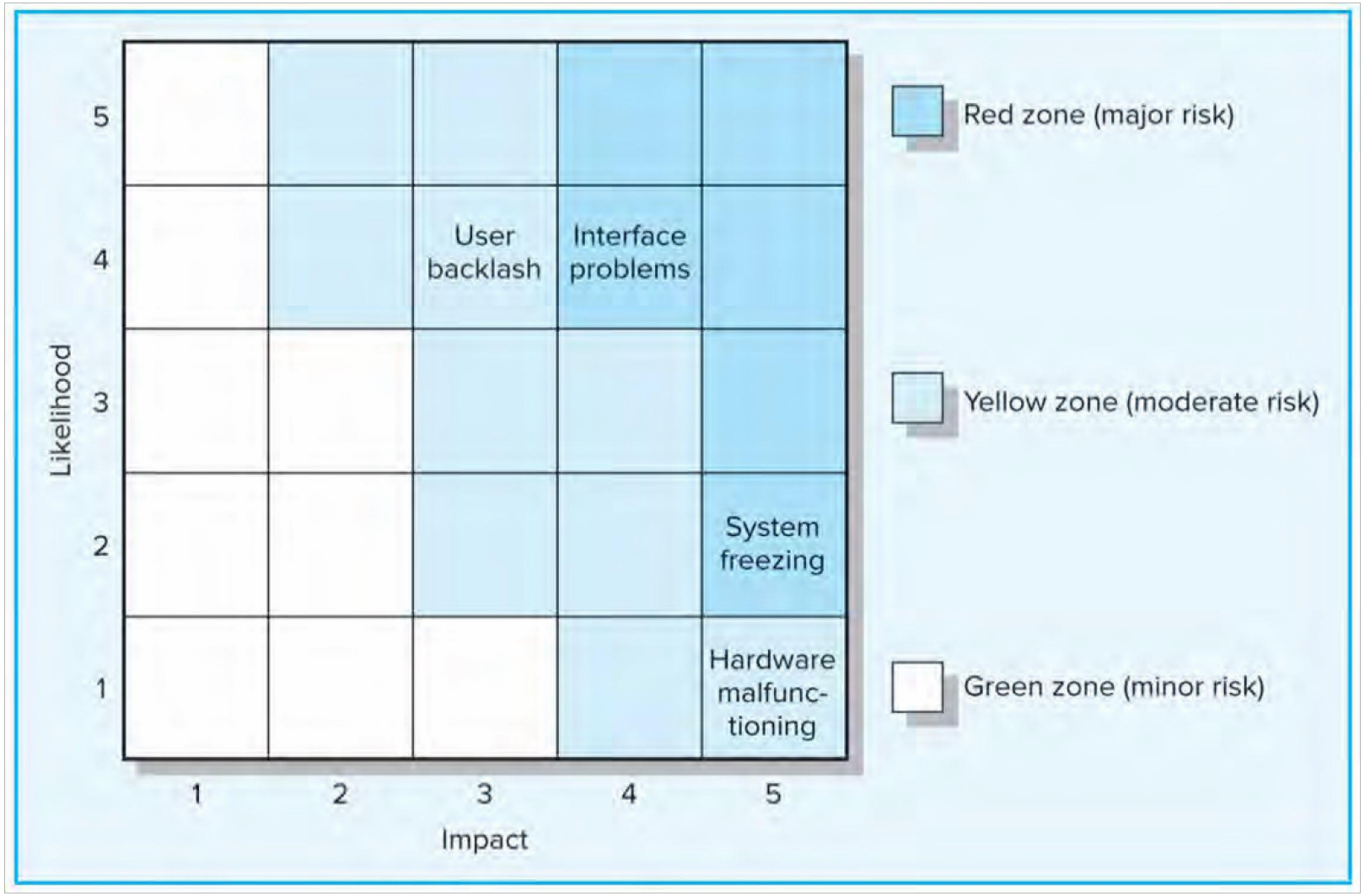
Statistical Techniques

PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 11.4.2 Perform Quantitative Risk assessment

- Quantitative analysis/ Monte Carlo modelling
- Decision trees – used to assess alternative action using expected values
- NPV – for cash flow risks

Chua, R. "How to use failure Mode and Effects analysis" video in course Six-Sigma green Belt accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Example | Risk Severity Matrix 1



Example | Risk Severity Matrix 2

0 – 5 = Low Risk 6 – 10 = Moderate Risk 11 – 15 = High Risk 16 – 25 = extremely high unacceptable risk		Severity of the potential injury/damage				
		Insignificant damage to Property, Equipment or Minor Injury **1**	Non-Reportable Injury, minor loss of Process or slight damage to Property **2**	Reportable Injury moderate loss of Process or limited damage to Property **3**	Major Injury, Single Fatality critical loss of Process/damage to Property **4**	Multiple Fatalities Catastrophic Loss of Business **5**
Likelihood of the hazard happening	Almost Certain **5**	5	10	15	20	25
	Will probably occur **4**	4	8	12	16	20
	Possible occur **3**	3	6	9	12	15
	Remote possibility **2**	2	4	6	8	10
	Extremely Unlikely **1**	1	2	3	4	5

Step 3 | Risk Response Development

Now that the risk event has been identified and assessed.

We need to make a decision on what type of response is appropriate for the specific event.

Stanton, D. “Identify & escalate issues” video in course Leading Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Risk Management Strategies

Mitigating/Reducing/Controlling Risk

- Reducing the likelihood an adverse event will occur.
- Reducing impact of adverse event.

Avoiding Risk

- Changing the project plan to eliminate the risk or condition.

Transferring Risk

- Paying a premium to pass the risk to another party.
- Requiring Build-Own-Operate-Transfer (BOOT) provisions.

Accepting/Retaining Risk

- Making a conscious decision to accept the risk.

Rogers, J. “Methods of Controlling Risk” video in course Construction Management: Managing Risk accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Contingency Planning

- An alternative plan that will be used if a possible foreseen risk event actually occurs
- A plan of actions that will reduce or mitigate the negative impact of a risk event
- Potential disadvantages of not having a Contingency Plan
  - Having no plan may slow managerial response
  - Decisions made under pressure can be potentially dangerous and costly

Contingency Funding

- Funds are established to cover project risks, both identified and unknown.
- Size of funds often reflects overall risk of a project
- Typical rules of thumb for funding levels
  - 1-10% for similar projects
  - 20-60% for unique and high tech projects
- Project owners are often reluctant to set up project contingency funds that seem to imply the project plan might be a poor one.

Types of Contingency funding

Budget reserves

Are linked to the **identified risks** of specific work packages or cost accounts in **WBS**.

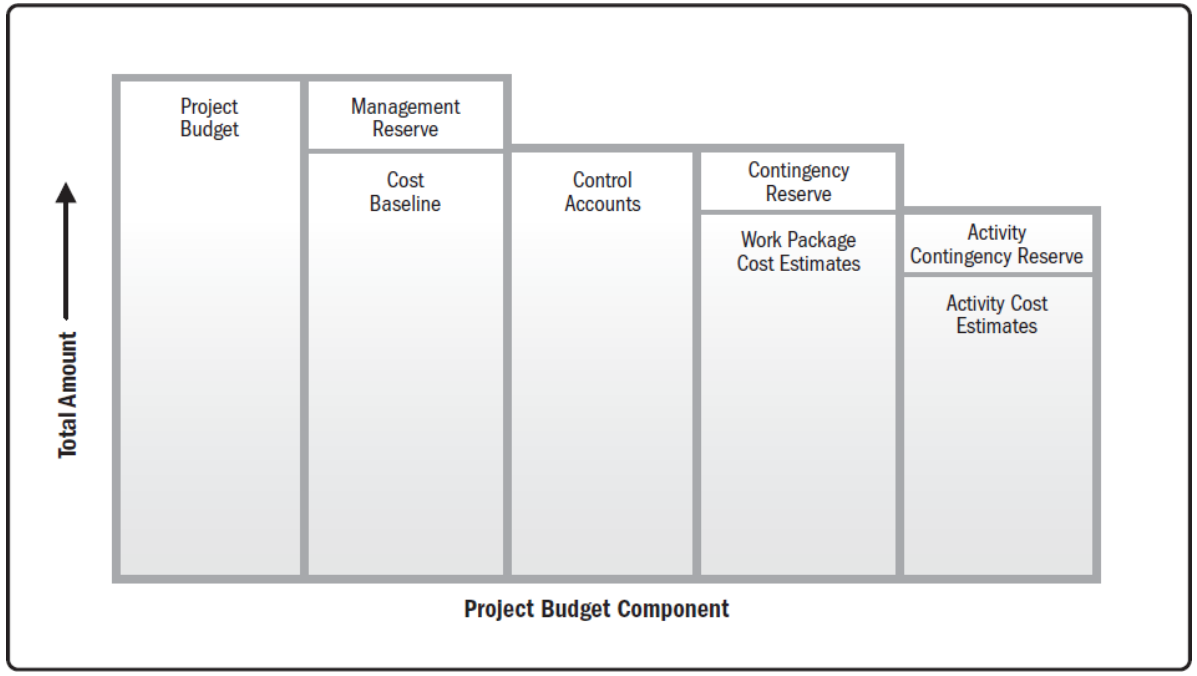
Management reserves

- Are funds to be used to cover major **unforeseen risks** (e.g. change in project scope) of the total project
- Are created after budget reserves are identified

Contingency funding

Activity	Budget Baseline		Project Budget
Design	$500,000		$515,000
Code	900,000		980,000
Test	20,000		22,000
Subtotal	$1,420,000		$1,517,000
Total	$1,420,000	$97,000	$1,567,000

PMBOK Guide (6th Ed.) 2017 Part 1
Sec. 6.4.2. Estimate Activity Durations: Tools & Techniques
6.4.2.6 /7.2.2.6 Data analysis (reserve analysis)



PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 7.3.3
Determine budget: outputs

Time Buffers

Are amounts of time used to compensate for unplanned delays in the project schedule

Time buffers are often added to:

- Activities with severe risk
- Merge activities that are prone to delays due to one or more preceding activities being late
- Noncritical activities to reduce the likelihood that they will create another critical path
- Activities that require scarce resources to ensure resources are available when needed

Common types of project risks

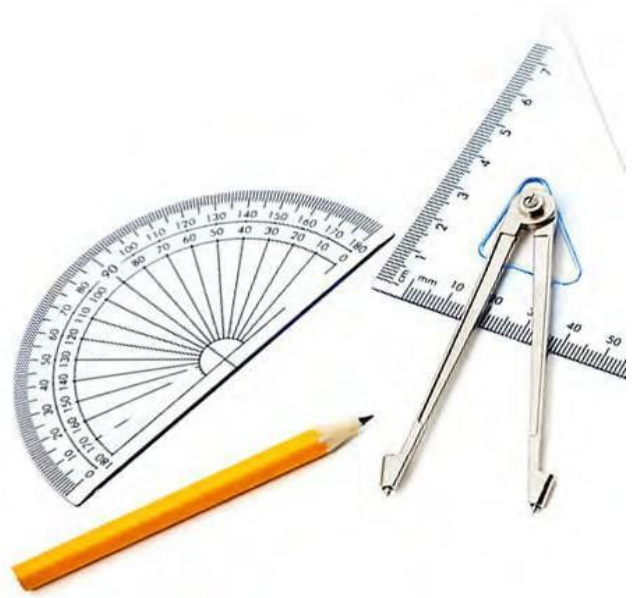
- Technical
- Schedule
- Cost
- Funding

Technical Risks

Technical risks are often difficult to manage

Mitigation Strategies

- Backups/Alternatives
  - Different solutions can be implemented if a chosen technology fails
- Testing and modeling
  - Assessing whether technical uncertainties can be resolved through the use of:
    - CAD systems
    - Build models/prototypes
    - Experiments



Schedule Risks

Is the threat of a project not finishing on time

Mitigation Strategies

- Time Buffers/Project Slack
- Compression/Crashing of project schedules by running activities in parallel or changing relationships (e.g. start- to-start lag relationships)

Cost Risks

Projects of long duration often need some contingency for price changes.

Mitigation Strategies

- Contingency funding
- Cost sensitive projects should be evaluated item by item

Funding Risks

Changes in the supply of funds for the project can dramatically affect the likelihood of implementation or successful completion of a project

Mitigation Strategies

- Contingency funding
- Modularisation of project

Opportunity Management tactics

Exploit

- Seeking to eliminate the uncertainty associated with an opportunity to ensure that it definitely happens.

Share

- Allocating some or all of the ownership of an opportunity to another party who is best able to capture the opportunity for the benefit of the project.

Enhance

- Taking action to increase the probability and/or the positive impact of an opportunity.

Accept

- Being willing to take advantage of an opportunity if it occurs, but not taking action to pursue it.

Risk Register

Contains the following information:

- All identified risks and descriptions
- Probability of occurrence
- Impact
- Responses (mitigations / contingencies)
- Owners (Work packages)
- Current Status

McGannon, B. “Risk records and registers” video in course Leading Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Risk Response Control

Involves the

- Execution of the risk response strategy
- Monitoring of triggering events
- Initiating contingency plans
- Watching for new risks
- Establishment of a Change Management System
  - Monitoring, tracking, and reporting risk
  - Fostering an open organization environment
  - Repeating risk identification/assessment exercises
  - Assigning and documenting responsibility

Probabilistic Vs Deterministic Assessments

Probabilistic risk assessment

- is ubiquitous in industry, business, PM, (academia!).
- Most easily recognized in the impact/likelihood risk matrix.
- Readily extended to quantitative methods (see PMBOK Ch. 11)

The problem with PRA

- For low frequency events, the probability is (almost) never accurately known
- Even if you know the probability, a low probability does not preclude the event happening to you.
- The black swan effect says that the most significant changes are usually caused by such low probability events.

Deterministic Risk Assessment

- Any/all adverse events are assumed to occur, regardless of probability
- Objective is to demonstrate that adequate contingencies are in place, for any combination of these impacts.
- Drawback is it may results in expensive treatment of very unlikely and unimportant events.
- Advantage is that by planning contingencies, you are in fact developing a range of responses that can be modified for an emerging scenario (the essence of emergency plans)

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Summary of PRA Vs DRA

- PRA is demonstrating your plan *can work*, while DRA is demonstrating it *can't not work.*
- Despite some weakness, PRA is normal, and widely accepted
- You might consider deterministic assessment for unacceptable events, such as crises and events that could result in injury
- In a limited PM context, many major project risks are treated by escalation.
- Severe hazards are a notable exception, because they cannot ever be delegated, or completely transferred.

Communications Plan

GSOE9820 Engineering Project Management

UNSW SYDNEY

Communication plan needs to describe:

- Why are you telling them?
- What do you expect them to do?
- What information does the Stakeholder need?
- How often?
- What media (phone, email, video, chat…)
- How urgent is it? What latency is allowed?
- What is the risk if they don’t know?

Developing your communications plan

Tips from the change management discipline

- Who?
- Why and When?
- How?
- What?

Stanton, D. “Project Communications” video in course Leading Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Who?

- Use stakeholder register
- Target individuals and groups with a tailored message

Why and when?

Engagement level of stakeholders – from stakeholder management

Name	Unaware	Resistant	Neutral	Supportive	Leading
Faculty Mgmt.	C		D		
MME Mgmt.				CD	
Convenor				C →	D
Demonstrators			C →	D	
Students		C		→	D

C=Current position
D=Desired position

Stakeholders in '100% digital delivery and assessment in GSOE9820 T2 2020'

Why (cont.)

- Attract users or customers
- Support the HR management plan
- To mitigate risks (e.g. resistance to change)
- If comms is a prerequisite to success criteria (remember - organizational strategy?)

What?

5 pressing questions for people undergoing organizational change:

1. What is changing?
2. Why are we changing?
3. How does it affect me?
4. How will I know if I’m going OK?
5. What kind of support is available to me?

Human Resources Planning

Things to include in a HR plan

- Acquiring resources – how will you find the team?
- Roles and responsibilities (use RACI chart)
- Project organization chart
- Position descriptions for project team members
- Training strategies for team members

(See PMBOK Ch. 9)

What do people cost?

•All the people in your project must be paid for their time.

Cost =

Work (time) x Base salary rate ($/time) x [1 + oncost rate] x [1 + overheads]

UNSW salary and oncost rates:
https://www.hr.unsw.edu.au/services/salaries/salrates.html

Risks associated with HR

- Can’t fill a position
- Recruit people with inappropriate skills/ can’t do the job
- People take longer to train than you expect
- And others…

UNSW employment policy

Most roles need to be advertised. Some of the advantages are:

- Contracts can be extended in the future
- Wider selection pool, best candidate selected
- May be required if visa sponsorship is involved (labour market testing)

Professional roles require a minimum of **2 weeks advertising** and academic roles require a **minimum of 4 weeks**

Some instances where advertising may not be feasible as a first option and a nomination request can be submitted for approval as per the UNSW nomination policy

- Strictly short-term (under 12 months). If the role is required beyond 12 months, need to advertise again (no extensions).
- If the position and candidate are highly specialised (often senior appointments), there is a very limited pool of applicants and the appointment does not exceed 3 years.

Position Descriptions

Need to make it sound interesting! Have a look at some job profiles https://external-careers.jobs.unsw.edu.au/cw/en/listing/

- Position title:
- Background surrounding the position:
- Responsibilities:
- Essential/Desirable attributes of the applicant:
- Appointment duration:
- Level:
- Full time/ Part time / casual:

Training strategies

- Take existing UNSW courses
- Go to conferences
- Attend industrial training, e.g. by manufacturers
- Self study (reading, online learning etc.)

Note: all require duration, work hours and resources!