PMP® V5 RDS

Project Time Management

V1.1

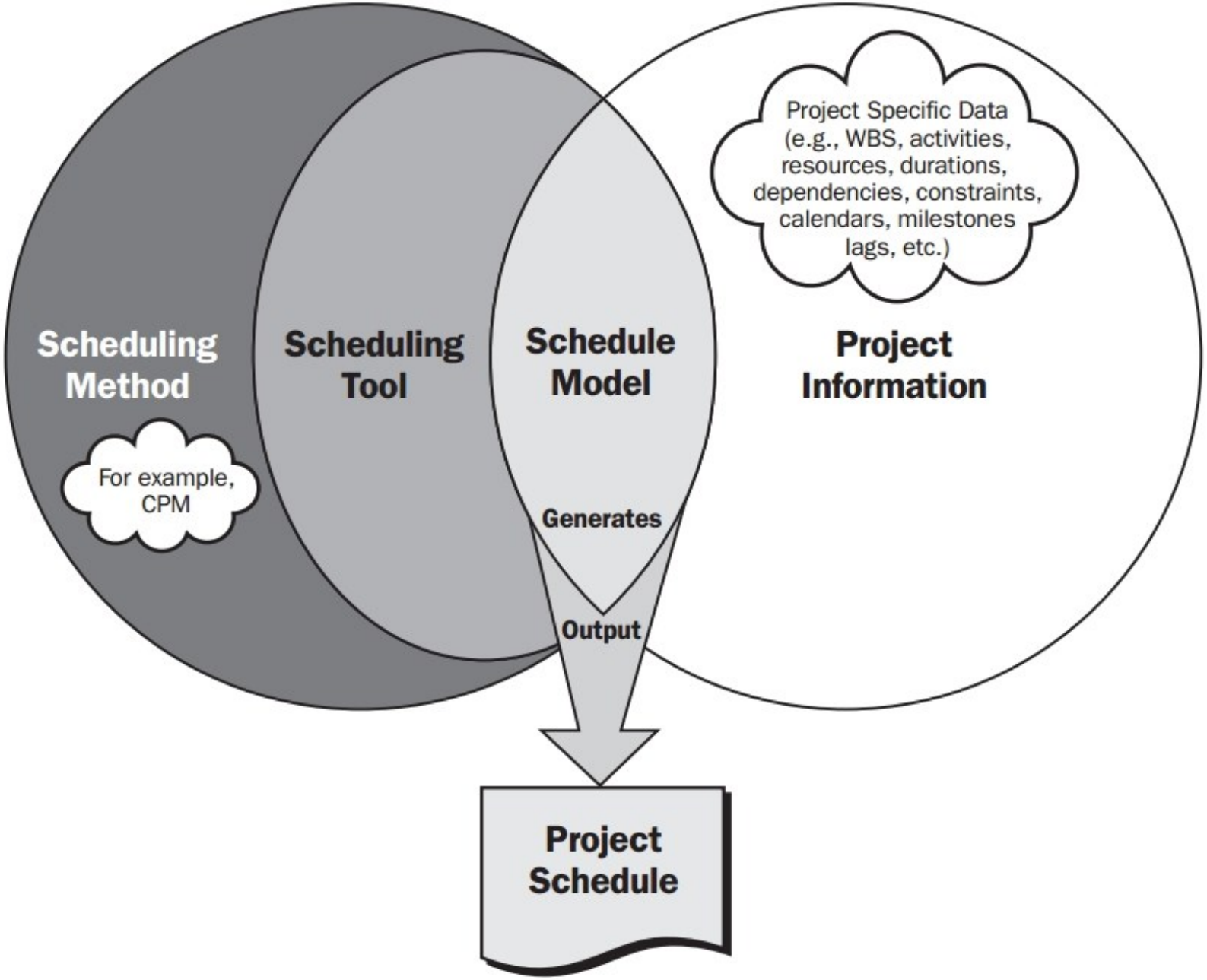
Time Management Processes

- Project Time Management includes the processes required to manage the timely completion of the project.

- **6.1 Plan Schedule Management —** The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.
- **6.2 Define Activities —** The process of identifying and documenting the specific actions to be performed to produce the project deliverables.
- **6.3 Sequence Activities —** The process of identifying and documenting relationships among the project activities.

Time Management Processes

- **6.4 Estimate Activity Resources —** The process of estimating the type and quantities of material, human resources, equipment, or supplies required to perform each activity.
- **6.5 Estimate Activity Durations —** The process of estimating the number of work periods needed to complete individual activities with estimated resources.
- **6.6 Develop Schedule —** The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model.
- **6.7 Control Schedule —** The process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan.


Project Specific Data
(e.g., WBS, activities,
resources, durations,
dependencies, constraints,
calendars, milestones
lags, etc.)
Scheduling
Method
For example,
CPM
Scheduling
Tool
Schedule
Model
Project
Information
Generates
Output
Project
Schedule

Plan Schedule Management

(planning)

Plan Schedule Management

- The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule
- The key benefit of this process is that it provides guidance and direction on how the project schedule will be managed throughout the project

Schedule Management Plan

Plan Schedule Management: Outputs

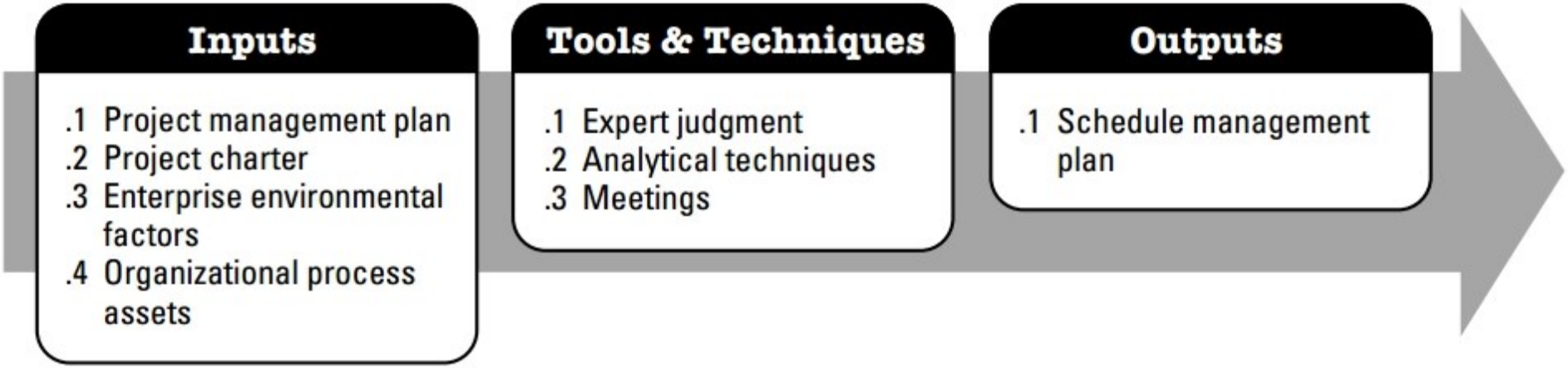
- Establishes the criteria and the activities for developing, monitoring, and controlling the schedule.
- Formal or informal, highly detailed or broadly framed
- Establish the following:
  - Project schedule model development: methodology and tool
  - Level of accuracy
  - Units of measure
  - Organizational procedures links: e.g. WBS
  - Project schedule model maintenance
  - Control thresholds
  - Rules of performance measurement
  - Reporting formats
  - Process descriptions

Schedule Management Plan

Plan Schedule Management: Outputs

- Establishing a schedule baseline for measuring against during the monitoring and controlling process
- Identifying the performance measures to be used
- To identify variances early, so that progress can be measured as the project work continues
  - e.g. 0.8 < SPI < 1.2 (covered in cost management)
- Planning for how schedule variances will be managed
- Identifying schedule change control procedure

Plan Schedule Management
(planning)



Define Activities

(planning)

Define Activities

- Identifying and documenting the specific actions to be performed to produce the project deliverables
- The key benefit of this process is to break down work packages into activities that provide a basis for estimating, scheduling, executing, monitoring, and controlling the project work

Define Activities

- Further breakdown from the work packages of WBS
- Decomposed into smaller components (activities) that represent the work necessary to complete the work package
- Activities provide the basis for estimating, scheduling, executing, and monitoring and controlling
- Requires:
  - Scope baseline: scope statement, WBS, WBS dictionary
  - Team members' inputs

Rolling Wave Planning

Define Activities: Tools and Techniques

- Plan as you go; more detailed planning
- Progressive elaboration planning: work to be accomplished in the near term is planned in detail, but future work is planned at a higher level of the WBS
- Not planning activities to the detail needed to manage the work until you start the project management process

Activity List

Define Activities: Outputs

- A comprehensive list that includes all schedule activities required on the project
- Includes
  - Activity identifier
  - Scope of work description
  - Title that describes its place in the schedule

Activity Attributes

Define Activities: Outputs

- Details of the activity, may include:
  - Activity ID
  - WBS ID
  - Activity Name
  - Activity code
  - Activity description
  - Predecessor & Successor activities
  - Logical relationships
  - Leads and lags
  - Resource requirements
  - Dates
  - Constraints
  - Assumptions, etc.

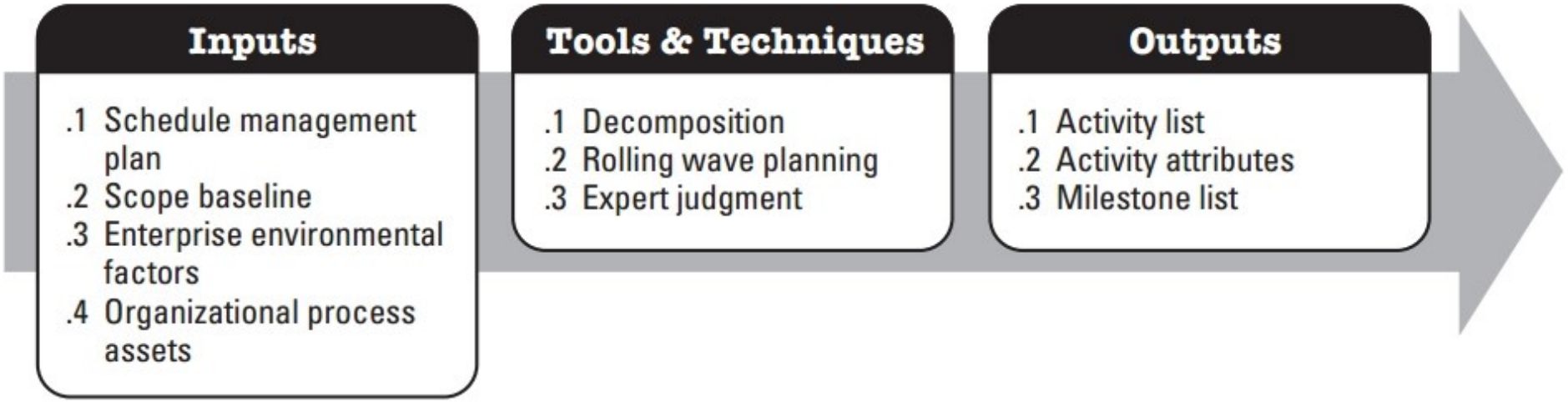
* WBS dictionary describes work packages; activity attributes describe activities

Milestones List

Define Activities: Outputs

- Significant points/events in the project
- May be imposed by sponsor
- Project charter includes a summary of milestones
- PM may impose additional milestones as checkpoints to help control the project
- Is part of the project management plan, included in project scope statement and WBS dictionary
- Similar to regular schedule activities, with the same structure and attributes, but they have zero duration

Define Activities
(planning)



Sequence Activities

(planning)

Sequence Activities

- The process of identifying and documenting relationships among the project activities
- The key benefit of this process is that it defines the logical sequence of work to obtain the greatest efficiency given all project constraints

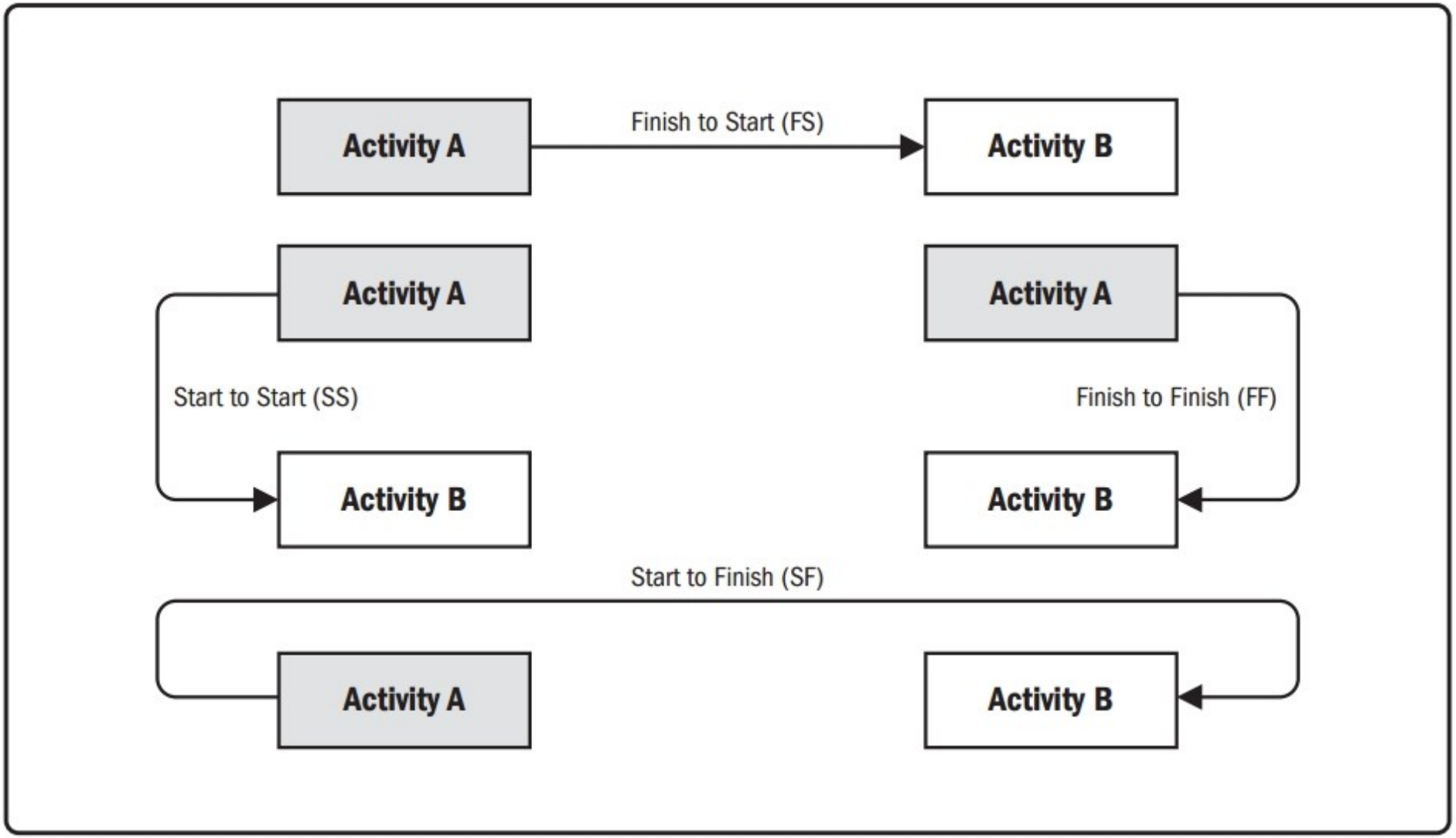
Sequence Activities

- Which one goes first? Which one follows?
- Identifying and documenting relationships among activities
- Apply lead or lag times
- Results in a network diagram

Precedence Diagramming Method (PDM)

Sequence Activities: Tools and Techniques

- Another name: AON – Activity-on-Node
- Nodes/boxes: represent activities, arrows show activity dependencies
- 4 types of logical relationships:
  - Finish to Start (FS):
    - Most common: Dig hole -> Plant tree
  - Finish to Finish (FF):
    - Testing -> Documentation
  - Start to Start (SS):
    - Design -> Coding
  - Start to Finish (SF):
    - Rarely used


Activity A
Finish to Start (FS)
Activity B
Activity A
Activity A
Start to Start (SS)
Finish to Finish (FF)
Activity B
Activity B
Start to Finish (SF)
Activity A
Activity B

Dependency Determination

Sequence Activities: Tools and Techniques

- Mandatory dependencies (hard logic):
  - Contractually required or inherent in the nature of the work,
  - e.g. You must design before you construct
- Discretionary dependencies (Preferred logic, preferential logic, soft logic)
  - Determined by project team based on knowledge/best practices.
  - Can be changed if needed
  - Options should be fully documented (for fast tracking consideration).
- External dependencies
  - Involves a relationship between project activities and non-project activities.
  - Usually outside the project team's control
  - E.g. regulations

Leads and Lags (Waiting Time)

Sequence Activities: Tools and Techniques

- Lead:
  - The amount of time whereby a successor activity can be advanced with respect to a predecessor activity
  - E.g. on a project to construct a new office building, the landscaping could be scheduled to start two weeks prior to the scheduled punch list completion
  - This would be shown as a finish-to-start with a two-week Lead
  - Lead is often represented as a negative value

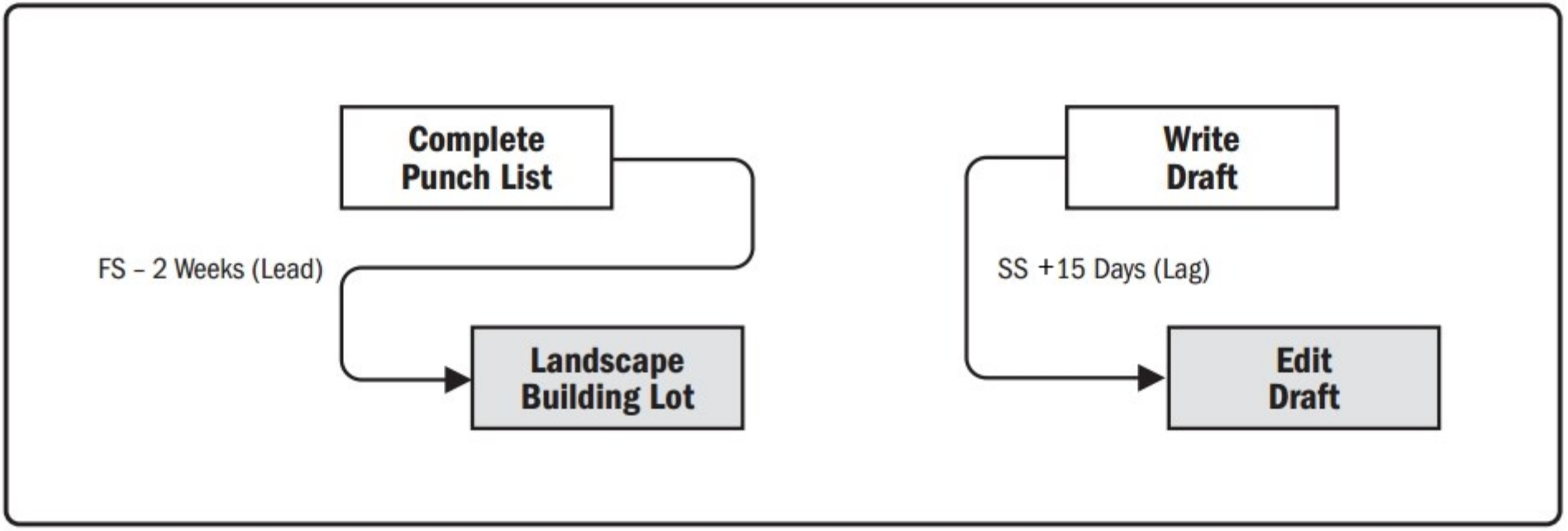
Leads and Lags (Waiting Time)

Sequence Activities: Tools and Techniques

- Lag:
  - The amount of time whereby a successor activity will be delayed with respect to a predecessor activity
  - E.g. a technical writing team may begin editing the draft of a large document 15 days after they begin writing it
  - This can be shown as a start-to-start relationship with a 15-day lag
  - Lag is often represented as a positive value

Leads and Lags

Sequence Activities: Tools and Techniques

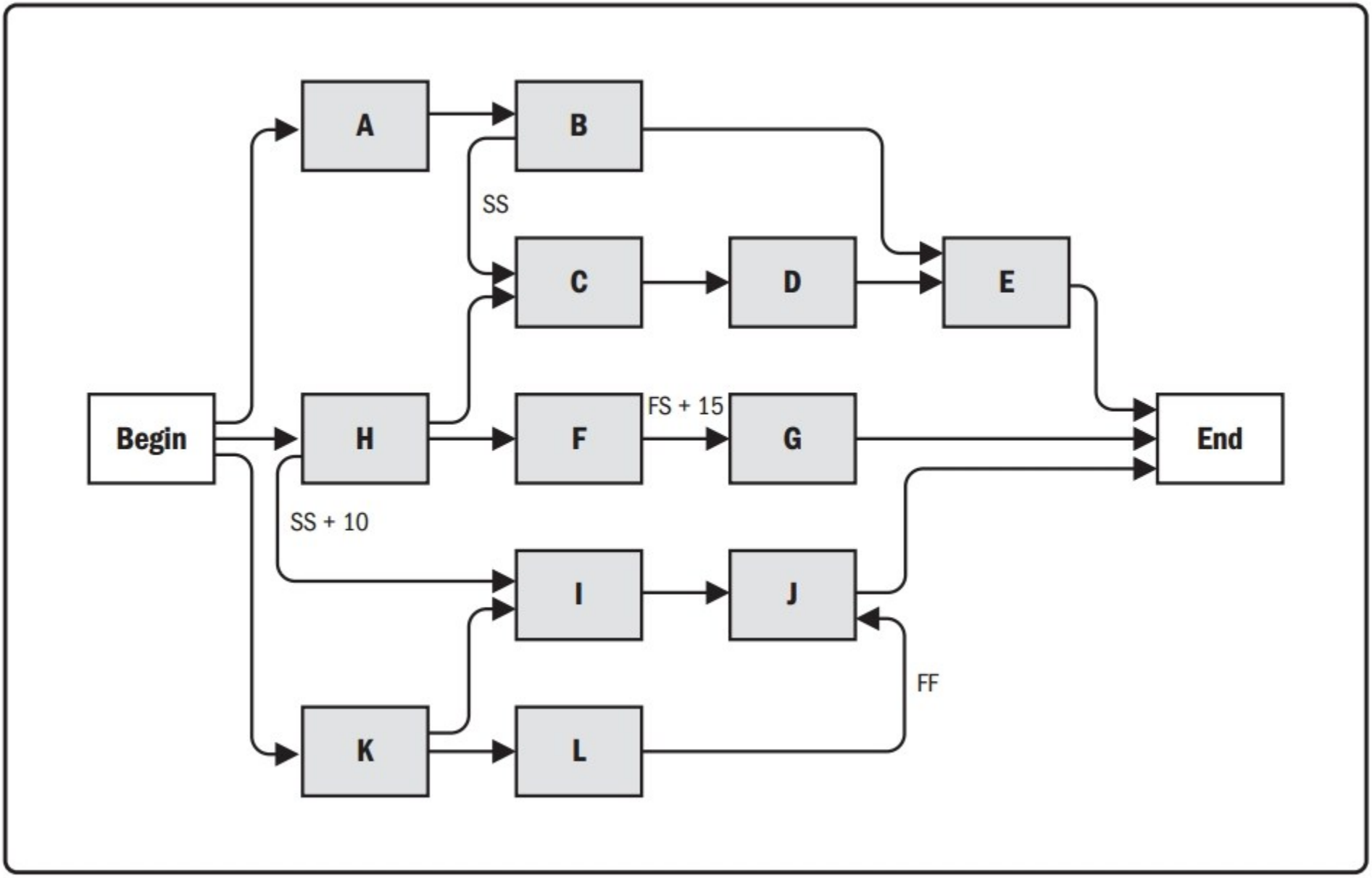


Project Schedule Network Diagrams

GREAT LEARNING EDUCATION CENTRE

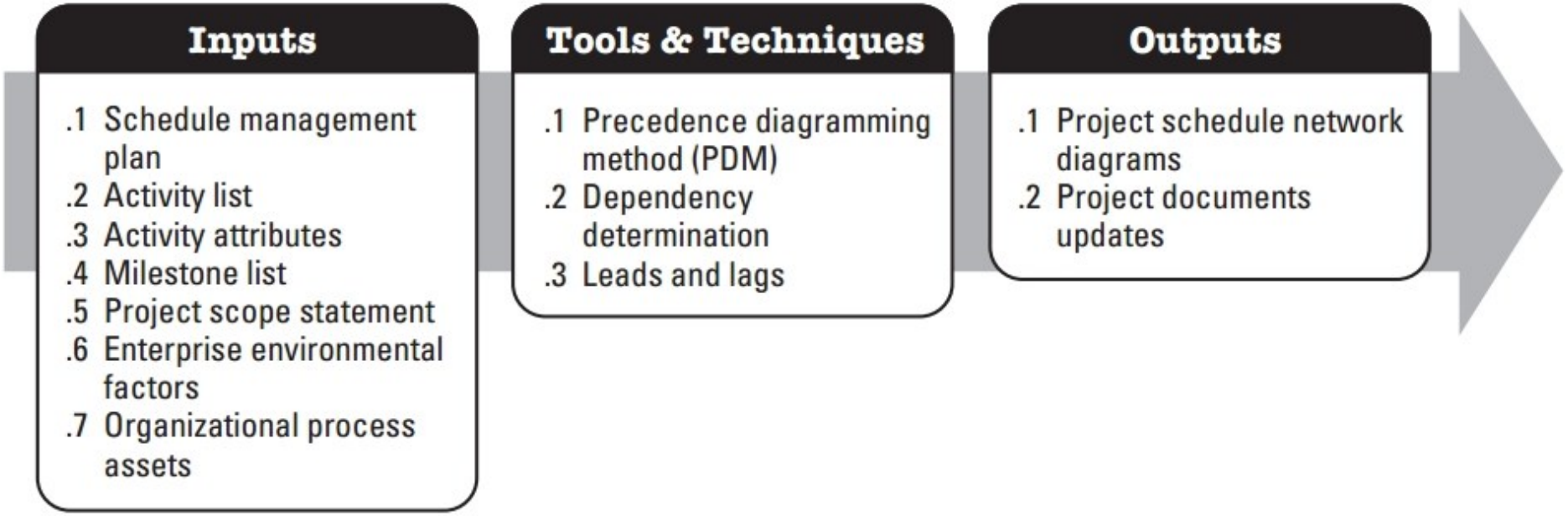
Sequence Activities: Outputs

- Help justifying your time estimate for the project
- Aid in effective planning, organizing, and controlling the project
- Show interdependencies of all activities
- Show workflow in a specific sequence
- Identify opportunities to compress the schedule in planning and throughout the life of the project
- Show project progress



* For reference only

Sequence Activities
(planning)



Estimate Activity Resources

(planning)

Estimate Activity Resources

- The process of estimating the type and quantities of material, human resources, equipment, or supplies required to perform each activity
- The key benefit of this process is that it identifies the type, quantity, and characteristics of resources required to complete the activity which allows more accurate cost and duration estimates

On Estimating

- Apply to 3 processes: estimating resources, durations, and costs
  - Should be based on a WBS
  - Use historical information to improve estimates
  - Estimates are more accurate if smaller-size work components are estimated
  - A project manager should never just accept constraints from management
  - Estimating should be done by the person doing the work
  - Padding is not acceptable
  - Estimates can be decreased by reducing or eliminating the risks (by reducing reserves)
  - Estimates must be reviewed to see if they are reasonable
  - The project manager has the responsibility to provide estimates that are as accurate as feasible

Estimate Activity Resources

- Once activities are sequenced, the type and quantity of needed resources is determined
- Resources required for each activity include:
  - Material, people, equipment, supplies, etc.
- Resources must be planned and coordinated to avoid common problems such as:
  - lack of resources or resources being taken away from the project
- Closely coordinated with Estimate Costs process

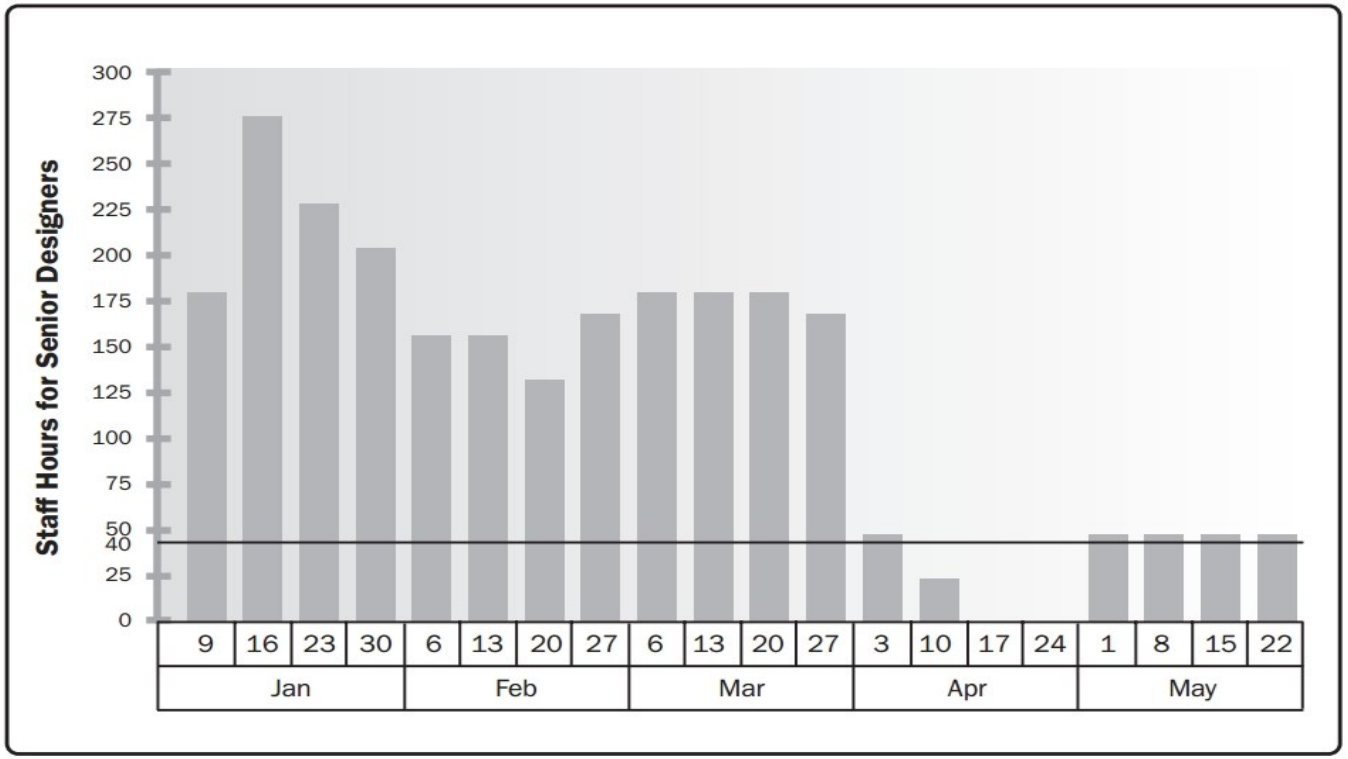
Actions

- Review resource availability
- Review the WBS and activity list
- Identify potentially available resources
- Review organizational policies on resources use
- Analyze alternative ways of completing the work
- Make make-or-buy decisions
- Quantify resource requirements by activity

Resource Calendars

Estimate Activity Resources: Inputs

- Specify when and how long identified project resources will be available during the project.
- May be at the activity or project level
- Resource availability will change during the project



Bottom-Up Estimating

Estimate Activity Resources: Tools and Techniques

- When an activity cannot be estimated with a reasonable degree of confidence, the work within the activity is decomposed into more detail
- The individual resource needs are estimated
- These estimates are then aggregated into a total quantity for each of the activity's resources

Bottom-Up Estimating

Estimate Activity Resources: Tools and Techniques

- Padding: extra time or cost added to an estimate because the estimator does not have enough information
- Padding should be addressed through the risk management process
  - Educate the team about the difference between reserve and padding
- Uncertainties should be identified and addresses openly with the PM
- Padding makes the schedule unrealistic

Bottom-Up Estimating

Estimate Activity Resources: Tools and Techniques

- Drawbacks:
  - Padding
  - Creates a schedule that no one believes in when a person estimates that an activity will take 20 days but it is completed in 15 days
    - It can make the person who provided the estimate look untruthful and untrustworthy
    - Wasting time
  - The estimators will work against the PM to protect themselves

Bottom-Up Estimating

Estimate Activity Resources: Tools and Techniques

- Role of project manager
  - Provide the team with enough information to properly estimate each activity
  - Let those doing the estimating know how refined their estimates
  - Complete a sanity check of the estimates
  - Formulate a reserve
  - Make sure assumptions made during estimating are recorded for later review

Project Management Software

Estimate Activity Resources: Tools and Techniques

- Can help plan, organize, and manage resource pools and develop resource estimates
- Can define the following to assist in optimizing resource utilization:
  - Resource breakdown structure
  - Resource availability
  - Resource rates
  - Various resource calendars

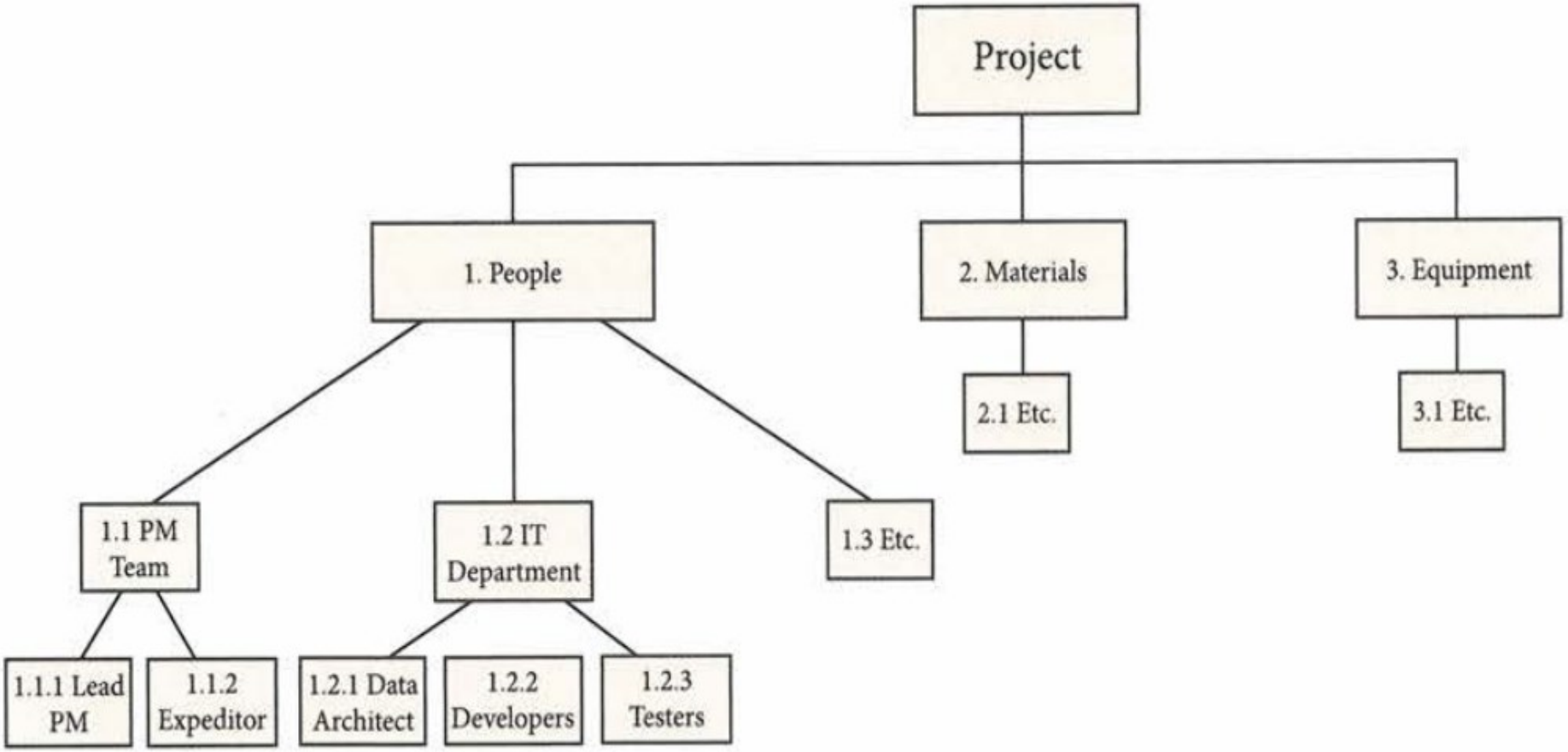
Resource Breakdown Structure

Estimate Activity Resources: Outputs

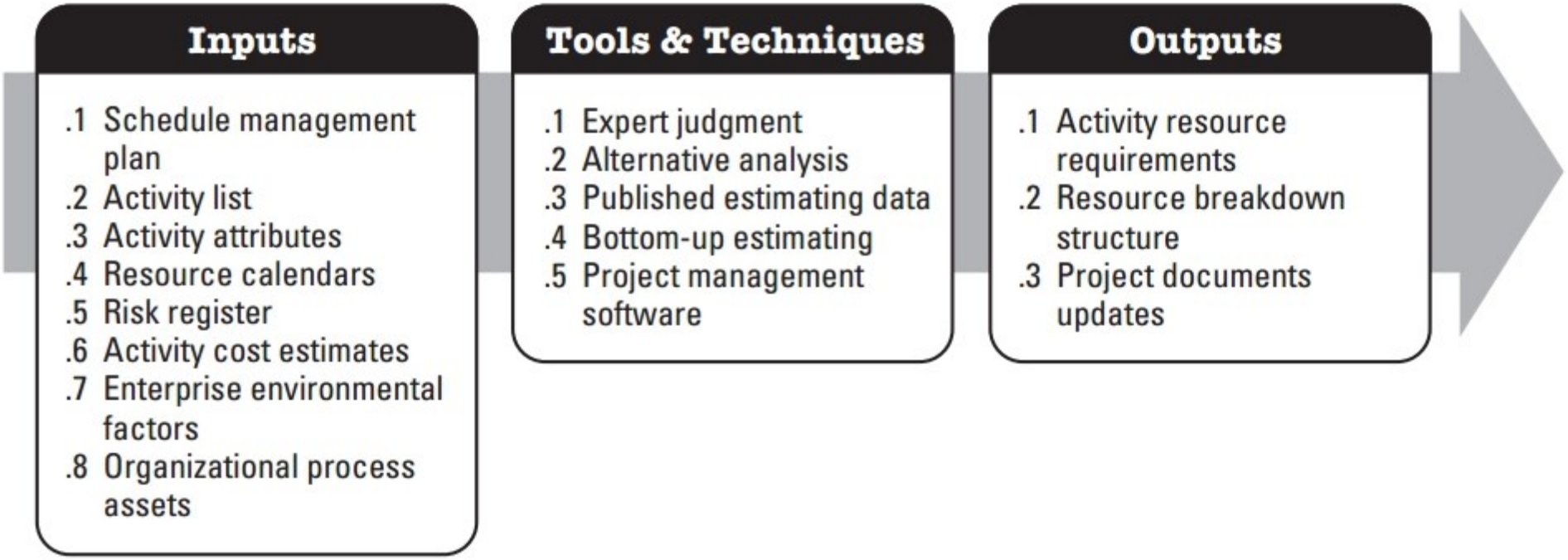
- A hierarchical structure of the identified resources by resource category and resource type
- Resource categories include labour, material, equipment, and supplies
- Resource types include the skill level, grade level or other information as appropriate to the project
- The resource breakdown structure is useful for organizing and reporting project schedule data with resource utilization information

Resource Breakdown Structure

Estimate Activity Resources: Outputs



Estimate Activity Resources
(planning)



Estimate Activity Durations

(planning)

Estimate Activity Durations

- The process of estimating the number of work periods needed to complete individual activities with estimated resources
- The key benefit of this process is that it provides the amount of time each activity will take to complete, which is a major input into the Develop Schedule process

Estimate Activity Durations

- Estimate the amount of time each activity is expected to take with estimated resources
- A good estimate requires
  - Activity resource requirements
  - Resource calendars

Analogous Estimate

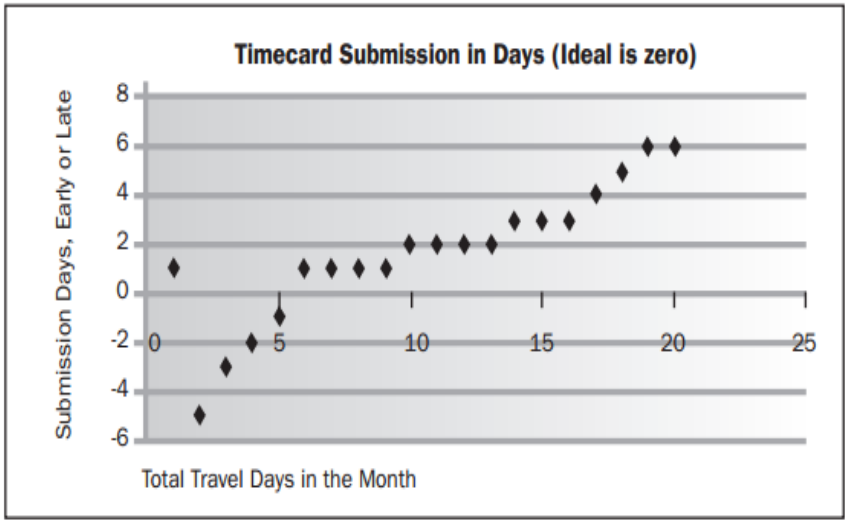
Estimate Activity Durations: Tools and Techniques

- Top-down method
- For the whole project or an activity
- Uses expert judgment and historical information to predict the future
- A gross value estimating approach
- Used to estimate project duration when there is limited information, for example, in the early phases of a project.
- Less costly and time consuming than other techniques, but it is also generally less accurate

Parametric Estimating

Estimate Activity Durations: Tools and Techniques

- Uses a statistical relationship between historical data and other variables to calculate an estimate for activity parameters
  - E.g. time per linear metre
- Regression Analysis (scatter diagram): tracks two variables to see if they are related
- Learning curve
  - Improved efficiency when workers become more skillful on their job



Rule of Thumb

- Heuristics: rule of thumb.
  - E.g. 80/20 rule: 80% of quality problems are caused by 20% of potential sources of problems
  - A schedule heuristic might be, “Design work is always 15% of the total project length”
  - For spotting great differences

Three-Point Estimating

Estimate Activity Durations: Tools and Techniques

- Program Evaluation and Review Technique (PERT).
- Uses three estimates to define an approximate range for an activity's duration:
  - **Most likely M, Optimistic O, Pessimistic P**

Expected Activity Duration	Activity Standard Deviation	Activity Variance
$\frac{(P+4M+O)}{6}$	$\frac{P-O}{6}$	$\left[\frac{P-O}{6}\right]^2$

Range of EAD = EAD +/- SD

Start of the range = EAD – SD

End of the range = EAD + SD

PERT can be used for both time and cost estimates; particularly for quantitative analysis.

Three-Point Estimating

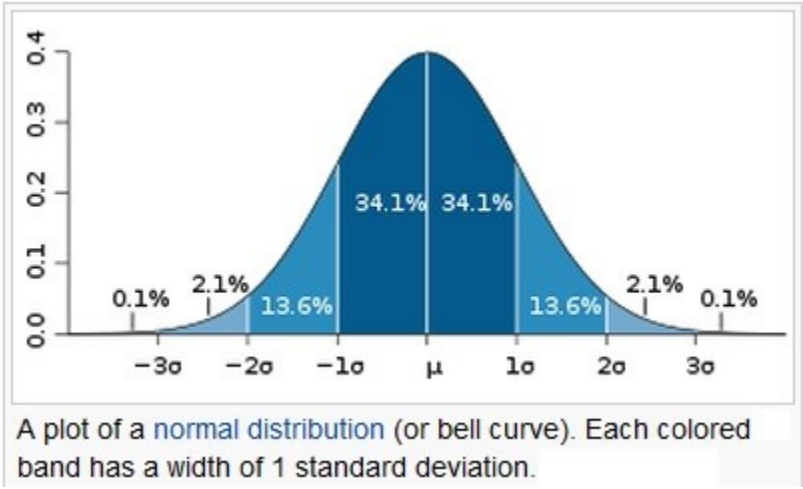
Estimate Activity Durations: Tools and Techniques

- Pessimistic = 47, Most likely = 27, Optimistic = 14
- Expected Activity Duration (EAD)
  - = (P+4M+0)/6 = 28.167
- Standard Deviation (SD)
  - = (P-O)/6 = 5.5
- Start of range (if +/- one SD is used)
  - = EAD – SD = 22.667
- End of range (if +/- one SD is used)
  - = EAD + SD = 33.667
- Range of estimate (if +/- one SD is used)
  - = 22.667 to 33.667 OR 28.167 +/- 5.5

Three-Point Estimating

Estimate Activity Durations: Tools and Techniques

- +/- one SD = 68% confidence level
- +/- two SD = 95% confidence level



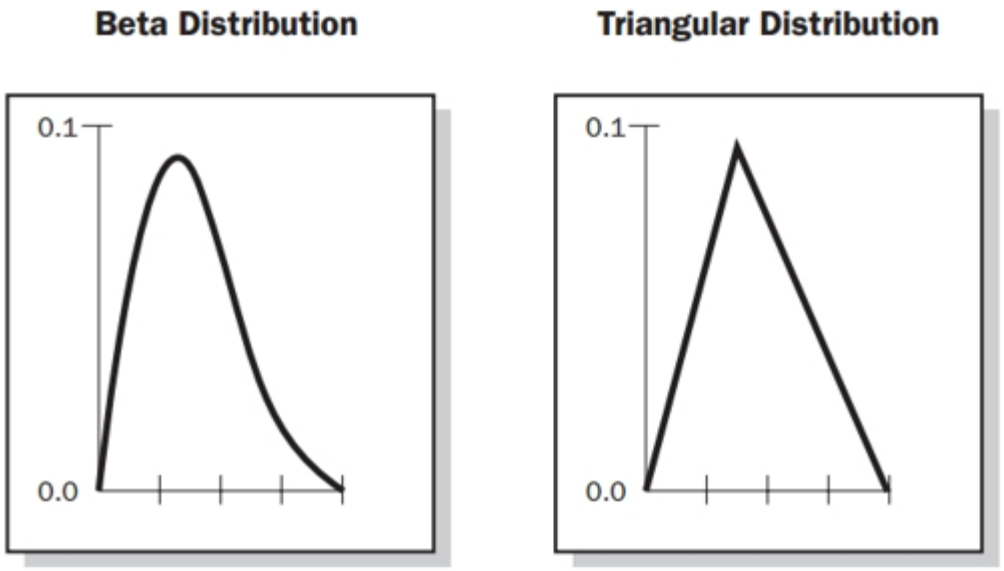
A plot of a normal distribution (or bell curve). Each colored band has a width of 1 standard deviation.

- Use these concepts to better control project: it's a confidence interval, not an absolute value
- To assess risk: the larger the SD, the riskier

Three-Point Estimating

Estimate Activity Durations: Tools and Techniques

- The previous mentioned formulas are for PERT with Normal Distribution
- Other distributions:

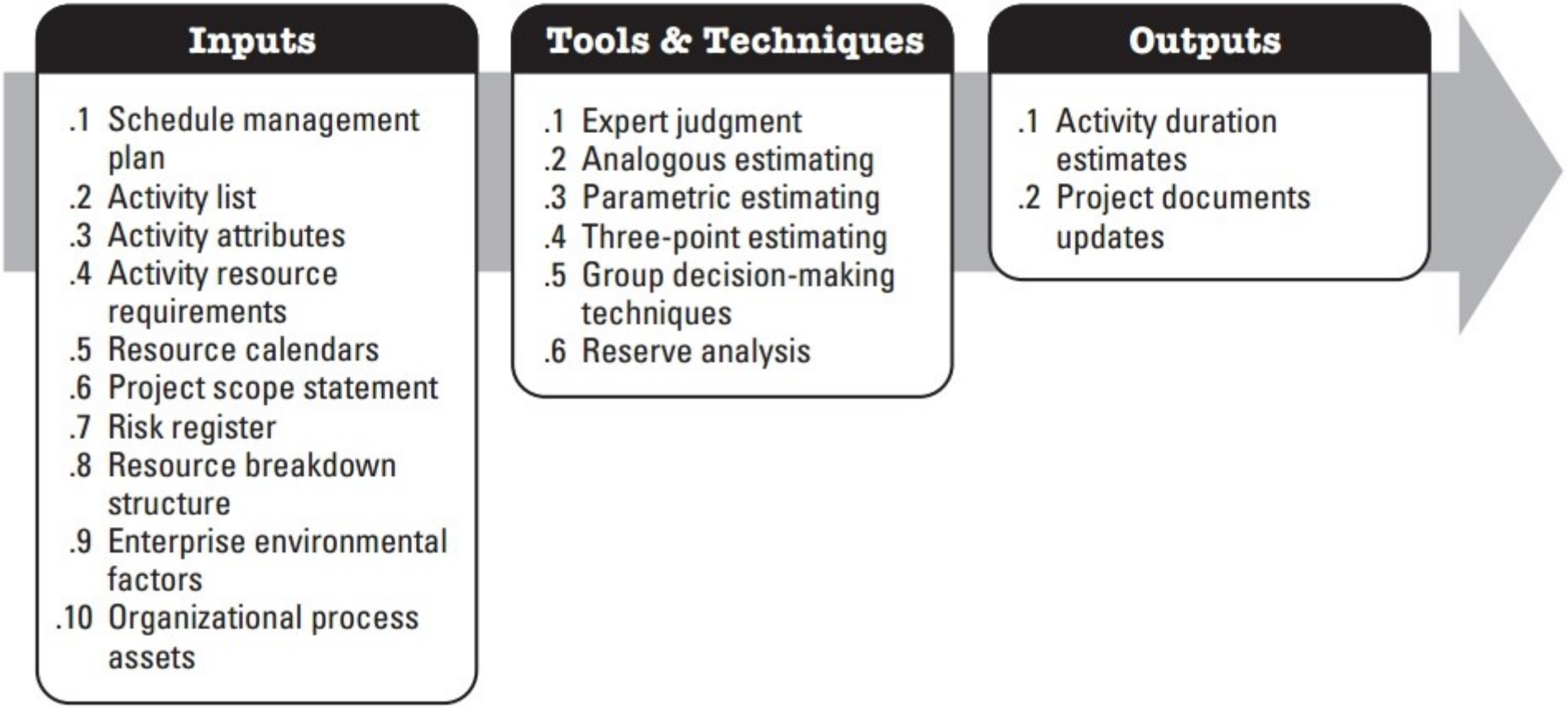


Reserve Analysis

Estimate Activity Durations: Tools and Techniques

- Duration estimates may include contingency reserves to account for schedule uncertainty
- It can be
  - a percentage of the estimated activity duration
  - a fixed number of work periods
  - developed by using quantitative analysis methods
- As more precise information available, the contingency reserve may be used, reduced, or eliminated

Estimate Activity Durations
(planning)



Develop Schedule

(planning)

Develop Schedule

- The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model
- The key benefit of this process is that by entering schedule activities, durations, resources, resource availabilities, and logical relationships into the scheduling tool, it generates a schedule model with planned dates for completing project activities

Develop Schedule

- Is an iterative process
- It determines the planned start and finish dates for project activities and milestones
- Revising and maintaining a realistic schedule continues throughout the project as work progresses
- PM then performs various calculations and alternative what-if analysis to determine the optimum schedule

Actions

- Look for alternative ways (less time, cost, risk, better quality)
- Look for impacts on other projects (compete for resources)
- Meet with resource managers to negotiate for resource availability
- Compress the schedule by crashing, fast tracking, etc.
- Level resources
- Give the team a chance to buy in the final schedule
- Conduct meetings and conversations to gain stakeholders and management formal approval

Critical Path Method

Develop Schedule: Tools and Techniques

- Critical Path is
  - The longest duration path through a network diagram
  - The shortest time to complete the project
- Determines
  - The longest path in the network diagram
  - The earliest and latest an activity can start
  - The earliest and latest an activity can be completed
- The critical path helps
  - Proving how long the project will take
  - The project manager determines where best to focus the project management efforts
  - Determining if an issue needs immediate attention
  - Providing a vehicle to compress the schedule
  - Determining which activities have float and can therefore be delayed without delaying the project or other activities

Near Critical Path

- Close in duration to the critical path
- If something could happen that shortens the critical path or lengthens the near-critical path, such that the near-critical path becomes critical
- Critical and near-critical paths should be closely monitored

Float (Slack)

- Float: amount of time the project/activity can be delayed without causing a delay so subsequent tasks or project completion date
  - Total float (activity level)
    - Amount of time an activity can be delayed without impacting the project end date or an intermediary milestone (project schedule)
  - Free float (activity level)
    - Amount of time an activity can be delayed without impacting the early start date of any of its successor(s)
  - Project float (project level)
    - Amount of time a project can be delayed without delaying the externally imposed project completion date required by the customer or management or previously committed to by the project manager
- Activities on critical path have 0 float

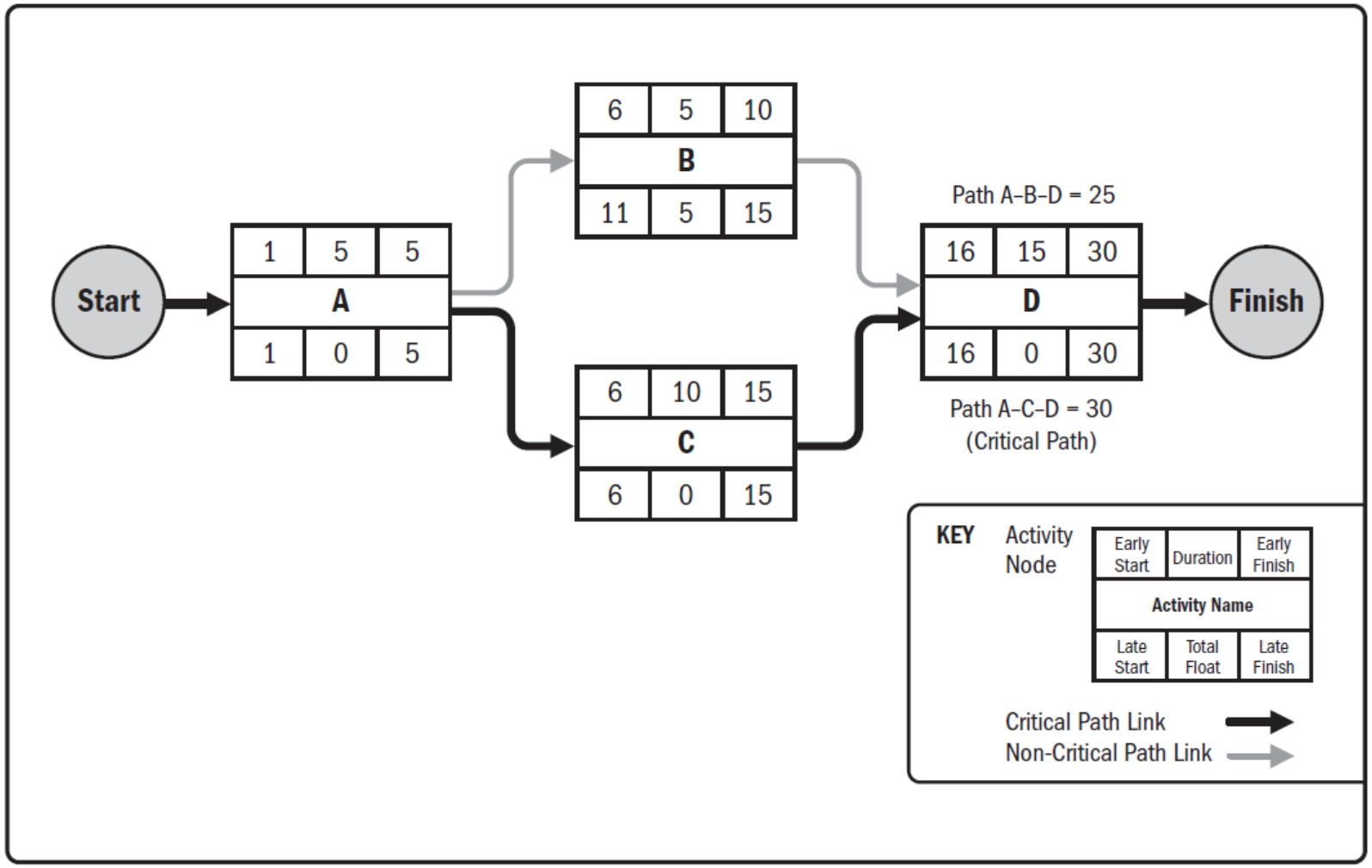
Float

- Float is an asset to PM: use float as a way to focus on project management
  - E.g. can assign an inexperienced resource to work on the activity with the most float, without affecting project schedule
- Tells team members on how much time flexibility they have for each activity, allowing them discretion to work on other tasks should there be float available

Float

- **Early Start Date (ES):** the earliest possible time on which the uncompleted portions of a schedule activity can start
- **Early Finish Date (EF):** the earliest possible time on which the uncompleted portions of a schedule activity can finish
- **Late Finish Date (LF):** the latest possible time that a schedule activity may be completed
- **Late Start Date (LS):** the latest possible time that a schedule activity may begin
- Float = LS - ES = LF - EF

Example of Critical Path



Forward Pass & Backward Pass

- Forward Pass
  - The calculation of the early start and early finish dates
  - Find the “early” figures by calculating from the beginning to the end, following dependencies in the network diagram
- Backward Pass
  - The calculation of late finish dates and late start dates
  - Find the “late” figures by moving from the end to the beginning of the project, following the dependencies

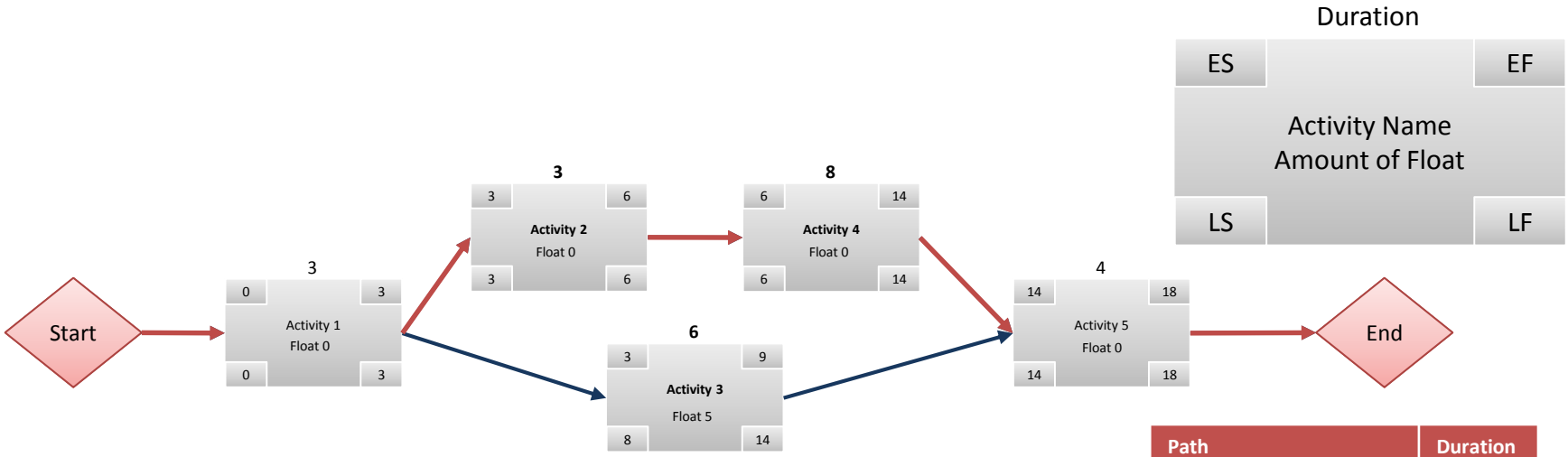
Constructing a Network Diagram

- Identify the critical path
- For activities on the critical path
  - Forward pass
  - As on the critical path, float = 0, therefore, ES = LS, EF = LF
- For activities not on the critical path
  - Forward pass
  - Backward pass

* Constructing a network diagram and identifying the critical path is an essential skill

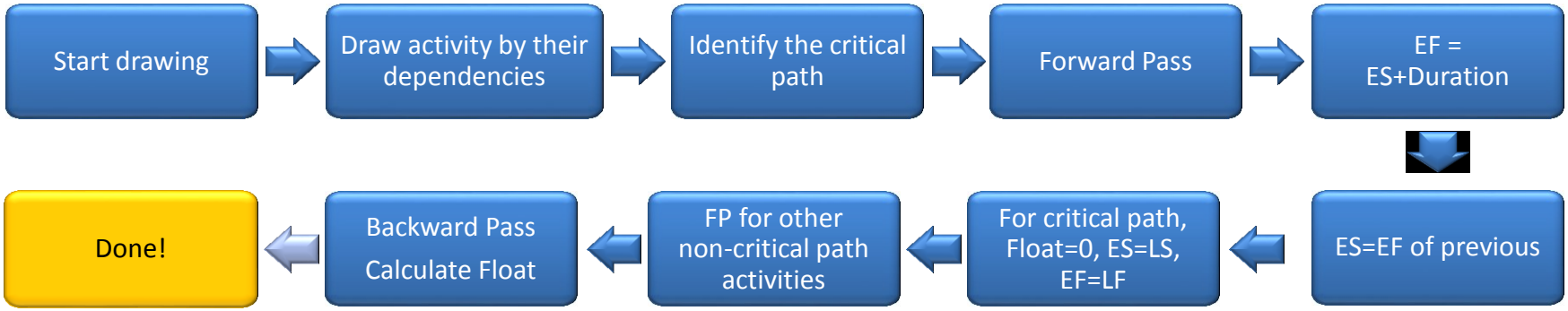
* Identifying ES, FS, LS, LF, and float is less important

Exercise 1

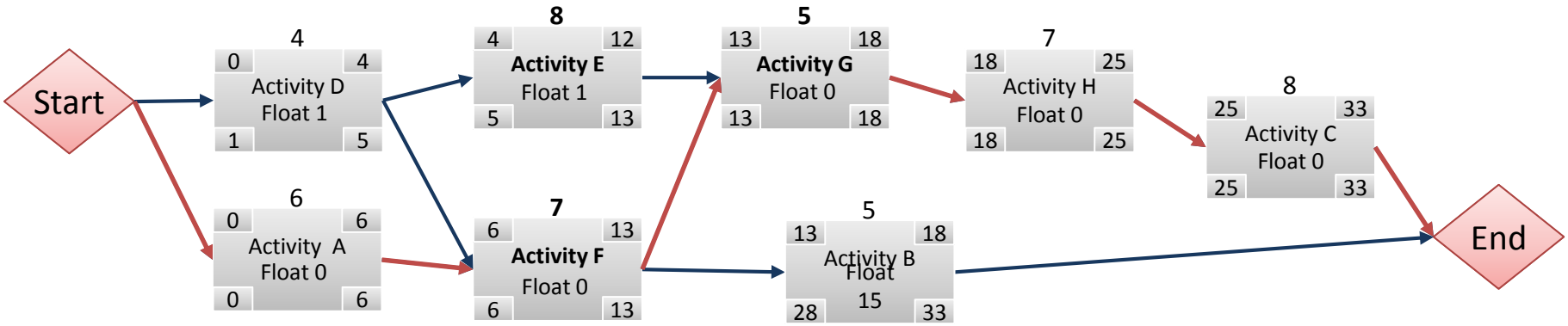


Path	Duration
Start, 1, 2, 4, 5, End	18
Start, 1, 3, 5, End	13

- Activity 1 can start immediately and has an estimated duration of 3 weeks
- Activity 2 can start after activity 1 is completed and has an estimated duration of 3 weeks.
- Activity 3 can start after activity 1 is completed and has an estimated duration of 6 weeks.
- Activity 4 can start after activity 2 is completed and has an estimated duration of 8 weeks.
- Activity 5 can start after activity 4 is completed and after activity 3 is completed. This activity takes 4 weeks.

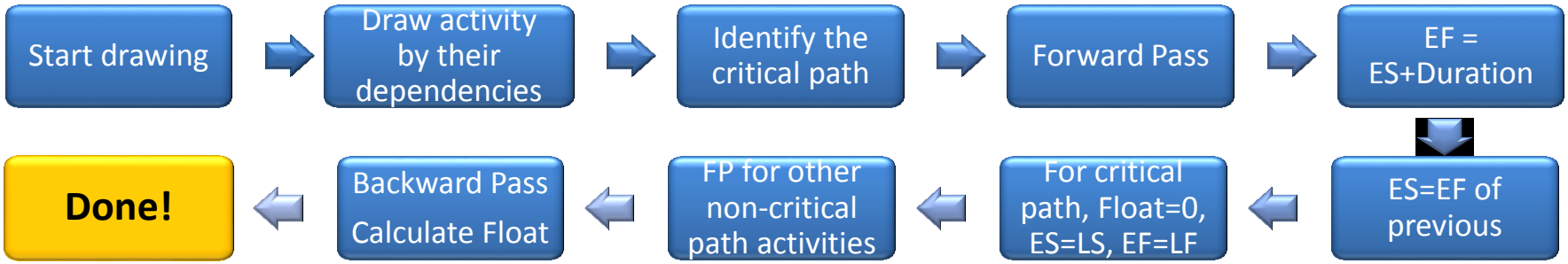


Exercise 2



Activity	Preceding Activities	Estimate in Months
Start		0
D	Start	4
A	Start	6
F	D, A	7
E	D	8
G	F, E	5
B	F	5
H	G	7
C	H	8
End	C, B	0

Path	Duration
Start, D, E, G, H, C, End	32
Start, D, F, G, H, C, End	31
Start, D, F, B, End	16
Start, A, F, G, H, C, End	33
Start, A, F, B, End	18



Critical Path Summary

- Can there be more than one critical path?
- Yes
- Do you want there to be?
- No; it increases risk
- Can a critical path change?
- Yes
- How much float does the critical path have?
- Zero float

Critical Path Summary

- Can there be negative float?
- Yes, it shows you are behind
- Does the network diagram change when the required end date changes?
- No, but the project manager should investigate options to meet the new date. Then, with approved changes, the project manager should change the network diagram accordingly.
- Would you leave the project with a negative float?
- No, you would compress the schedule.

Modelling Techniques

Develop Schedule: Tools and Techniques

- What-if Scenario Analysis
  - The process of evaluating scenarios in order to predict their effect, positively or negatively, on project objectives.
  - The outcome of the what-if scenario analysis can be used to assess the feasibility of the project schedule under adverse conditions, and in preparing contingency and response plans to overcome or mitigate the impact of unexpected situations.
  - Exam mainly on Monte Carlo Analysis

Modelling Techniques

Develop Schedule: Tools and Techniques

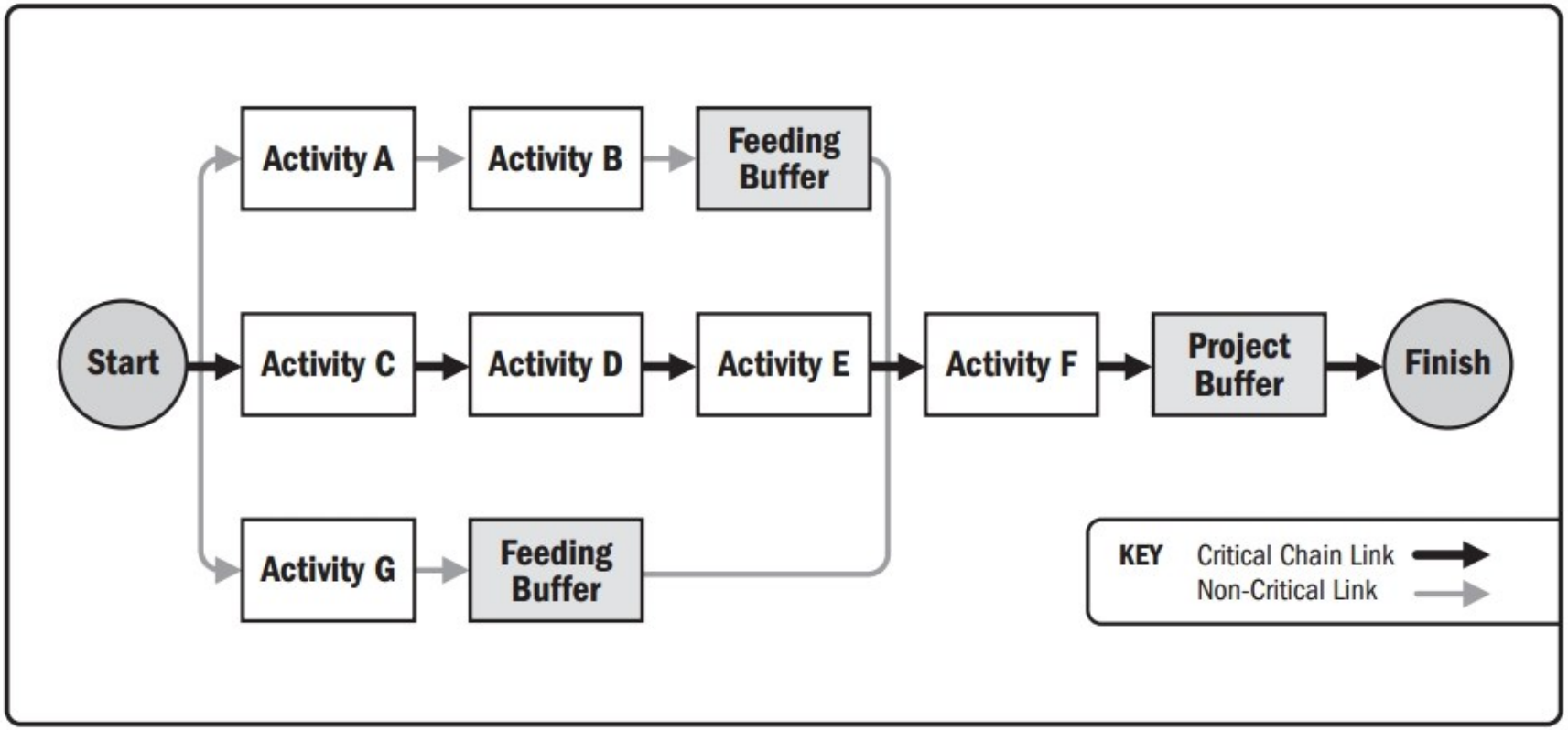
- Monte Carlo Analysis is a kind of what-if analysis
- Use computer software to simulate the outcome of a project
- Making use of the three-point estimates for each activity and the network diagram
- More details will be covered in project risk management

Critical Chain Method

Develop Schedule: Tools and Techniques

- A schedule method that allows the project team to place buffers on any project schedule path to account for limited resources and project uncertainties.
- Developed from the critical path method approach and considers the effects of resource allocation, resource optimization, resource leveling, and activity duration uncertainty on the critical path determined using the critical path method
- It introduces the concept of buffers and buffer management.
  - **Project buffer:** protects the target finish date from slippage along the critical chain
  - **Feeding buffers:** placed at each point where a chain of dependent activities that are not on the critical chain feeds into the critical chain. It thus protect the critical chain from slippage along the feeding chains

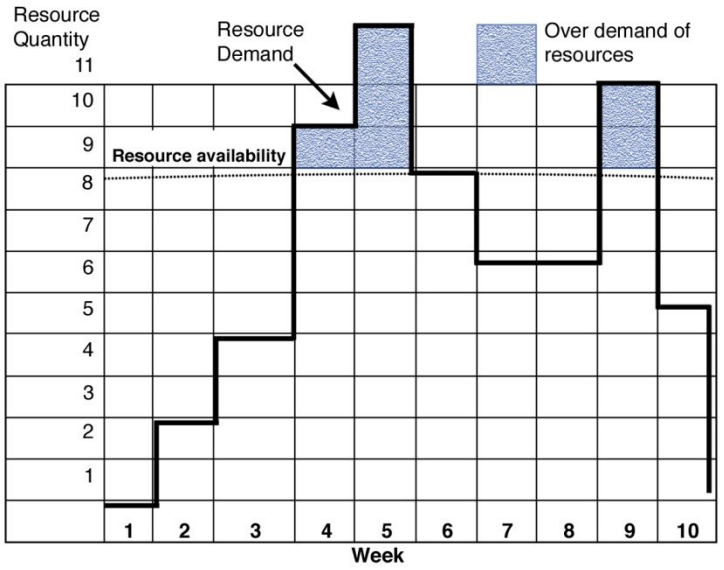
Critical Chain Example



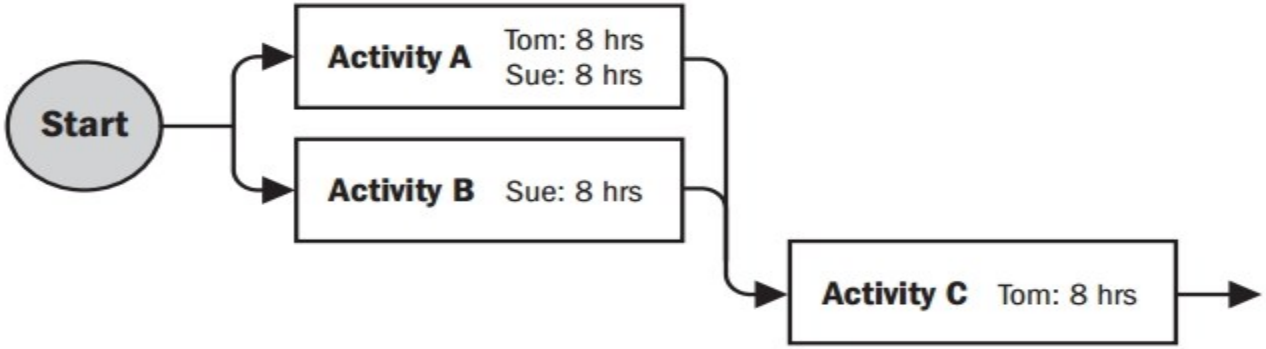
Resource Optimization Technique

Develop Schedule: Tools and Techniques

- Resource Levelling
  - Examines unbalanced use of resources over time, and resolve over-allocations or conflicts
  - Lets the schedule slip and cost increase to deal with a limited amount of resources, resource availability, and other resource constraints
  - Level the peaks and valleys of resource use from one month to another, resulting in a more stable number of resources on the project
  - Could result in a later project finish date if the activities affected are in the critical path

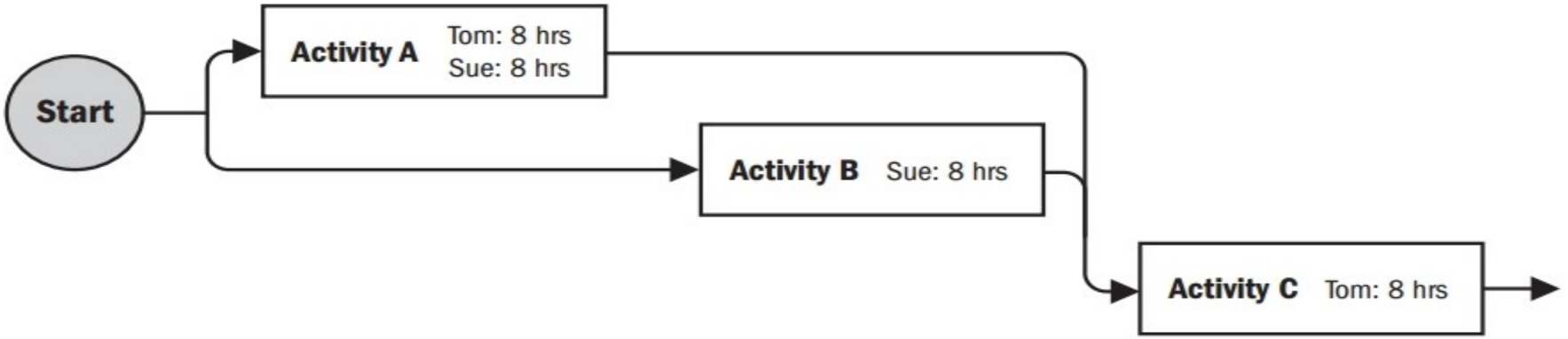


Activities Before Resource Leveling



Day 1	Day 2	Day 3
Tom: 8 hrs Sue: 16 hrs	Tom: 8 hrs	

Activities After Resource Leveling



Day 1	Day 2	Day 3
Tom: 8 hrs Sue: 8 hrs	Sue: 8 hrs	Tom: 8 hrs

Resource Optimization Technique

Develop Schedule: Tools and Techniques

- Resource Smoothing
  - Adjusts the activities of a schedule model such that the requirements for resources on the project do not exceed certain predefined resource limits
  - Resource smoothing, as opposed to resource leveling, the project's critical path is not changed and the completion date may not be delayed.
  - Activities may only be delayed within their free and total float.
  - Resource smoothing may not be able to optimize all resources.

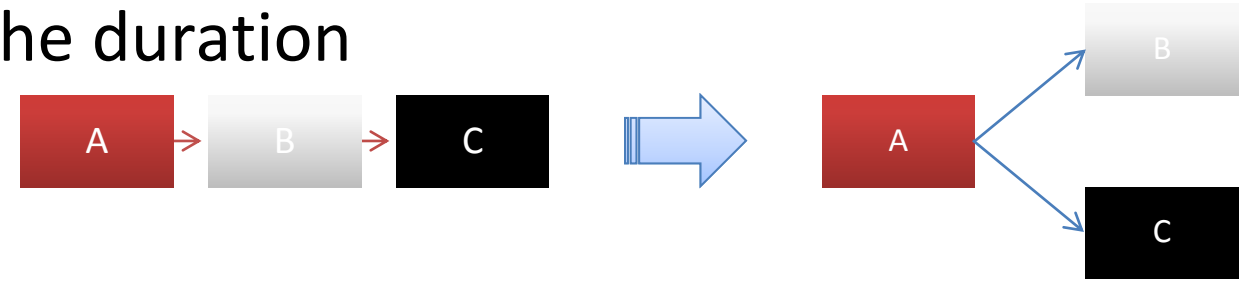
Schedule Compression

Develop Schedule: Tools and Techniques

- Done during project planning to see if the desired completion date can be met and what can be changed to make that date
- Also as a tool in control schedule
- Also during integrated change control to look at the schedule impacts of changes to cost, scope, quality, risk, and resources
- Objective: compress the schedule without changing the project scope

Fast Tracking

- Doing critical path activities in parallel, that were originally planned in series
- For discretionary dependency activities only; should already identified during Sequence Activities
- Often result in rework, increases risks, and requires more attention to communications
- Only works if activities can be overlapped to shorten the duration



Crashing

- Trade-offs between cost and schedule: compress the schedule the most with the least incremental cost while maintaining the project scope
- Always results in increased costs by definition
  - E.g. resources added to a critical path activity, from other activity or form outside the project
  - E.g. purchase a software application to improve team's efficiently, at the cost of the purchase

Compression: Points to Note

- Investigate all alternatives, and select the one with the least negative impact on the project
- Options for negative float/requirement to compress schedule
  - Execute activities on critical path in parallel (Fast Tracking)
  - Add resources from within the organization (Crashing)
  - Re-estimate (Review risks): lower the risk to reduce required time

Compression Options

- Cut activity (Reduce scope)
- Hire consultants to assist on activities on critical path (Crashing)
- Move more experienced people to activities on critical path (Crashing)
- Reduce time and cost (Cut quality)
- Say “no” (Stand your ground, for unrealistic schedule set by management)
- Get more work done with the same amount of resources (e.g. work overtime without compensation)
  - Not an option during project planning
  - Save it as a last resort

Compression: Impacts

Option	General Impacts to the project
Fast track	▪ Adds risk ▪ May add management time for the project manager
Crash	▪ Always adds cost ▪ May add management time for the project manager
Reduce scope	▪ Could possibly save cost and time ▪ May negatively impact customer satisfaction
Cut quality	▪ Could possibly save cost and resources ▪ May increase risk ▪ Requires good metrics

Schedule Compression Notes

- How to choose on the exam?
  - Behind schedule (SPI < 1); determine the CPI first
    - Under budget (CPI > 1) → Crashing
    - Over budget (CPI < 1)
      - Activities are not risky or discretionary dependency → Fast Tracking
      - Activities are risky or Mandatory dependency → Re-estimate risk OR value analysis
    - If management sets unrealistic schedule → Say "no"
    - Nothing mentioned → Look for other options
    - Below should not be the answers in exam
      - Reduce scope, cut quality (if not requested by the customers)
      - Work overtime without compensation (NOT PROFESSIONAL and UNETHICAL!)

Schedule Baseline

Develop Schedule: Outputs

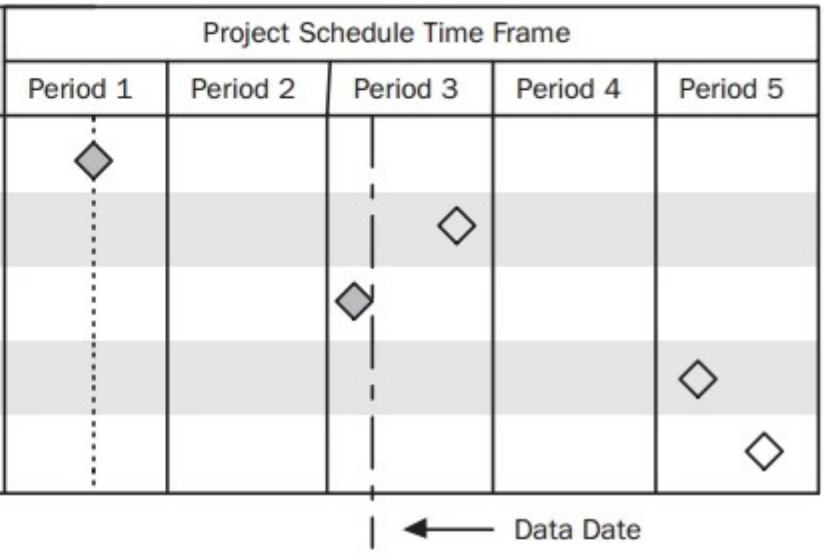
- Part of the project management plan
- The final schedule
- Can only be changed by formally approved changes
- Meeting the schedule baseline is one of the measures of project success
- Schedule can be shown using:
  - Network diagram
  - Milestone chart
  - Bar chart

Project Schedule Presentation

- Milestone Charts
  - Only show major events
  - No duration, just completion of events
- Bar Chart/Gantt Charts
  - Weak planning tools, but effective for progress reporting and control.
  - NOT part of the project management plan, only for reporting progress
  - Does not show inter-dependencies

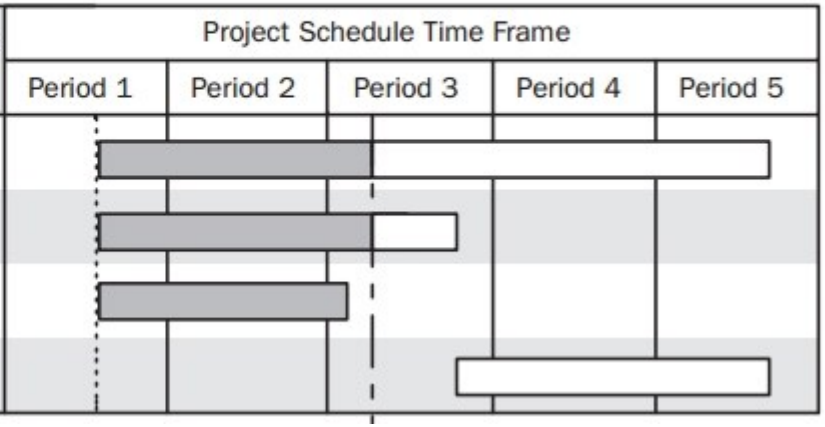
Milestone Schedule

Activity Identifier	Activity Description	Calendar units
1.1.MB	Begin New Product Z	0
1.1.1.M1	Complete Component 1	0
1.1.2.M1	Complete Component 2	0
1.1.3.M1	Complete Integration of Components 1 & 2	0
1.1.3.MF	Finish New Product Z	0



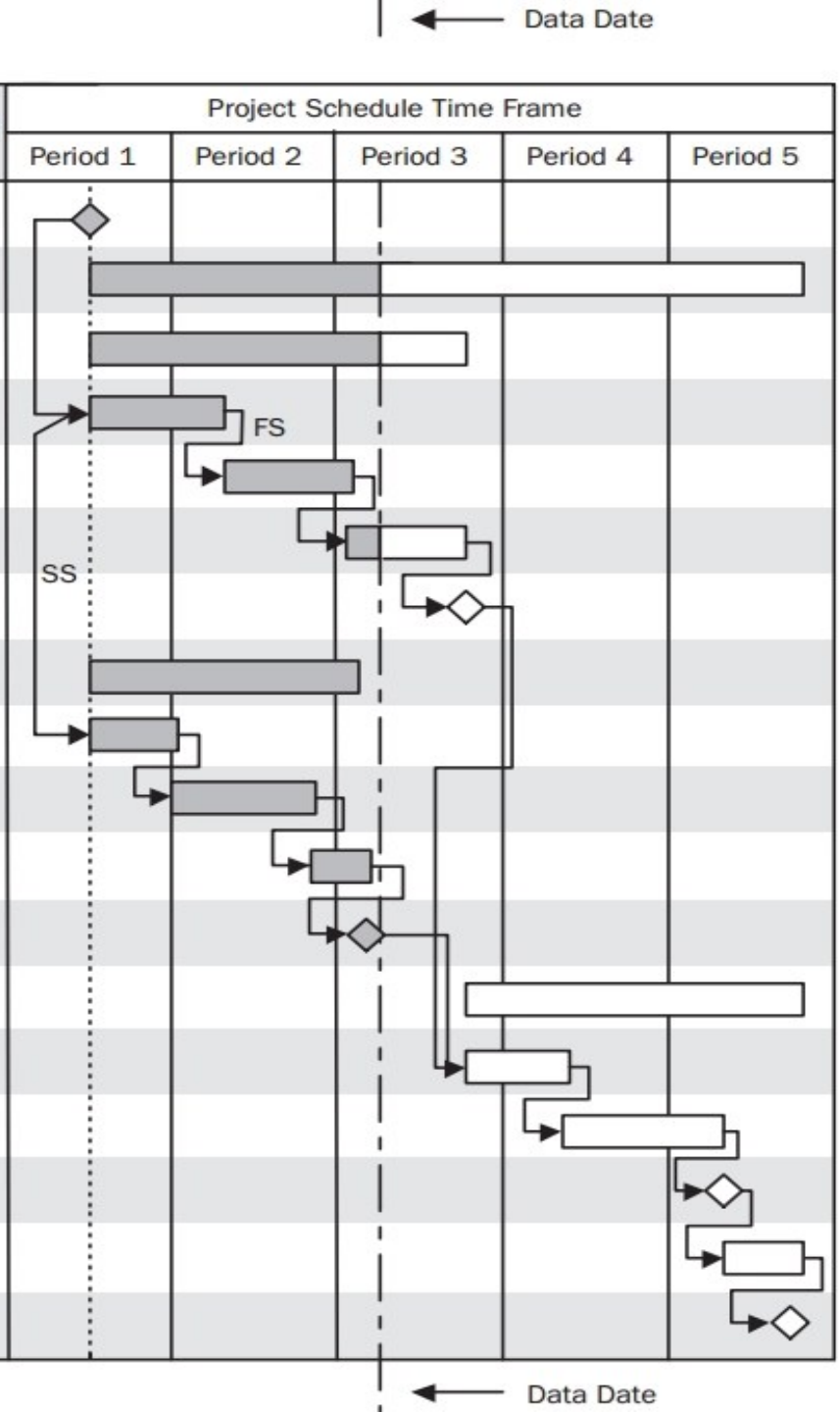
Summary Schedule

Activity Identifier	Activity Description	Calendar units
1.1	Develop and Deliver New Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.2	Work Package 2: Component 2	53
1.1.3	Work Package 3: Integrated Components 1 and 2	53



Detailed Schedule

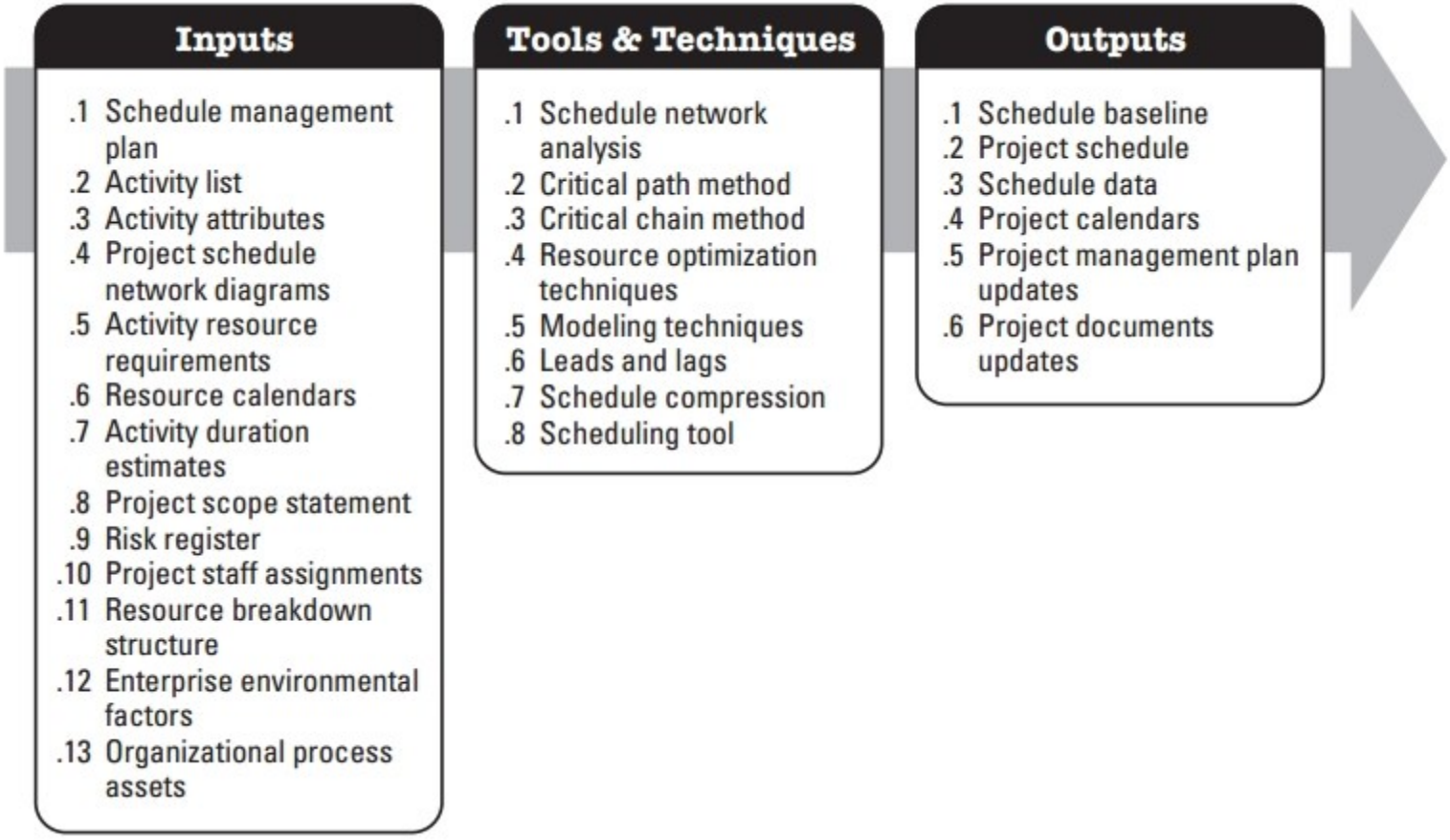
Activity Identifier	Activity Description	Calendar units
1.1.MB	Begin New Product Z	0
1.1	Develop and Deliver Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.1.D	Design Component 1	20
1.1.1.B	Build Component 1	33
1.1.1.T	Test Component 1	14
1.1.1.M1	Complete Component 1	0
1.1.2	Work Package 2: Component 2	53
1.1.2.D	Design Component 2	14
1.1.2.B	Build Component 2	28
1.1.2.T	Test Component 2	11
1.1.2.M1	Complete Component 2	0
1.1.3	Work Package 3: Integrated Components 1 and 2	53
1.1.3.G	Integrate Components 1 and 2 as Product Z	14
1.1.3.T	Complete Integration of Components 1 and 2	32
1.1.3.M1	Test Integrated Components as Product Z	0
1.1.3.P	Deliver Product Z	7
1.1.3.MF	Finish New Product Z	0



Project Schedule Presentation Comparison

- Under what circumstances would you use a network diagram instead of a bar chart?
  - To show interdependencies between activities
- Under what circumstances would you use a milestone chart instead of a bar chart?
  - To report to senior management
- Under what circumstances would you use a bar chart instead of a network diagram?
  - To track progress
  - To report to the team

Develop Schedule
(planning)



Control Schedule

(monitoring and controlling)

Control Schedule

- The process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan
- The key benefit of this process is that it provides the means to recognize deviation from the plan and take corrective and preventive actions and thus minimize risks

Control Schedule

- Concerns with
  - Determining the current status of the project schedule
  - Influencing the factors that create schedule changes
  - Determining that the project schedule has changed
  - Managing the actual changes as they occur
- A component in Perform Integrated Change Control

Activities

- Conduct performance reviews
- Adjust future parts of the project to deal with delays, rather than asking for a time extension
- Measure variances against the planned schedule, and determine if those variances warrant attention
- Level resources
- Continue to play “What if…?”
- Adjust progress reports and reporting
- Utilize the change control process
- Identify the need for change requests
- Usually performed with Control Costs
  - Always study schedule and cost management concurrently

Performance Reviews

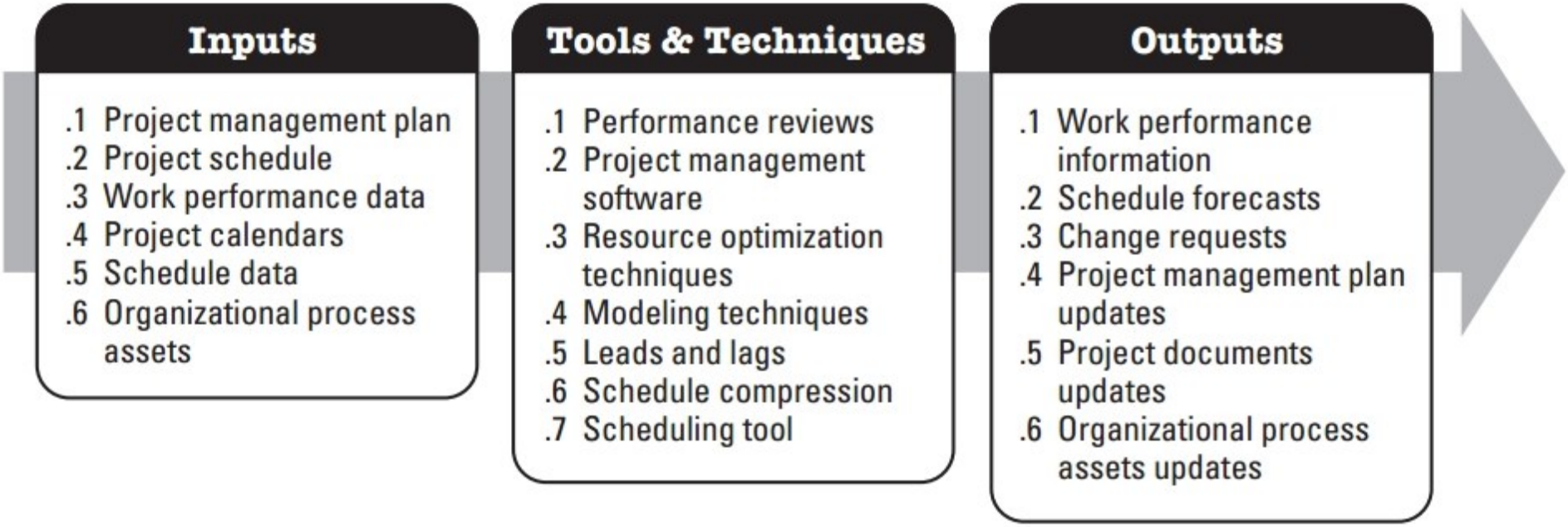
Control Schedule: Tools and Techniques

- Trend analysis
  - Examines project performance over time to determine whether performance is improving or deteriorating.
- Critical path method
- Critical chain method
- Earned value management (EVM)

Re-estimating

- It is standard practice to re-estimate the remaining project work at least once over the life of the project to make sure the end date, budget or other objectives can be met, and adjust if necessary

Control Schedule
(monitoring and controlling)



Exercise

- The project manager has performed schedule network analysis, compressed the schedule and completed a Monte Carlo analysis. What time management activity should be done NEXT?

A. Update resource requirements
B. Recommend corrective actions
C. Estimate Activity Durations
D. Create a milestone list

Answer: A

- A heuristic is BEST described as a:
  A. Control tool.
  B. Scheduling method.
  C. Planning tool.
  D. Rule of thumb.

Answer: D

- A project manager decides to bring expected future schedule performance in line with the project management plan. What is this a definition of?
  A. Corrective action
  B. Lessons learned
  C. Scope validation
  D. Scope planning

Answer: A

- A scope change has been approved by the change control board. Which of the following MUST be impacted?
  A. The early start date of the activities later in the network diagram
  B. The cost of the project
  C. The expected monetary value of project risks
  D. The number of resources used on the project

Answer: A

- A project manager has received activity duration estimates from his team. Which of the following does he need in order to complete the Develop Schedule process?
  A. Change requests
  B. Schedule change control
  C. Recommended corrective actions
  D. Reserves

Answer: D

- The project manager is involved in the Develop Schedule process for the project. He has analyzed the project, compressed the schedule and completed a Monte Carlo analysis. Which of the following is the following action of Develop Schedule?

  A. Activity duration estimates
  B. Change requests
  C. Resource requirement updates
  D. Work breakdown structure

  Answer: C

- A project manager is using weighted average duration estimates to perform schedule network analysis. Which type of mathematical analysis is being used?
  A. Critical path method
  B. PERT
  C. Monte Carlo
  D. Resource leveling

Answer: B

- Total float is the amount of time an activity can be delayed without delaying the:
  A. Project.
  B. Completion date required by the customer.
  C. Early start of its successor.
  D. Project completion date.

Answer: D

- What does “resource leveling” mean in project management?
  A. Shortening the time it takes to complete the project
  B. Making the most efficient use of the available resources
  C. Hiring contractors to fill in during “peak” times on the project schedule
  D. Reducing the project costs

Answer: B

- Which of the following is the waiting time between two activities?
  A. Free float
  B. Total float
  C. Lag
  D. CPM

Answer: C

- Your project management plan results in a project schedule that is too long. If the project network diagram cannot change but you have extra personnel resources, what is the BEST thing to do?

A. Fast track the project.
B. Level the resources.
C. Crash the project.
D. Monte Carlo analysis.

Answer: C

- Which of the following BEST describes comparing actual dates with planned dates?
  A. Develop Schedule
  B. Resource leveling
  C. Variance analysis
  D. Three-point estimating

Answer: C

- The float of an activity is determined by:
  A. Performing a Monte Carlo analysis.
  B. Determining the waiting time between activities.
  C. Determining lag.
  D. Determining the amount of time the activity can be delayed before it delays the critical path.

Answer: D

- Which of the following is the BEST thing to do to try to complete a project two days earlier?
  A. Tell senior management that the project's critical path does not allow the project to be finished earlier.
  B. Tell your boss.
  C. Meet with the team and look for options for crashing or fast tracking the critical path.
  D. Work hard and see what the project status is next month.

Answer: C

- A problem occurs on an activity with free float and the project manager has extended its duration. What is MOST likely to be affected?
  A. Project duration
  B. Resource schedules
  C. Project scope management plan
  D. The latest start for the successor activity

Answer: B

- An activity has an early start (ES) of day 3, a late start (LS) of day 13, an early finish (EF) of day 9 and a late finish (LF) of day 19. What is the activity's float?
  A. 10
  B. 3
  C. 1
  D. 9

Answer: A

- A dependency requiring that design be completed before manufacturing can start is an example of a:

A. Discretionary dependency
B. External dependency
C. Mandatory dependency
D. Scope dependency

Answer: C

- Which of the following are GENERALLY illustrated BETTER by bar charts than network diagrams?
  A. Logical relationships
  B. Critical paths
  C. Resource trade-offs
  D. Progress or status

Answer: D

- While working with your project team to develop a network diagram, your data architects suggest that quality could be improved if the data model is approved by senior management before moving on to other design elements. They support this suggestion with an article from a leading software development journal. Which of the following BEST describes what this type of input is called?

A. Mandatory dependency
B. Discretionary dependency
C. External dependency
D. Heuristic

Answer: B, an article can serve as a good practice

- A new product development project has four levels in the work breakdown structure and has been sequenced using the precedence diagramming method. The activity duration estimates have been received. What should be done NEXT?

A. Create an activity list
B. Begin the work breakdown structure
C. Finalize the schedule
D. Compress the schedule

Answer: D

The End