



California
DEPARTMENT OF TECHNOLOGY

Project Academy Series

Project Time Management

- 01/22/2015
- 01/23/2015



Welcome and Introductions

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Agenda

- Objectives
- Time Management Knowledge Area
 - Inputs
 - Tools & Techniques
 - Outputs
 - Practical Application
- Q & A



Objectives

- **Familiarity With Project Schedule Development & Management**
 - What are the steps to developing a schedule
 - What Tools and Techniques to use
 - How to Monitor Schedule
- **Get PMP Study Tips**
- **Find Sources for Additional Knowledge**

Ice Breaker

Finish one sentence below:

- The best project – Why?
- The worst project – Why?
- The riskiest thing I ever did was – What did you learn?



Opening Thoughts

- **Doubt and skepticism**
 - It will never work
 - Schedule always slips and no point in developing one
 - Why waste time planning?

Giving up on a goal because of a setback is like slashing your other three tires because you got a flat...



Opening Thoughts

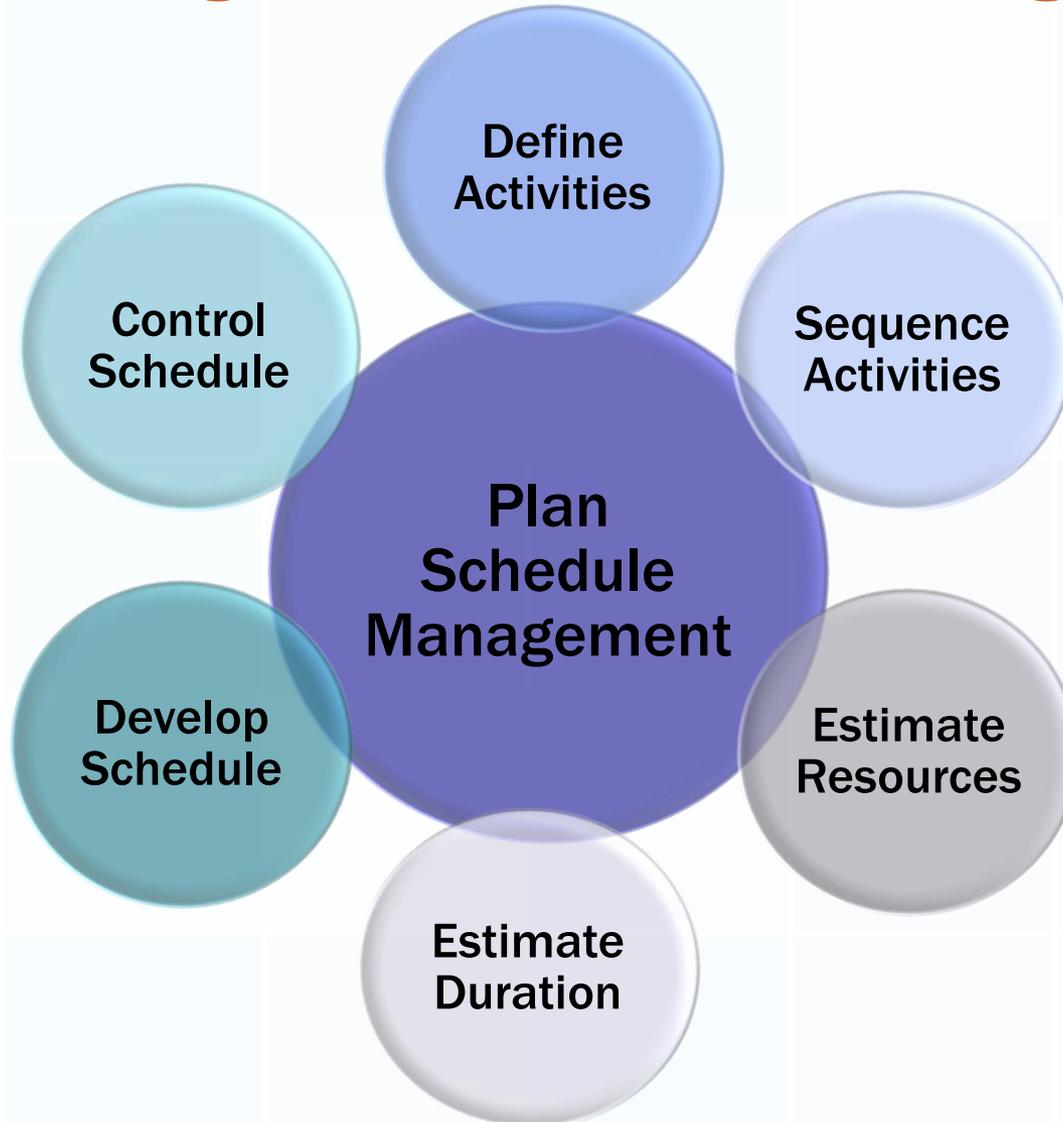
- **What Is Not Measured Cannot Be Managed**
 - To measure changes, you have to establish baselines
 - Schedule management is all about monitoring changes

Opening Thoughts

*Lost and Confused Alice approaches the Cheshire cat and asks,
"Would you tell me, please, which way I ought to go from here?"
"That depends a good deal on where you want to get to," said the Cat
"I don't much care where," said Alice.
"Then it doesn't matter which way you go," said that Cat.*

- **Managing projects successfully is hard work & can be complicated.**
- **Be aware of the end game & goals ("Big Picture")**
- **Plan and follow past successful practices or risk ending up like Alice playing the Red Queen.**

Knowledge Area: Time Management



Project Time Management: Overview

■ Plan Schedule Management

- PMBOK: Process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule

■ Define Activities

- PMBOK: Identify & document specific activities to produce deliverables
- PMBOK: Break down work packages for estimating, scheduling, executing, monitoring, and controlling

Project Time Management: Overview

■ Sequence Activities

- PMBOK: Identify & document relationships between activities
- PMBOK: Logical sequence to obtain greatest efficiency with constraints

■ Estimate Resources

- PMBOK: Estimate type and quantity of material, human resources, equipment, or supplies

Project Time Management: Overview

■ Estimate Durations

- PMBOK: Estimate number of work periods needed to complete each activity with estimated resources

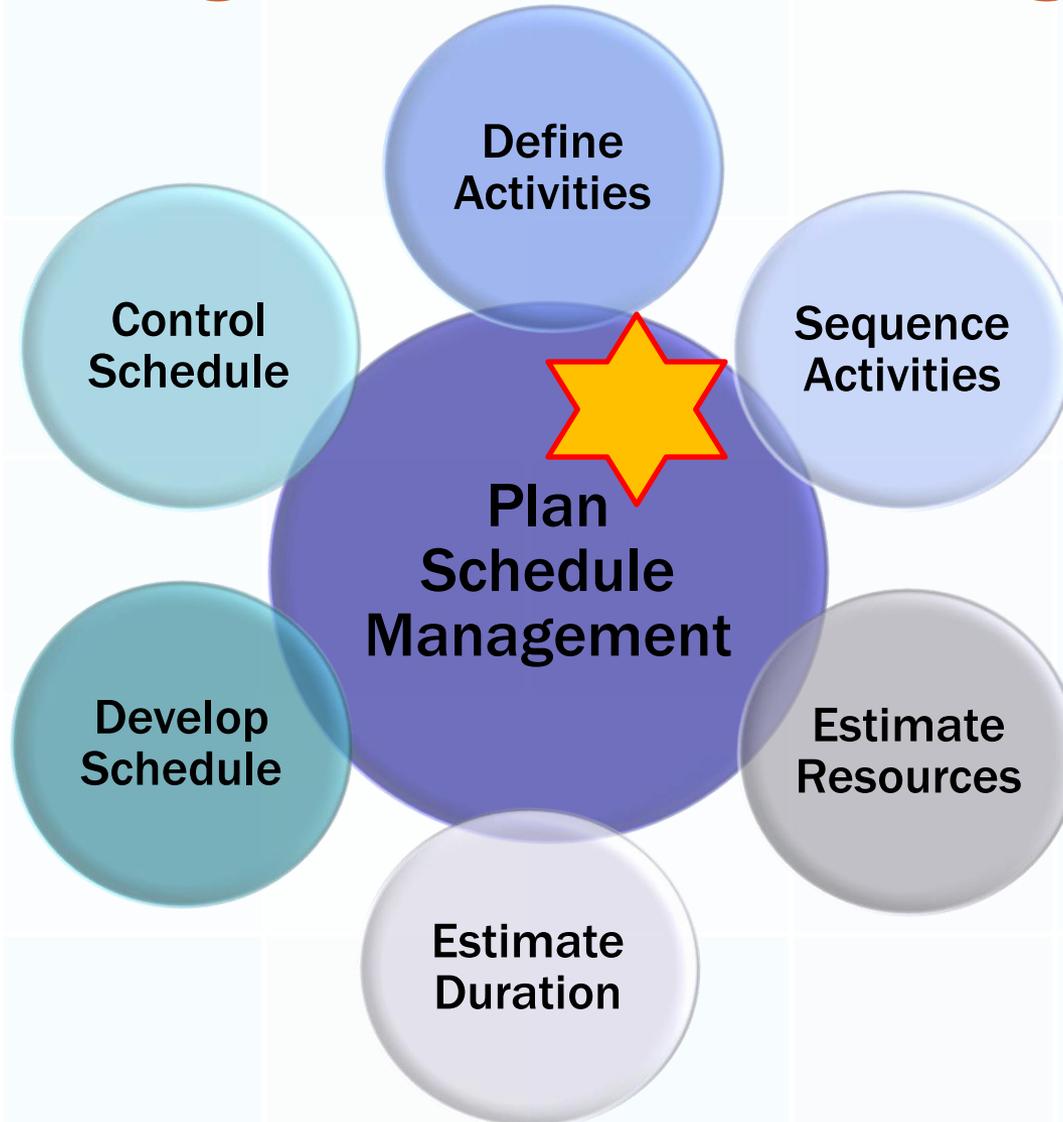
■ Develop Schedule

- PMBOK: Analyze activity sequence, duration, resources, and constraints to create the project schedule model

■ Control Schedule

- PMBOK: Monitor status of activities to update progress and manage changes by taking corrective or preventive actions to minimize risk

Knowledge Area: Time Management



Plan Schedule Management: Overview

- In this step we develop

- Schedule Management Plan

- This guides the rest of the schedule Mgmt. activities
 - Forms the basis for all future schedule/time management activities

Plan Schedule Management: Inputs

- **Project Management Plan**

- Scope, WBS, Cost, Risk, Communications Decisions

- **Project Charter**

- Milestones and Approval Requirements

- **Enterprise Environmental Factors**

- Culture, Structure, Resource Availability and Skills, PM Software, External Standards, Best Practices, Governance

- **Organizational Process Assets**

- Monitoring & Reporting Tools, Historical Data, Schedule Control Tools, Templates, Governance Procedures

Plan Schedule Management: Tools & Techniques

■ Expert Judgment

- Historical data and gurus provide insight from prior projects and suggest opportunities or pitfalls

■ Analytical Techniques

- Scheduling methods, estimating tools or techniques, PM software, top down, bottom up, rolling wave, Agile Product Grooming, alternative analysis, issue papers, leads and lags

■ Meetings (Yes, MORE meetings)

- Assemble the brain trust to develop the schedule management plan for buy-in, ensuring stakeholders needs are met, reality checks, collaboration, and communication

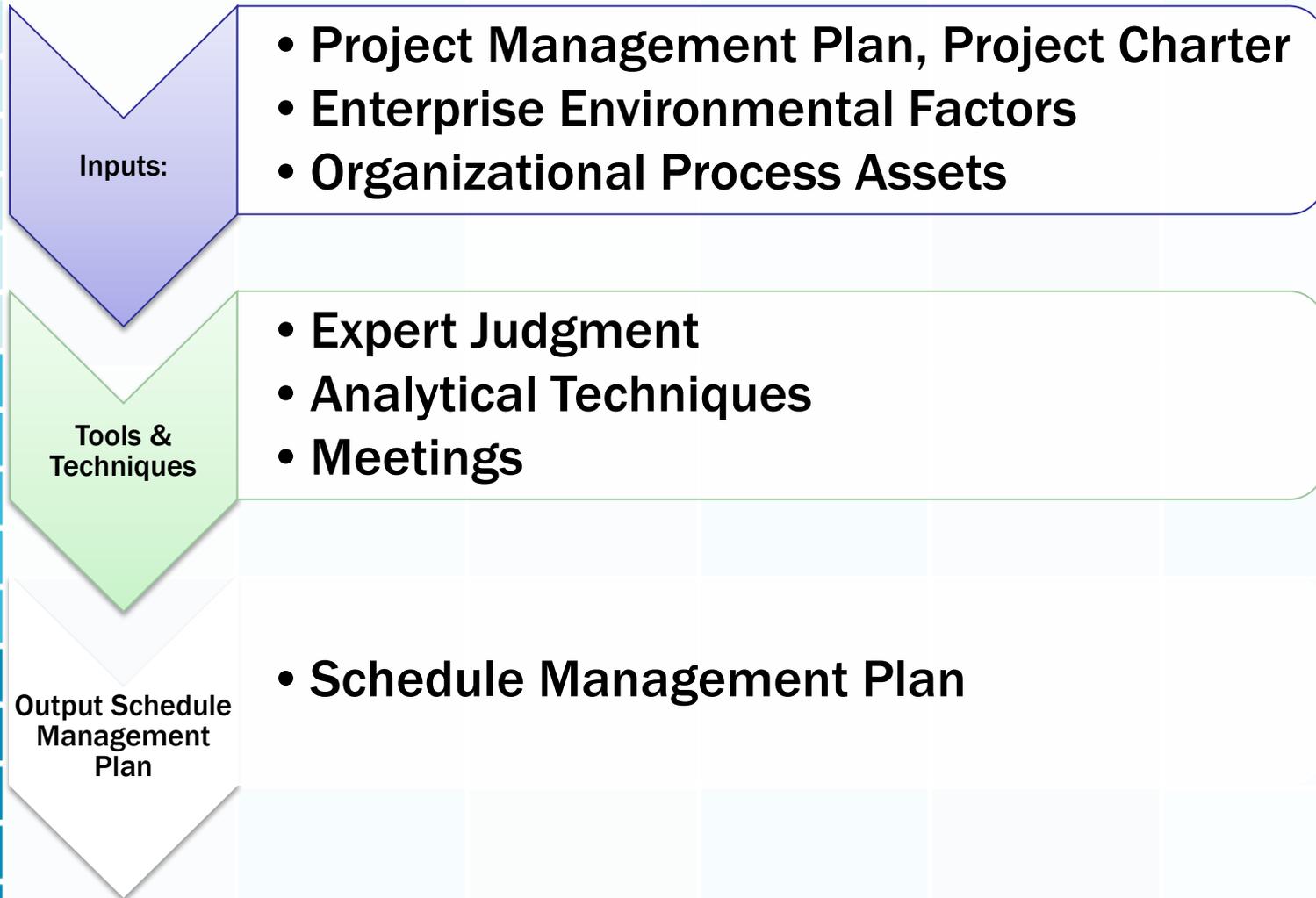
■ Templates, Process maps, instructions

- <http://www.bestpractices.osi.ca.gov/sysacq/documents/Schedule%20Mgmt%20Plan.doc>
- http://www.bestpractices.osi.ca.gov/sysacq/documents/Schedule_Management-Supplemental_Information.docx

Plan Schedule Management: Outputs

- **Schedule Model Development**
 - Methodology and tools
- **Level of Accuracy**
 - Range used for realistic accuracy duration estimates and possible contingency times
- **Units of Measure**
 - Staff hours, days, materials tons, cubic yards, metric defined for each resource
- **Organizational Procedures Links**
 - WBS developed in Scope Management
- **Project Schedule Model Maintenance**
 - Process used to update status and record progress during project execution
- **Control Thresholds**
 - Variance rules to indicate when action needs to be taken
- **Rules of Performance Measurement**
 - % complete, Earned Value, Schedule Variance, Schedule Performance Index, Baselines
- **Reporting Formats**
 - Format and frequency
 - Reporting Venues
- **Process Descriptions**
 - Describe all the above
- **Escalation process**

Plan Schedule Management: Summary



Knowledge Area: Time Management



Define Activity: Overview

■ Key Points

■ Flows from Work Breakdown Structure

- PMBOK: Hierarchical decomposition of the total scope of work...to accomplish the project objectives and create the required **deliverables**
- Lowest level of WBS is the work package – products and deliverables
- Work packages broken down or decomposed to schedule activities
- Activities should be small enough to estimate for resources, time, and cost and can be assigned to a single person or group

Define Activity: Inputs

- **Schedule Management Plan**
 - Level of detail needed to describe the work
 - How the process of define activities will be done
- **Scope Baseline**
 - Provides explicit guidance to define activities
 - WBS, WBS dictionary
- **Enterprise Environmental Factors**
 - Culture, Structure, Resource Availability and Skills, PM Software, External Standards, Best Practices, Governance
- **Organizational Process Assets**
 - Monitoring & Reporting Tools, Historical Data, Schedule Control Tools, Templates, Governance Procedures

Define Activity: Tools & Techniques

■ Decomposition

- Breaking down, or dividing and subdividing the WBS work packages into smaller, more manageable activities...verbs instead of nouns

■ Rolling Wave Planning

- Iterative planning technique
- Imminent (current month/quarter) activities are identified in great detail
- Activities further in the future are planned in less detail or higher level
- Progressive elaboration

■ Expert Judgment

- Experienced and skilled team members or experts will create activities...the organization may have templates from previous similar projects

Define Activity: Outputs

■ Activity List

- Complete and total list of all activities, at the appropriate level of detail
- Should include an activity identifier and sufficient description so team members understand what they are to do
- Unique title for each activity
- Should point to one and only one WBS work package

■ Activity Attributes

- Have durations, usually have resources, may have costs
- Additional attributes are described in resources, duration, and order are defined
- Used for schedule model development and for sorting or displaying activities in different reports

■ Milestones

- Significant point or event in a project
- Have zero duration, no resources, no cost
- Should be identified in Schedule Management Plan
- May be contractually related or a requirement from the organization's standards
- Mandatory requirements

Define Activity: Summary

Inputs:

- Schedule Management Plan, Scope Baseline
- Enterprise Environmental Factors
- Organizational Process Assets

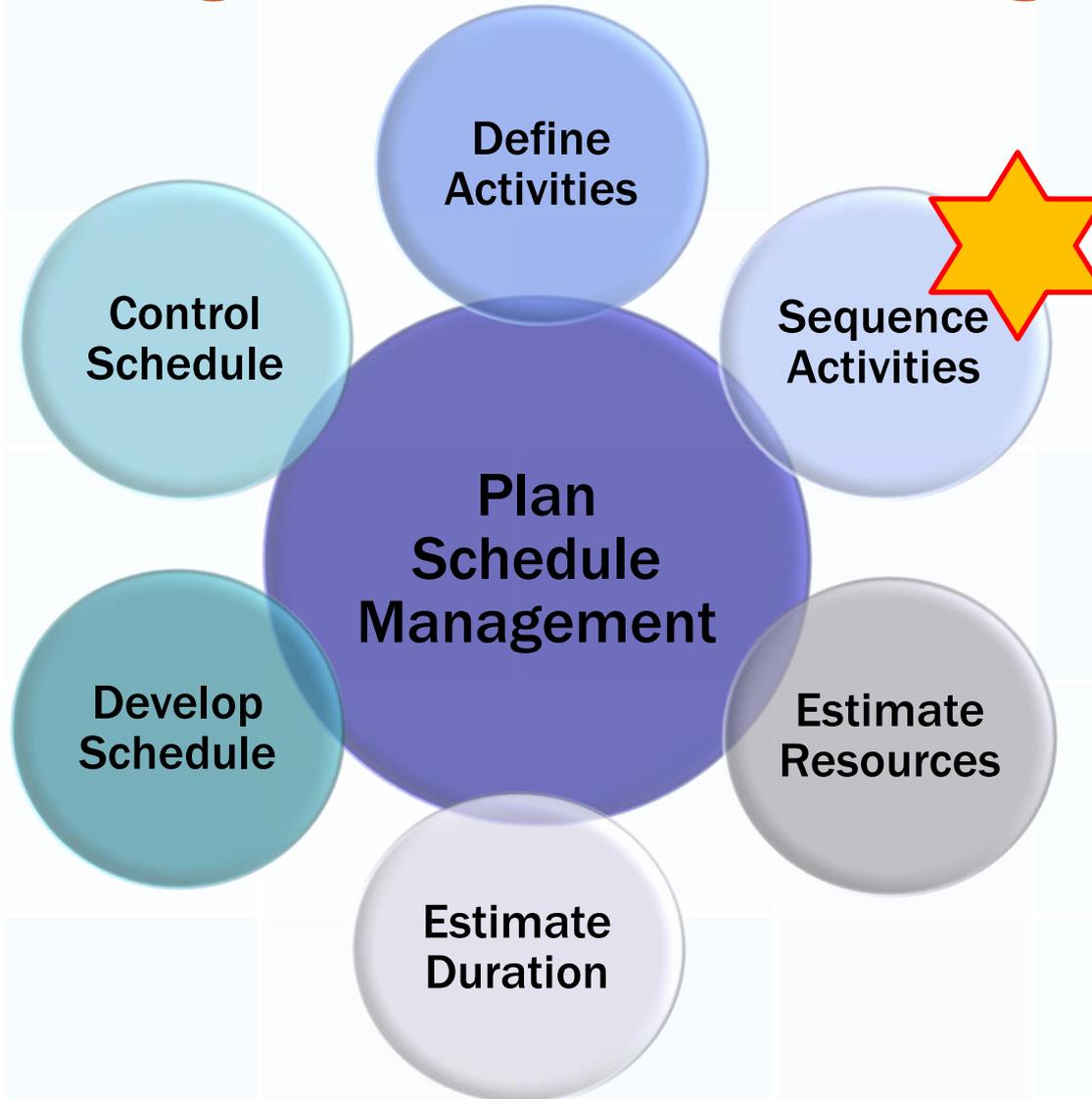
Tools & Techniques

- Decomposition
- Rolling Wave or Other Activity Processes
- Expert Judgment

Output

- Activity List
- Activity Attributes
- Milestone List

Knowledge Area: Time Management



Sequence Activities: Overview

- **Planning Process that Creates a sequenced representation of schedule activities called the;**
 - **Project Schedule Network Diagrams**
 - **Contains activity/task dependencies or links (Implied or explicitly stated)**
 - **Network Diagram shows the “rules” that govern the order in which the activities must be performed**

Sequence Activities: Inputs

- **Schedule Management Plan**
 - IDs scheduling methods and tools
- **Activity List**
 - Includes Activity Attributes
 - Describes mandatory sequence
- **Milestone List**
 - Specific dates for certain milestones
- **Project Scope Statement**
 - Details that impact sequence
 - Ensure that activity list and sequence is complete and meets objectives of the project

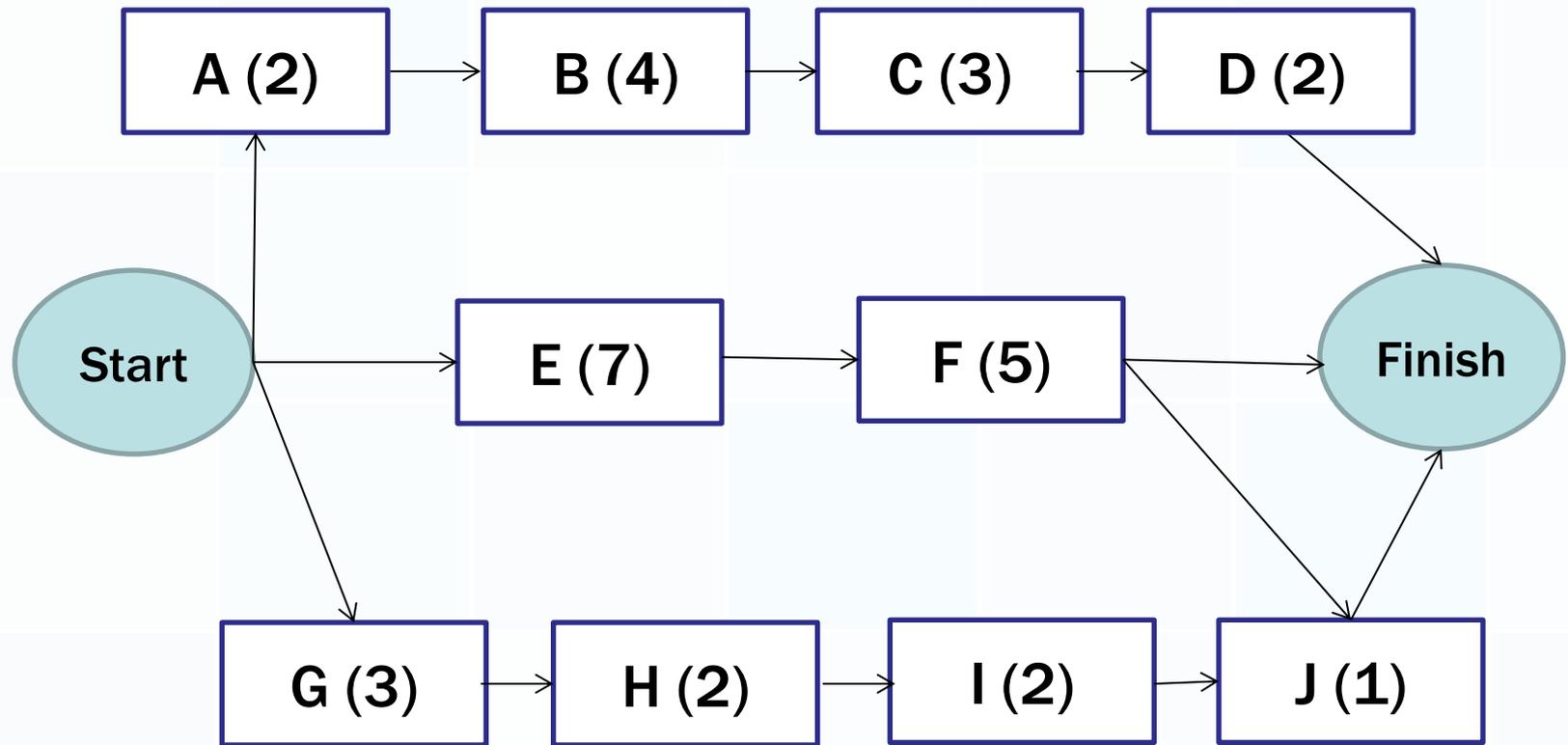
Sequence Activities: Inputs

- **Enterprise Environmental Factors**
 - Culture, Structure, Resource Availability and Skills, PM Software, External Standards, Best Practices, Governance
 - Government / Industry standards,
 - Framework, Tools and technology (CA-PMM, MS-Project)
- **Organizational Process Assets**
 - Project knowledgebase
 - Policies, procedures and guidelines
 - Templates
 - Scheduling methodology

Sequence Activities: Tools & Techniques

- **Precedence Diagramming Method (PDM)**
 - Activity-on-node is a type of PDM and is used by most PM scheduling software products
 - Finish to start, finish to finish, start to start, start to finish
- **Dependency Determination**
 - Determines which activities must precede which ones
 - Mandatory, discretionary, external, and internal
 - e.g., Legal and contractual required steps
- **Leads and Lags**
 - A lead lets you start a successor activity sooner
 - A lag is the time needed to delay a successor activity

Project Network Diagram (AKA Precedence Diagram)



Rectangular nodes - Activity Node (Represents Activity)

Arrows - Represents Dependency.

(Activity J cannot start till both H and E are finished).

Numbers - Represent Units of Duration

Task Dependencies

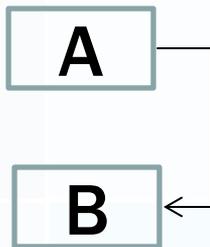
■ Finish to Start

- A FS B = B cannot start till A is finished



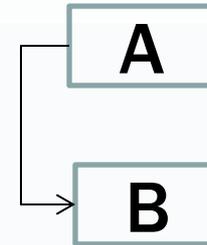
■ Finish to Finish

- A FF B = B cannot finish before A finishes



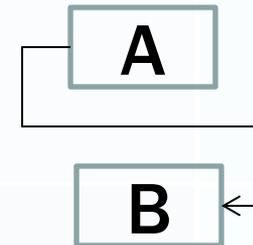
■ Start to Start

- A SS B = B cannot start till A has started



■ Start to Finish

- A SF B = B Cannot finish until A Starts



Critical Path Method (CPM)

- Schedule analysis method focusing on the critical path
- Will be covered later in schedule development section

Sequence Activities: Outputs

- **Project Schedule Network Diagram**
 - Any unusual activity sequences should be fully described
- **Project Document Updates**
 - Activity list
 - Activity Attributes
 - Milestone list
 - Risk Register

Sequence Activities: Summary



Inputs:

- Schedule Management Plan, Project Scope Document
- Activity List, Activity Attributes
- Milestone List, Enterprise Environmental Factors
- Organizational Process Assets

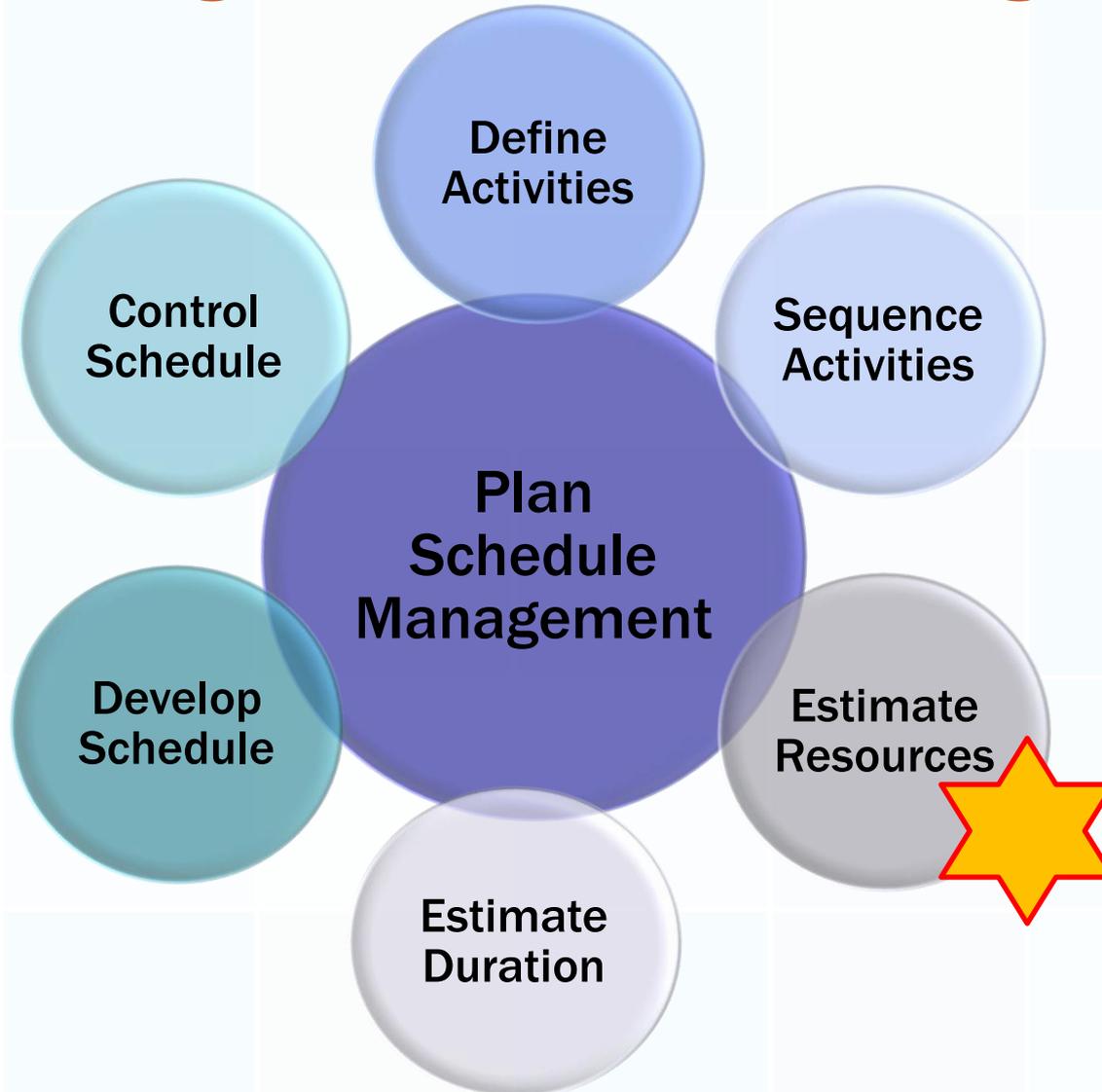
Tools & Techniques

- Precedence Diagramming Method
- Dependency Determination
- Leads and Lags

Output

- Project Schedule Network Diagrams
- Project Document Updates

Knowledge Area: Time Management



Estimate Resources: Overview

- PMBOK: Type, quantity, and characteristics...to complete an activity...allows more accurate cost and duration estimates
- Resources are personnel, material, equipment, infrastructure, etc.
 - Number, type, skill set may change duration or level of quality
- Resources should be estimated and assigned to each activity
- Resource pool may exist

Estimate Resources: Inputs

■ Schedule Management Plan

- Describes level of accuracy and units of measure

■ Activity List

■ Activity Attributes

■ Resource Calendar

- Who is available, when, how long, what days or times, geographical location, KSAs

■ Risk Register

- Risk events may impact selection and availability

■ Activity Cost Estimates

- Senior vs. junior

■ Enterprise Environmental Factors

■ Organizational Process

- Staffing rules such as no overtime
- Ability to gain resources (BCP)
- Rent or buy equipment or software

Estimate Resources: Tools & Techniques

■ Expert Judgment

- Requires specialized knowledge in resource planning & estimating

■ Alternative Analysis

- Should we use a senior or junior C#/.net programmer?
- Build, rent, buy?

■ Published Estimating Data

- Organization standards (e.g., Small Project – 1 PM, 1 Architect etc.)
- Data published by different industries which provide recognized standards for estimating resources

Estimate Resources: Tools & Techniques

■ Bottom-up Estimating

- Aggregate the estimates of smaller work packages

- **MOST EFFECTIVE SCHEDULING METHOD** ★

- Document dependencies and assumptions

■ Project Management Software

- Resource breakdown structures, rates, and calendars
- Example is MS Project Enterprise can hold this data

Estimate Resources: Outputs

- **Activity Resource Requirements**
 - Types and quantity needed for each activity
 - Will be used to estimate resources for each work package or work period
 - Can include basis for estimation and assumptions made
- **Resource Breakdown Structure**
 - Graphical or hierarchical chart similar to the WBS which groups resources needed by category & type
- **Project Documents Updates**
 - Includes: activity list, activity schedules, calendars

Estimate Resources: Summary

Inputs:

- Schedule Management Plan, Activity List, Activity Attributes
- Resource Calendars, Risk Register, Activity Cost Estimates
- Enterprise Environmental Factors, Organizational Process Assets

Tools & Techniques

- Expert Judgment, Alternatives Analysis
- Published Estimating Data, Bottom-Up Estimating
- Project Management Software

Output

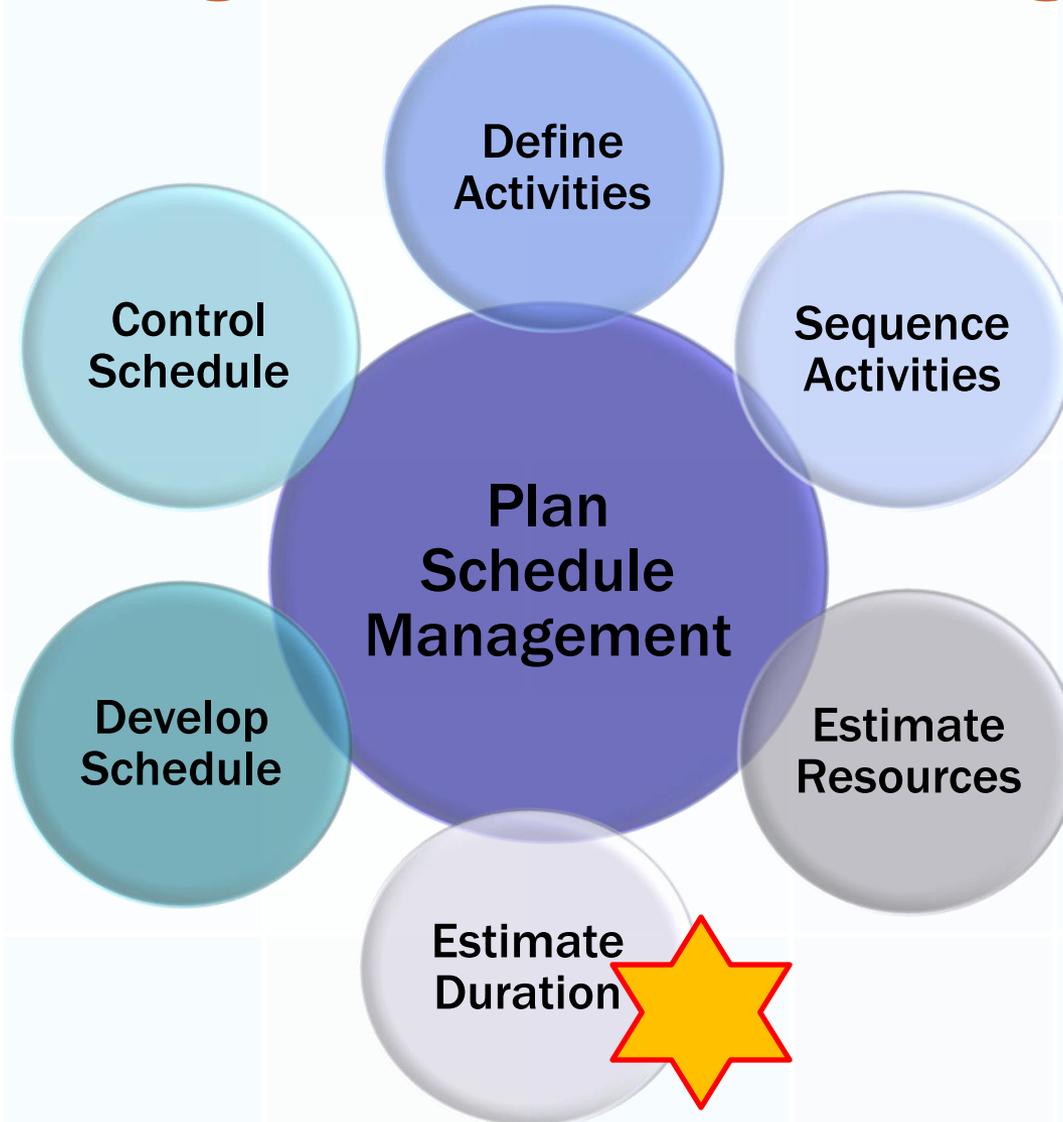
- Activity Resource Requirements
- Resource Breakdown Structure
- Project Document Updates



SHORT BREAK

Please be back in **10** minutes

Knowledge Area: Time Management



Estimate Activity Duration: Overview

- Planning process that determines how long each of the scheduled activities take
 - Closely associated with Activity Resource Estimation
 - Generally done together
- Results in Activity Duration Estimates

Estimate Activity Duration: Inputs

■ Inputs

■ Schedule Management Plan

- Describes method & level of accuracy

■ Activity List & Attributes

- Activities that we need to resource estimates for
- Attributes drive the resource requirements

■ Activity Resource Requirements, Calendars, Breakdown Structure

- Resource requirements drive the duration
 - E.g., Skill/Capacity of resources drives the duration (Jr. engr. vs Sr. engr.)

■ Project Scope Statement, Risk Register

- May include contract requirements, risks may point out that key resources may be unavailable

■ Enterprise Environmental Factors & Organizational Process Assets

- Estimating software , productivity metrics, historical information, lessons learned, organizational maturity level

Estimate Activity Duration: Tools & Techniques

■ Expert Judgment

- May help with reality checks or reconciling differences in differing estimation results

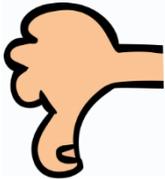
■ Analogous Estimating ★

- Estimate based on actual duration data from similar activities performed previously or on other projects.

■ Three Point Estimation (PERT Estimate) ★

- Uses weighted average of most likely (t_M), Optimistic (t_O), and Pessimistic (t_P)
- Triangular $t_E = (t_M + t_O + t_P)/3$
- Beta Distribution $t_E = (4t_M + t_O + t_P)/6$
- SD of PERT = $(t_P - t_O) \div 6$

Estimate Activity Duration: Tools & Techniques

- **Parametric Estimating** ★
 - Uses an algorithm such as story point or function point analysis and actual duration data from previous or similar activities
 - E.g., Cocomo Model ($\text{Effort} = a * (\text{KLOC})^b * c \dots$ etc.)
- **Group Decision Making (Bottom-Up)** ★
 - Engages team members, improves commitment by team
 - Task members participate in the estimating process
- **Reserve Analysis**
 - Set aside for unforeseen or risk contingency
- **Fiat (Top Down)** 
 - Boss says to do it by a certain date
 - Legislative mandate (e.g., cover California Portal)

Estimate Activity Duration: Outputs

■ Activity Duration Estimates

- The length of time (in days, weeks, etc.) each activity is expected to last
- May be expressed as a range (Accuracy of estimate)

■ Project Document Updates

- New or changed activity or resource attributes

Estimate Activity Duration: Summary

Inputs:

- Schedule Management Plan, Activity List, Attributes
- Activity Resource Requirements, Calendar
- Project Scope Statement, Risk Register
- Resource Breakdown Structure, Enterprise & Organizational Assets

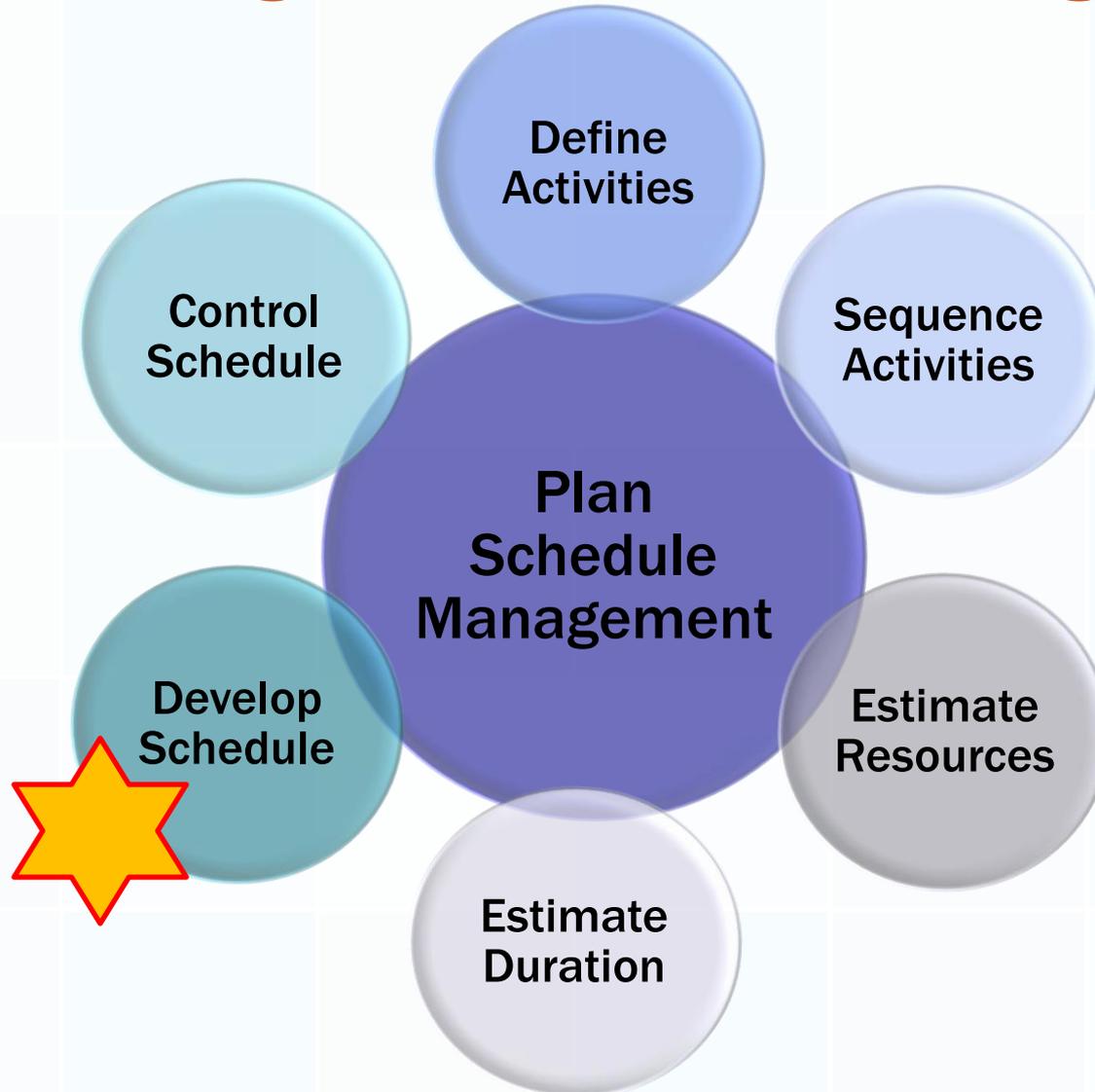
Tools & Techniques

- Expert Judgment
- Analogues Estimation, Parametric Estimating
- 3 Point Estimating, Group Decision Making
- Reserve Analysis

Output

- Activity Duration
- Project Documents Updates

Knowledge Area: Time Management



Develop Schedule: Overview

- **Planning process that creates a Project schedule**
 - **Integrates**
 - **Activities**
 - **Sequencing**
 - **Resources**
 - **Duration**
 - **Creates a schedule baseline**

Develop Schedule: Overview

- When you are done, it will answer
 - What/Which Activities Must be performed?
 - Activity List
 - In what order
 - Network Diagram / Dependencies
 - When can it be performed
 - Resource Availability
 - How long will it take
 - Activity Duration
 - May be iterative
 - Remember rolling wave planning
 - See the PMI Practice Standard for Scheduling

Develop Schedule: Inputs

- **Schedule Management Plan**
 - Identifies method, tools, & calculations
- **Activity List, Attributes,**
- **Project Schedule Network Diagrams**
 - Logical ordering
- **Resource Requirements, Calendars, Activity Duration Estimates**
 - Availability, quantitative durations
- **Scope Statement, Risk Register, Project Staff Assignments, Resource Breakdown Structure**
 - Assumptions & constraints
 - Risks that impact schedule
 - Details of resources
- **Enterprise & Organizational Assets**
 - Standards, templates, communication channels
 - Methodology, calendars

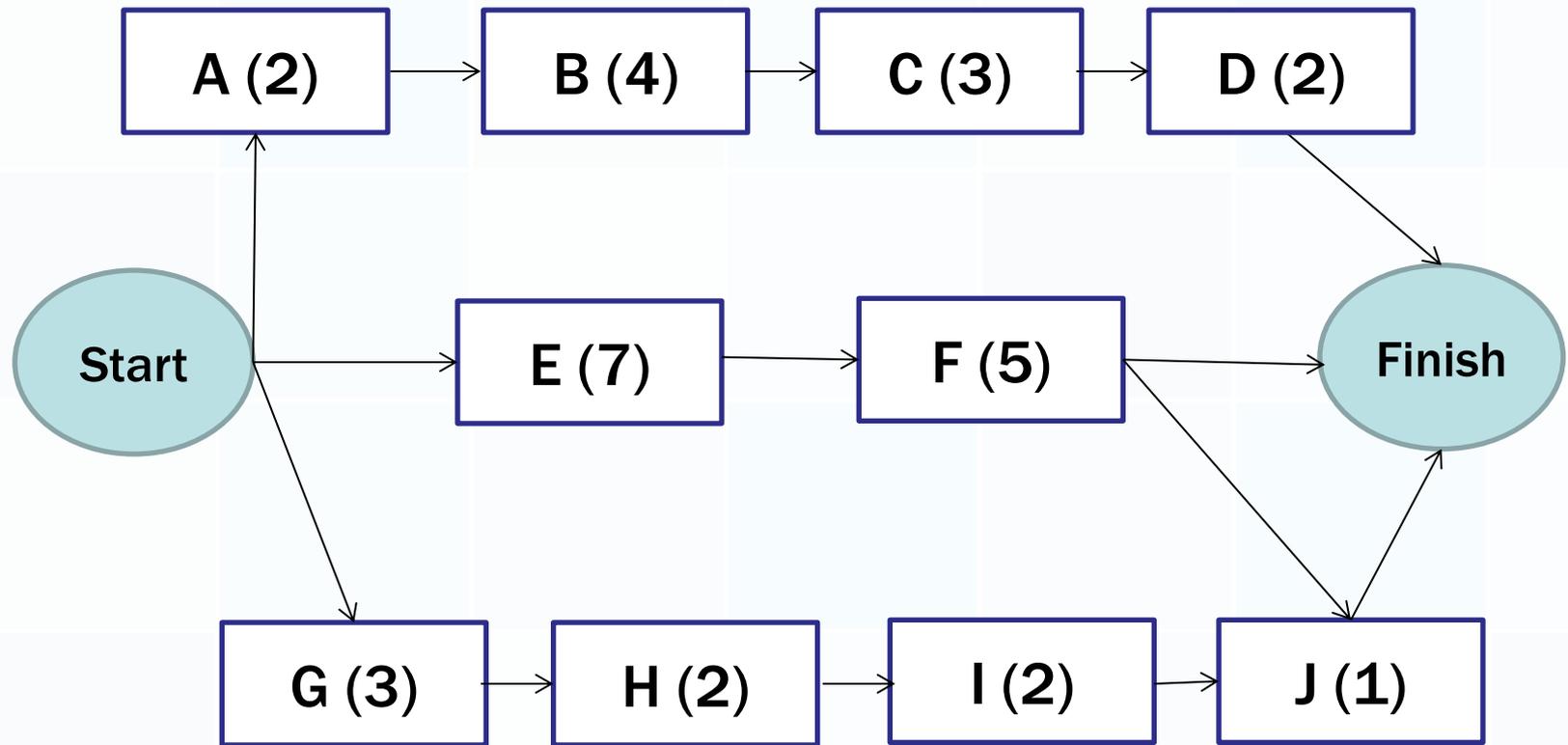
Develop Schedule: Tools & Techniques

■ Schedule Network Analysis

■ Uses the following techniques

- Identifies early and late start & finish dates
- Used for Critical Path Analysis
- Can be used for compressing, crashing, or fast tracking a schedule

Project Network Diagram (AKA Precedence Diagram)



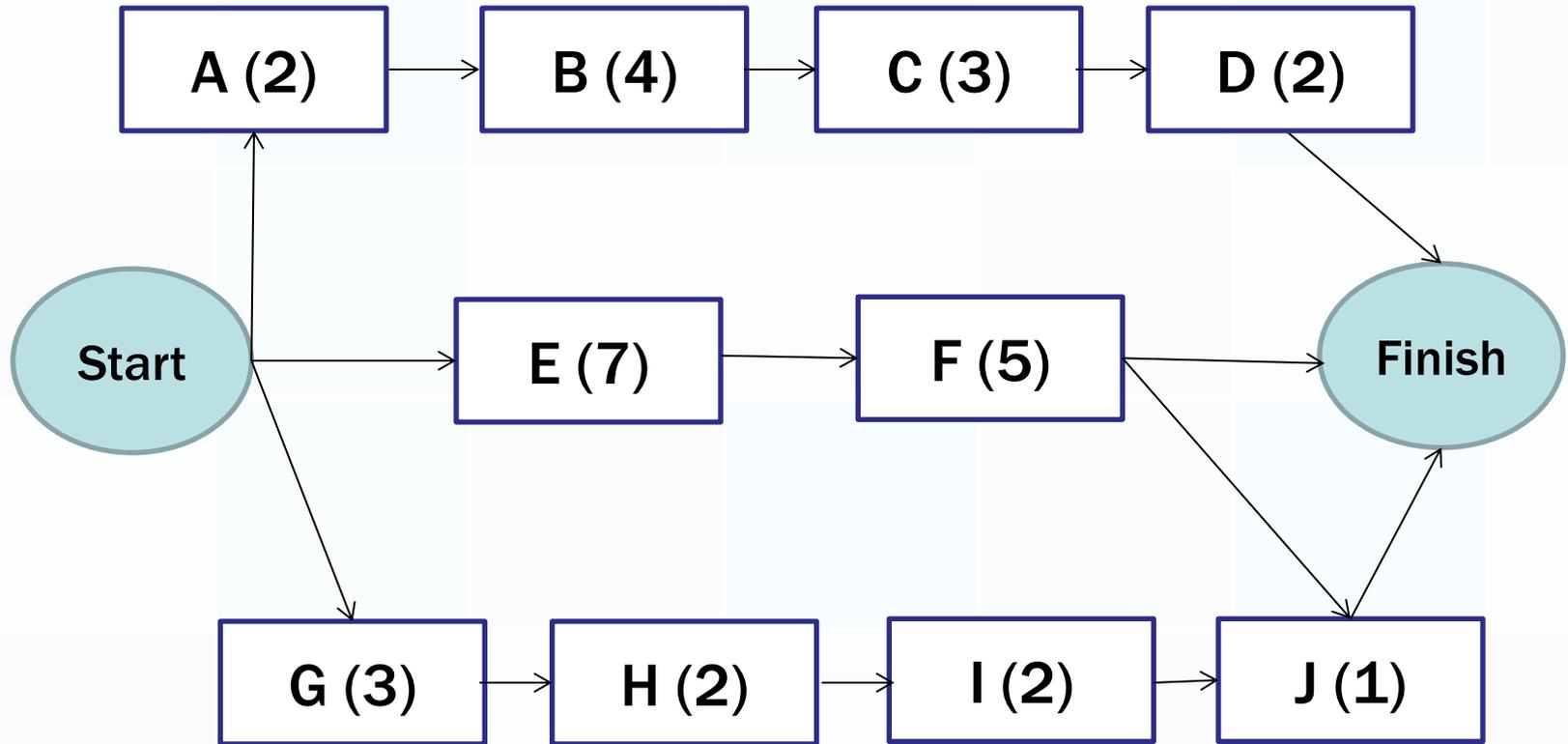
Rectangular nodes - Activity Node (Represents Activity)

Arrows - Represents Dependency.

(Activity J cannot start till both F and I are finished).

Numbers - Represent Units of Duration

Paths



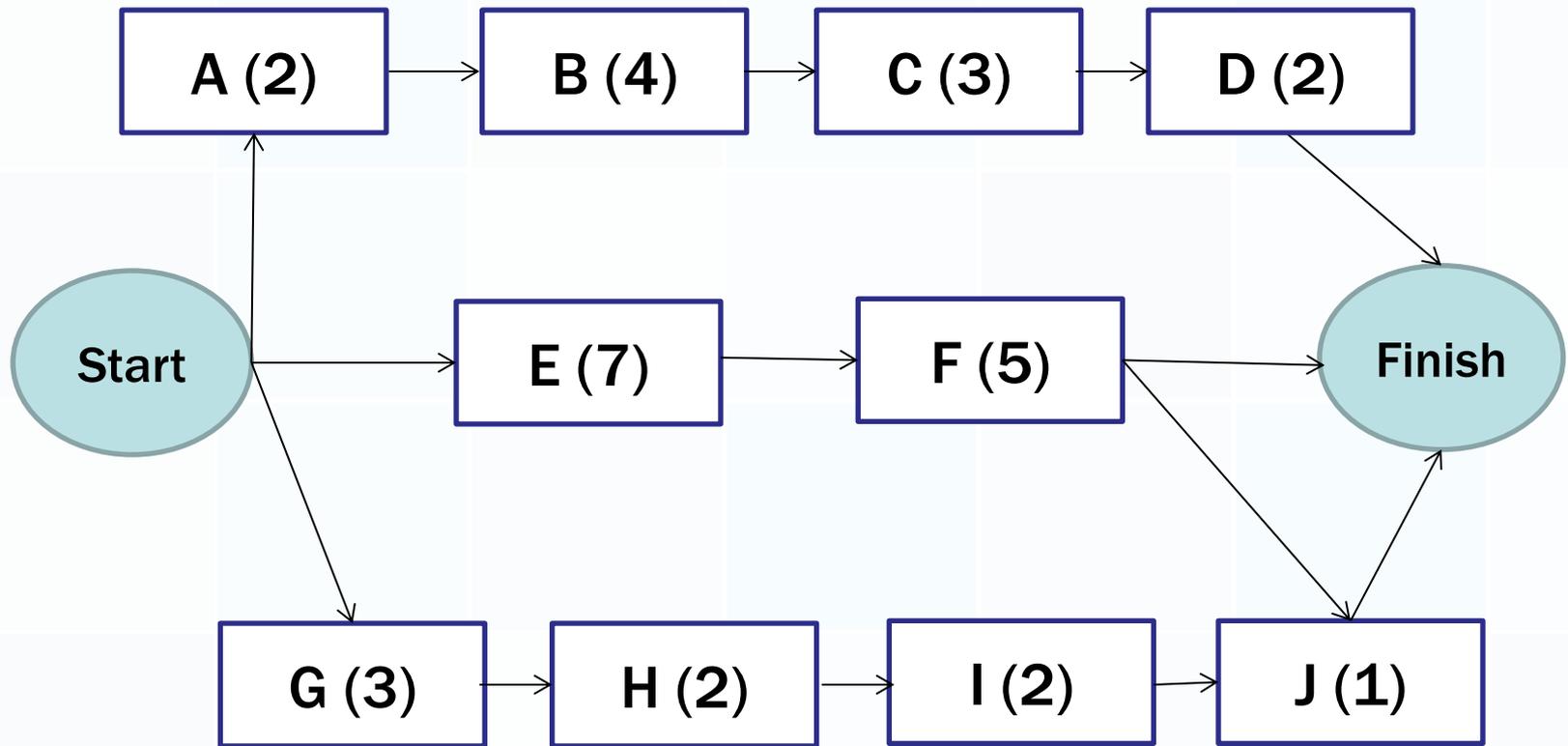
St - A - B - C - D - Fi

St - E - F - Fi

St - E - F - J - Fi

St - G - H - I - J - Fi

Critical Path



$$\text{St - A - B - C - D - Fi} = 2 + 4 + 3 + 2 = 11$$

$$\text{St - E - F - Fi} = 7 + 5 = 12$$

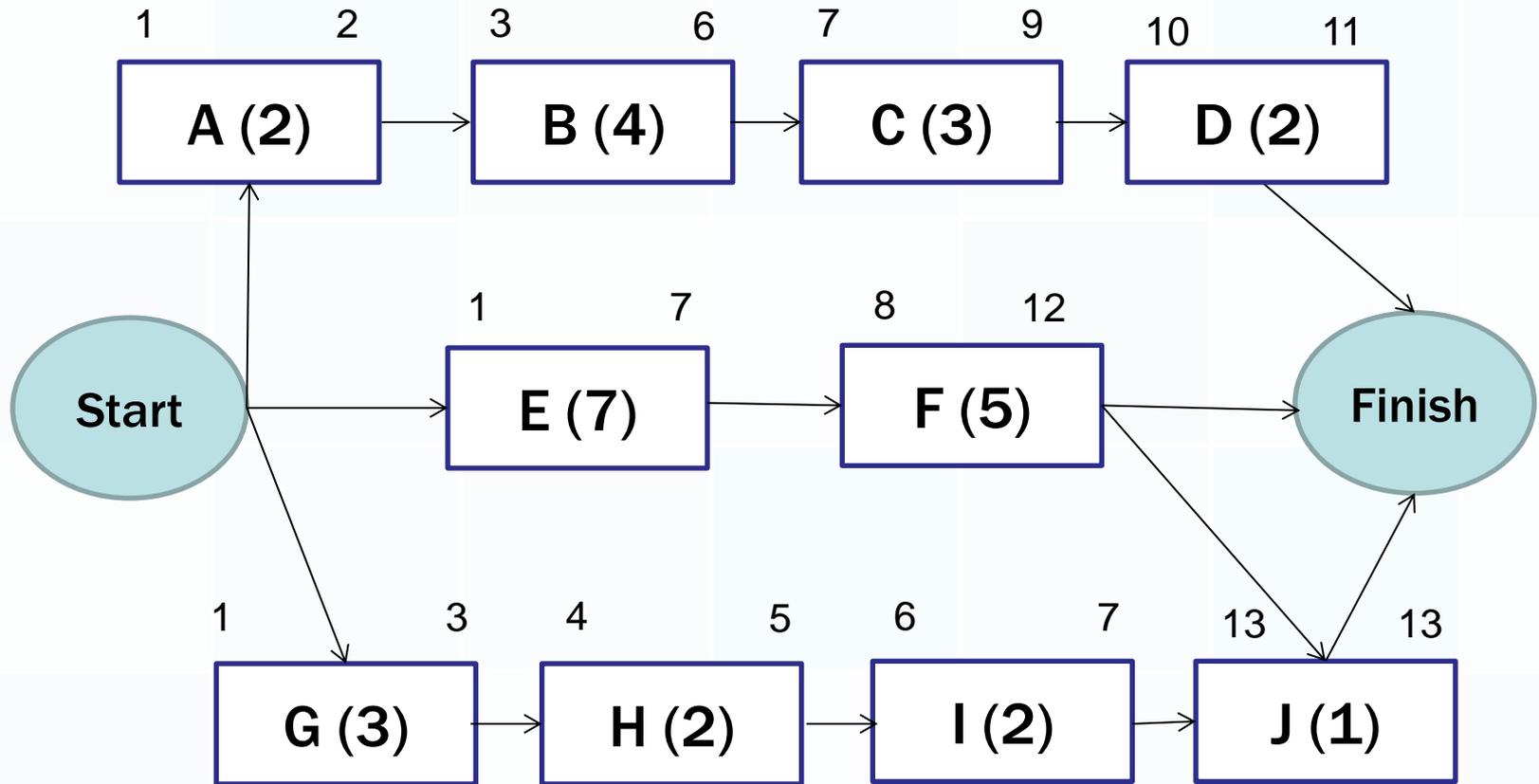
$$\text{St - E - F - J - Fi} = 7 + 5 + 1 = 13$$

$$\text{St - G - H - I - J - Fi} = 3 + 2 + 1 + 1 = 7$$

Early Start / Finish

- Calculate Early Start and Finish To Optimize the Schedule
- Early Start & Finish Reduces Risk & May Free Up Resources
- Early Start
 - Earliest possible start date for an activity to begin
- Early Finish
 - Earliest date a task could finish
- These are calculated by forward pass
 - Left to Right

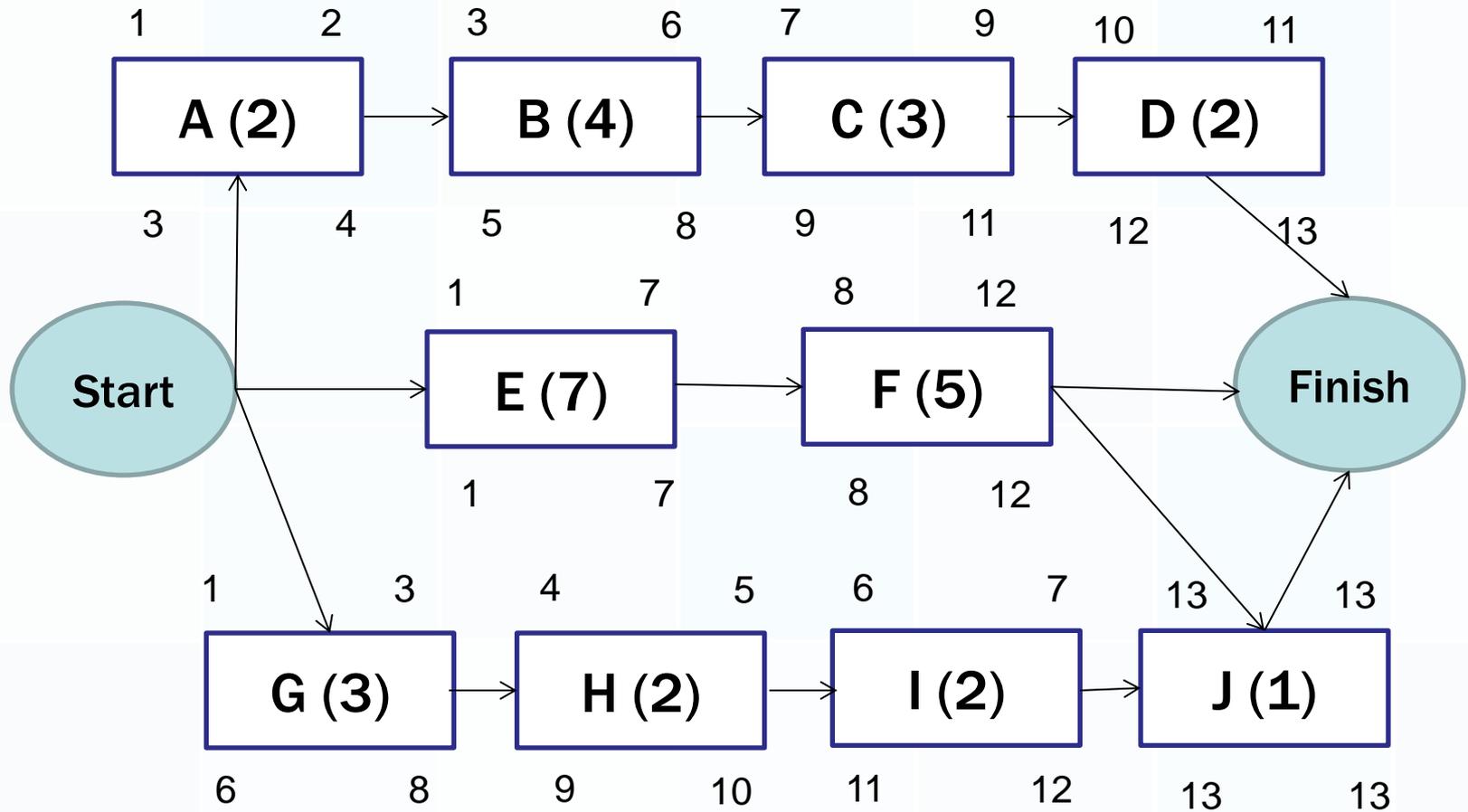
Early Start / Finish



Late Start / Finish

- Late Start & Finish Help Manage Delay Risk
- Helps to optimize your resources
- Late Start
 - Latest possible time a task can start without delaying subsequent tasks
- Late Finish
 - Latest possible date an activity could finish without delaying subsequent tasks
- These are calculated by Backward Passes
 - Right to Left

Late Start / Finish



Float

■ Float or Total Float

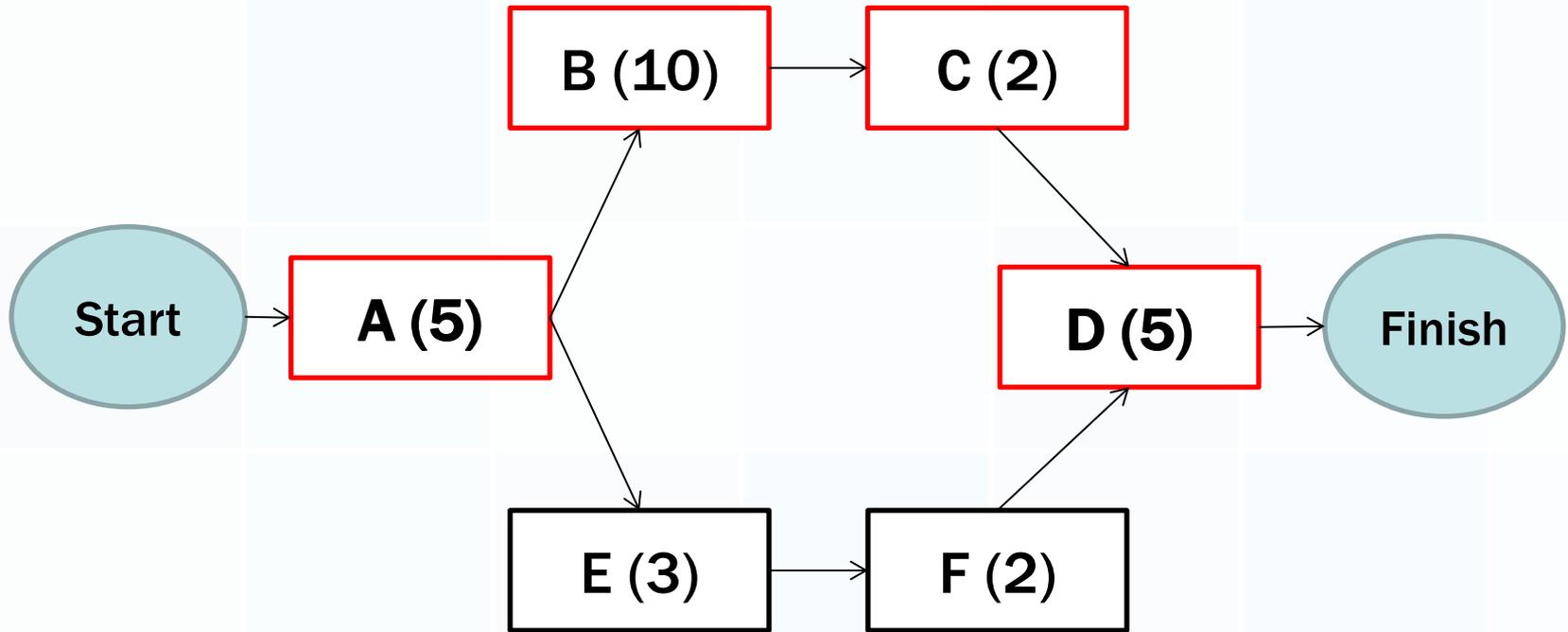
- Total float is the amount of time that an activity can be delayed without delaying the project completion date.
- On a critical path, the total float is zero.
- $TF = \text{Duration}_{\text{Critical Path}} - \text{Duration}_{\text{Non-Critical Path}}$
- $TF_{\text{Activity}} = (\text{Late Finish} - \text{Early Finish})$.

■ Free Float

- Free float is the amount of time that an **ACTIVITY** can be delayed without delaying the Early Start of its successor activity.

$$\text{■ } FF_{\text{Activity}} = ES_{\text{Next Activity}} - EF_{\text{Activity}} - 1$$

Float Example



St – A – B – C - D - Fi = 22 Days (Longest & Hence Critical Path)

St – A – E – F – D - Fi = 15 Days

Total float on Path_{AEFD} = 22 - 15 = 7 Days

Homework – Figure out Free Float for activities in the next section

Develop Schedule: Tools & Techniques

■ Critical Path Method

- A technique for determining the longest path in your schedule
- Critical to manage the tasks on the critical path closely to deliver project on schedule
- By shortening the critical path, project duration can be improved

Critical Path

- Called critical because if one activity slips, the project finish will be delayed
- Tasks on these paths pose the greatest risks to the overall schedule and hence need special attention
- There can be more than one critical path
- As the project progresses, critical path could change

Issues with Critical Path

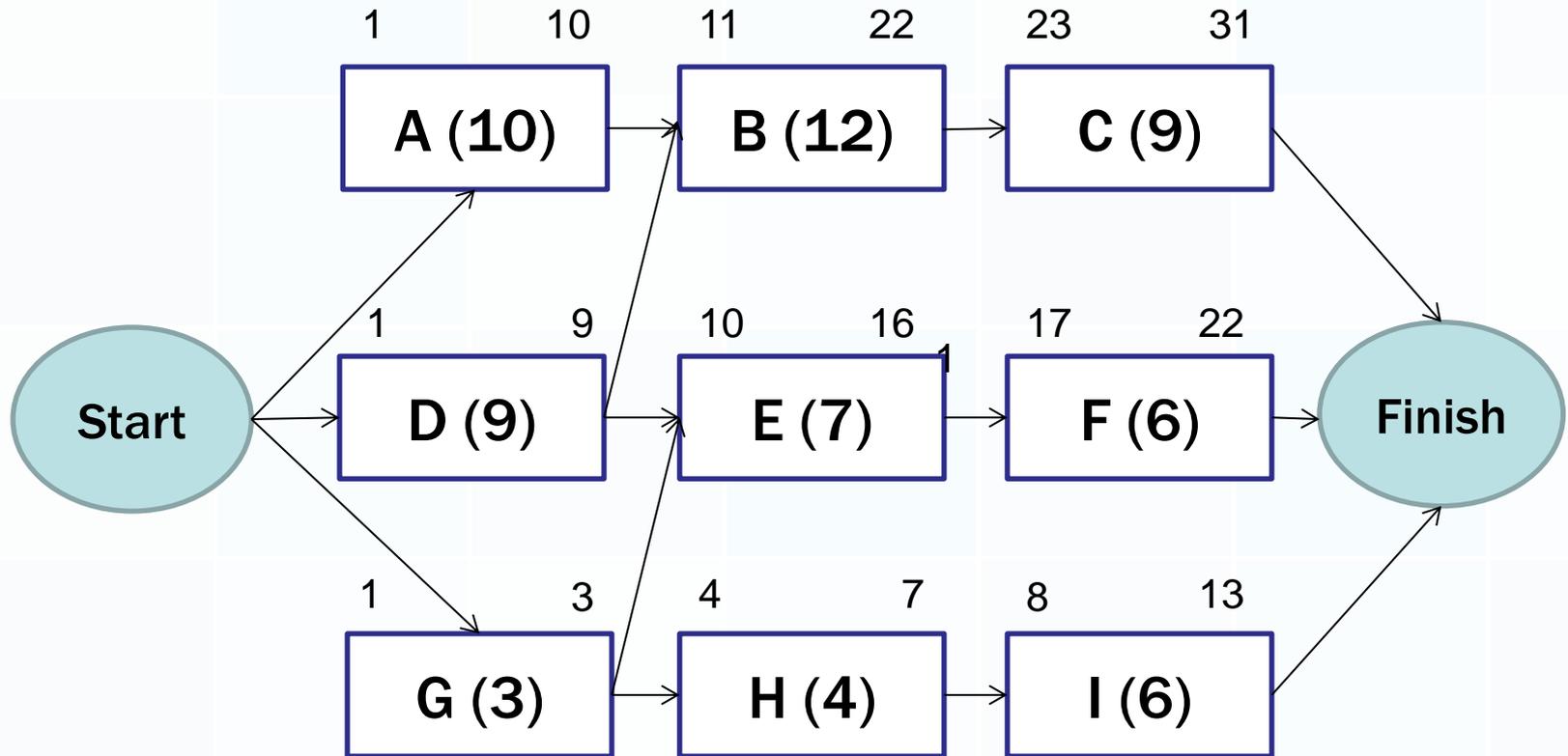
- **Assumes unlimited resources**
 - All resources are available all the time
 - Managing resources may be difficult due to other activities
 - Very optimistic way of managing scheduling
- **Misuse of float and slack**
 - Parkinson's law – Work expands to fill the available time!
 - Team members misuse slack and float
- **Delays accumulate, but Gains do not**

Develop Schedule: Tools & Techniques

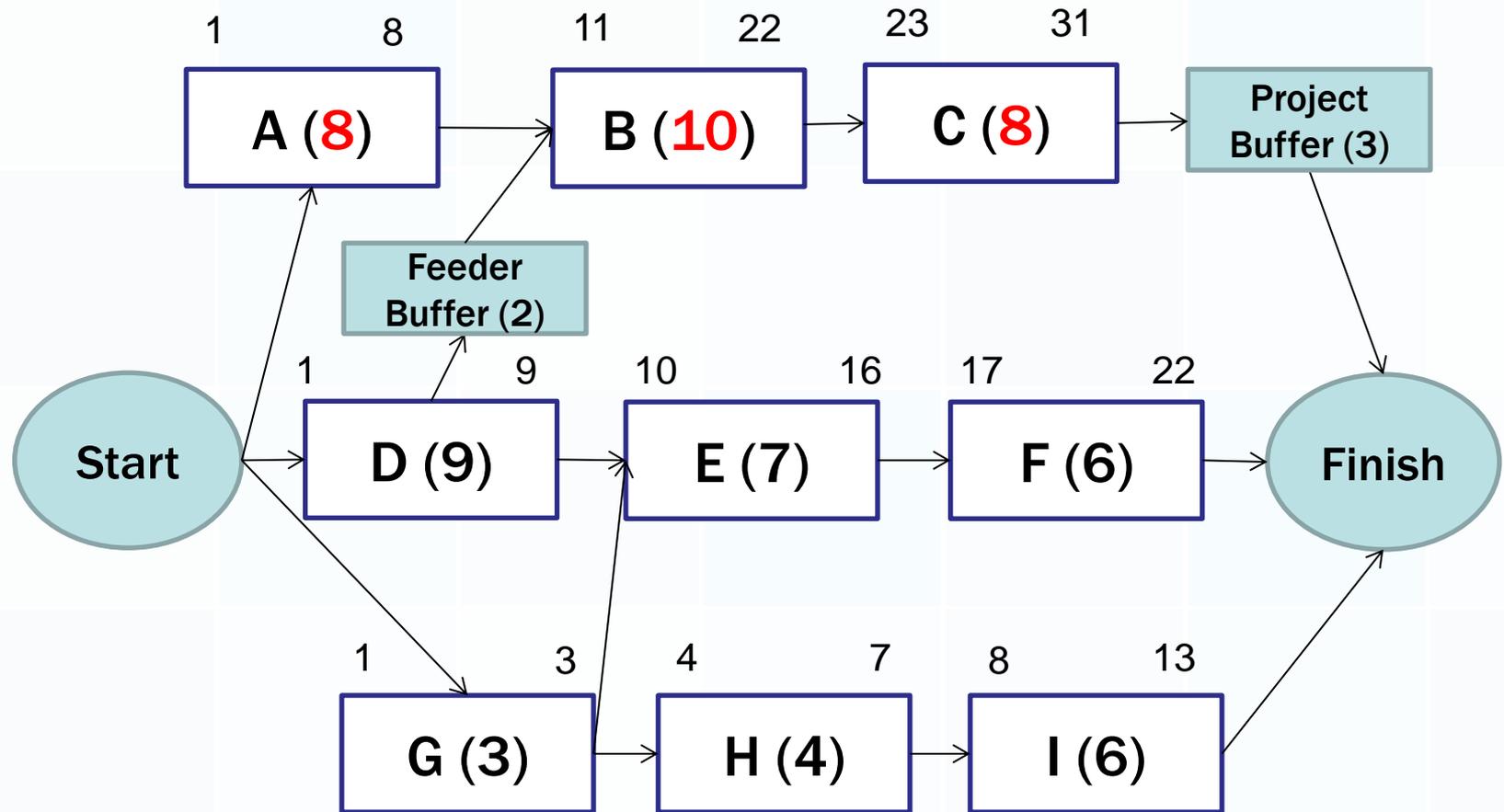
■ Critical Chain Method (CCM)

- **Buffers - Duration (“Non-Activity”)** buffers are added to manage uncertainty
 - Project buffer is at the end of the critical path
 - Usually you take 50% of time for contingency built into each task and build the buffer
 - Saves overall Schedule time Resource
 - Feeder buffers added to non-critical to critical path chain of activities (non-critical path activity feeds into critical path)
 - Feeding Buffers protect critical chain from slippage along the feeding chains
 - Resource buffers – Dummy activities with resources allocated
- Manage time remaining in buffers
- Improves probability of On-Time delivery

CCM: Buffers (Before)



CCM: Buffers (After)

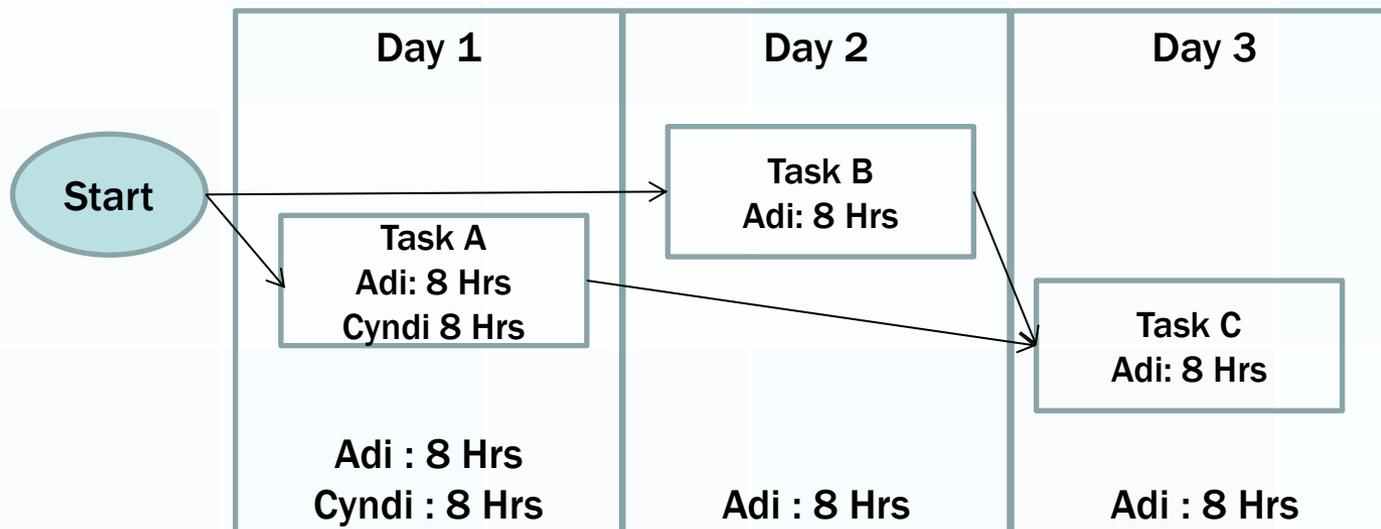
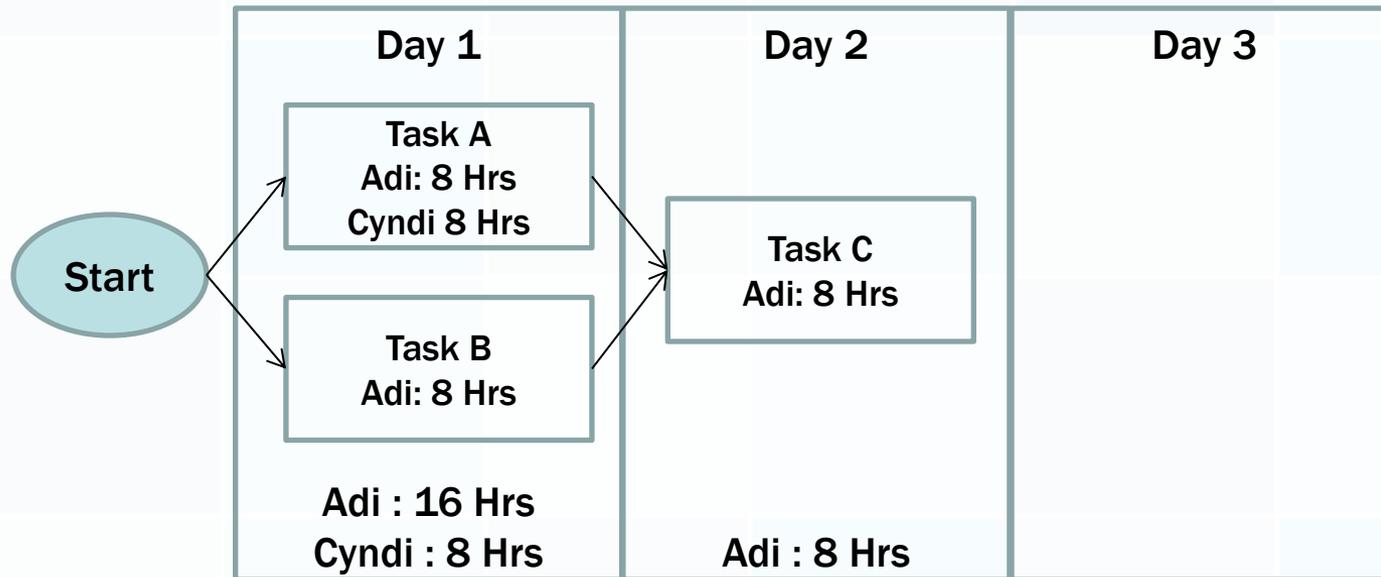


Assumes a contingency of 20%

Develop Schedule: Tools & Techniques

- **Resource Optimization Techniques**
 - **Resource Levelling** – Adjust the schedule dates to balance demand for shared or critical resources
 - May lengthen critical path
 - Reduces risk
 - **Resource Smoothing** – Adjust the schedule model for each activity to stay below predefined resource limits
 - Maintains critical path
 - Completion date is not changes
 - Activities are delayed only within their Float.

Develop Schedule: Resource Levelling



Develop Schedule: Tools & Techniques

■ Modeling “What If” Analysis

- Process of evaluating scenarios in order to predict their effect.
- Network analysis is performed to compute different scenarios
 - Differing resource loading or constraints
 - Differing equipment delivery times

■ Modeling “Simulation” Analysis

- Calculate multiple project durations with different assumptions and probability distributions (e.g. different 3 point estimates)
- Monte Carlo simulation – Common technique

Develop Schedule: Tools & Techniques

■ Leads & Lags

- Refinements during network analysis to adjust start times of successor tasks
- Leads advance a successor activity
- Lags are used when a set time elapses that does not impact resources or work

Develop Schedule: Tools & Techniques

■ Crashing

■ Schedule compression technique by increasing resources

- Use 3 painters instead of 1 to finish the job early

■ Issues of Crashing

■ Some tasks cannot be compressed

- Give an e.g.

■ Usually increases costs as returns are not linear

■ Increases communication and other overhead

■ Sometimes may increase the schedule

- Mythical man month

- Give an e.g.

Develop Schedule: Tools & Techniques

■ Fast Tracking

- Compressing of schedule by performing activities in parallel that otherwise would have been done in sequence
 - Instead of painting 1 wall at a time, paint 2 walls at a time
 - May be constrained by resources (why the e.g., above will not work)
 - Code in parallel while design is in progress using draft design document
 - Develop User Manuals while user interface design is in progress using draft design document
- Increases risk
- May increase cost if there is rework
- May impact schedule due to rework
- Takes a lot more co-ordination and configuration control

Develop Schedule: Outputs

■ Project Schedule

- Gantt Charts, Network Diagram, Milestone Charts

■ Schedule Baseline

- Schedule placed under change control
- Compare to actual results to respond to variances
- Component of project management plan

■ Schedule Data

- Used to describe and control the schedule
- Resource requirements by time
- Scheduling of contingency reserves
- Alternate views: best case, worst case

Develop Schedule: Outputs

- **Project Calendars**
 - Working days and shifts
 - Shows available times vs. unavailable times
 - May be useful to have more than one calendar
- **Project Management Plan and Project Documents Updates**
 - Schedule baseline or management plan
 - Risk register, activity attributes, resource requirements

Schedule Development: Summary

Inputs:

- Schedule Management Plan, Activity List, Activity Attributes
- Activity Resource Requirements, Resource Calendars
- Activity Duration Estimates, Resource Breakdown Structure
- Project Network Diagram, Scope Statement, Risk Register
- Project Staff Assignments, Enterprise, Organizational

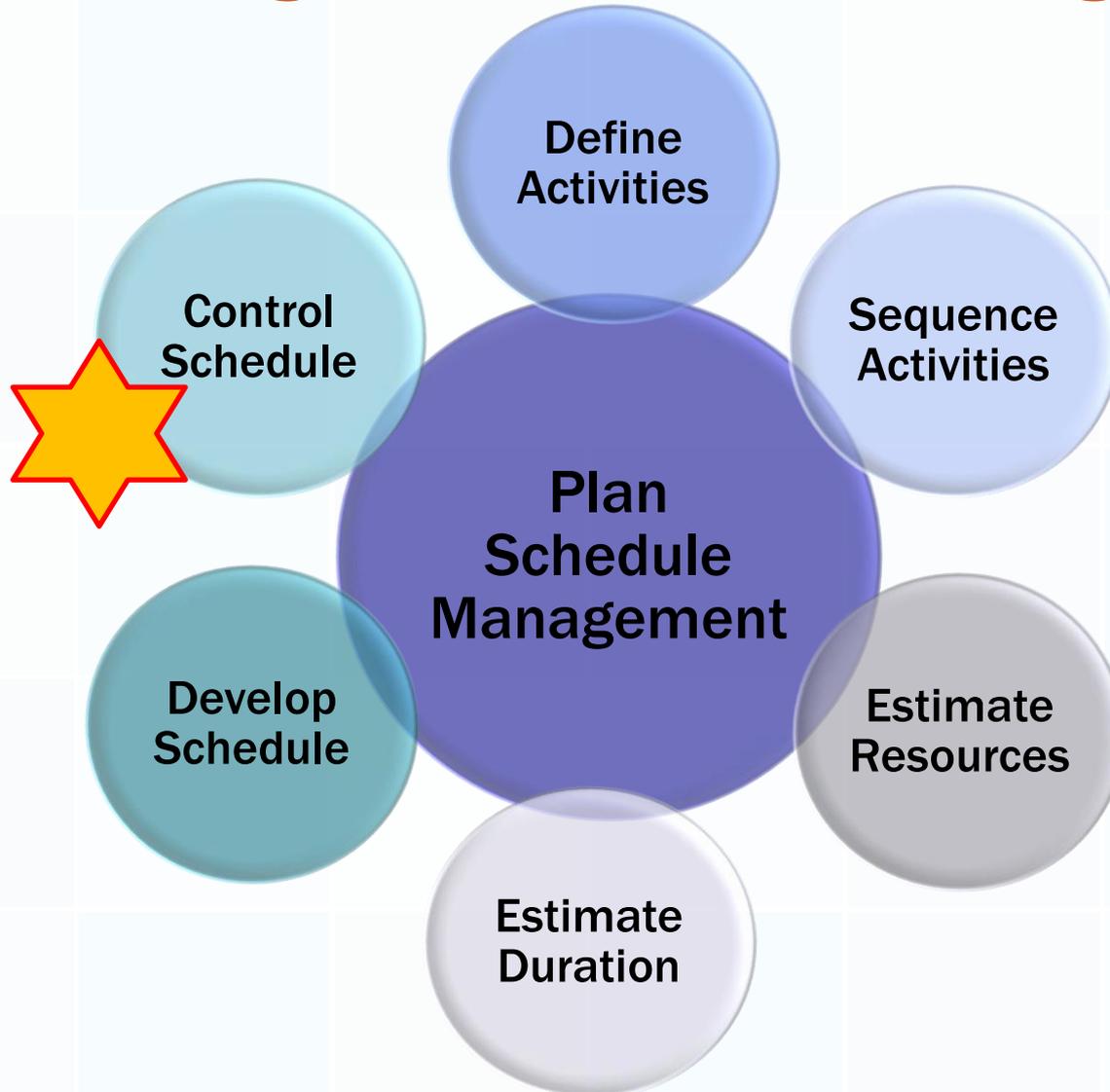
Tools & Techniques

- Schedule Network Analysis,
- Critical Path Method, Critical Chain Method
- Resource Optimization Techniques, Modeling Techniques,
- Leads and Lags, Schedule Compression, Scheduling Tool

Output

- Project Schedule, Baseline
- Schedule Data, Project Calendars,
- Project Management Plan Updates
- Project Document Updates

Knowledge Area: Time Management



Control Schedule: Overview

- **Monitoring and controlling process**
 - **Proactive**
 - Monitor for variance
 - Recognize that change is occurring
 - Influencing the factors that create change
 - A good project manager knows how to do this!
 - **Reactive**
 - A mediocre project manager is always in this mode
 - Take corrective actions
 - Manage changes and change requests
 - To manage changes, follow schedule management plan
 - Closely related to change management

Control Schedule: Inputs

- **Project Management Plan**
 - Contains baseline, how schedule will be managed
- **Project Schedule**
 - Most recent version, percent complete, updates, in progress or not started activities
- **Work Performance Data**
 - Actual start, elapsed or remaining duration
- **Project Calendars**
 - Use to calculate forecasts based on past results
- **Schedule Data**
- **Organizational Process Assets**
 - Schedule policies & procedures, schedule tools, reporting templates

Control Schedule: Tools & Techniques

■ Performance Reviews

- Showing how the project is performing against the plan/schedule
- Trends, Comparing actual progress against the critical path
- Critical chain compares remaining buffer against needed buffer

■ Root cause for deviations from plan

- Cause and Effect diagram – Fishbone/Ishikawa
- Pareto charts
- Flowcharts
- Scatter diagrams
- Checklists
- Control charts

Control Schedule: Earned Value

- **Schedule Performance Index (SPI)**
- **$SPI = EV \div PV$ (usually expressed in \$\$)**
 - **EV = Earned Value = Actual % Complete * BAC**
 - **PV = Planned Value = Planned % Complete * BAC**
 - **BAC = Budget At completion**
 - **E.g., Task A takes 10 days by one programmer Costing \$100/day.**
 - **BAC = \$1000 (or 10 Days)**
 - **Day 4 Planned Value is \$400 (or 4 Days)**
 - **At day 4 if the % complete is 30% EV = \$300 (Or 3 Days)**
 - **SPI on day 4 = $300/400$ (or $3/4$) = 0.75**
 - **We are performing at 75% efficiency**
 - **SPI less than 1 is bad**
 - **SPI 1 or above are good**

Control Schedule: Earned Value

- **Schedule Variance (SV)**
- **$SV = EV - PV$ (Also expressed as \$\$)**
 - $300 - 400 = -100$ (or $3 - 4 = -1$)
 - Negative SVs are bad
 - Zero or Positive SVs are good
- **There are other EV calculations**
 - Out of scope for this session

Control Schedule: Tools & Techniques

- **Project Management Software**
 - Tracks planned vs. actual
 - Reports variances with helpful graphics
 - Forecast the effects of changes
- **Resource Optimization**
 - Scheduling resources to take advantage of their availability and project time
- **Modeling**
 - Review various scenarios
 - Risk Mitigation
 - Bring the schedule model in line with baseline and project management plan
- **Lead and Lags**
 - Adjustments
 - Starting tasks early
- **Schedule Compression**
 - Bring activities back into alignment
 - Use buffers
 - Add resources
 - Reduce scope
- **Scheduling Tool**
 - Updates to schedule model
 - Visual or graphic warnings of variances

Control Schedule: Outputs

- **Work performed (% Complete)**
 - Schedule Performance Index
 - Schedule Variance (SV)
 - Communication to stakeholders
- **Schedule forecasts**
 - Based on the current status (Work efficiency), when will the project milestones be accomplished?
 - At what efficiency do we need to run to bring the schedule back on track?
- **Corrective actions**
 - Change approach
 - Change personnel
 - Others (Participants to list!)
- **Change Requests**
 - Change happens!
 - Approved through governance
 - May react to beneficial or harmful change
 - May course correct to avoid or mitigate risk
- **Project Management Plan & Documents Updates**
 - Approved changes may change baseline
 - Schedule management plan
 - New Baseline(s) (Schedule, Cost)
- **Organizational Process Updates**
 - Lessons learned

Control Schedule: Summary

Inputs:

- Project Management Plan, Project Schedule
- Work Performance Data, Schedule Data
- Project Calendars, Organizational Process Assets

Tools & Techniques

- Performance Reviews
- Project Management Software, Scheduling Tool, Schedule Compression
- Resource Optimization & Modeling Techniques
- Leads & Lags

Output

- Work Performance Information
- Schedule Forecasts
- Change Requests
- Organizational Process Assets Updates
- Project Management Plan and Project Documents Updates

Extra Learning

■ PMI

- http://www.pmi.org/passport/mar09/passport_mar09_seven-tips-on-how-to-build-a-solid-schedule.html

- <https://www.youtube.com/watch?v=LYusPqtEYJc>

- http://www.cio.ca.gov/Government/IT_Policy/SIMM_17/

- Your friends & co-workers

Closing Thoughts

- **Project Management is a Science**
 - Science of PM as described in PMBOK
- **Actually Managing a Project is an Art**
 - Few things that might make for a successful PM are;
 - Domain Knowledge
 - Instinct to spot the risks and take preemptive actions
 - Keen sense to spot the critical tasks/items to address in a project
 - Good communications
 - Foster good teamwork.
 - Keep the stakeholders engaged and motivated
 - Be the “Leader” or the “Strategic one”
 - Planning alone will not get you there, but it is great Start!

Questions



One Last Thought...

*The best time to plant a tree
is twenty years ago. The
second best time is now.*

- Chinese Proverb