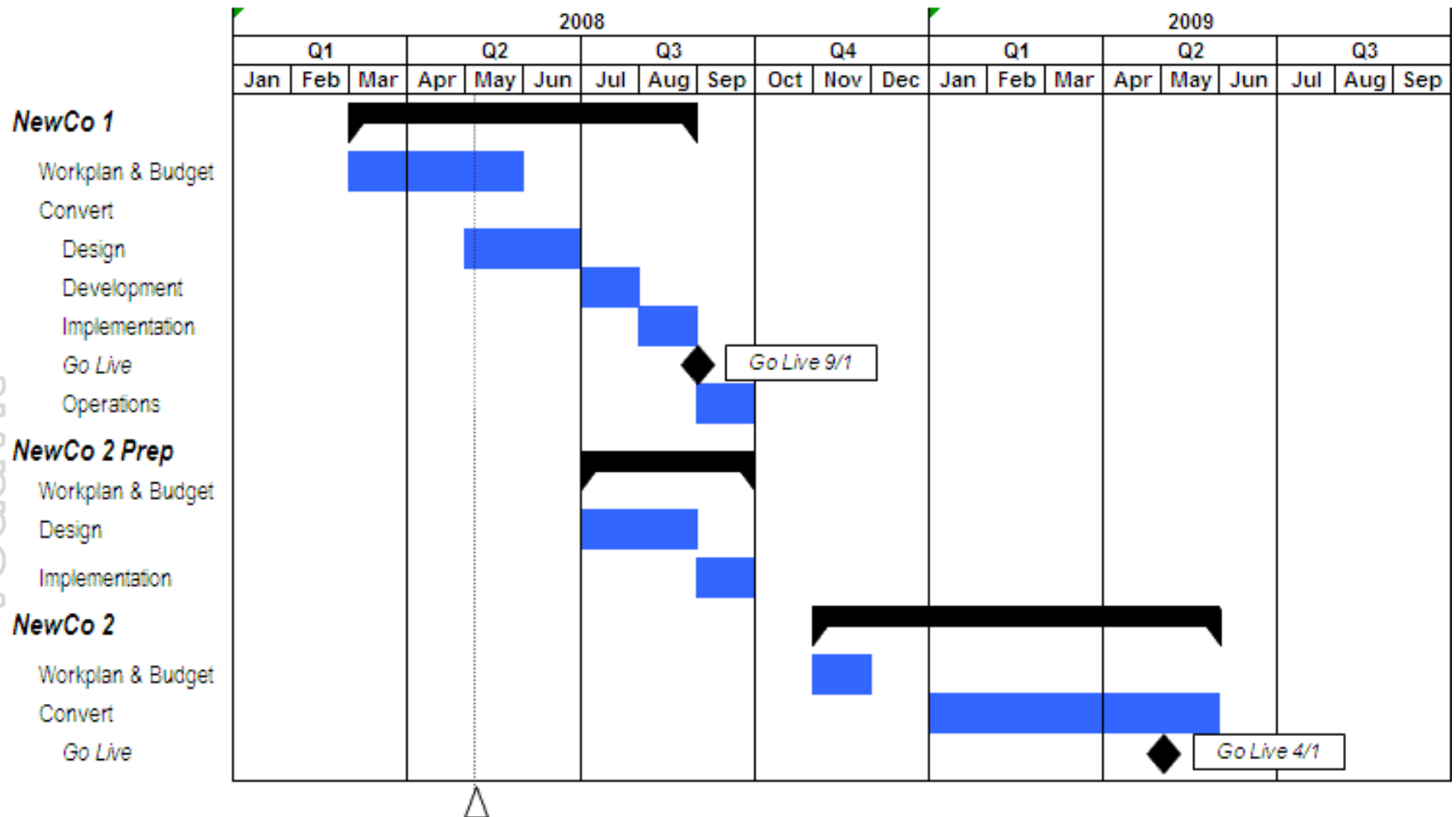


Project Time Management

Project Time Management



Project Time Management

“Doing your project without a plan is like watching television with someone else holding the remote control”- Peter Turla

"The bad news is time flies. The good news is you're the pilot." - Michael Altshuler

"I made this letter longer than usual because I lack the time to make it shorter." – Pascal

“Time is a great teacher, but unfortunately it kills all its pupils.” - Hector Louis Berlioz

Project Time Management



Definition

Processes required to manage timely completion of the project.



Project Time Management

- 13. Plan Schedule Management [PLANNING]
- 14. Define Activities [PLANNING]
- 15. Sequence Activities [PLANNING]
- 16. Estimate Activity Resources [PLANNING]
- 17. Estimate Activity Durations [PLANNING]
- 18. Develop Schedule [PLANNING]
- 19. Control Schedule [M&C]

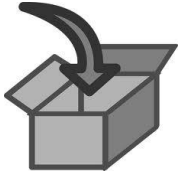
13. Plan Schedule Management



Definition

Establishing the policies, procedures and documentation for planning, developing, managing, executing, and controlling the project schedule

Plan Schedule Management



1. Project Management Plan
2. Project Charter
3. Enterprise Environmental Factors
4. Organization Process Assets



1. Expert Judgement
2. Analytical techniques
3. Meetings



1. Schedule Management Plan

Schedule Management Plan

It includes

- Scheduling tools to be used
- Level of accuracy
- Units of measure for each resource
- Organizational procedure links
- Process of updating the progress in schedule model
- Control thresholds
- Rules of performance measurement (baselines, %complete, fixed formula etc.)
- Define scheduling reporting format

14. Define Activities



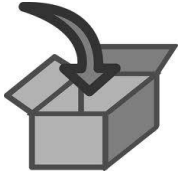
Definition

Identifying the specific actions to be performed to produce the project deliverables

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**Define
Your Own
road
in Life.**

Define Activities



1. Schedule Management Plan
2. Scope Baseline
3. Enterprise Environmental Factors
4. Organization Process Assets



1. Decomposition
2. Rolling Wave Planning
3. Expert Judgement

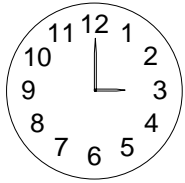


1. Activity List
2. Activity Attributes
3. Milestone List

Activity Attributes

- Dependency
- Location of performance
- Type of dependency
- Level of efforts (work contour)
- Efforts required
- Related Deadline
- Related WBS account
- Critical activity
- Type of task (fixed duration, resources, work)
- Resource & skills required
- Duration
- Lead & Lag

Discussion/Exercise 12



5 Minutes

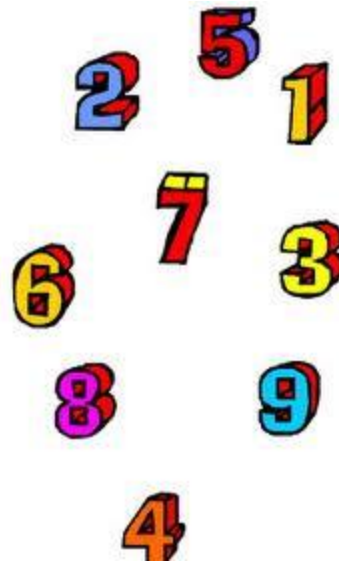
- **Write activities & their attributes for previously created 2 level WBS for your project**

15. Sequence Activities



Definition

Identifying and documenting relationships among the project activities.



Sequence Activities



1. Schedule Management Plan
2. Activity List
3. Activity Attributes
4. Milestone List
5. Project Scope Statement
6. Enterprise Environmental Factors
7. Organization Process Assets

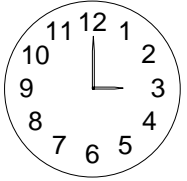


1. Precedence Diagramming Method
2. Dependency Determination
3. Leads and Lags



1. Project Schedule Network Diagrams
2. Project Documents Updates

Discussion/Exercise 13

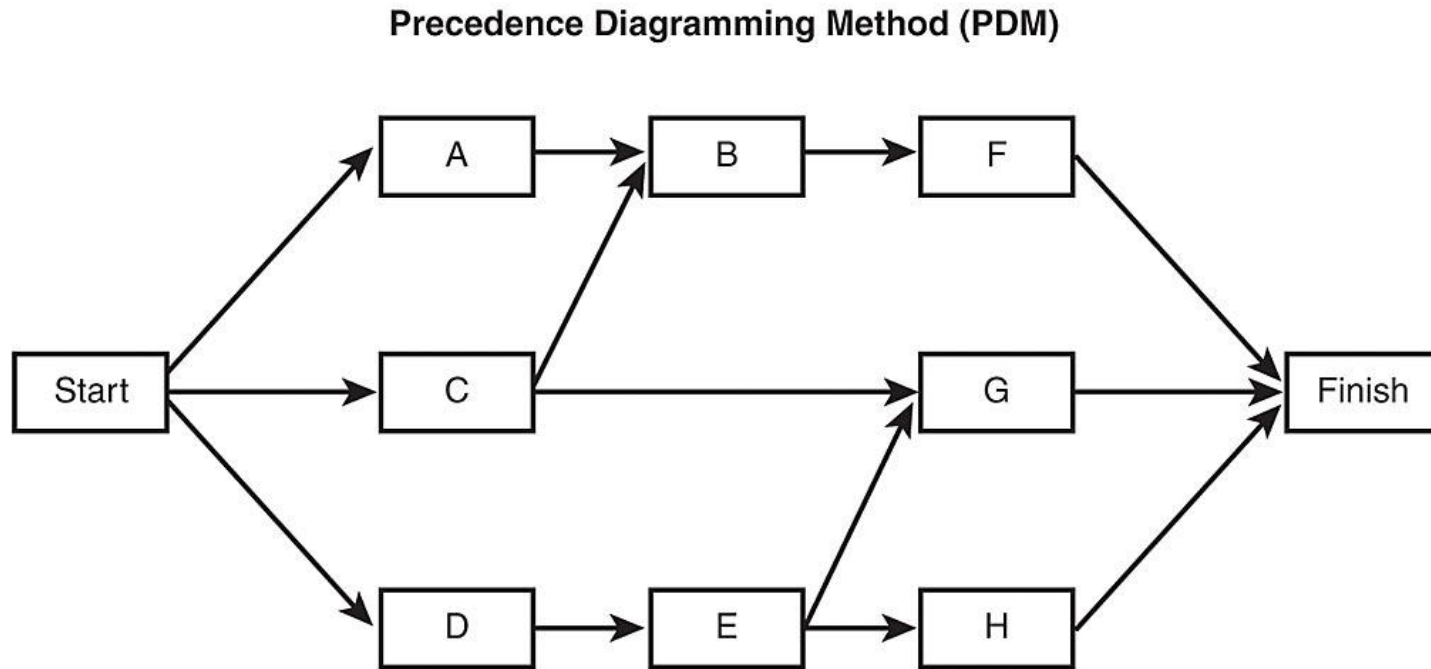


2 Minutes

- **Sequence Previously activities of your project write FS, SF, FF, SS after the activities**
- **FS- (Finish first to start the next) Documentation – Review**
- **FF- (Finish next to finish the previous) Documentation & Product**
- **SF- (Start next to finish the previous) Shift working environment, changing mortar**
- **SS- (Start next to start previous) Listening & Speaking, Start meeting & Start a topic to discuss**

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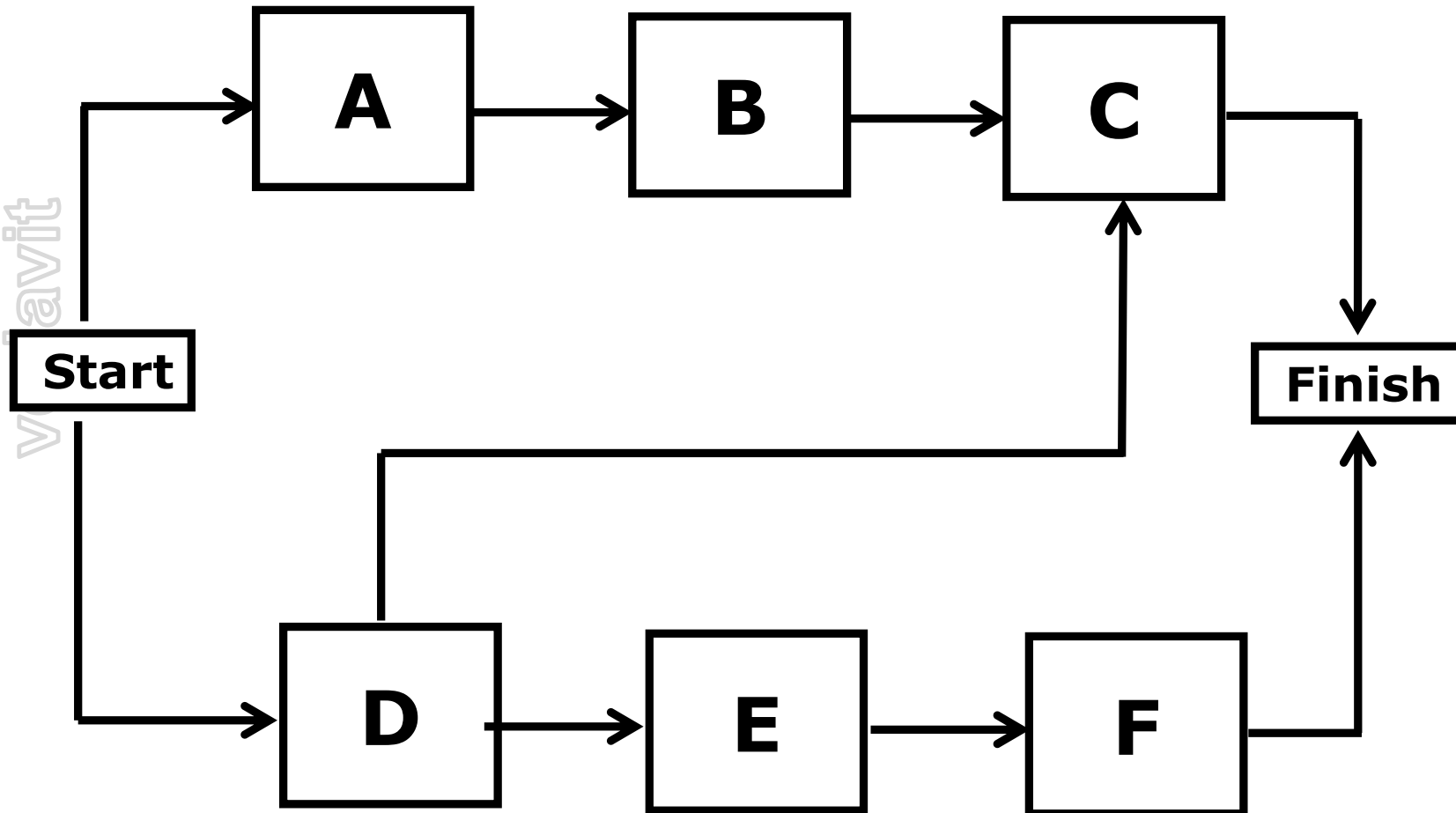
Precedence Diagramming Method (PDM)



Also known as Activity on Nodes (AON)

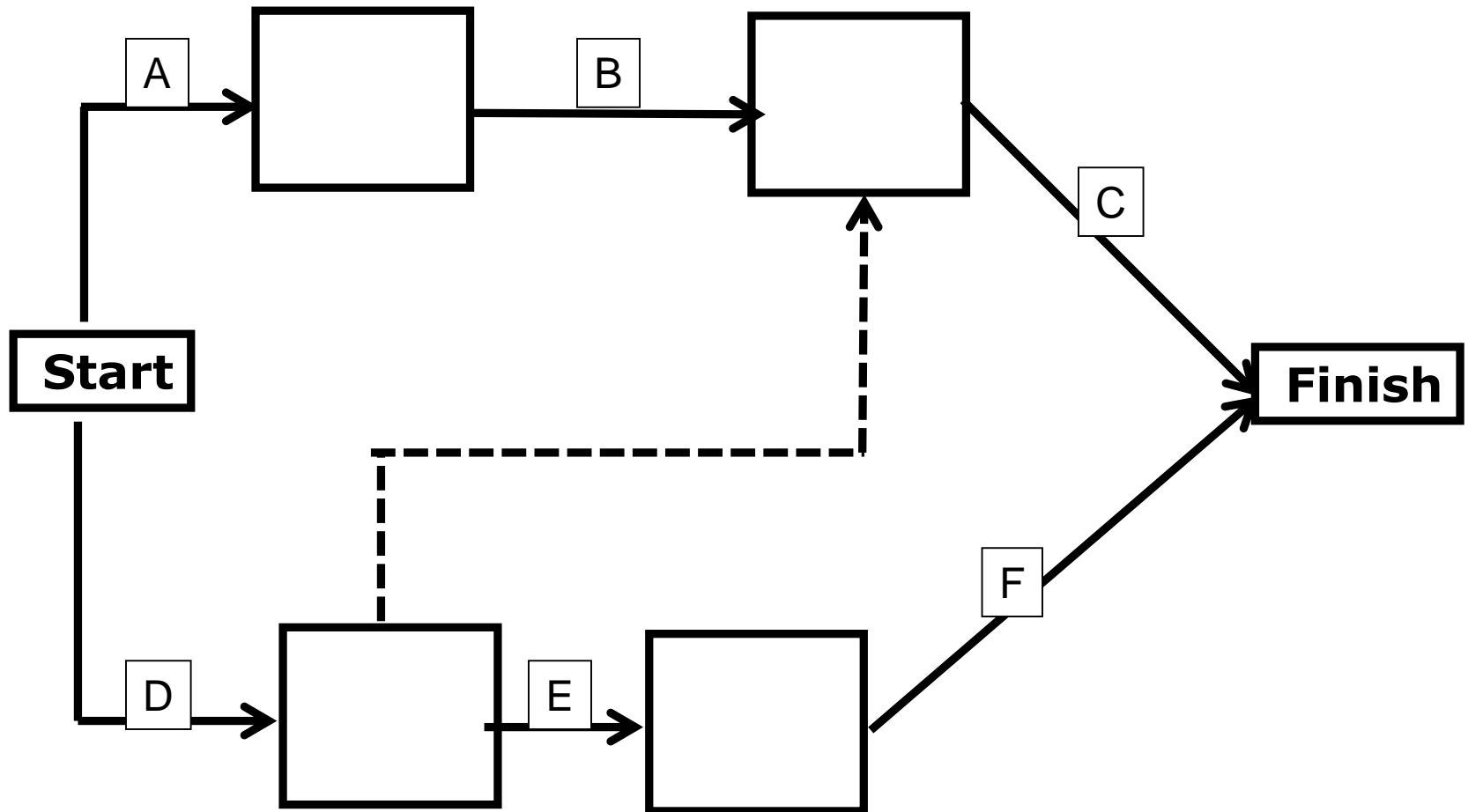
Network Development

Precedence Diagramming Method (AON)



Network Development

Precedence Diagramming Method (AOA)

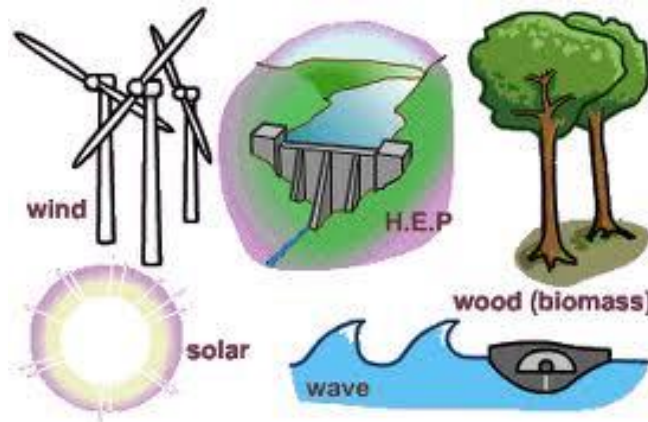


16. Estimate Activity Resources



Definition

Estimating the type and quantities of material, people, equipment or supplies required to perform each activity.



Estimate Activity Resources



1. Schedule Management Plan
2. Activity List
3. Activity Attributes
4. Resource Calendars
5. Risk Register
6. Activity Cost Estimates
7. Enterprise Environmental Factors
8. Organization Process Assets



1. Expert Judgement
2. Alternatives Analysis
3. Published Estimated Data
4. Bottom-up estimating
5. Project Management Software

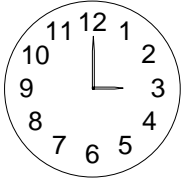


1. Activity Resource Requirements
2. Resource Breakdown Structure
3. Project Documents Updates

Resource Breakdown Structure

Project ABC RBS												
Labor										Material	Expenses	
PM (1)	Config Mgmt		Technical Leadership			Dev Team			Test Team			
	Config Mgr	Release Mgr	Arch (1)	UIExpert (1)	DBA (1)	Sr.Dev (4)	Jr.Dev (3)	TL (1)	Test Mgr	Tester (4)	Laptop (10 Units)	Procurement Team
											Desktop (Units)	Systems Team
											Leaseline (2 Mbps)	Travel Cost (3 People)
											Servers (2 Units)	Boarding Lodging Cost (60 Days)
												HR

Discussion/Exercise 14



2 Minutes

- **Estimate Activity Resources for previously sequenced activities of your project**

17. Estimate Activity Durations

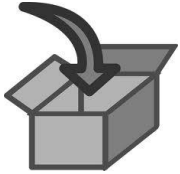


Definition

Approximating the number of work periods needed to complete individual activities with estimated resources.



Estimate Activity Durations



1. Schedule Management Plan
2. Activity List
3. Activity Attributes
4. Activity Resource Requirements
5. Resource Calendars
6. Project Scope Statement
7. Risk Register
8. Resource Breakdown structure
9. Enterprise Environmental Factors
10. Organization Process Assets



1. Expert Judgement
2. Analogous Estimating
3. Parametric Estimating
4. Three-point estimates
5. Group Decision Making Techniques
6. Reserve Analysis

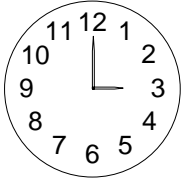


1. Activity Duration Estimates
2. Project Documents Updates

PERT – Program Evaluation and Review Technique

- PERT Estimate = $(\text{Optimistic} + 4 * \text{Most Likely} + \text{Pessimistic})/6$
- Standard Deviation (using PERT) = $(\text{Pessimistic} - \text{Optimistic})/6$
- Variance (using PERT) = $((\text{Pessimistic} - \text{Optimistic})/6)^2$

Discussion/Exercise 15



5 Minutes

- **Estimate Activity Duration for activities where resources are identified**

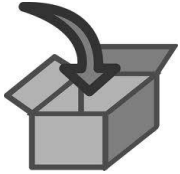
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Develop Schedule



1. Schedule Management Plan
2. Activity List
3. Activity Attributes
4. Project Schedule Network Diagrams
5. Activity Resource Requirements
6. Resource Calendars
7. Activity Duration Estimates
8. Project Scope Statement
9. Risk Register
10. Project staff assignment
11. Resource Breakdown structure
12. Enterprise Environmental Factors
13. Organization Process Assets



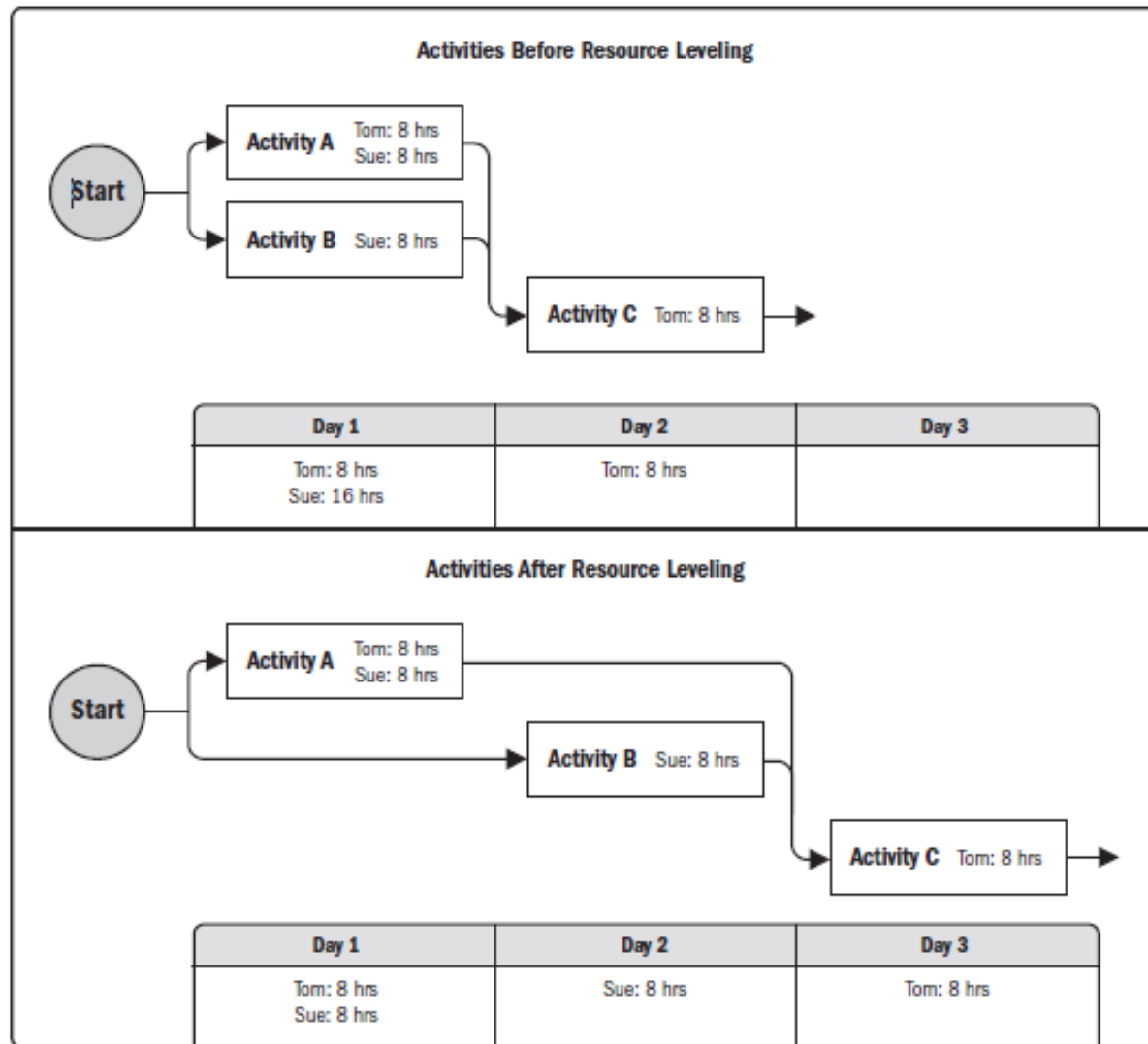
1. Schedule Network Analysis
2. Critical Path Method
3. Critical Chain Method
4. Resource Optimization techniques
5. Modeling Techniques
6. Leads and Lags
7. Schedule Compression
8. Scheduling Tool



1. Schedule baseline
2. Project Schedule
3. Schedule Data
4. Project Calendars
5. Project Management Plan Updates
6. Project Documents Updates

Resource Optimization techniques

- Resource Levelling
 - Ensure resource are not allocated more than their availability for the given project. Can lead to change in critical path.
- Resource Smoothing
 - Adjust activities in such a way that resources requirement do not exceed than defined limit. No change in critical path. Activities can be delayed within their float (free/total).



Modeling Techniques

- What if scenario analysis
 - Assess the feasibility of project schedule under adverse conditions. Prepare a contingency plan to overcome the problems. Or prepare mitigation plan to reduce the impact of unexpected situations.
- Simulation
 - Calculate multiple project duration using tools like Monte Carlo Simulation. In this case use assumptions and distribution constructed using 3 Point estimates.

19. Control Schedule

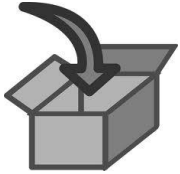


Definition

Monitoring the status of the project to update project progress and manage changes to the schedule baseline



Control Schedule



1. Project Management Plan
2. Project Schedule
3. Work Performance Data
4. Project Calendars
5. Schedule Data
6. Organization Process Assets

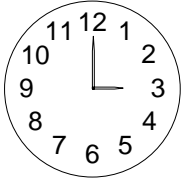


1. Performance Reviews
2. Project Management Software
3. Resource Optimization Techniques
4. Modeling Techniques
5. Leads and Lags
6. Schedule Compression
7. Scheduling Tool



1. Work Performance Information
2. Schedule Forecasts
3. Change Requests
4. Project Management Plan Updates
5. Project Documents Updates
6. Organization Process Assets Updates

Discussion/Exercise 17



5 Minutes

- **Write work performance measures and their values of your project with respect to Schedule Management**

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Big Concepts

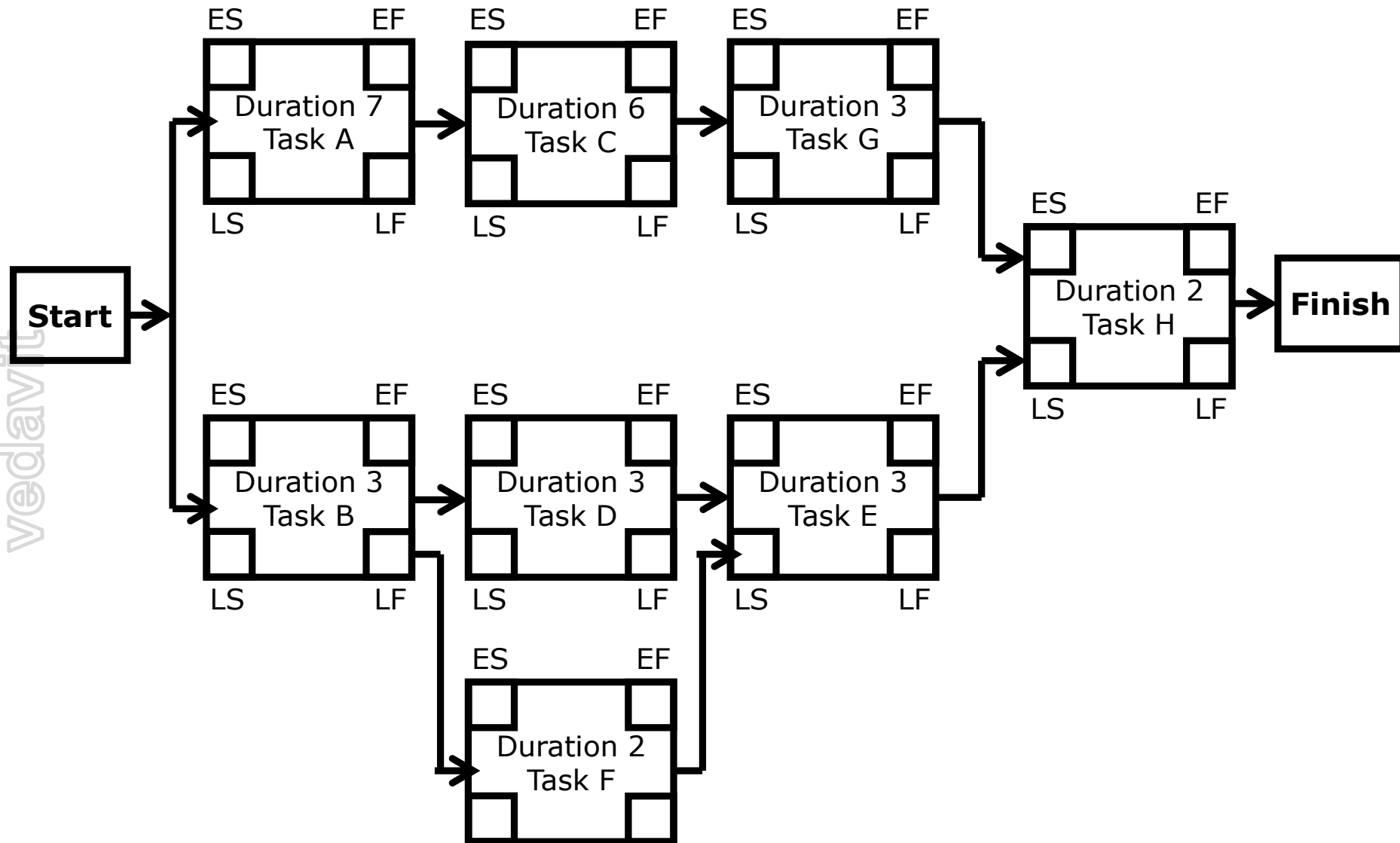
Critical Path Method (CPM)
Critical Chain Method (CCM)

Critical Path Method (CPM)

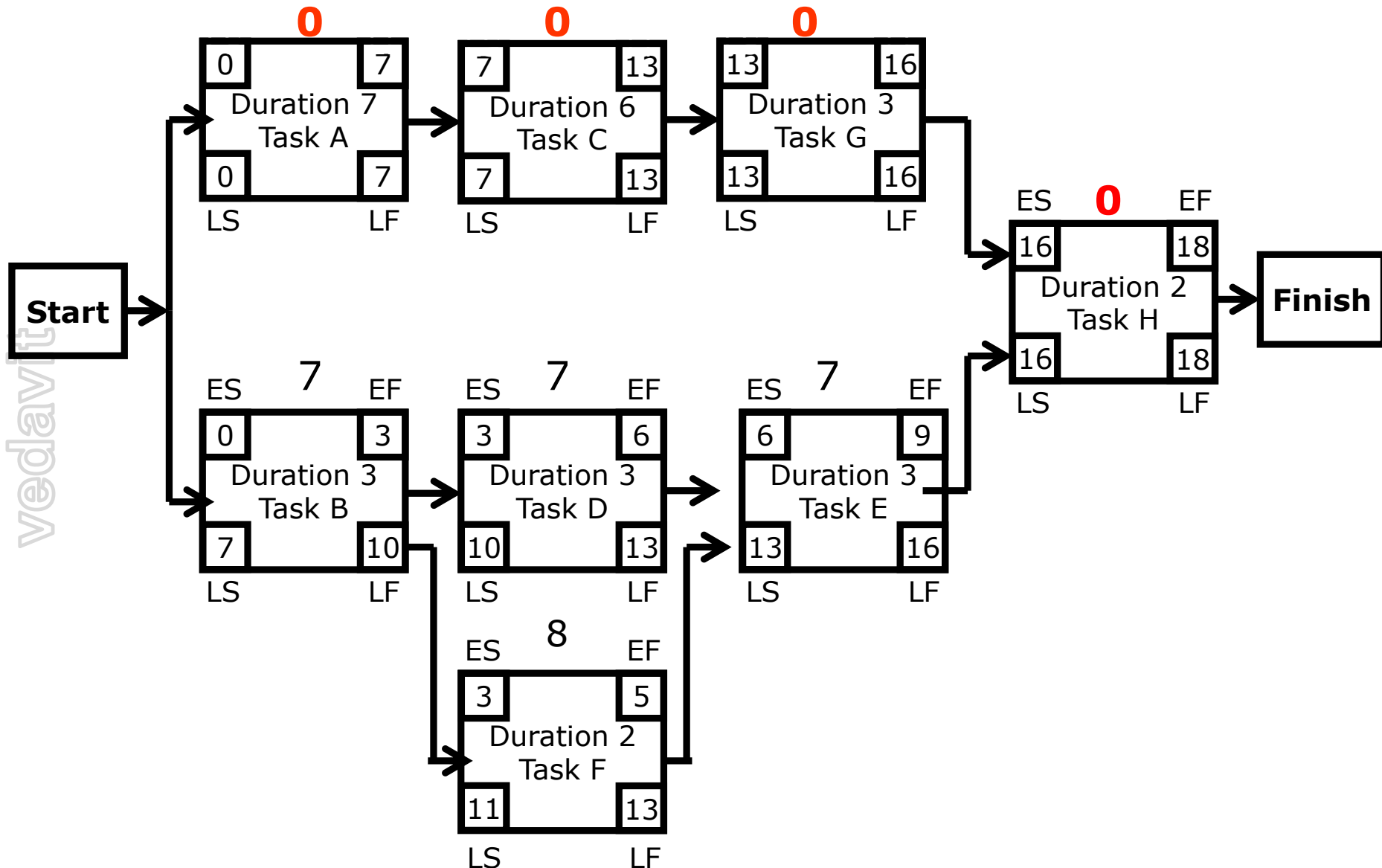
Critical Path Method (CPM)

Critical Path method is a planning technique that is used to demonstrate and view the chronological activities of a program or project, and identifies any possible timing risks and can be used to establish the least amount of time to complete a project.

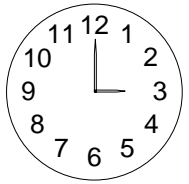
Critical Path



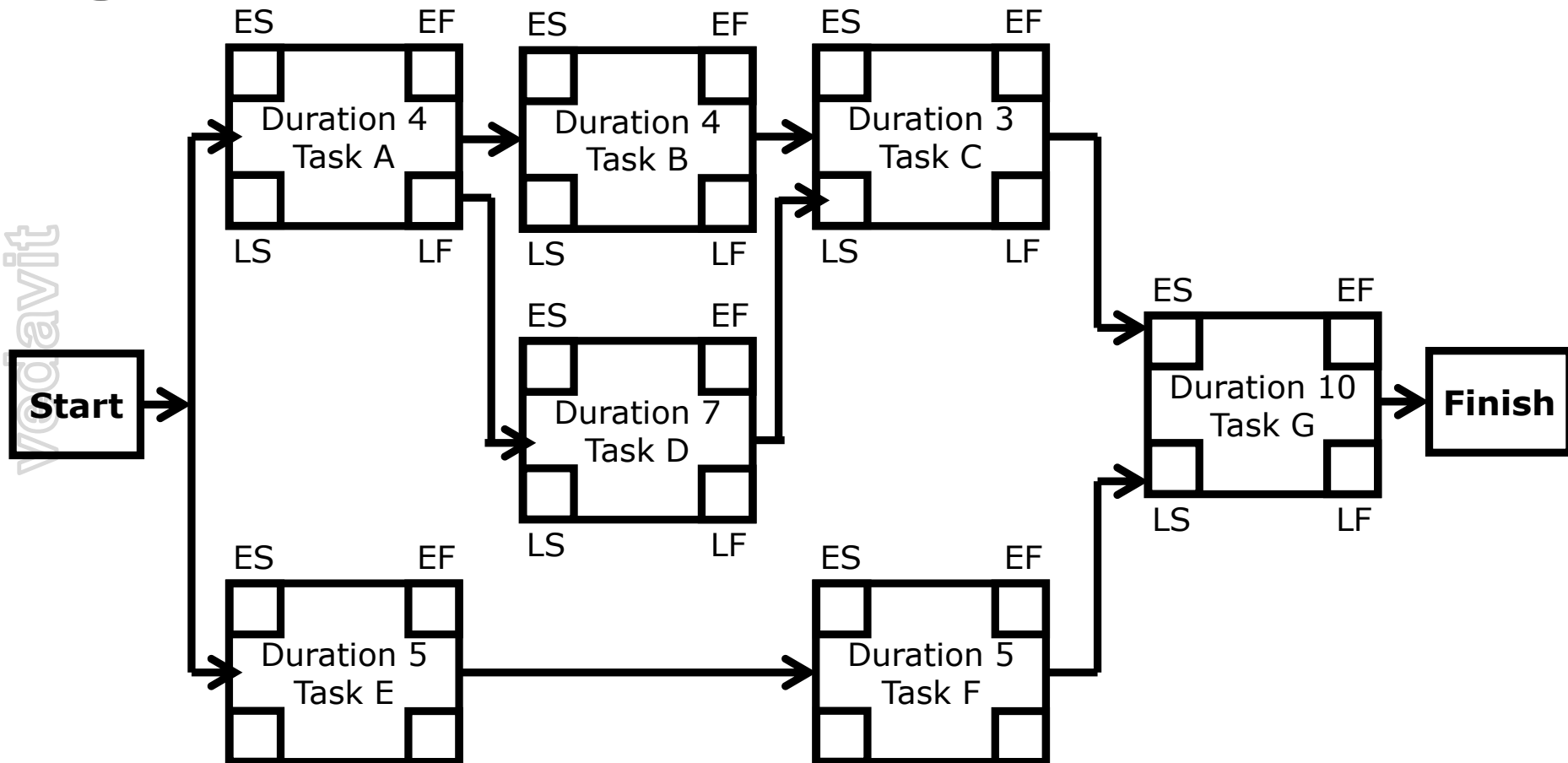
Critical Path – Longest Path, Zero Float



Discussion/Exercise-16

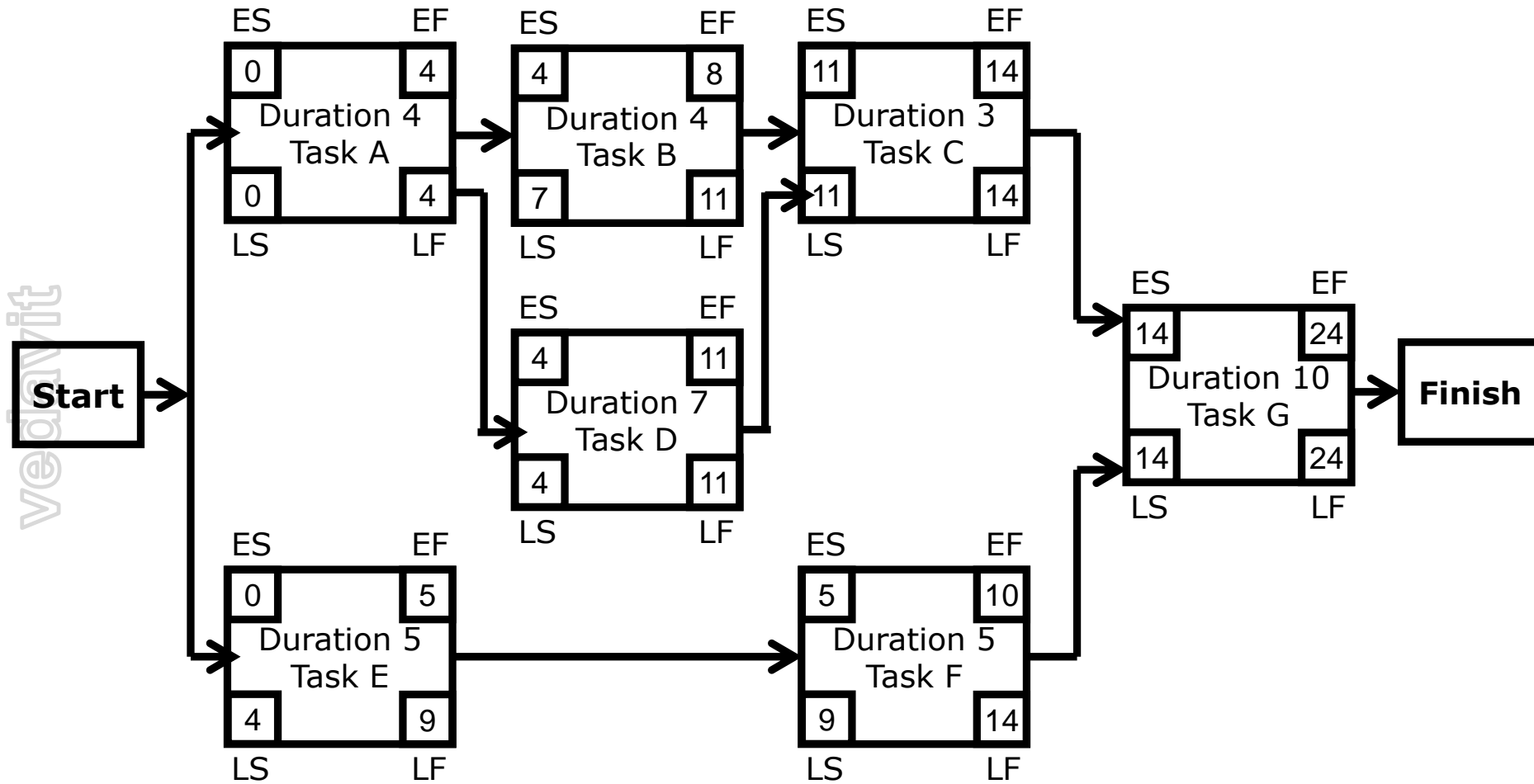


5 Minutes



Network Exercise - solution

Critical Path : ADCG



Facts/Tips for Critical Path

- Total Float is the amount of time the task can be delayed without delaying the project finish date.
- Free float is the amount of time a task can slip without delaying the early start of any task that immediately follows it
- It is possible that a zero float activity may not be on critical path
- Longest path & shortest time possible to complete the project
- A project can multiple critical paths
- Difference between late and early is float
- Positive float (the activity can wait to start even after previous activity finishes)
- Negative float (the activity must start before previous finishes)
- Zero float (the activity must immediately start after the finish of previous one)
- Crashing activities to short the overall duration of project
- Fast-tracking activities to short the overall duration of project
- Be cautious that non-critical activity is not being delayed than the allowed free float
- Take care of sub-critical path or non-critical path
- Manage critical path resources very closely
- Do not overload critical path activity resources
- Avoid multitasking for resources working on critical path activities

Benefits of PERT/CPM

It Provides following information

- Expected Project completion time
- Probability of completion before a specified date
- The critical path activities that directly impact the completion time
- The activities that have slack time and that can lend resources to critical path activities
- Activity start and end dates

Critical Chain Method (CCM)

Background

- Eliyahu Goldratt proposed CCM
- This is developed based on the TOC framework

Why CCM is needed?

- You have CPM available why CCM is needed?
 - You can manage the delays on non-critical path using buffers/floats. BUT
 - How do you manage the delays on critical path?

Principles Behind CCM

- **Delays accumulate; gains don't advantage**
 - Sequential Steps: Resources are not available to start early
 - Parallel Steps: Three activity each takes 5 days time start in parallel. If one activity takes 10 days and other finish on time, early activities will not be able to take advantage.
 - If above sequential and parallel activities are dependent then affect is magnified
- **Other Time Wasters**
 - Multitasking
 - Student Syndrome
 - Parkinson's Law

Critical Chain Method

- CPM is developed using the believe that book as many resource as in advance and they will be available when need because it has been promised
- CCM says that if a resource is over booked on any activity he will not be available to work on that activity therefore level the resource on the project activities. Thus resource constrained critical path is critical chain.
- CPM is about hoarding, greed. Therefore over-estimation and project management laws like Parkinson law, Murphy law, Student syndrome applies here.
- CCM is about believe and assumption that it will available when needed but we need to have proper alert system in place.

CCM Concepts

- **Resource Buffer:** Notify dependent task resources that when I will finish my work on regularly basis and final notification 1-2 days before. So that resource is available to start the work.
- **Safety or project buffer** should be added at the end of critical-chain as non-activity buffer
- **Feeding buffer:** Add buffer where chain of non-critical activity joins the critical path. This way non critical task can be avoided being critical

How to estimate in CCM

- Resource will give t80, t90 estimate.
- Half them to get t50 estimate.
- Do not put end date to task and let people finish the task as early as possible.
- No penalty for finish beyond t50.
- Project Buffer should be 50% of the buffer removed from activity.

How to manage CCM

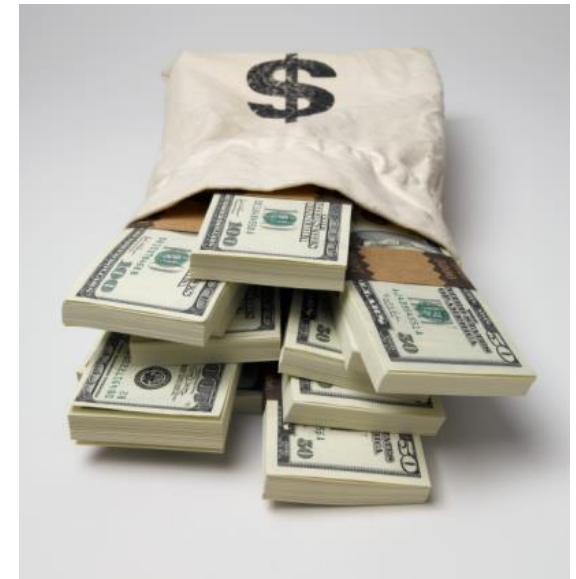
- If activity finishes late time is borrowed from project buffer.
- If activity finishes early, gained time is added to project buffer

Discussions !

Project Cost Management

Project Cost Management

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Project Cost Management- A Thought

- ✓ If you don't plan, it doesn't work. If you do plan, it doesn't work either.

Why plan!

- ✓ The same work under the same conditions will be estimated differently by ten different estimators or by one estimator at ten different times. So why to estimate!
- ✓ Any project can be estimated accurately (once it's completed).
- ✓ Nothing is impossible for the person who doesn't have to do it.

Project Cost Management



Definition

Processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget

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Project Cost Management

20. Project Cost Management [PLANNING]

21. Estimate Costs [PLANNING]

22. Determine Budget [PLANNING]

23. Control Costs [M&C]

Components of Contract Price

Contract Price = Material + Labor + Expenses + Overheads + Risk
Management Budget + Profit Margins

Who estimates Material cost for your project?

Who estimates Labor cost for your project?

Who estimates Expenses cost for your project?

Who estimates Overhead cost for your project?

Where do you adjust the buffer?

Where do you earn profit?

What is the price?

Types of Cost

- ✓ Fixed Cost vs Variable Cost
- ✓ Direct vs Indirect Cost
- ✓ Material, Labour, Services
- ✓ Overhead Cost
- ✓ Sunk Cost
- ✓ Opportunity Cost

Types of Cost

- ✓ **Direct cost: purchased, used, consumed in the project directly.**
- ✓ **Indirect cost: shared cost between project.**

Types of Cost

- ✓ **Sunk Cost-** Retrospective cost/ that cannot be recovered/ Cost gone and very low value or zero value was taken out. Plant developed but not of any use now additional money is required but by that money some better work can be done, so not to invest and let already invested money sunk. Software developed but it is not of any use now due any reason.
- ✓ **Perspective Cost-** cost to be occurred in future
- ✓ **Allocated Cost-** Cost of security service is shared by all division/companies of the building. Spreading the cost among those that use it.

Types of Cost

- ✓ **Apportioned Cost**- To find apportioned cost you should know % of each appraised value (land, building, machine)
- ✓ **Value Added Cost**- Sale price of a product and cost price of material is value add
- ✓ **Transfer Cost** -Cost of transfer or transaction between two entities
- ✓ **Opportunity cost**- Value lose because of exercising an option. It is just economic cost. Does not reflect in financial books

20. Plan Cost Management



Definition

Establishing policies, procedures and documentation for planning, managing, expending and controlling project costs

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Plan Cost Management



1. Project Management Plan
2. Project Charter
3. Enterprise Environmental Factors
4. Organization Process Assets



1. Expert Judgement
2. Analytical techniques
3. Meetings



1. Cost Management Plan

Cost Management Plan

It includes

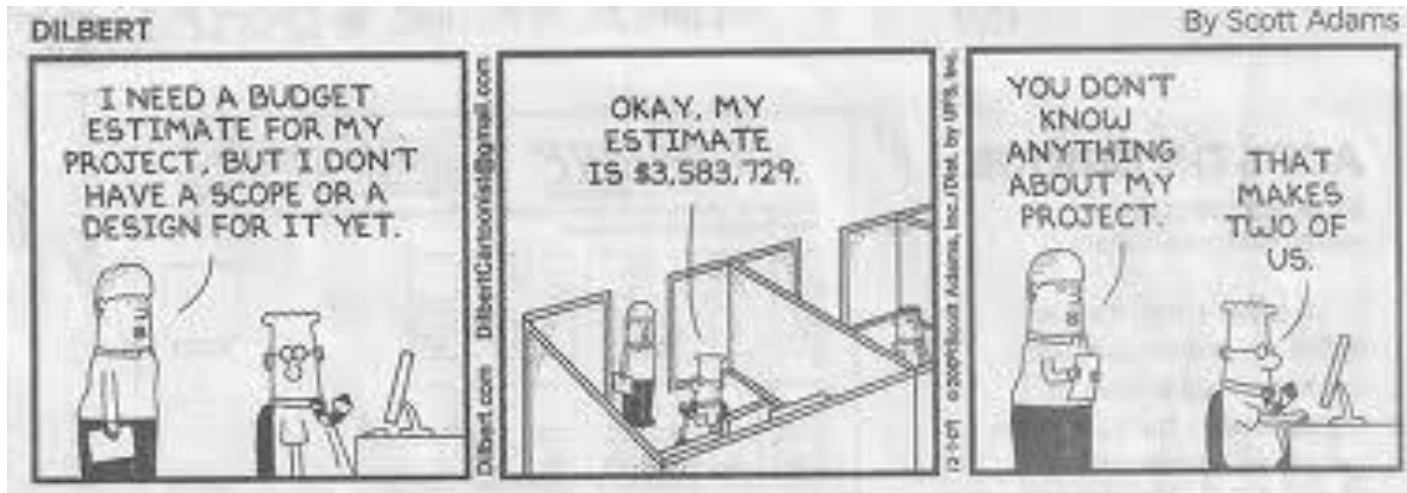
- Cost management tools to be used
- Level of accuracy (acceptable range +/- 5%)
- Level of precision (US\$ 100.01)
- Units of measure for each resource
- Organizational procedure links
- Process of updating the progress in schedule model
- Control thresholds (an allowed variation before some action need to be taken)
- Rules of performance measurement (baselines, %complete, fixed formula etc.)
- Project cost recording process
- Currency exchange rate fluctuation adjustment process
- Define scheduling reporting format

21. Estimate Costs



Definition

Developing an approximation of the costs of the resources needed to complete project activities.



Estimate Cost



1. Cost Management Plan
2. Human Resource Management Plan
3. Scope Baseline
4. Project Schedule
5. Risk Register
6. Enterprise Environmental Factors
7. Organization Process Assets



1. Expert Judgement
2. Analogous Estimating
3. Parametric Estimating
4. Bottom-up estimating
5. Three-point estimates
6. Reserve Analysis
7. Cost of Quality
8. Project Management Software
9. Vendor Bid Analysis
10. Group Decision Making Techniques



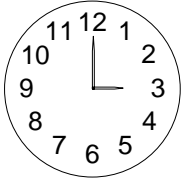
1. Activity Cost Estimates
2. Basis of estimates
3. Project Documents Updates

Project Cost Estimation Ranges

Cost estimation may include only Direct Cost or in combination of with Indirect Costs

Class Name	%	Range
Definitive	- 5 -> +5%	10%
Capital Cost	-15 -> +10%	25%
Appropriation	-25 -> +15%	40%
Budget Estimates	-10 -> +25%	35%
Feasibility	-35 -> +25%	60%
Order of Magnitude	-50 -> +50%	100%

Exercise-18



3 Minutes

Write Activity cost estimates for 5 activities and their basis of estimates for your project

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Three Point Estimates

Program Evaluation Review Technique (PERT)

ESTIMATED COST = (Pessimistic + 4*(Most Likely) + Optimistic) / 6

22. Determine Budget



Definition

Aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline

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Determine Budget



1. Cost Management Plan
2. Scope Baseline
3. Activity Cost Estimates
4. Basis of estimates
5. Project Schedule
6. Resource Calendars
7. Risk Register
8. Agreements
9. Organization Process Assets



1. Expert Judgement
2. Cost Aggregation
3. Reserve Analysis
4. Historical Relationships
5. Funding Limit Reconciliation



1. Cost Baseline
2. Project Funding requirements
3. Project Documents Updates

Estimation Traps

Customer: “How long will this project take?”

Project Manager: “What is the project about?”

Customer: “It is a systems upgrade project.”

Project Manager: “Can you tell me more about the project?”

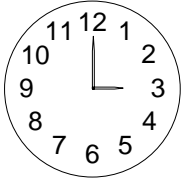
Customer: “I don’t know, we will get into that later, but just tell me how long will it take.”

Five Ways to Avoid Estimation Traps

1. Provide a range instead of number.
 - Ranges reveals level of uncertainty in the scope. Customer will appreciate it if you tell him why that kind of range is given.
 - +/- 10 or +/- 50%. You can discuss cone of uncertainty with customer
2. Highlight underlying assumptions and constraints
 - Based on this (current information) assign confidence level or probability
3. Use objective estimation techniques like 3 Point or PERT
 - Don't play estimation games like padding estimates by doubling and then customer make it halve. Next time you quadruple it. This unnecessarily creates cycle of mistrust.
4. Use a combination of techniques and solicit multiple perspectives
5. Track and compare actual results
 - Initially everybody fights for getting “accurate estimates” after that people forget about it

Next time you are asked to provide an accurate estimate, don't fall into the trap. Instead, use it as an opportunity to engage and educate your stakeholders about the reality of estimates.

Exercise-19



3 Minutes

Establish cost performance baseline for your project & write funding requirements for your project.

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23. Control Costs



Definition

Monitoring the status of the project to update the project budget and managing changes to the cost baseline



Control Cost



1. Project Management Plan
2. Project Funding requirements
3. Work Performance Data
4. Organization Process Assets



1. EVM
2. Forecasting
3. TCPI
4. Performance Reviews
5. Project Management Software
6. Reserve Analysis



1. Work Performance Information
2. Cost Forecasts
3. Change Requests
4. Project Management Plan Updates
5. Project Documents Updates
6. Organization Process Assets Updates

Big Concepts

Earn Value Management

Earned Value Management – Basic Concepts

Planned Value (PV)- BCWS

Authorized budget assigned to the work to be accomplished for an activity or work breakdown structure component.

Earned Value (EV)- BCWP

Value of work performed expressed in terms of the approved budget assigned to that work for an activity or work breakdown structure component.

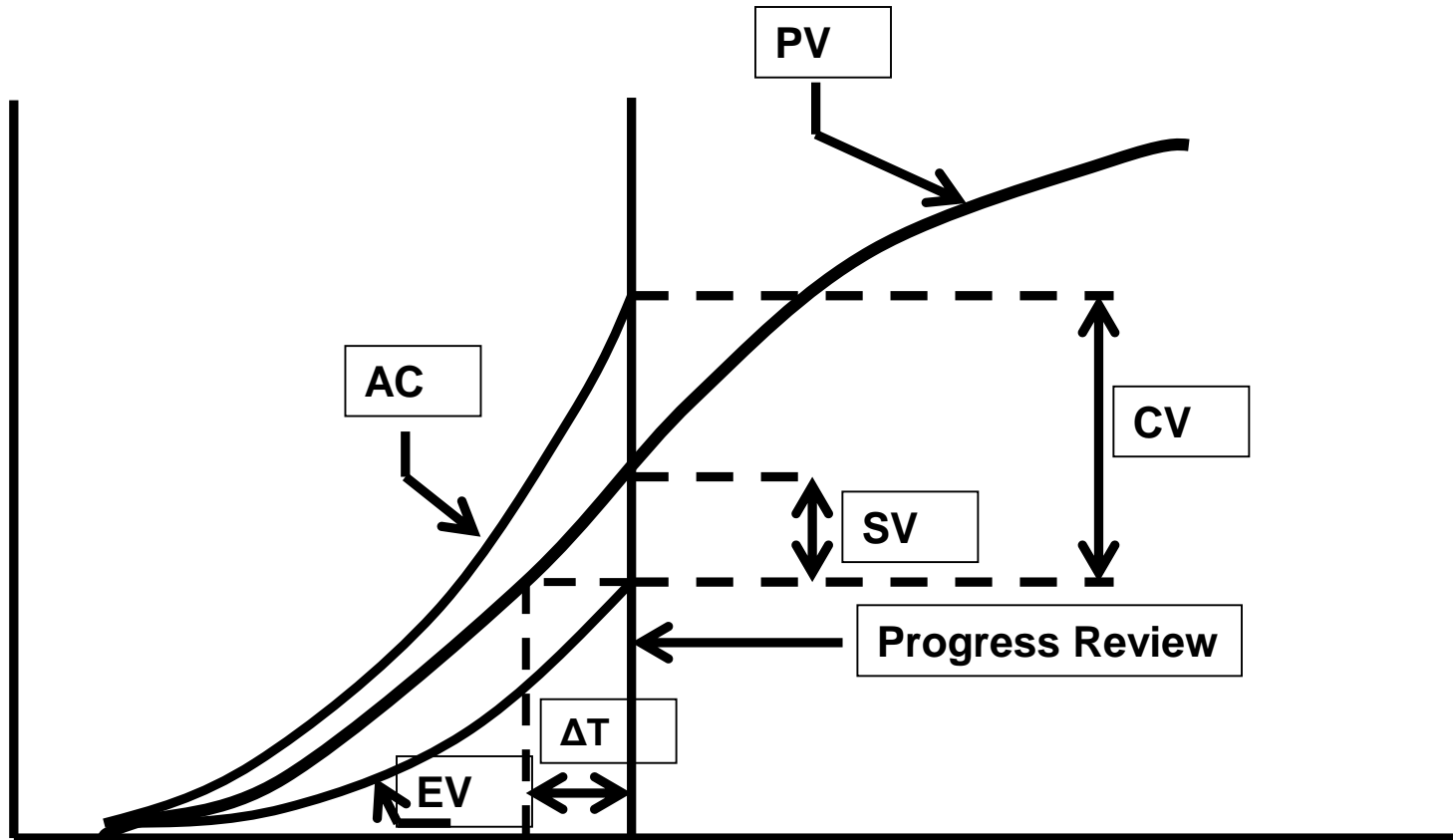
Actual Cost (AC)- ACWP

Total cost actually incurred and recorded in accomplishing work performed for an activity or work breakdown structure component.

Earn Value Rules

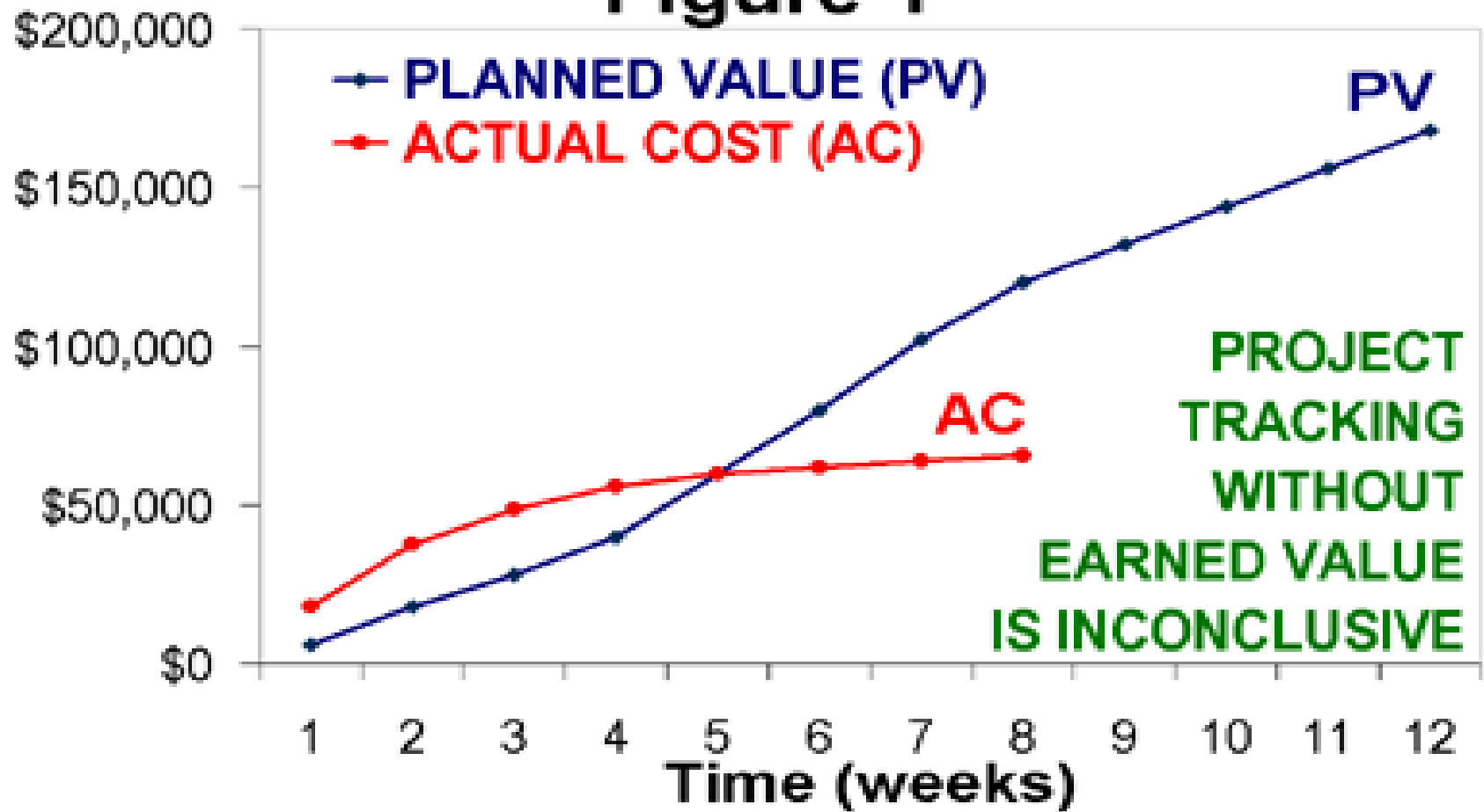
- 0% - 100%
- 50% - 50%
- 20% - 80%
- 25% - 75%

Earned Value Management – S Curve



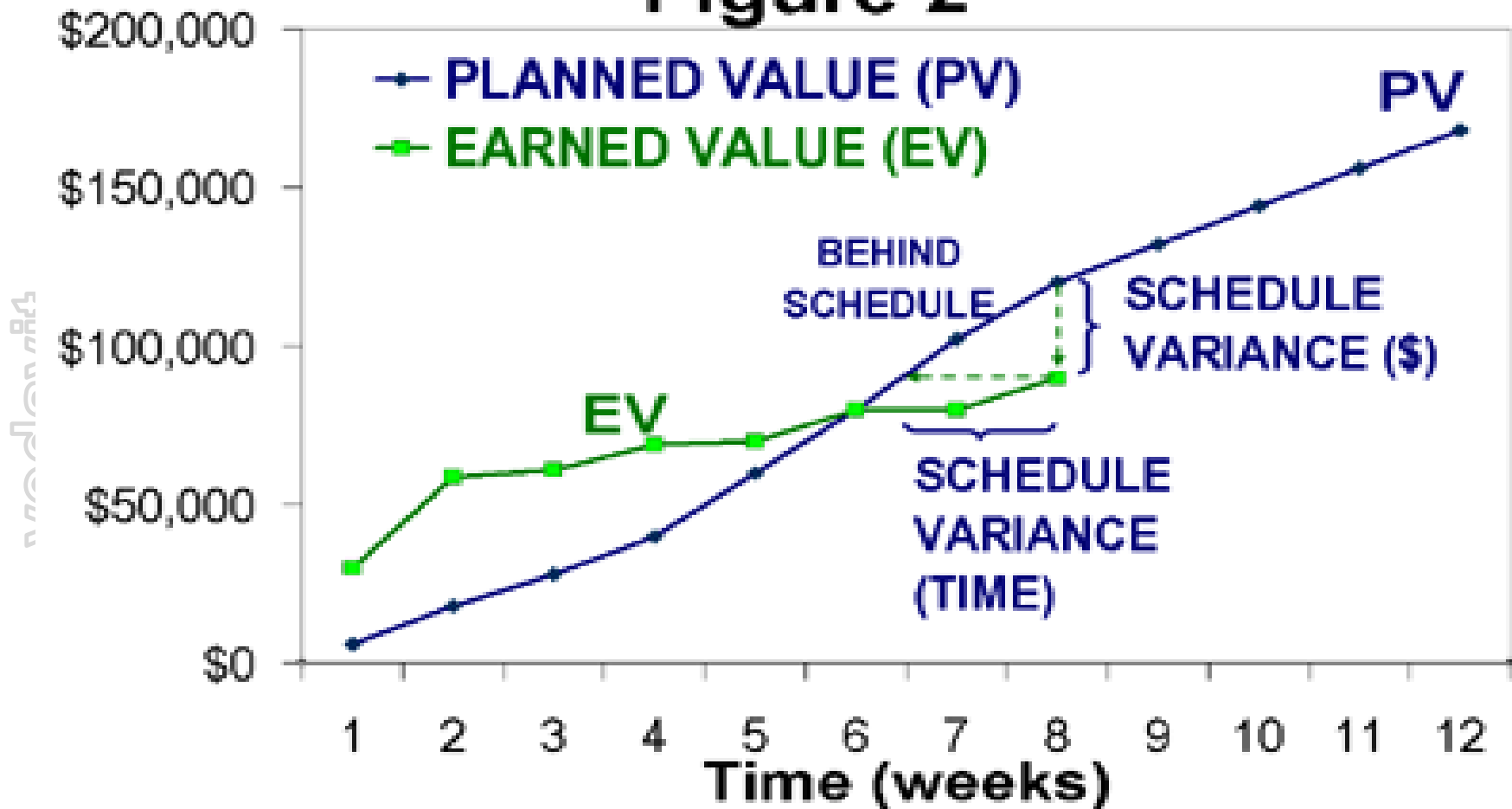
How project is progressing?

Figure 1



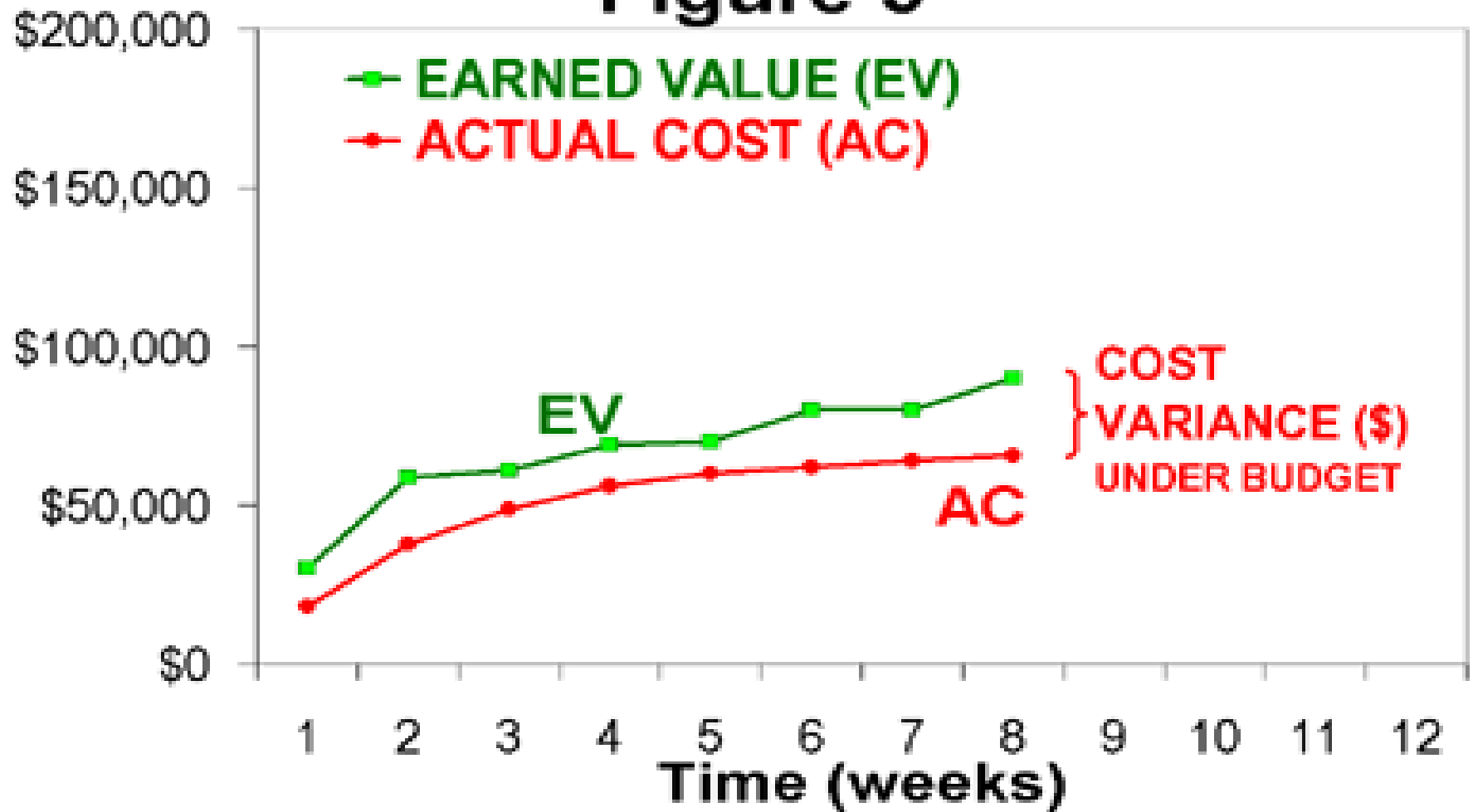
How project is progressing?

Figure 2



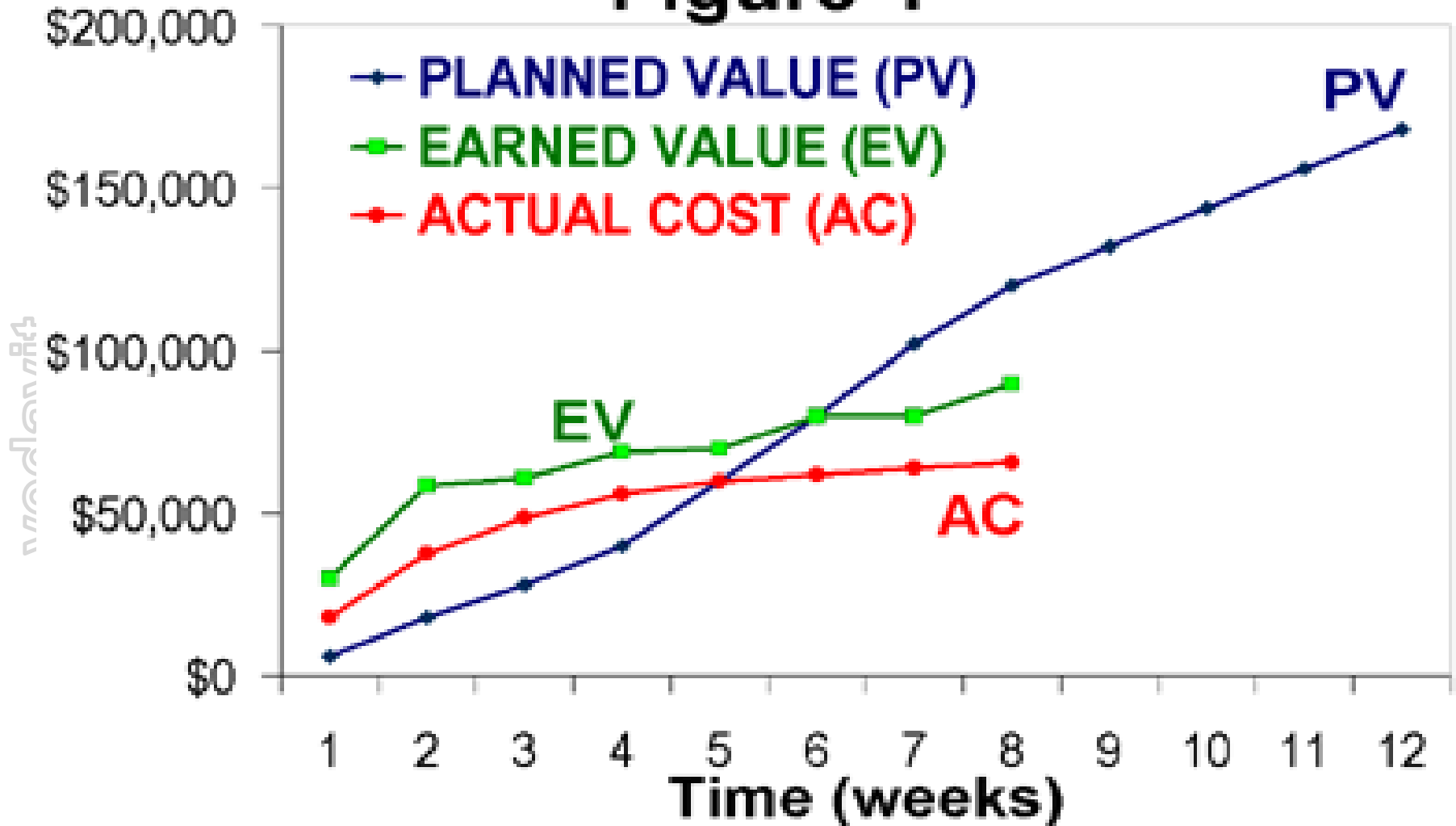
How project is progressing?

Figure 3



How project is progressing?

Figure 4



EVM-Variations

CV (Cost Variance) = EV - AC

CV = 0 => the Project is proceeding as per plan on cost

CV < 0 => the Project is over budget

CV > 0 => the Project is under budget

SV (Schedule Variance) = EV - PV

SV = 0 => the project is on plan, time-wise

SV < 0 => the project is BEHIND schedule

SV > 0 => the project is AHEAD of schedule

EVM- Indexes

CPI (Cost Performance Index) tells you how much worth of job you are getting for every \$ being spent.

$$CPI = EV/AC$$

CPI = 1 => the project is on plan, cost wise

CPI < 1 => the project is over budget or under performing

CPI > 1 => the project is under budget or over performing

SPI tells the PM how much worth of job has been completed against planned work

$$SPI = EV / PV$$

SPI = 1 => the project is on schedule

SPI < 1 => the project is BEHIND schedule

SPI > 1 => the project is AHEAD of schedule

EVM- Critical Ratio

CR tells the PM the overall shape of your project

$$\mathbf{CR = CPI \times SPI}$$

CR = 1 => the project is on schedule & within budget

CR < 1 => the project is BEHIND schedule or budget or both

CR > 1 => the project is AHEAD of schedule or budget or both

CPI & SPI Summary

Cumulative CPI / SPI Matrix



Forecasting- ETC

- *Recalculate it, if original estimate are no longer valid now.*
- *Calculate it manually based on the progress, if original estimates are still valid*
 - $ETC = BAC - EV$

Forecasting- EAC

Estimate at Completion(EAC)

1. $EAC_{(atypical)} = AC + ETC_{(Re-estimated)}$

2. $EAC_{(atypical)} = AC + BAC - EV_{(Estimated\ based\ on\ Progress)}$

3. $EAC_{(typical\ considering\ CPI\ \&\ SPI)} = AC + ETC / (CPI \times SPI)$

4. $EAC_{(typical)} = AC + ETC / CPI = BAC / CPI$

If you feel that you will be able to complete the project on time in spite of current delay then you can consider SPI as 1. In that case CR= SPI

Forecasting- Variance at Completion

- Variance at Completion (VAC)

$$VAC = BAC - EAC$$

- *Variance at Completion (%)*

$$PVAC = (BAC - EAC) / BAC$$

Forecasting: TCPI

TCPI (To complete Performance Index) can be calculated using BAC or EAC

- TCPI using BAC = $(BAC - EV) / (BAC - AC)$
- TCPI using EAC = $(BAC - EV) / (EAC - AC)$

Case Study — Case 1

- $PV = \$ 500$
- $EV = \$ 500$
- $AC = \$ 500$

This is the ideal situation where everything goes as per plan.



Case Study — Case 2

- $PV = \$1,800$
- $EV = \$1,500$
- $AC = \$1,700$

- $CV = EV - AC = -\$200$
- $SV = EV - PV = -\$300$
- $CPI = EV/AC = 0.88$
- $SPI = EV/PV = 0.83$

- $PV = \$2,900$
- $EV = \$2,700$
- $AC = \$2,500$

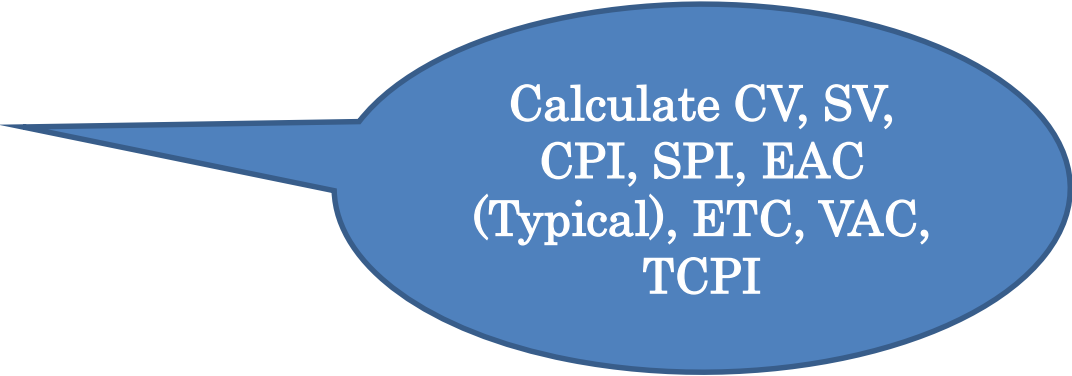
- $SV = -200$
- $SPI = 0.92$
- $CV = 200$
- $CPI = 1.08$



Calculate CV, SV,
SPI, SPI

EVM- Case 3

- $PV = \$1,700$
- $BAC = \$5,000$
- $EV = \$1,800$
- $AC = \$1,600$



Calculate CV, SV,
CPI, SPI, EAC
(Typical), ETC, VAC,
TCPI

- $CV = 200$
- $SV = 100$
- $CPI = 1.125$
- $SPI = 1.058$

- $EAC = BAC / CPI = \$4,444$
- $ETC = EAC - AC = 4,444 - 1,600 = \$2,844$ (Org Estimate Incorrect)
- $ETC = BAC - EV = 5,000 - 1,800 = \$3,200$ (Org Estimate Correct)
- $VAC = BAC - EAC = \$556$
- $TCPI \text{ using } BAC = \frac{5,000 - 1,800}{5,000 - 1,600} = 0.941$
- $TCPI \text{ using } EAC = \frac{5,000 - 1,800}{4,444 - 1,600} = 1.125$

Discussions !