Estimation: Effort, Schedule and Cost

Planning and Tracking

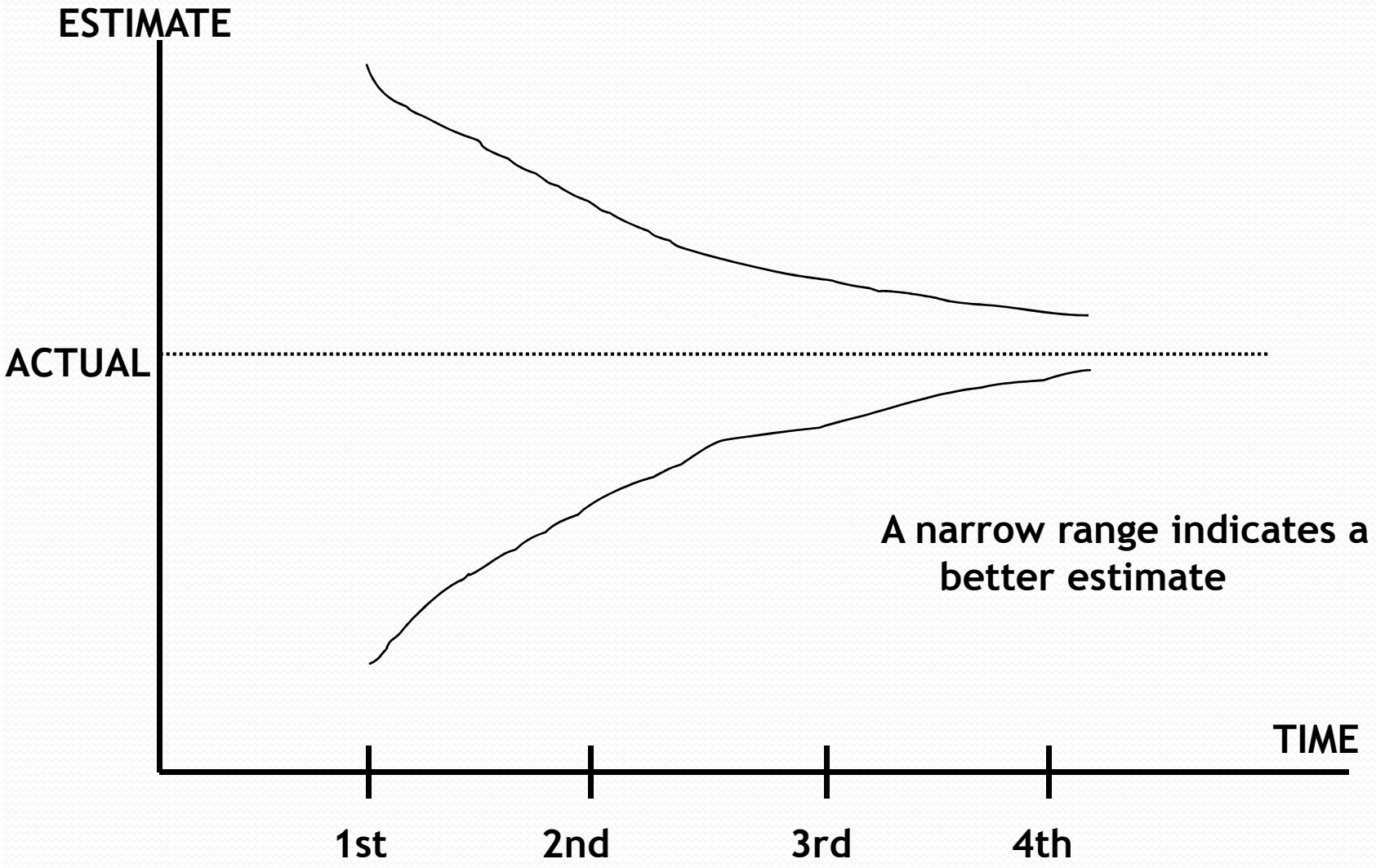
Estimation

- At what stages of the project do you develop estimates?
- What all do you estimate?
- Which methods or techniques do you use at different stages? ##

Estimation is not a one-time activity

- Proposal stage estimate – Bottom-Up, Analogous, Parametric
  - Bottom-up: number of deliverables or programs or features
  - Analogous: based on similar past project
  - Parametric: Based on Function Point or UCP (Use Case Point) or LOC (Lines of Code)
- The degree of error of the Proposal Stage estimate is large
- Must validate it with a WBS based Bottom-up Estimate!
- Raise early Alert if gap in estimates is significant!! ##

Estimate quality improves with more info!



Estimation examples

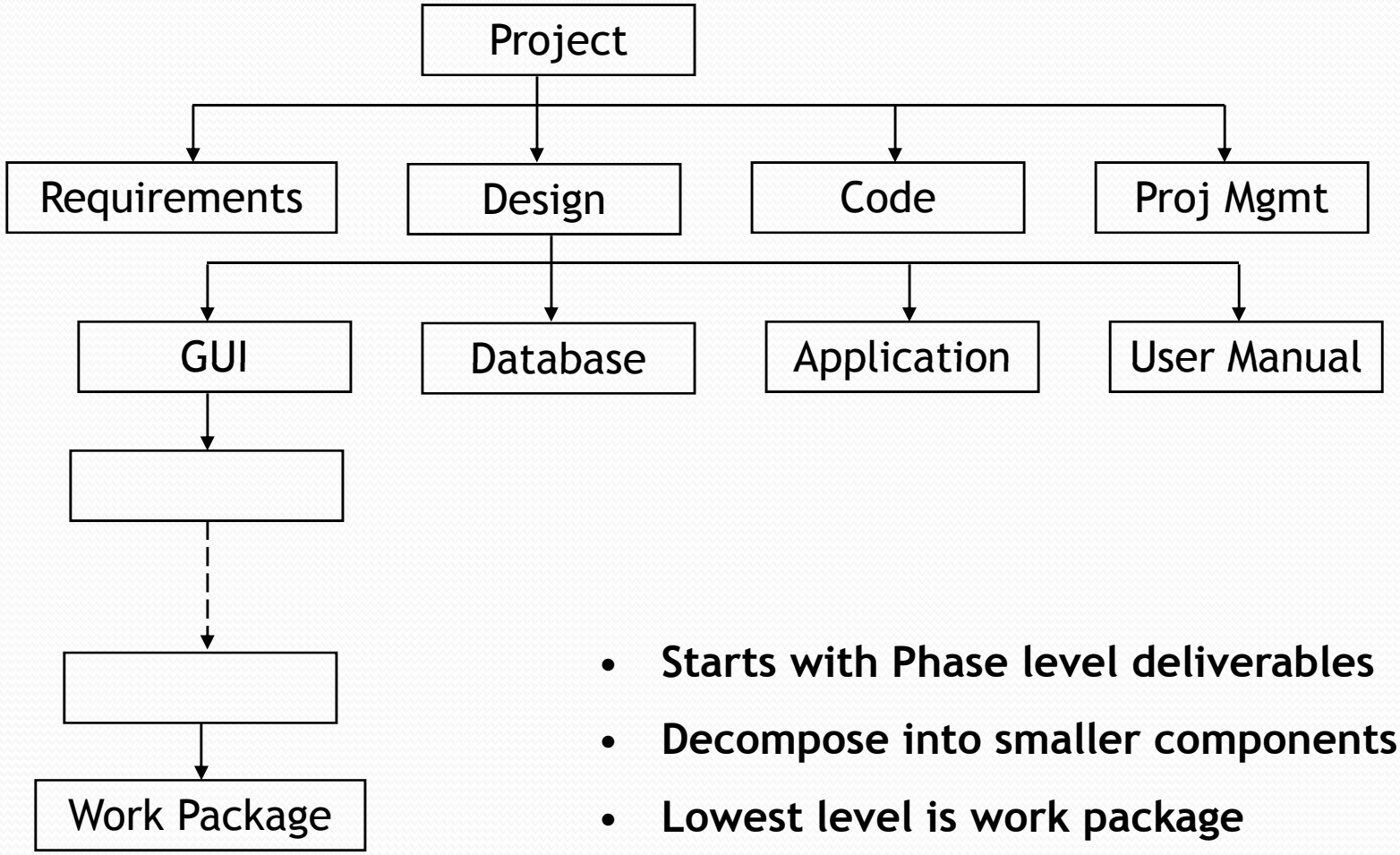
- Analogous: It takes 5 minutes to go from Building 1 to Building 2; Building 3 is further ahead. So I estimate it will take 10 minutes to go from B1 to B 3;

- Parametric: I can climb at the rate of 1 minute per floor. So it will take me 10 minutes to reach the 10th floor!!
  - Beware of scaling problems in parametric estimates!
  - This will be true for a lift but not for a human being!!

Bottom-up Estimation

- From detailed Scope Statement, create the WBS (Work Breakdown Structure)
- WBS is a deliverable oriented, hierarchical decomposition
- Divides project into smaller, more manageable pieces
- Prevents work from slipping thru the cracks
- Provides team with the big picture and where their piece fits
- Provides a basis for estimating efforts, resources, cost and time
- WBS – How far to decompose? Till you get reasonably accurate estimates! ##

WBS



- **Starts with Phase level deliverables**
- **Decompose into smaller components**
- **Lowest level is work package**

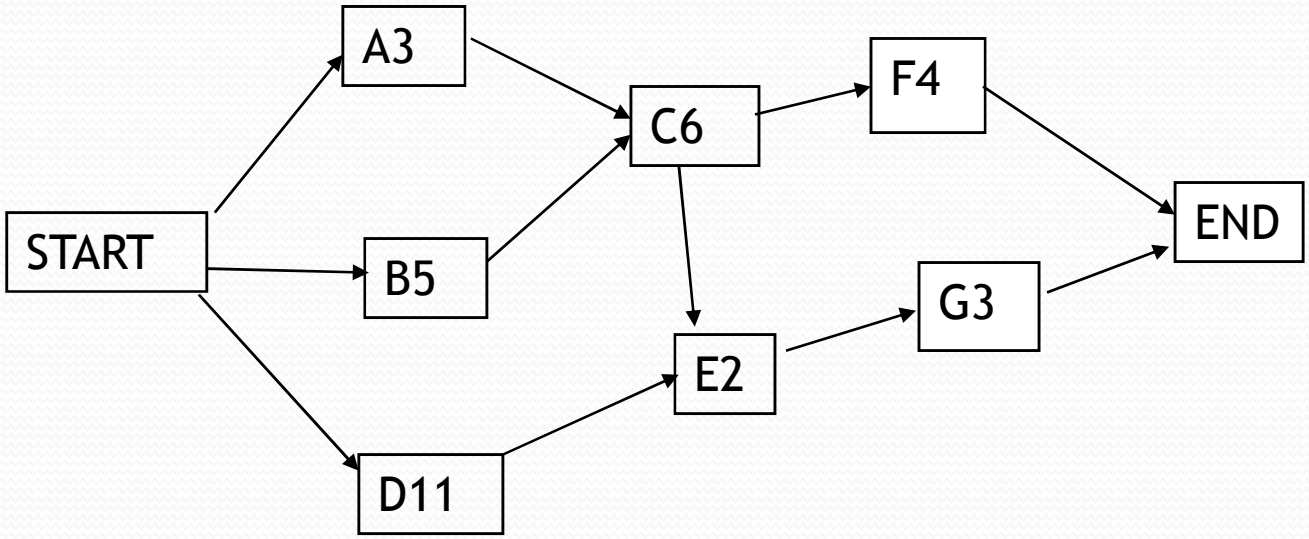
Estimation

- WBS is an inverted tree; lowest level elements are work packages
- Work packages are components making up the deliverables
- From the work packages, create the Activity Lists
- Use Activity Dependencies to create Network Diagrams
- Identify the Critical Path and CP duration; Compare with imposed schedule
- Estimate the Activity Durations and Resource Requirements
- Apply Resource rates to develop Cost Estimates; Compare with budget
- Evaluation Options and Negotiate; ##

Project Network Diagrams

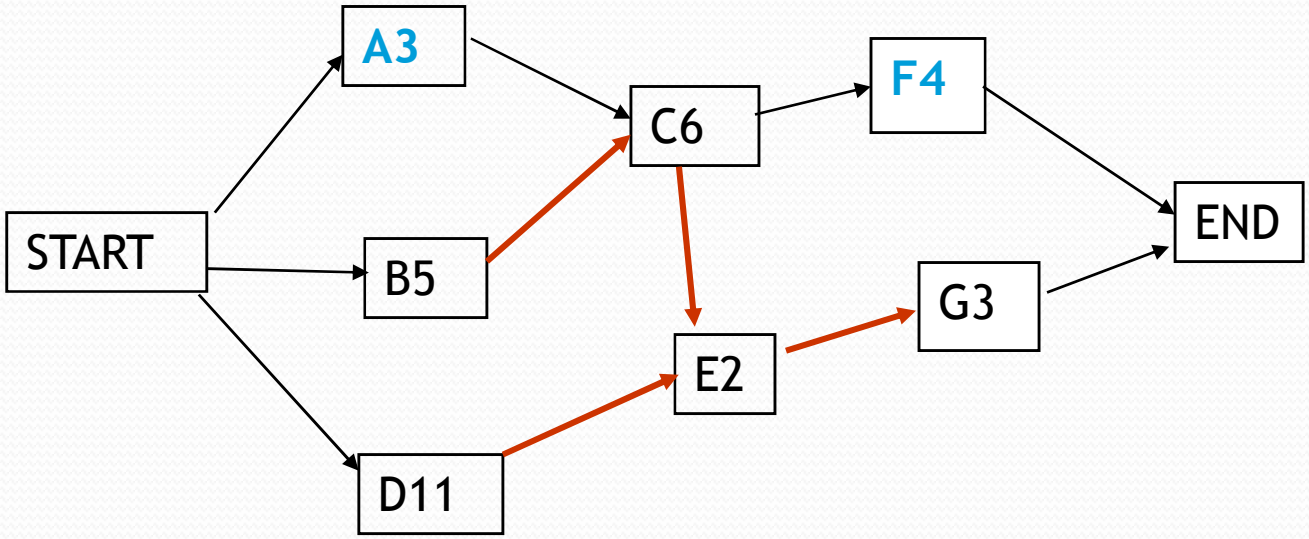
- A project has 7 activities: A, B, C, D, E, F and G. A, B and D can start anytime. A takes 3 weeks, B takes 5 weeks and D takes 11 weeks. A and B must be completed before C can start. C takes 6 weeks. C and D must be completed before E can start. E takes 2 weeks. F can start as soon as C is completed and requires 4 weeks. E must be completed before G can start. G takes 3 weeks. F and G must be completed for the project to be completed. What activities have slack available?

Project Network Diagram - Solution



- Which is the Critical Path? Which activities have slack? How much is it?
- Why is the Critical Path important for a PM/TL?

Project Network Diagram - Solution



PATHS

- **ACF 13**
- **ACEG 14**
- **BCF 15**
- **BCEG 16**
- **DEG 16**

- DEG and BCEG are critical paths (length 16)
- Which Activities can be delayed w/o affecting end date?
  - Slack for A=2, F=1
- If 2 or more paths are critical, what is the implication?
- If additional resources are available, where would you deploy them? ##

Exercise

Give your effort estimate for the following:

- Analysis, Design, Coding and Testing of 1000 LOC in Java;
- Make assumptions as necessary, but state them clearly!

Exercise - discussion

- What is the variability in estimates of all participants?
- What is the difference in estimate for the best-case and worst-case scenarios?
- Did you assume average or best resources?
- Did you factor the risks in the estimate or did you assume all will go well?

Understanding Variability in Estimates

An estimate is not a single number.
It's a range of possibilities - a statistical entity

What is 8 times 8? 64? Are you sure?

What is 8? 8? Or 8±1?

So, what is
8±1 times 8±1?

Somewhere between 49 and 81! With 64 being most likely.

So, what if it is 8±2 times 8±2? ...

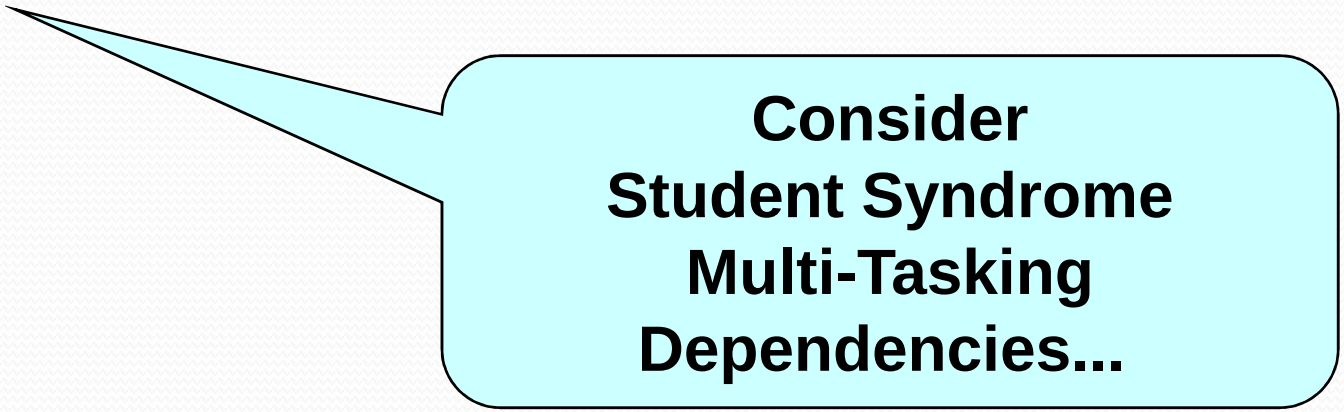
Five plus Five equals …?

- Five plus Five equals … Thirteen!
- Every level of reviewer adds his own safety
- The "Global Cut" by the customer is also built in!
- When you add it up, safety must be the majority of the estimated time for a project!

If this is true, how come so many projects have effort / schedule overrun?

Safety

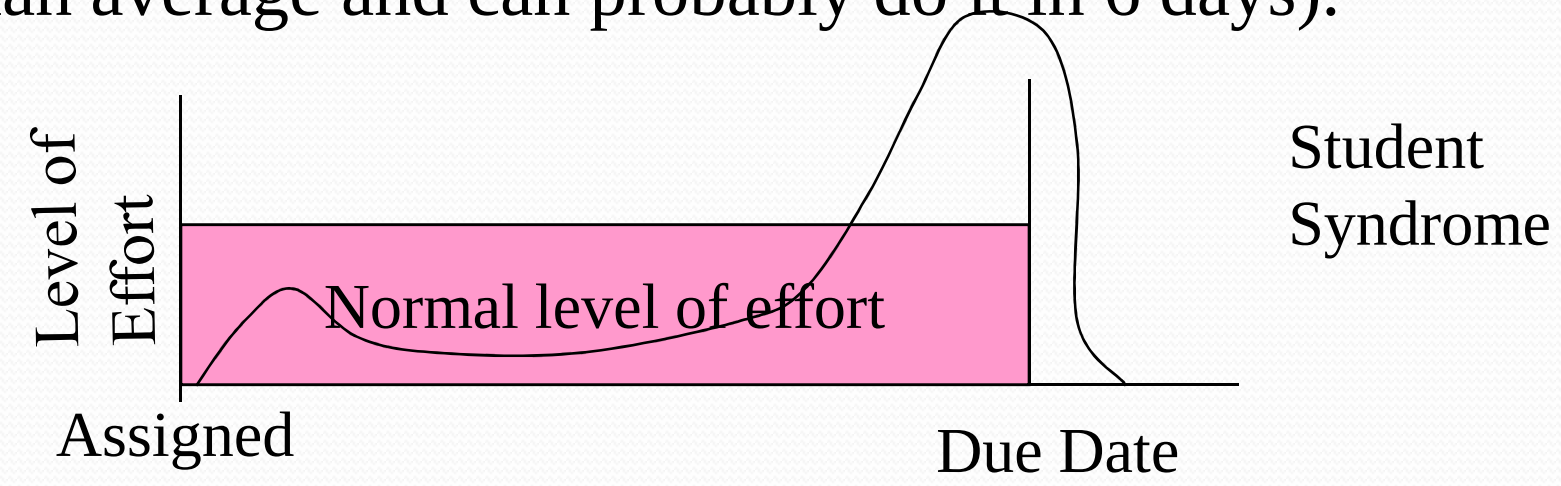
- Is there something wrong in the logic that leads us to assume that so much safety exists? Or
- Is there something fundamentally wrong in the way we are using that safety?



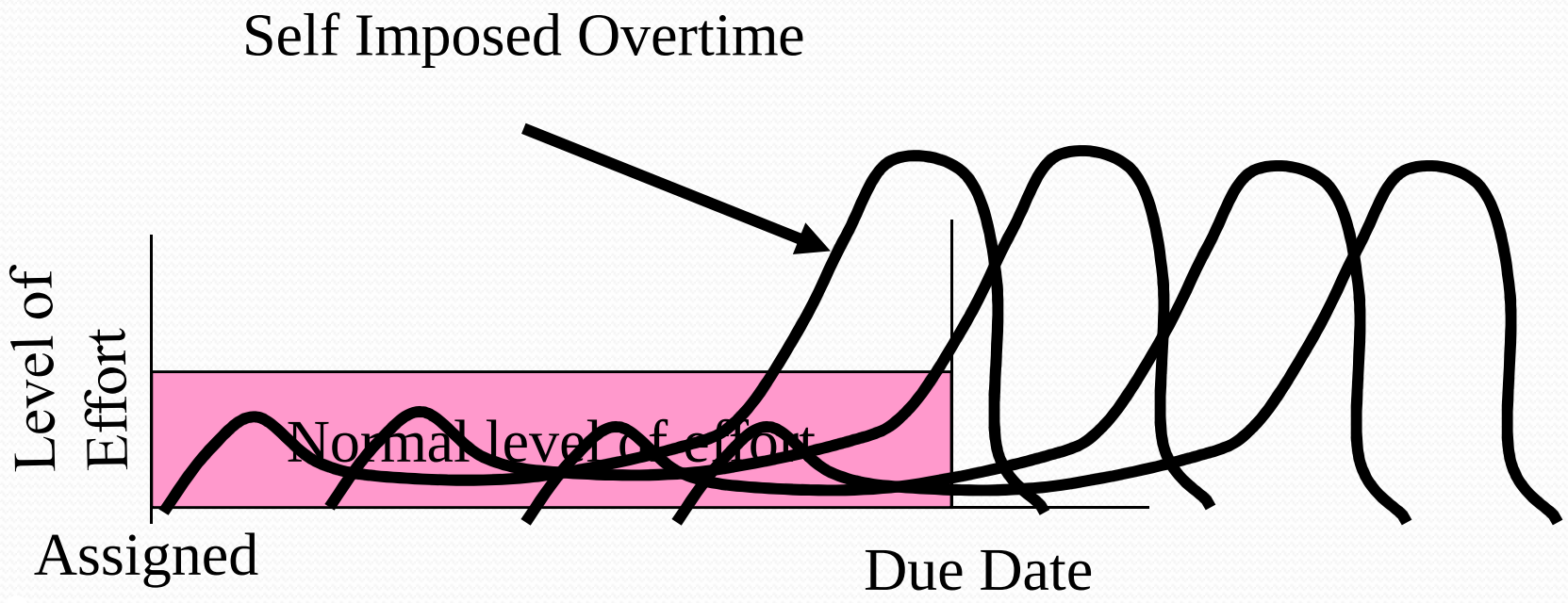
STUDENT SYNDROME

Question: If you have 16 days to do a 10 day project, when do you start?

Immediately! Or,
After 6 days. Or,
After 10 days (since you know you are faster than average and can probably do it in 6 days).



I hate Student Syndrome!



But then, we see many people slog, day in and day out. They are under tremendous pressure

Multi-tasking

When someone is working on four tasks, he is spending 10% of his productive time on each task.

That adds up to 40% of his time. Where does the other 60% go?

That missing 60% goes to …

That missing 60% goes to:

--breaking concentration on the task A

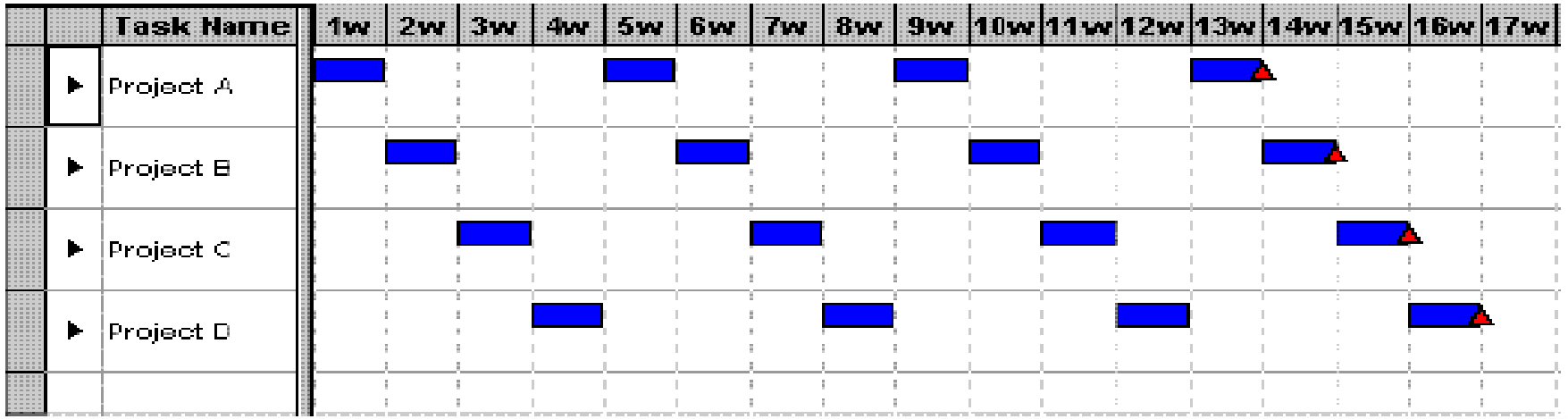
--picking up task B

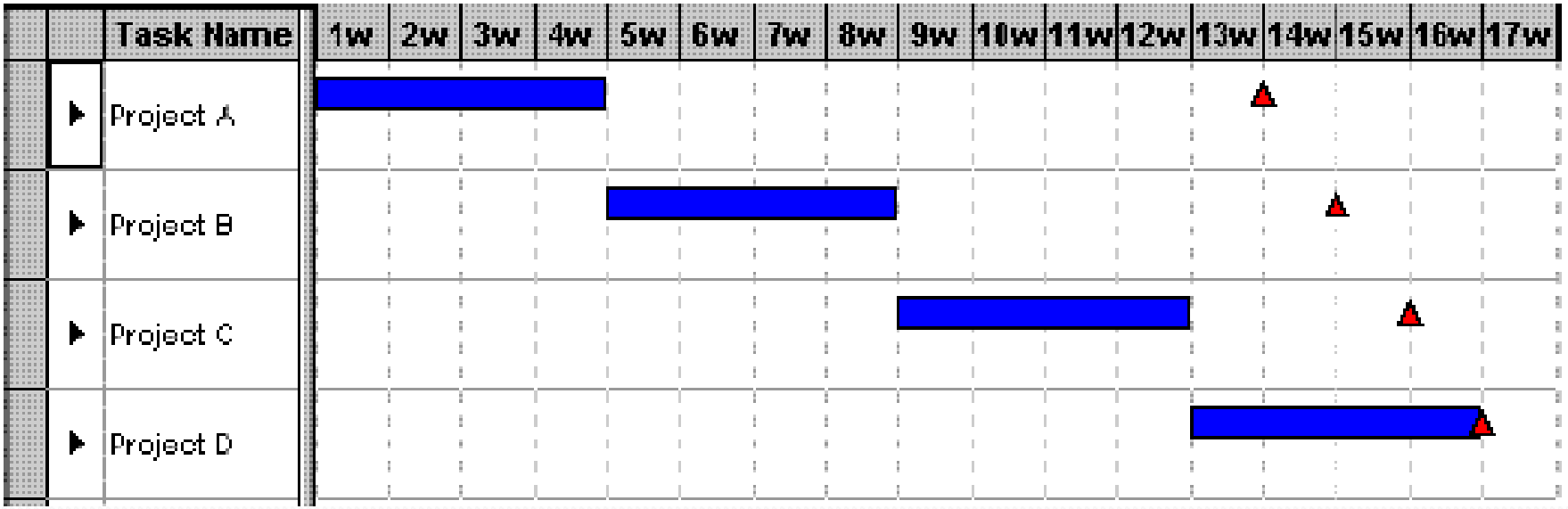
--organizing materials related to task B

--establishing concentration on task B

--recreating the train of thought that got you to the current point on task B….
and so on.

How Safety is Lost? - Multi-tasking





Exercise on multi-tasking

Note how much work is completed in one minute for each step.

1. Write numbers starting at 1 incrementing by 2,3,4, etc
2. Write alphabets starting at A skipping next 2,3,4 etc
3. Do Step 1 and 2 together, alternately writing one number and one alphabet

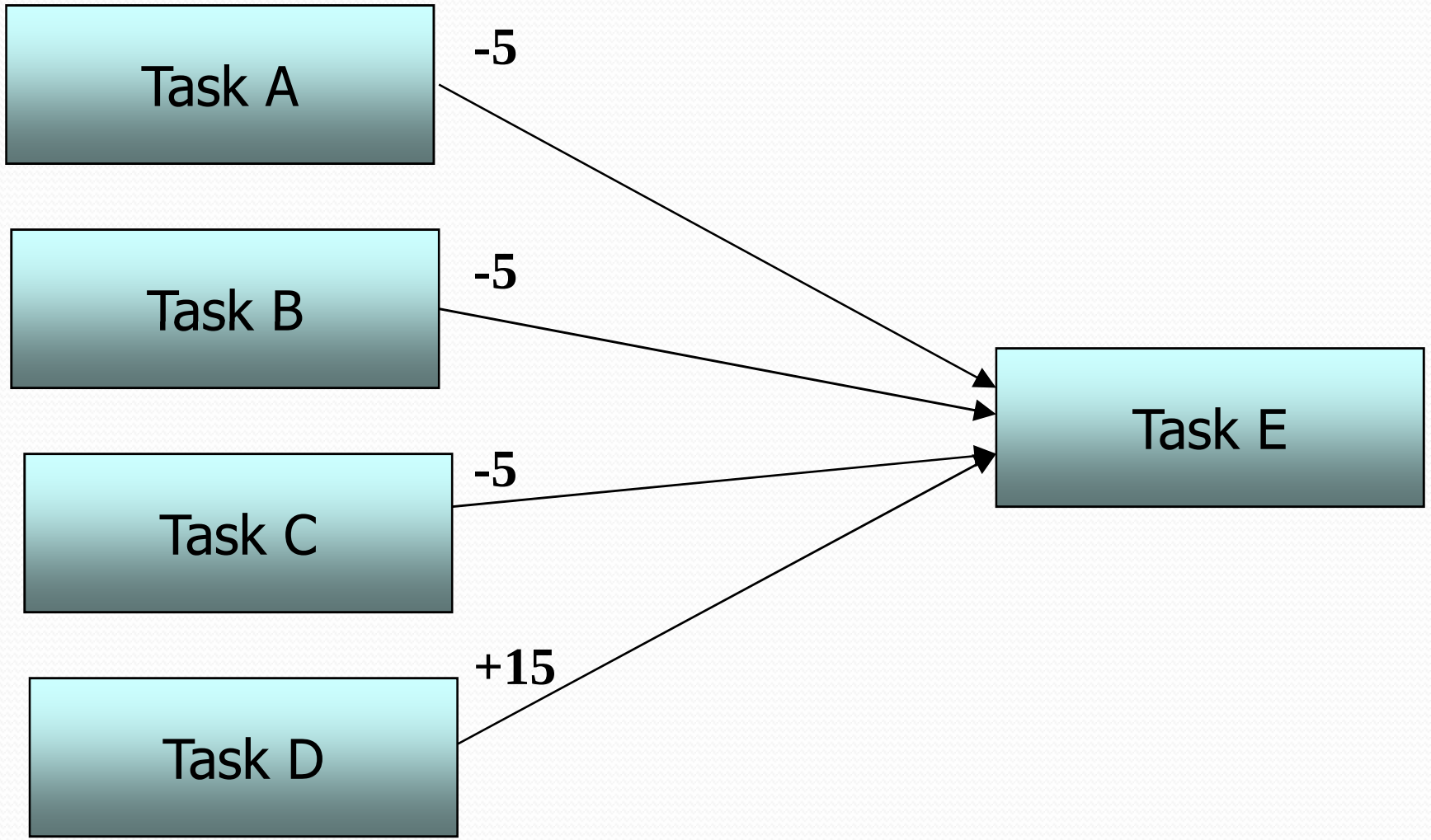
Dependencies

- A delay in one step is passed, in full, to the next step
- An advance made in one step i.s usually wasted

What about parallel steps?

In sequential steps, deviations do not average out. Delays accumulate, while advances do not. Safety disappears!

Dependencies



How Safety is Lost? - Dependencies

- In the case of parallel steps, the biggest delay is passed on to the next step
- All other early finishes do not count at all!
- This way, most of the safety put in doesn't help at all

Psychology

Parkinson's Law: "Work expands to fill (and often exceed) the available time"

Murphy's Law: "If anything can go wrong, it will"

How safety is Lost? - Summary

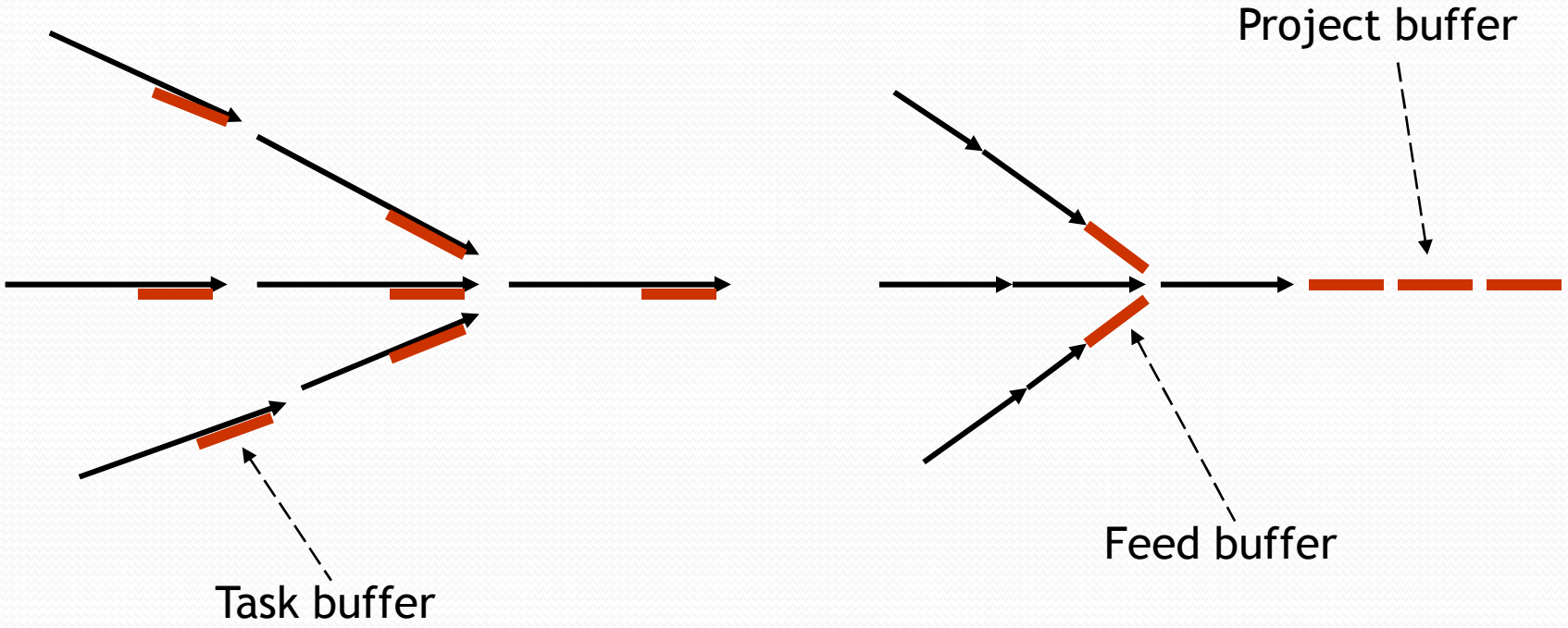
- Student Syndrome
- Multi-Tasking
- Delays accumulate, advances do not
- Parkinson's Law
- Murphy's Law

If we could find a way to put the safety only where it's needed ...

Manage buffers differently

- CCPM – Critical Chain Project Management
  - Convert task level buffers into project buffers
  - Look at the Network Diagram
  - Move task buffers on the critical path to the end of the path (called project buffer)
  - Move tasks buffers on a non-critical path to the point where it meets the critical path (called feed buffers)

Moving Task buffers to Project Buffer



CCPM Summary

- Convert task level buffers into project buffers
- Encourage reporting of early finishes
- Encourage relay-runner work ethic – start next task asap
- No penalties for task level delays – 50% tasks may be delayed
- Avoid Multi-tasking

- More about CCPM – Read Critical Chain by Eliyahu Goldratt

Planning and Tracking Scenario

- On Monday, you assign a work of size 2 week to your developer. You expect it to be done by Friday of 2nd week.
- On Friday, end of day, of first week, you ask the status to your developer “How much Percentage is complete”. What will he/she answer?
- What are the reasons/motives of each of those answers?
- Is it good for the Project?
- So how would you handle it? ##

Early Finish almost never gets reported!

- There is little positive incentive to finish ahead of time
- If you finish a task earlier than planned, you might be accused of sandbagging your estimates instead of being rewarded for completing ahead of schedule
- Your future estimates are cut based upon history
- The next task may not be ready for an early start
- You are not liked by your colleagues who are struggling to meet their due dates

End of Session