



**BITS Pilani**

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# SS ZG622: Software Project Management Contact Session # 6

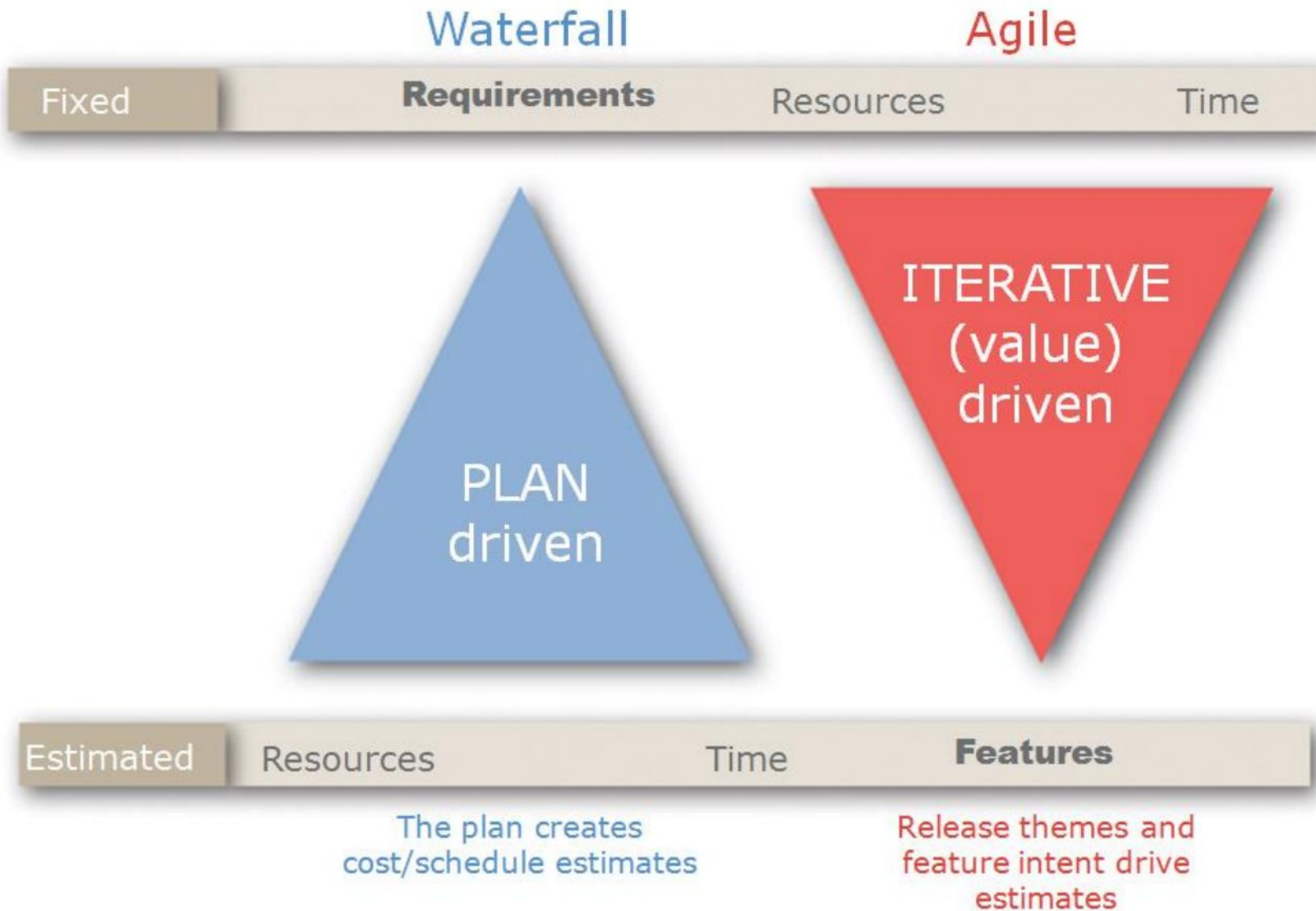
Prof. Narasimha Bolloju, BITS-Pilani, Hyderabad Campus

# Project planning - Topics



- Project planning in plan-driven methods
  - Mapping effort to duration (and schedule)
  - Example of effort distribution in waterfall methods
  - COCOMO II – overview and application
  - Work breakdown structure (WBS)
  - Gantt charts and critical path(s)
- Project planning in agile methods
  - Example of effort distribution in agile methods
  - Example tool - Pivotal Tracker (user stories, bugs, chores and milestones)

# The Agile Paradigm Shift



# Mapping effort to duration



- Effort in function points or KLOC (source lines of delivered code in thousands)
- Effort to duration
  - Experience-based and/or heuristics-based methods
  - Parametric methods like COCOMO81 and COCOMO II

# CS6-#1 Estimate project duration



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Assuming that the effort and productivity for the Mux-core project are as follows:

- Function points ~ 500
- Average productivity 10 function points per month per member

What should be the ideal project duration?

<https://www.ifpug.org/wp-content/uploads/2017/04/IYSM.-Thirty-years-of-IFPUG.-Software-Economics-and-Function-Point-Metrics-Capers-Jones.pdf>

# COCOMO formula for duration

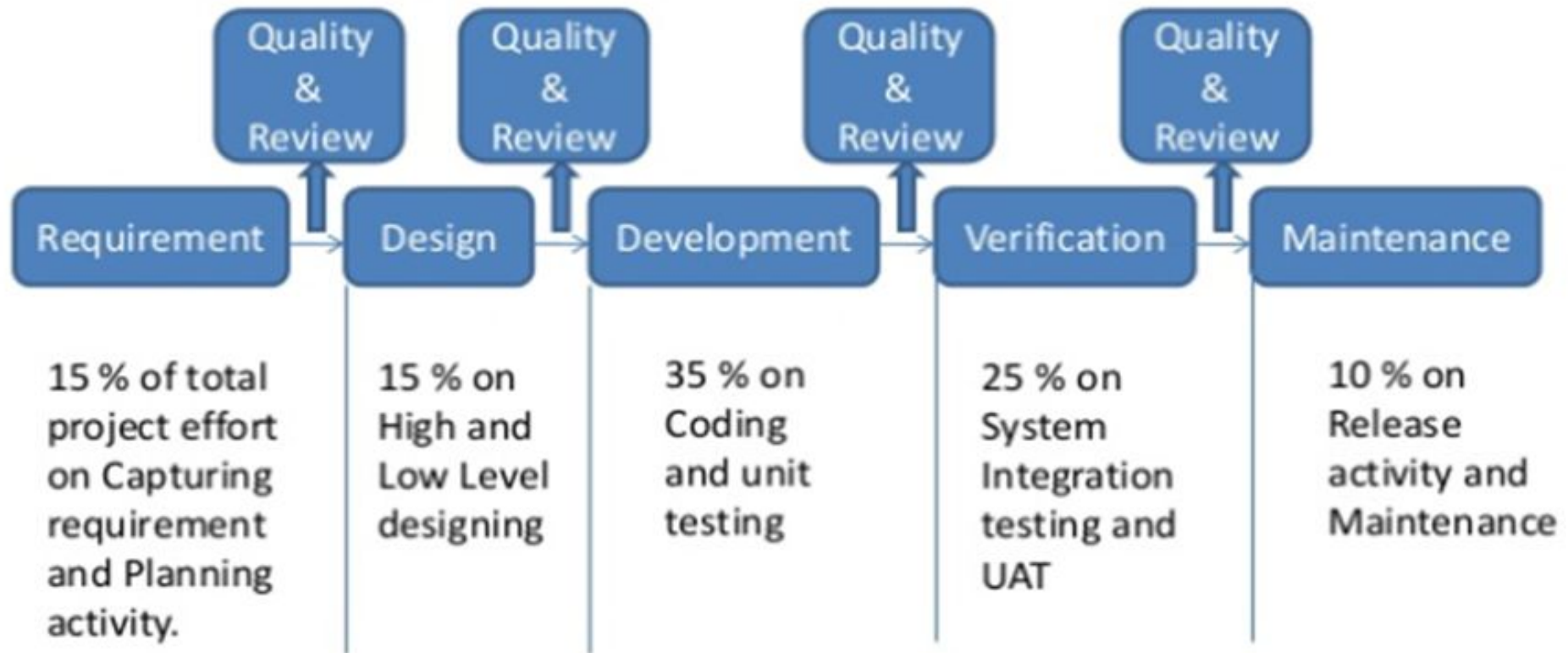


COCOMO formula for duration calculation:  $M = a \times E^b$   
where  $E$  is the estimated effort and

Project Type	$a$	$b$
Organic	2.5	0.38
Semi-detached	2.5	0.35
Embedded	2.5	0.32

Assuming that Mux-Core is a semi-detached project type with 500 fp, the project duration should be 22 months

# Example of effort distribution in waterfall process



<https://www.slideshare.net/brickedestimation/effort-distributiononwaterfallandagile>



# Software Cost Estimation Methods

- Cost estimation : prediction of both the person-effort and elapsed time of a project
- **Methods:**
  - Algorithmic
  - Expert judgement
  - Estimation by analogy
  - Parkinsonian
  - Price-to-win
  - Top-down
  - Bottom-up
- **Best approach is a combination of methods**
  - compare and iterate estimates, reconcile differences
- **COCOMO - the “COConstructive COst MOdel ”**
  - COCOMO II is the update to Dr. Barry Boehm ’s COCOMO 1981
- **COCOMO is the most widely used, thoroughly documented and calibrated cost model**

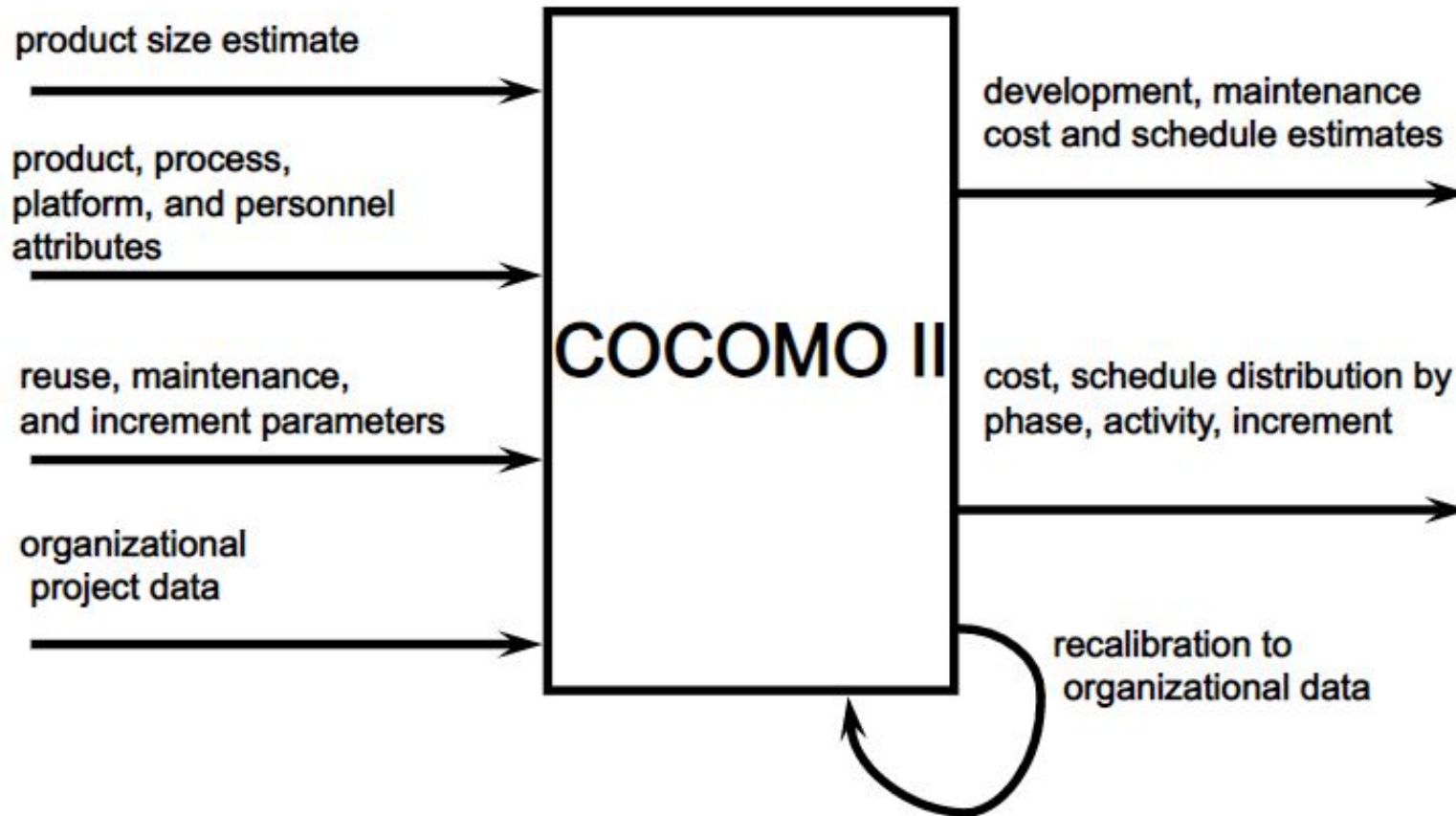
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<https://slideplayer.com/slide/7947860/>



# COCOMO Black Box Model



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Brief introduction -

<https://www.geeksforgeeks.org/software-engineering-cocomo-ii-model/>

<https://slideplayer.com/slide/7947860/>

# COCOMO II Calculator (read chap 5 of the text book for details)



**Software Size** Sizing Method **Function Points**

Unadjusted Function Points **440** Language **Java**

**Software Scale Drivers**

Precedentedness	<b>Nominal</b>	Architecture / Risk Resolution	<b>Nominal</b>	Process Maturity	<b>Nominal</b>
Development Flexibility	<b>Nominal</b>	Team Cohesion	<b>Nominal</b>		

**Software Cost Drivers**

<b>Product</b>		<b>Personnel</b>		<b>Platform</b>	
Required Software Reliability	<b>Nominal</b>	Analyst Capability	<b>Nominal</b>	Time Constraint	<b>Nominal</b>
Data Base Size	<b>Nominal</b>	Programmer Capability	<b>Nominal</b>	Storage Constraint	<b>Nominal</b>
Product Complexity	<b>Nominal</b>	Personnel Continuity	<b>Nominal</b>	Platform Volatility	<b>Nominal</b>
Developed for Reusability	<b>Nominal</b>	Application Experience	<b>Nominal</b>	<b>Project</b>	
Documentation Match to Lifecycle Needs	<b>Nominal</b>	Platform Experience	<b>Nominal</b>	Use of Software Tools	<b>Nominal</b>
		Language and Toolset Experience	<b>Nominal</b>	Multisite Development	<b>Nominal</b>
				Required Development Schedule	<b>Nominal</b>

**Maintenance** **Off**

<http://softwarecost.org/tools/COCOMO/>

# COCOMO II Calculator (read chap 5 of the text book for details)



## Results

### Software Development (Elaboration and Construction)

Effort = 169.9 Person-months

Schedule = 20.0 Months

Cost = \$4246906

Total Equivalent Size = 40000 SLOC

Effort Adjustment Factor (EAF) = 1.00

100% 100% 100% 100% 100% 100% 100% 100% 100% 100%

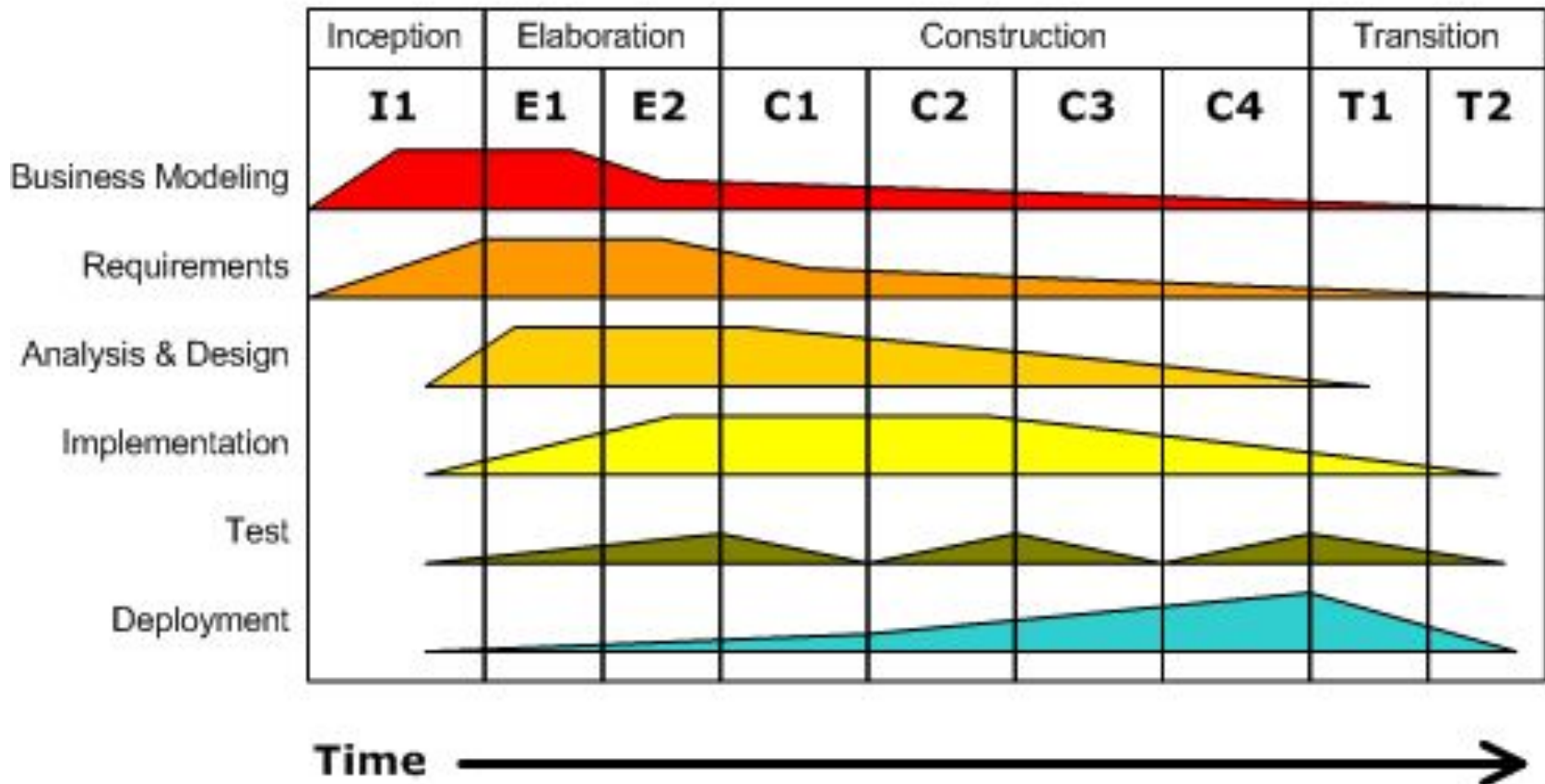
Note: Assume \$ = INR for interpretation of the inputs and results;; i.e., 25k rupees average salary per month

# Unified Process (for explaining estimation results)



## Iterative Development

Business value is delivered incrementally in time-boxed cross-discipline iterations.



# COCOMO II Calculator



## Results

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Effort = 169.9 Person-months

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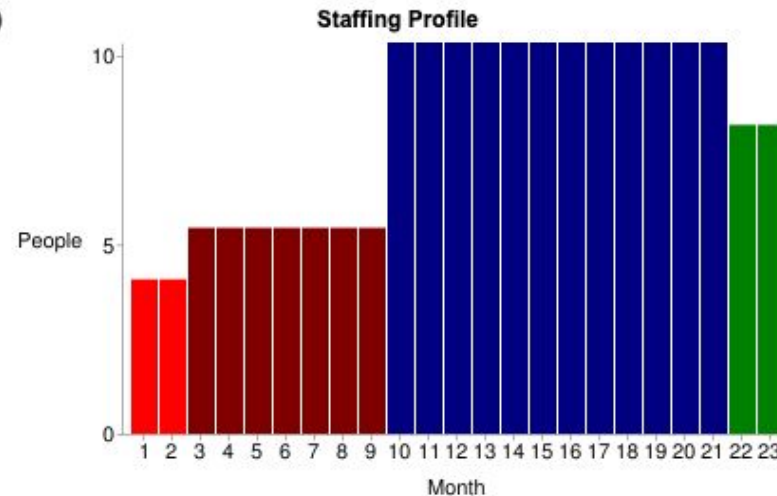
Cost = \$4246906

Total Equivalent Size = 40000 SLOC

Effort Adjustment Factor (EAF) = 1.00

### Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	10.2	2.5	4.1	\$254814
Elaboration	40.8	7.5	5.4	\$1019258
Construction	129.1	12.5	10.3	\$3227649
Transition	20.4	2.5	8.2	\$509629



### Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	1.4	4.9	12.9	2.9
Environment/CM	1.0	3.3	6.5	1.0
Requirements	3.9	7.3	10.3	0.8
Design	1.9	14.7	20.7	0.8
Implementation	0.8	5.3	43.9	3.9
Assessment	0.8	4.1	31.0	4.9
Deployment	0.3	1.2	3.9	6.1

<https://csse.usc.edu/tools/COCOMOIi.php>



# COCOMO II Calculator (read chap 5 of the text book for details)



**Software Effort Distribution for RUP/MBASE (Person-Months)**

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Note: Assume \$ = INR for interpretation of the inputs and results;; i.e., 25k rupees average salary per month



# CS6-#2 COCOMO II Calculator

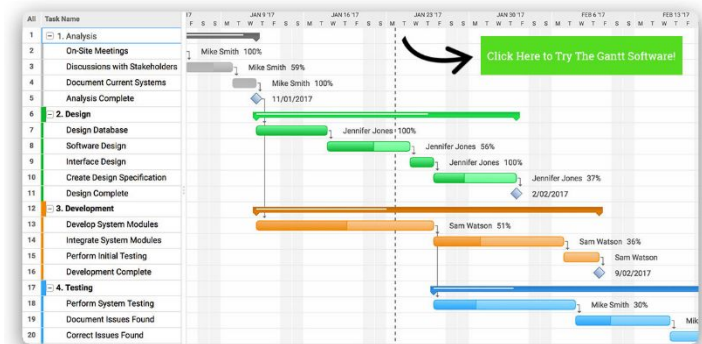


Keeping the function points as 500, observe the effect of software scale and cost drivers on the estimated effort, schedule and cost.

<http://softwarecost.org/tools/COCOMO/>

# Project Planning involves

- Work Breakdown Structure (WBS):**  
 Breaking down the work into parts and assign these to project team members, anticipate problems that might arise and prepare tentative solutions to those problems.
- Project Plan**, which is created at the start of a project, is used to communicate how the work will be done to the project team and customers, and to help assess progress on the project.



# Example of WBS fragment



## 3 Physical Design

### 3.01 Design or specify physical database

- 3.01.01 Review logical database design
- 3.01.02 Determine access methods to be used
- 3.01.03 Normalize database
- 3.01.04 Design database architecture
- 3.01.05 Identify reusable database structures
- 3.01.06 Develop detailed database layout
- 3.01.07 Develop database file, record, and schema descriptions
- 3.01.08 Develop module calling sequences
- 3.01.09 Update data dictionary entries
- 3.01.10 Validate physical database design

See WBS waterfall.pdf on the course website for a complete decomposition

# CS6-#3 Gantt Chart



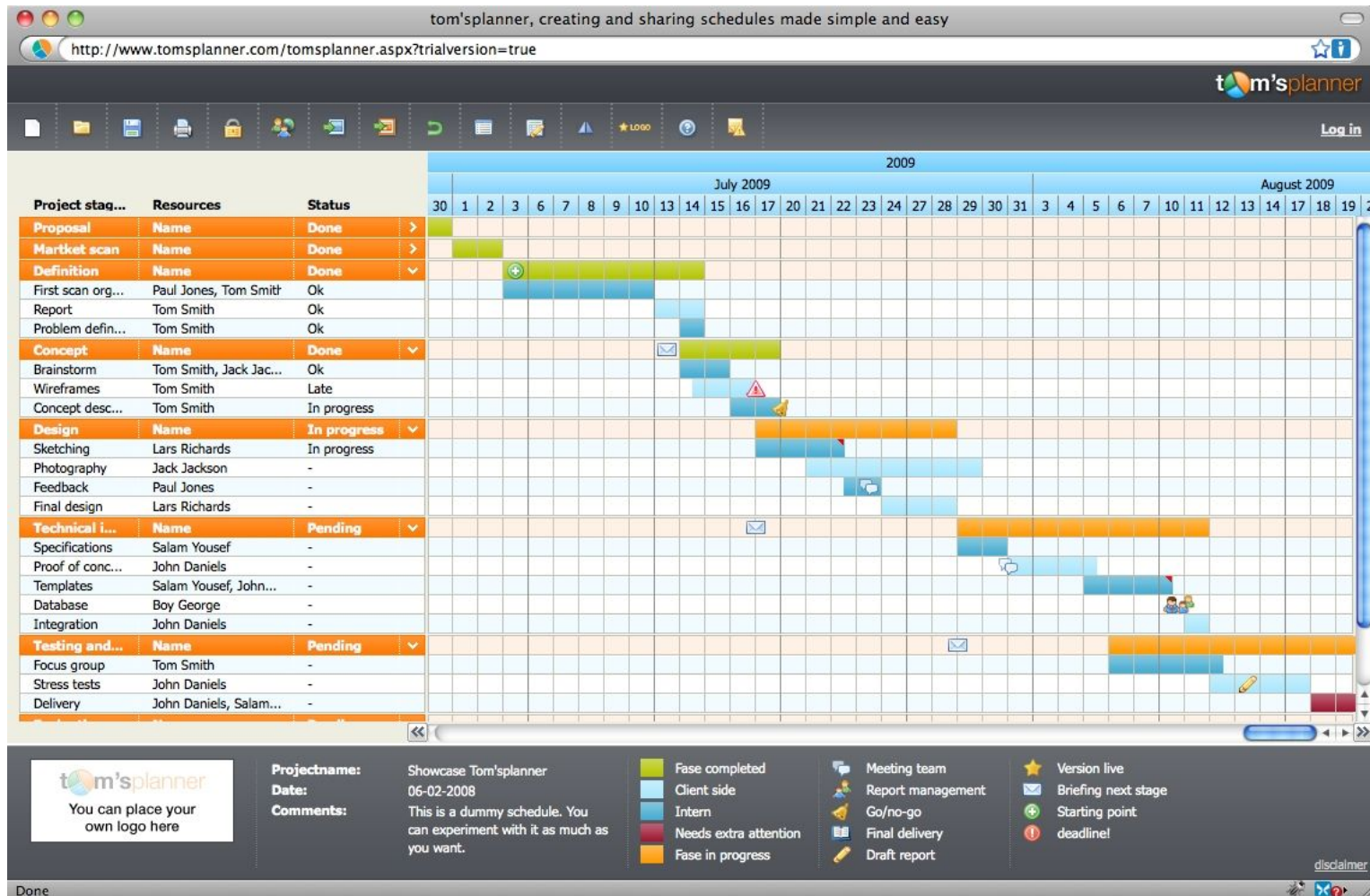
Activity	Duration (weeks)	Depends on	ResouGrce
A	3		SA
B	1	A	SD1
C	2	A	SD2
D	4	A	SD2
E	3	B	CD1
F	3	C	CD1
G	6	D	CD2
H	3	E,F,G	SA

Prepare a Gantt Chart (on paper or any tool you can find) to find the critical path and project duration

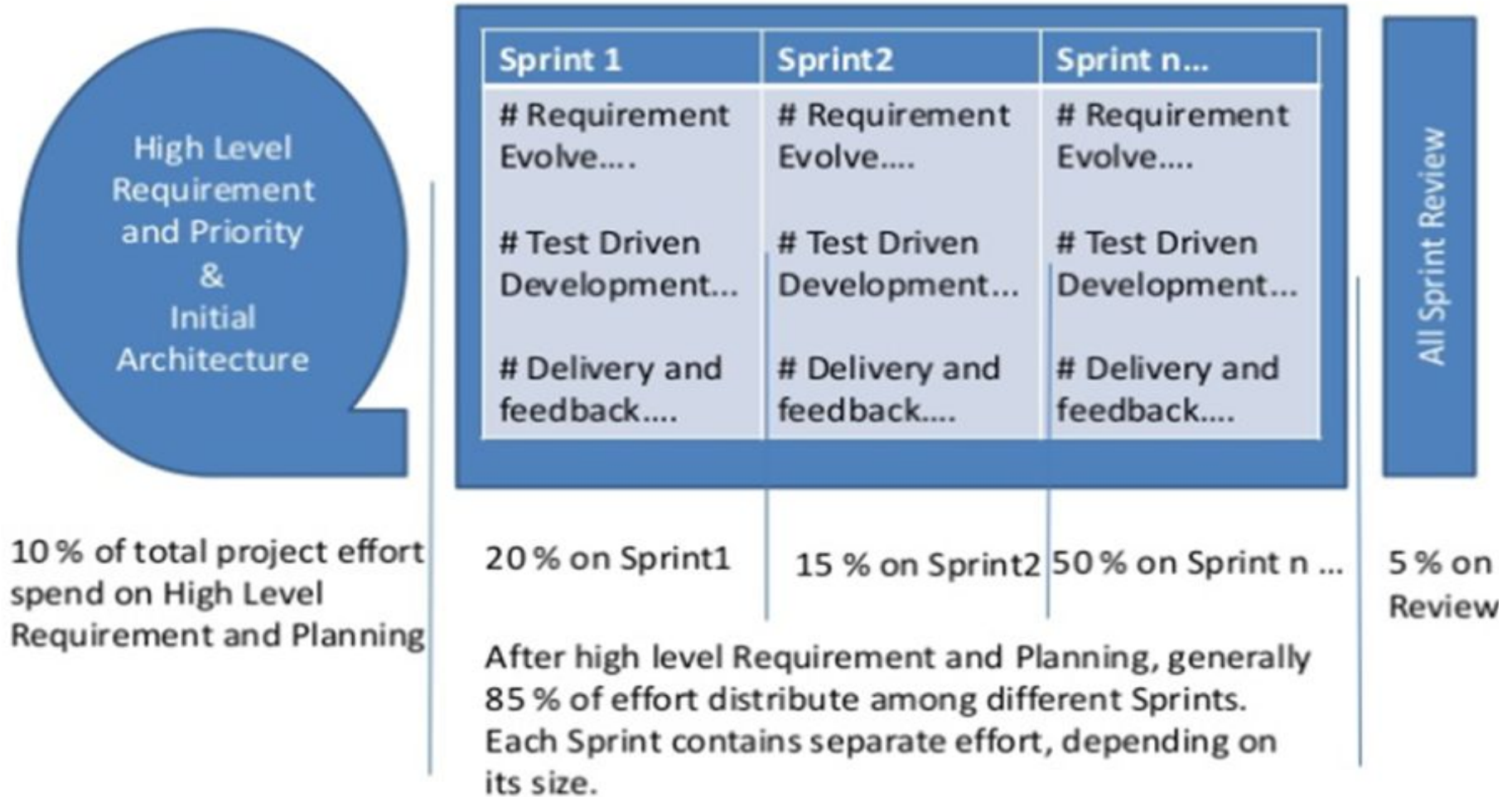
# Activity planning – Sample Gantt Charting tool



Tomsplanner (login using your BITS email ID)



# Example of effort distribution in agile process (Scrum)



<https://www.slideshare.net/brickedestimation/effort-distributiononwaterfallandagile>



# Pivotal Tracker



[https://www.pivotaltracker.com/help/articles/creating\\_a\\_project/](https://www.pivotaltracker.com/help/articles/creating_a_project/)

The screenshot displays the Pivotal Tracker interface for a project named "My Sample Project". The interface is divided into three main columns: "Current/Backlog", "Icebox", and "My Work".

- Current/Backlog:** This column is selected and shows a list of user stories. The top story is "Shopper should be able to click on a product, and see all product details, including photos" with a priority of 3 and a status of "Current". Below it are several other stories, some with "Accept" and "Reject" buttons. The bottom story is "Shopper should be able to search for product" with a priority of 4 and a status of "Current".
- Icebox:** This column is visible in the background and contains stories that are not currently being worked on. It includes stories like "Product browsing pagination not working in IE6", "Integrate with automated order fulfillment system", "native iPhone app to allow product browsing and checkout", and "Facebook app, allowing users to share favorite products".
- My Work:** This column is highlighted and shows a list of user stories. It includes stories like "Shopper should be able to view contents of shopping cart" and "Shopper should be able to remove product from shopping cart".

The interface also features a sidebar on the left with navigation options like "Add Story", "My Work", "Current/Backlog", "Icebox", "Done", "Epics", "Labels", and "Project History". The top bar includes a search bar and links to "HELP & UPDATES" and "MAIL".

# Pivotal Tracker



- Epics
- Icebox
- My work
- Story types
  - Features
  - Chores
  - Bugs
  - Releases