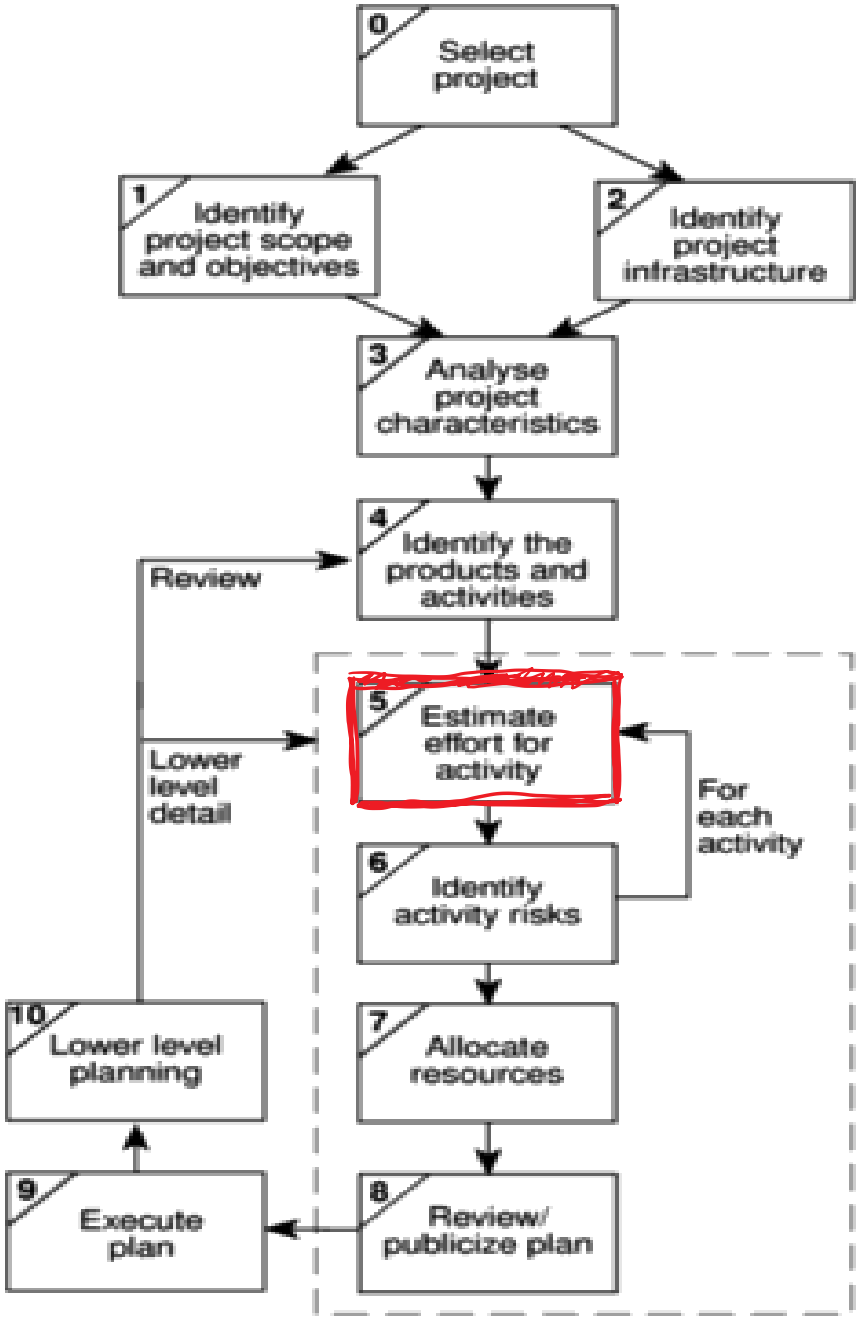
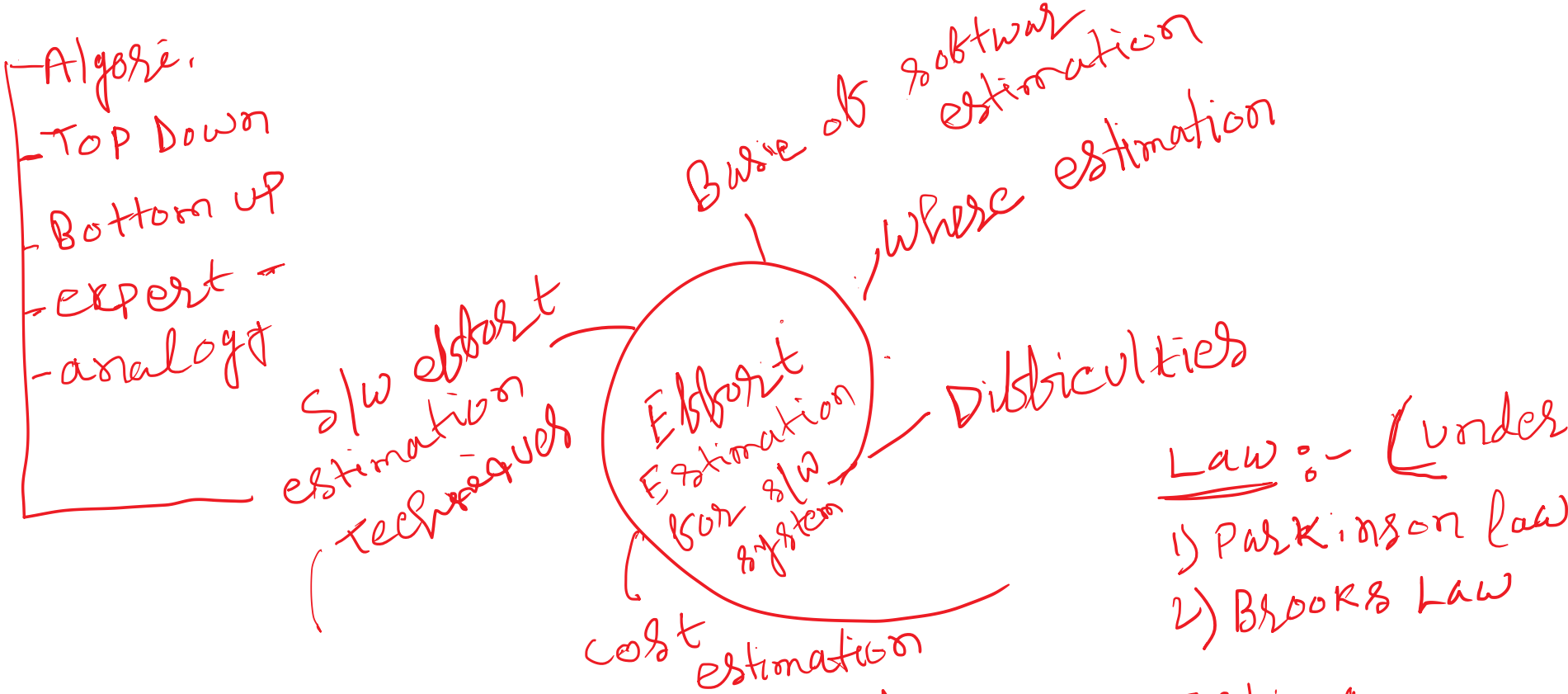
CSE 4016 Software Project Management

Software Effort Estimation

Dr. Sandip Mal


0
Select project
1
Identify project scope and objectives
2
Identify project infrastructure
3
Analyse project characteristics
4
Identify the products and activities
Review
5
Estimate effort for activity
Lower level detail
For each activity
6
Identify activity risks
7
Allocate resources
8
Review/ publicize plan
9
Execute plan
10
Lower level planning

- avoid the dangers of unrealistic estimates;
- understand the range of estimating methods that can be used;
- estimate projects using a bottom-up approach;
- count the function points and object points for a system;
- estimate the effort needed to implement software using a procedural programming language;
- understand the COCOMO approach to developing effort models.



Law :- (under)

1) Parkinson law
2) Brooks Law

SRS → Design — coding — Testing

Maint.

{ effort → person-Month
Duration → day, week, month, year

FP → function point, SLOC — source lin
KLOC → kilo line

1) Difficulties
- Changing of Technologies, Lack of project experie
- Political implication, Subjective nature of estimatio
  - Parkinson Law
  - Brooks

2) where estimation

WBS

SRS → FS → Design → Testing → Main.

3) Basis of s/w estimation
- effort → person-month (PM), Person week (PW)
- Duration → ~~days~~, month, year, week
- SLOC → source line of code → KLOC (Kilo line of code)
- FP → Function Point

3050 LOC / 1000 → 3.05 KLOC

S/W effort estimation
- Bottom up
- top down
- Algorithmic model

Techniques
- Parkinson
- Price to win
- Analogy
- expert judgement

Historical Data
- technology
- day

Difficulties
(Technologies, project, lack
change
Nature of estimating
estimation

where to estimate

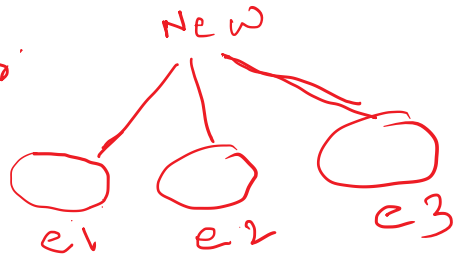
Effort estimation
S/W

(SLOC
FP)
Basis of estimation (effort duration)

S/W effort estimation Techniques
- Top
- Bott
- Algo
- exp
- ana
- Prec

SRS → Design – coding – Testing – Main.

System
2 hours | 4 hours



Difficulties

- Subjective nature of estimating
- Political implication
- Changing Technologies
- Lack of homogeneity of project experience
- Development of novel application

Where are estimation done

- Estimates are carried out at various stages of software project.
- Strategic Planning
  - Decide priority to each project.
- Feasibility Study
  - Benefits of potential system
- System Specification
  - Detailed requirement analysis at design stage.
- Evaluation of Suppliers Proposals
  - Tender Management
- Project Planning
  - Detailed estimates of smaller work components during implementation.

Problems with over and under estimates

Parkinson's Law:

work expands to fill the time available. Given an easy target staff will work less hard.

Brook's Law:

putting more people on a late job makes it later.

Basis for software Estimating

- Need of historic data
- Parameters to be estimated
  - Effort
  - duration
- Measure of work - SLOC and FP
  - No precise definition
  - Difficult to estimate at start of a project
  - Only a code measure
  - Programmer dependent
  - Does not consider code complexity

Software Effort estimation techniques

- Algorithmic model
- Expert judgement
- Analogy – similar completed project
- Parkinson – Staff effort available to do project
- Price to win – sufficiently low to win a project
- Top down – overall estimation is formulated
- Bottom up – individual components are evaluated

Bottom-up Estimating

- Work Breakdown Structure
- Assumptions about characteristics of final system
- Number and Size of software modules.
- Appropriate at detailed stages of project planning.
- When a project is completely novel or no historical data available.

- Explore the number and type of software modules in the system
- Estimate the SLOC of each identified modules
- Estimate the work content, taking into account complexity and technical difficulty.
- Calculate the work days effort.

Brigette at Brightmouth College has been told that there is a requirement, now that the payroll system has been successfully installed, to create a subsystem that analyses the staffing costs for each course. Details of the pay that each member of staff receives can be obtained from the payroll standing data. The number of hours that each member of staff spends teaching on each course can be obtained from standing files in a computer-based time-tabling system.

What tasks would have to be undertaken to implement this requirement? Try to identify tasks that would take one person about 1 or 2 weeks.

Top-down Approach and Parametric Models

- Effort = (system size) * (productivity rate)
- System size in the form of KLOC
- Productivity rate 40 days per KLOC
- Software module to be constructed is 2 KLOC
- Effort = 2 * 80 = 160 days

Note:
KLOC- Thousands of Lines of Code

Expert Judgment

- Asking for estimate of task effort from someone who is knowledgeable about either application or development environment.
- Experts use the combination of informal analogy approach where similar projects from past are identified and bottom up estimating.

Estimating by Analogy

- Called "Case Based Analogy"
- Estimator identifies completed projects source cases with similar characteristics to new project (target case)
- Effort of the source case used as base estimate for target.
- TOOL – ANGEL software tool
- Measuring Euclidean Distance between the cases

Say that the cases are being matched on the basis of two parameters, the number of inputs to and the number of outputs from the system to be built. The new project is known to require 7 inputs and 15 outputs. One of the past cases, Project A, has 8 inputs and 17 outputs. The Euclidean distance between the source and the target is therefore the square-root of $((7-8)^2+(17-15)^2)$, that is 2.24.

Project B has 5 inputs and 10 outputs. What would be the Euclidean distance between this project and the target new project being considered above? Is Project B a better analogy with the target than Project A?

Analogous Estimation Steps

The project manager and team have to collectively do analogous estimation.

- **Step 1** – Identify the domain of the current project.
- **Step 2** – Identify the technology of the current project.
- **Step 3** – Look in the organization database if a similar project data is available. If available, go to Step (4). Otherwise go to Step (6).
- **Step 4** – Compare the current project with the identified past project data.
- **Step 5** – Arrive at the duration and cost estimates of the current project. This ends analogous estimation of the project.
- **Step 6** – Look in the organization database if any past projects have similar modules as those in the current project.
- **Step 7** – Look in the organization database if any past projects have similar activities as those in the current project.
- **Step 8** – Collect all those and use expert judgment to arrive at the duration and cost estimates of the current project.

Advantages of Analogous Estimation

- Analogous estimation is a better way of estimation in the initial stages of the project when very few details are known.
- The technique is simple and time taken for estimation is very less.
- Organization’s success rate can be expected to be high since the technique is based on the organization’s past project data.
- Analogous estimation can be used to estimate the effort and duration of individual tasks too.

Albert Function Point

- External input types
- External output types
- External inquiry types
- Logical internal file types
- External interface file types

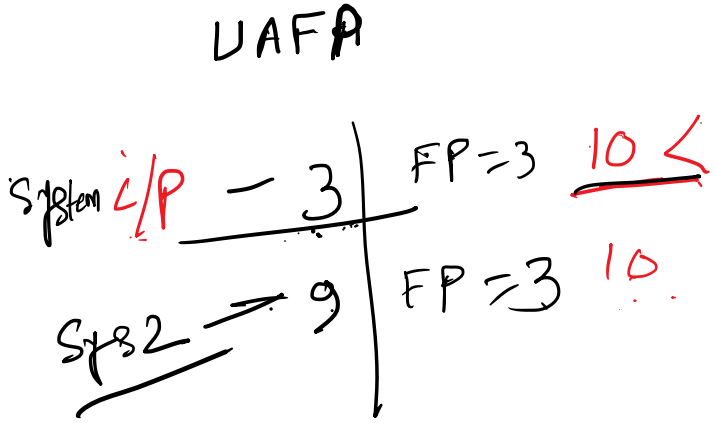


Table 5.2 *Albrecht complexity multipliers*

External user type	*Multiplier*		
	Low	*Average*	*High*
External input type	3	4	6
External output type	4	5	7
Logical internal file type	7	10	15
External interface file type	5	7	10
External inquiry type	3	4	6

Table 5.3 *IFPUG file type complexity*

Number of record types	*Number of data types*		
	<20	*20 to 50*	*>50*
1	low	low	average
2 to 5	low	average	high
> 5	average	high	high

Table 5.4 *IFPUG External input complexity*

Number of file types accessed	*Number of data types accessed*		
	<5	*5 to 15*	*>15*
0 or 1	low	low	average
2	low	average	high
> 2	average	high	high

Table 5.5 *IFPUG External output complexity*

Number of file types	*Number of data types*		
	<6	*6 to 19*	*>19*
0 or 1	low	low	average
2 or 3	low	average	high
> 3	average	high	high

Function Point

- ~~Albrecht~~ FP
  Albrecht
- Function-II (Function Point Mark II)
- cosmic FP
- COCOMO FPM
  - constructive cost Model

Albrecht FP :-

Function point mark II :-

$$PP = w_i \times i/p + w_e \times \text{number of entity} + w_o \times o/p$$

$w_i = 0.58$

$w_e = 1.66$

$w_o = 0.26$

$$FP = (0.58 \times 3) + (1.66 \times 2) + (0.26 \times 1)$$
$$\simeq 5.3$$

UAFP

* cash Receipt transaction system
  i) invoice ii) cash Receipt

data i/p → i) Invoice number
ii) Date of received
iii) ~~cash~~ cash i)

error message is the o/p of the trasaction.

Cosmic full FP (AFP) :-

- entries (E)
- exits (X)
- reads (R)
- writes (W)

Database

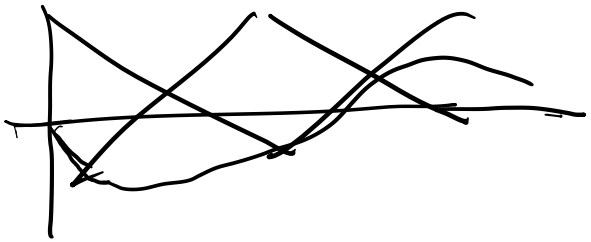
COCOMO FP Model :-

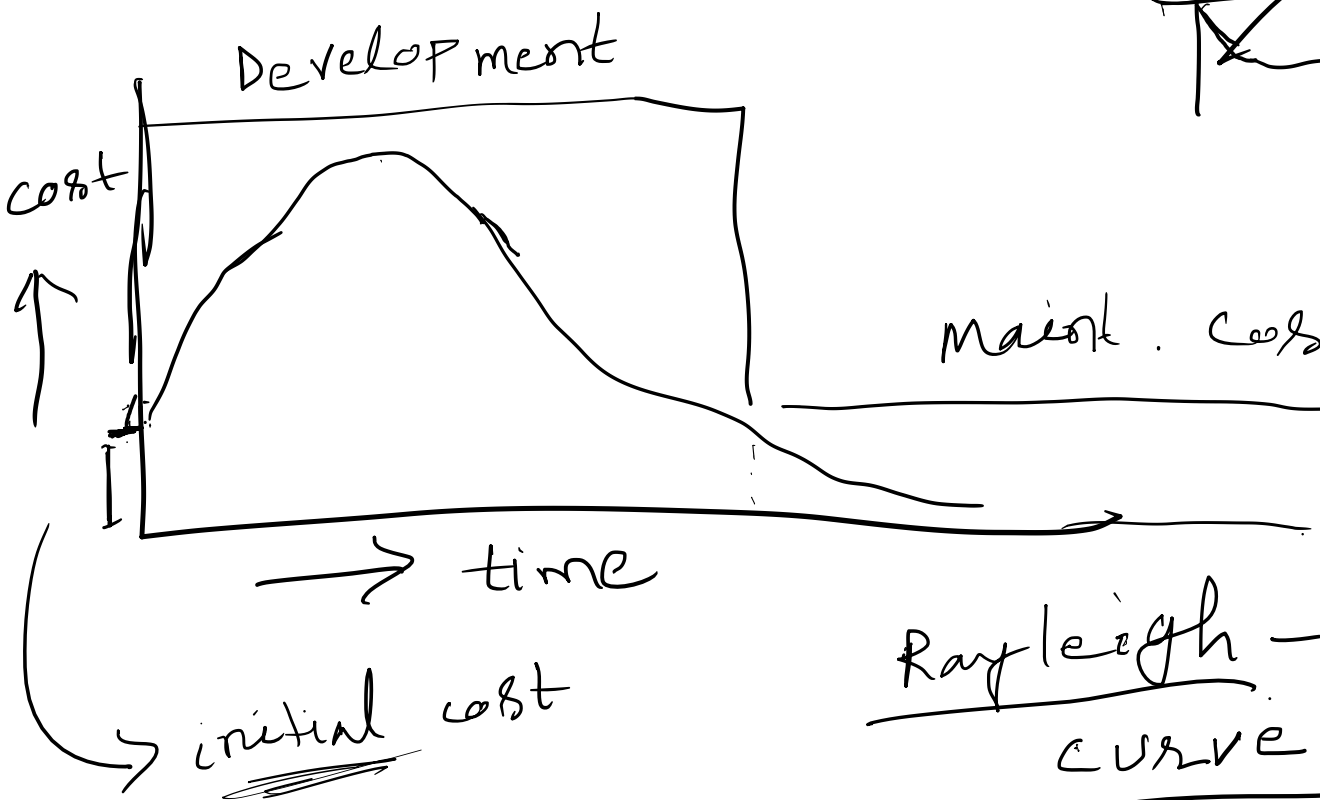
$LOC / KLOC

$$effort = c(size)^{K}$$

Type of system	C	K
Organic	2.4	1.05
Semi detached	3.0	1.12
Embedded	3.6	1.20

Cost estimation :-





Rayleigh – Norden curve.

Function Point

- Albrecht FP
- Function point Mark-II
- cosmic full FP
- COCOMO II : Productivity Model
  - Boehm, (constructive cost Mod

Effort < SLOC/KLOC / FP

cost (UAFP)

UAFP

FP Mark - II

Albrecht FP :

- External o/p type

$W_i = 0.56$

$W_e = 1.66$

$W_o = 0.26$

$FP = W_i \times i/P +$

$W_e \times$ Number of file acc

$W_o \times o/P$

cash Receipt transaction

- invoice
- cash receipt

} entity

i/p → invoice number, Date of received, cash received

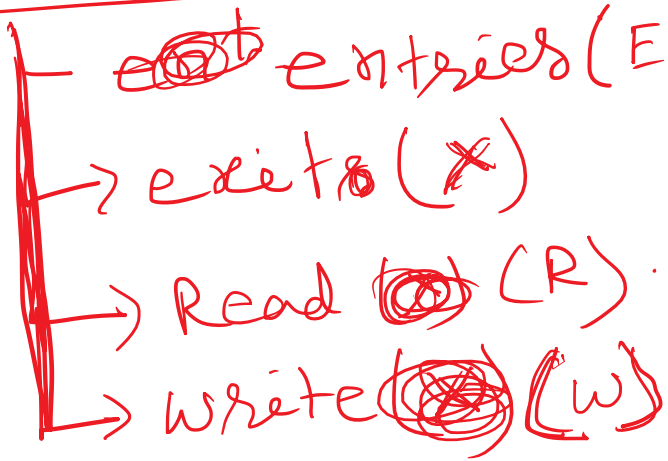
o/p → error message

FP = $w_i \times i/p + w_e \times entity + w_o \times o/p$

= $0.68 \times 3 + 1.66 \times 2 + 0.26 \times 1$

Effort =

Cosmic full function Point



i/p + r

AFP

CoCoMo PF 2

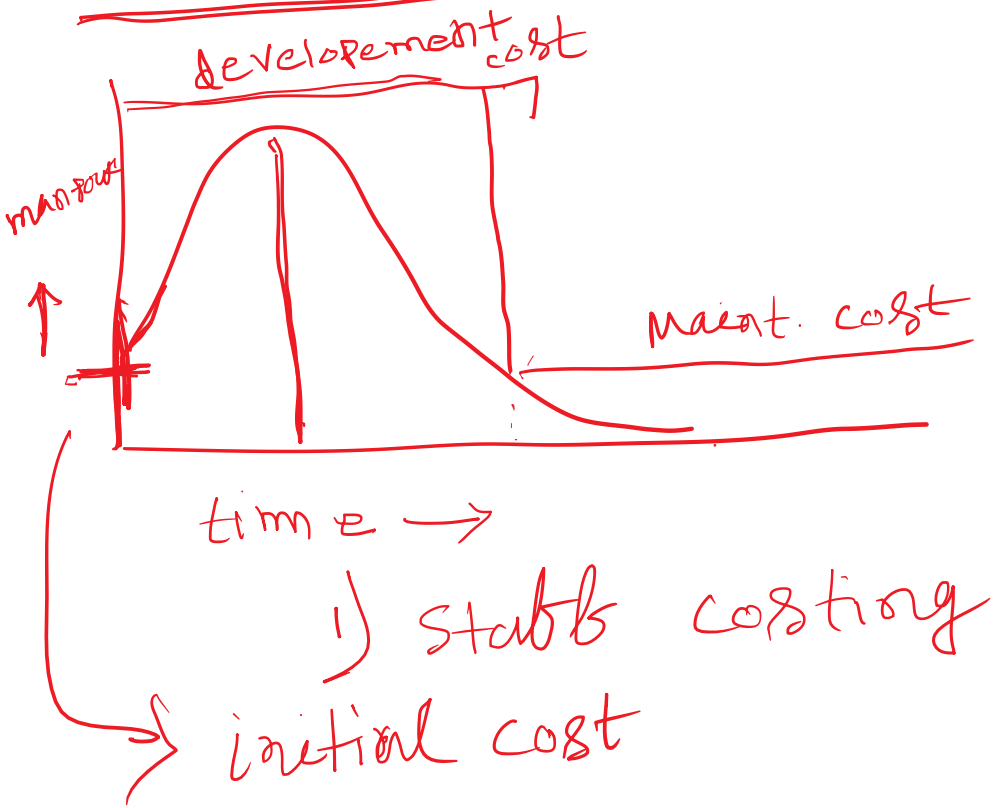
SLOC / KLOC

$$\text{effort} = c(\text{Size})^{K}$$

organic Mode
Embedded mode
semi detached))

	C	K
organic	2.4	1.05
semi	3.0	1.12
embed	3.6	1.20

cost estimation



→ Rayleigh - Norden curve -

1) static costing

→ initial cost