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SOFTWARE ENGINEERING LABORATORY (203105303) (Experiments)

Mr. Nirav Patel, Assistant Professor
CSE, PIET

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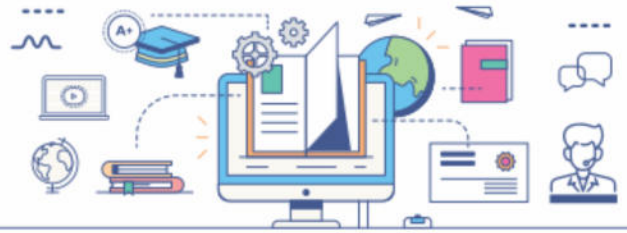

Experiment-5

Do Cost and Effort Estimation using Software Cost Estimation model.

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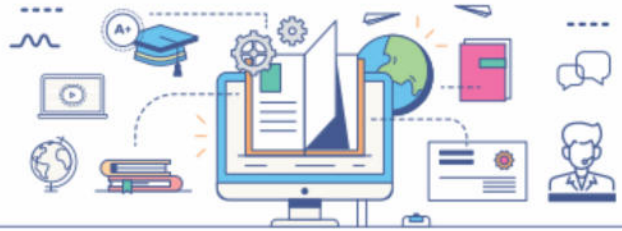
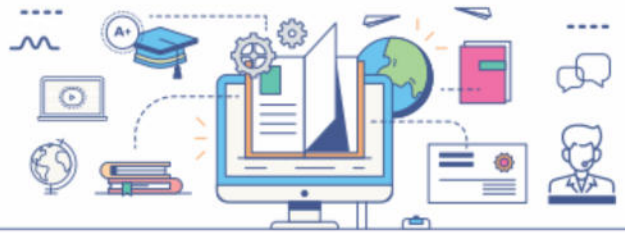


Aim: Do Cost and Effort Estimation using Software Cost Estimation model.

Objectives: To make use of COCOMO model to find out the cost of software development.



Software Development Project

Software Development Project Classification

Organic

Application programs
e.g. data processing programs

A **development project** can be considered of **organic** type, if the project deals with **developing** a **well understood application program**, the **size** of the **development team** is reasonably **small**, and the **team members** are **experienced** in **developing similar types of projects**

Semidetached

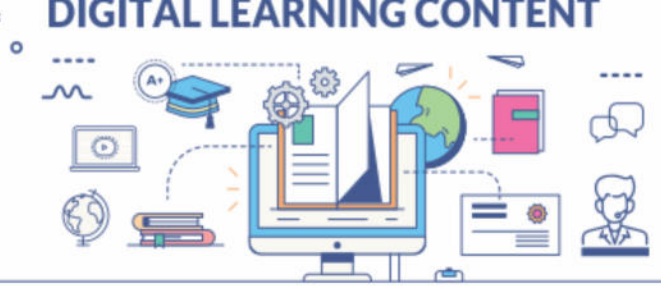
Utility programs
e.g Compilers, linkers

A **development project** can be considered of **semidetached** type, if the **development consists** of a **mixture** of **experienced** & **inexperienced staff**. Team members may have **limited experience on related systems** but may be unfamiliar with some aspects of the system being developed.

Embedded

System programs
e.g Operating systems, real-time systems

A **development project** is considered to be of **embedded** type, if the **software** being **developed** is **strongly coupled** to **complex hardware**, or if the **strict regulations** on the **operational procedures** exist



Software Development Project Cont.

Model	Project Size	Nature of Project	Innovation	Dead Line	Development Environment
Organic	Typically **2-50 KLOC**	Small Size Project, Experienced developers in the familiar environment, E.g. Payroll, Inventory projects etc.	Little	Not Tight	Familiar & In-house
Semi Detached	Typically **50-300 KLOC**	Medium Size Project, Medium Size Team, Average Previous Experience, e.g. Utility Systems like Compilers, Database Systems, editors etc.	Medium	Medium	Medium
Embedded	Typically **Over 300 KLOC**	Large Project, Real Time Systems, Complex interfaces, very little previous Experience. E.g. ATMs, Air Traffic Controls	Significant Required	Tight	Complex hardware & customer Interfaces

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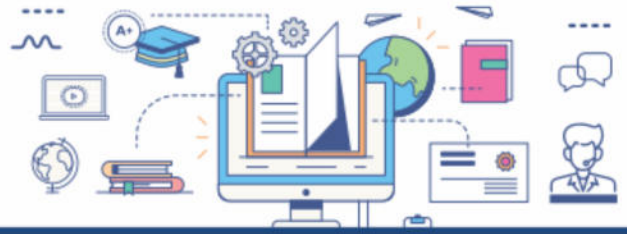
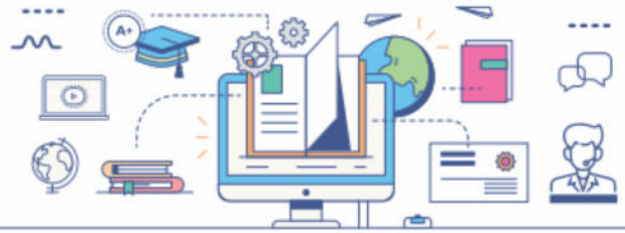


COCOMO Model

COCOMO (Constructive Cost Estimation Model) was proposed by Boehm According to Boehm, **software cost estimation** should be done through three stages:

- Basic COCOMO,
- Intermediate COCOMO, and
- Complete COCOMO



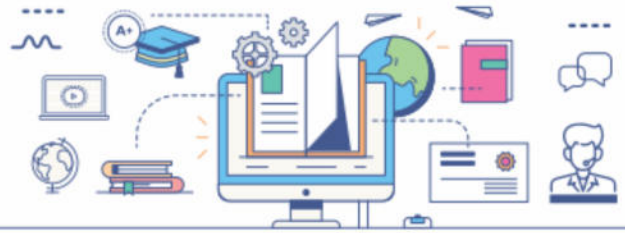
Basic COCOMO Model

The **basic COCOMO** model gives an **approximate estimate** of the project parameters

The **basic COCOMO estimation** model is given by the **following expressions**

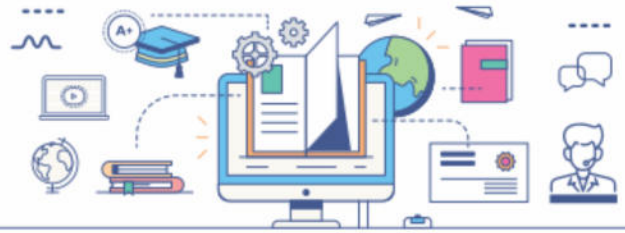
$$\boldsymbol{Effort} = a_1 * (KLOC)^{a_2}\ PM \qquad \boldsymbol{Tdev} = b_1 \times (Effort)^{b_2}\ Months$$

- **KLOC** is the estimated size of the software product expressed in Kilo Lines of Code,
- **a_1, a_2, b_1, b_2** are constants for each category of software products,
- **Tdev** is the estimated **time to develop** the software, **expressed in months**,
- **Effort** is the total effort required to develop the software product, expressed in **person months (PMs)**.



Basic COCOMO Model

Project	A1	A2	B1	B2
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

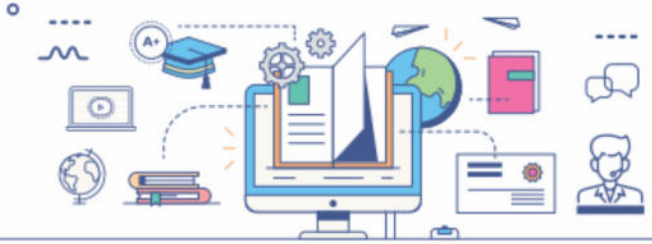


Basic COCOMO Model Cont.

- **Every line of source** text should be **calculated** as **one LOC irrespective of** the **actual number of instructions** on that line

- If a **single instruction spans several lines** (say **n lines**), it is **considered** to be **nLOC**

- The values of a_1, a_2, b_1, b_2 for different categories of products (i.e. organic, semidetached, and embedded) as given by Boehm



Basic COCOMO Model Cont.

- **Example:**

- Assume that the **size** of an **organic type** software product **has been estimated** to be **32,000 lines of source code**. Assume that the **average salary** of software **engineers** be **Rs. 15,000/- per month**. **Determine** the **effort required** to develop the software product **and** the **nominal development time**

$$\boldsymbol{Effort} = a_1 * (KLOC)^{a_2}\ PM$$

$$= 2.4 * (32)^{1.05}\ PM$$

$$= 91\ PM$$

$$\boldsymbol{Tdev} = b_1 \times (Effort)^{b_2}\ Months$$

$$= 2.5 \times (91)^{0.38}\ Months$$

$$= 14\ Months$$

Cost required to develop the product = 14 x 15000 = Rs. **2,10,000/-**

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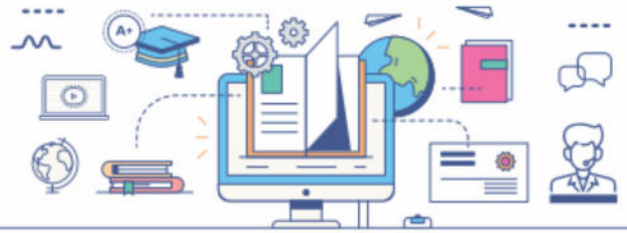
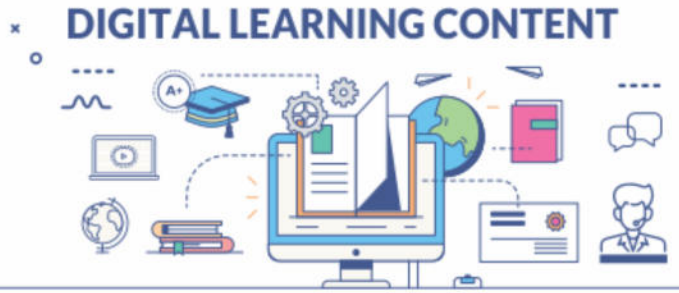


Experiment Demonstration



Cost Estimation for software

External Input:

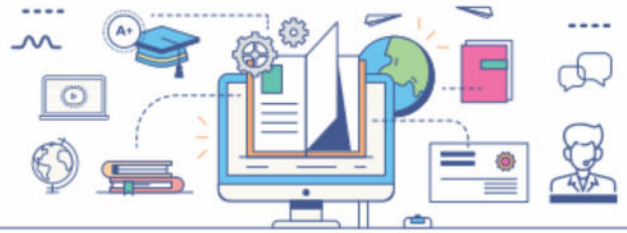
Req1.1	Req2.1.2	Req2.2
Req2.3	Req3.1	Req4.1
Req4.2		

External Output:

Req3.1	Req3.2

No. of Inquiries:

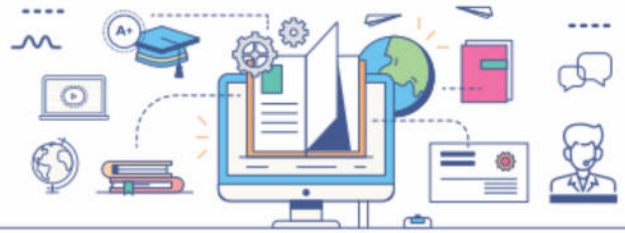
Member information
Status
Profit / Loss inquiry



Cost Estimation for software

No. of External Files:
database

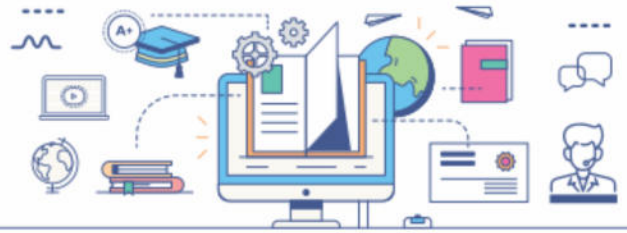
No. of External Interfaces:
Client machine
Printer



Cost Estimation for software

FP = Count Total * [0.65 + 0.01 * ∑(VAF)]

Information Domain Value	Count		Weighting factor Simple	Average	Complex		
External Inputs (EIs)		×	3	4	6	=	
External Outputs (EOs)		×	4	5	7	=	
External Inquiries (EQs)		×	3	4	6	=	
Internal Logical Files (ILFs)		×	7	10	15	=	
External Interface Files (EIFs)		×	5	7	10	=	
Count total	→						

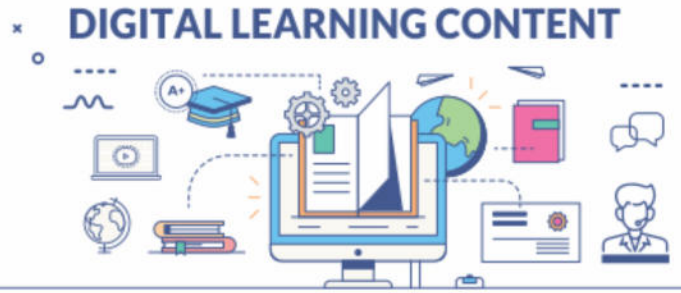


Cost Estimation for software

Calculation of Function Point (FP):

No. of External Inputs: 7
No. of External Outputs: 2
No. of External Inquiries: 3
No. of External Files: 1
No. of External Interfaces: 2

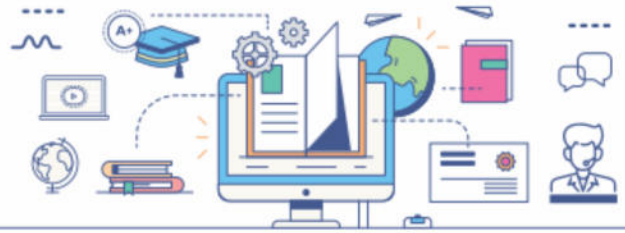
Count Total = 7*3+2*5+3*3+1*7+2*10
=67



Cost Estimation for software

Value Adjustment Factors (VAF)

F1: Does the system require reliable backup & recovery?	5
F2: Are data communications required?	5
F3: Are there distributed processing functions?	1
F4: Is performance critical?	3
F5: Will the system run in an existing, heavily utilized operational environment?	0
F6: Does the system require online data entry?	2
F7: Does the online data entry require the input transaction to be built over multiple screens or operation?	3
F8: Are the master files updated online?	4
F9: Are the inputs, outputs, files or inquiries complex?	1
F10: Is the internal processing complex?	1
F11: Is the code designed to be reusable?	2
F12: Are the conversion and installation included in design?	1
F13: Is the system design for multiple installations in different organizations?	2
F14: Is the application designed to facilitate change and ease of use by the user?	4



Cost Estimation for software

FP = Count Total * [0.65 + 0.01 * ∑(VAF)]

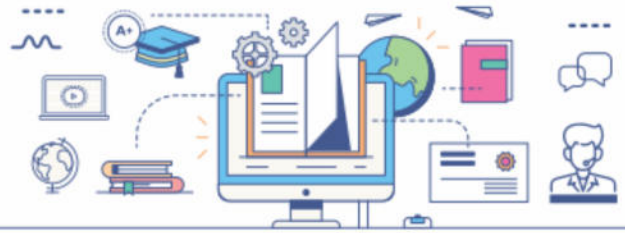
FP = 67*(0.65+0.01*(34))

FP = 66.33

1 FP = 32 LOC in VISUAL BASIC

so, 66.33 = 2122 LOC

so, Approximately 2 KLOC final size.



Cost Estimation for software

Efforts = 3.6 * (2)1.2
= 8.27 PM

Tdev = 2.5 * (8.27)0.32
= 4.91 months

END