Bahria University-Karachi Campus

Software Project Management

Fall-2024

Week 10

Engr. Majid Kaleem

مدرس: مہندس ماجد کلیم

جامعہ بحریہ، واقعگاہ کراچی

WEEK 10 - AGENDA

- Constructive Cost Model (COCOMO)

SPM-FALL-2024

CONSTRUCTIVE COST MODEL

- COCOMO is a model used in software engineering to estimate the *cost*, effort, and duration of a software development project.
- Developed by Barry Boehm in the 1970s, it helps in predicting the effort and cost required for a software project based on various parameters such as size, complexity, and other factors.

CONSTRUCTIVE COST MODEL

- COCOMO has three variations:
  1. Basic COCOMO: This model estimates the effort based on the size of the software to be developed.
  2. Intermediate COCOMO: It considers various project attributes and cost drivers to estimate effort and schedule.
  3. Detailed COCOMO: This is a more complex model, taking into account a higher number of project parameters to create a more accurate estimation.
- These models help in providing a framework for project managers to understand the resources required for software development, aiding in better planning and management.

CONSTRUCTIVE COST MODEL

- COCOMO (Constructive Cost Model) categorizes software projects into three different types based on their complexity and size. These types are referred to as modes:

1. Organic Mode:

- A software project is said to be an organic type if:
  - The project is small and simple.
  - The project team is small with prior experience.
  - The problem is well understood and has been solved in the past.
  - Requirements of projects are not rigid, such a mode example is the payroll processing system.

CONSTRUCTIVE COST MODEL

2. Semi-Detached Mode:

- A software project is said to be a Semi-Detached type if:
  - The project has complexity.
  - Project team requires more experience, better guidance, and creativity.
  - The project has an intermediate size and has mixed rigid requirements such a mode example is a transaction processing system which has fixed requirements.
  - It also includes the elements of organic mode and embedded mode.
  - A few such projects are a Database Management System(DBMS), a new unknown operating system, difficult inventory management system.

CONSTRUCTIVE COST MODEL

3. Embedded Mode:

- A software project is said to be an Embedded mode type if:
  - A software project has *fixed* requirements for resources.
  - Product is developed within very tight constraints.
  - A software project requiring the highest level of complexity, creativity, and experience requirement falls under this category.
  - Such mode software requires a larger team size than the other two models.

CONSTRUCTIVE COST MODEL

Mode	a	b	c	d
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.2	2.5	0.32

Effort	**a(KLOC)^b** *Person-Month*
Development Time	**c(Effort)^d** *Month*
Average Staff Size	**Effort/Dev. Time** *Persons*
Productivity	**KLOC/Effort** *KLOC/P-M*

Problem:

Suppose that a project was estimated to be 400 KLOC. Calculate effort and time for each of 3 modes of development:

1. *Organic*
2. *Semidetached*
3. *Embedded*

COCOMO Effort

Size	Appl	Util	Sys
5K	13.0	18.2	24.8
10K	26.9	39.5	57.1
15K	41.2	62.2	92.8
20K	55.8	86.0	131.1
25K	70.5	110.4	171.3
30K	85.3	135.3	213.2
35K	100.3	160.8	256.6
40K	115.4	186.8	301.1
45K	130.6	213.2	346.9
50K	145.9	239.9	393.6

SPM-FALL-2024

COCOMO MODEL

1. Organic:
   - Effort = 2.4 $(400)^{1.05}$ = 1295 PM
   - Dev. Time = 2.5$(1295)^{0.38}$ = 38 Months
2. Semi-detached:
   - Effort = 3 $(400)^{1.12}$ = 2462 PM
   - Dev. Time = 2.5$(2462)^{0.35}$ = 38.4 Months
3. Embedded:
   - Effort = 3.6 $(400)^{1.2}$ = 4772 PM
   - Dev. Time = 2.5$(4772)^{0.32}$ = 38 Months

SPM-FALL-2024

COCOMO MODEL

Boehm also determined that in his project data, there was a standard development time based on the type of project and the size of the project. The following are the formulas for development time (TDEV) in programmer-months:

1. Application programs: TDEV $= 2.5 * (PM)^{0.38}$
2. Utility programs: TDEV $= 2.5 * (PM)^{0.35}$
3. Systems programs: TDEV $= 2.5 * (PM)^{0.32}$

EXAMPLE
Calculate the standard TDEV using the COCOMO formulas for projects from 5 to 50 KDSI

SPM-FALL-2024

COCOMO MODEL

Mode	Effort	Schedule
Organic	$E=2.4*(KDSI)^{1.05}$	$TDEV=2.5*(E)^{0.38}$
Semidetached	$E=3.0*(KDSI)^{1.12}$	$TDEV=2.5*(E)^{0.35}$
Embedded	$E=3.6*(KDSI)^{1.20}$	$TDEV=2.5*(E)^{0.32}$

COCOMO Development Time

Size	Appl	Util	Sys
5K	6.63	6.90	6.99
10K	8.74	9.06	9.12
15K	10.27	10.62	10.66
20K	11.52	11.88	11.90
25K	12.60	12.97	12.96
30K	13.55	13.93	13.91
35K	14.40	14.80	14.75
40K	15.19	15.59	15.53
45K	15.92	16.33	16.25
50K	16.61	17.02	16.92

To be continued...