Use COCOMO Model to estimate the Effort of your Course Project.

Course Project – **CSE Academic Resource Management System (ASTU ASYST)**

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COCOMO Model

The Constructive Cost Model is a procedural software cost estimation model developed by Barry W. Boehm. This application derives the COCOMO software engineering metric as found in *Robert Pressman's "Software Engineering, A Practitioner's Approach"*, (McGraw-Hill, 97). The specific version utilized here is the "basic" model.

The key parameters which define the quality of any software products, which are also an outcome of the COCOMO are primarily Effort & Schedule:

- Effort: Amount of labor that will be required to complete a task. It is measured in person-months units.
- Schedule: Simply means the amount of time required for the completion of the job, which is, of course, proportional to the effort put. It is measured in the units of time such as weeks, months.
- Instructions: Enter the lines of code in Kilo Lines of Code (KLOC) as per the type of the project and estimated lines of code.

Boehm's definition of organic, semidetached, and embedded systems:

1. Organic – A software project is said to be an organic type if the team size required is adequately small, the problem is well understood and has been solved in the past and also the team members have a nominal experience regarding the problem.
2. Semi-detached – A software project is said to be a Semi-detached type if the vital characteristics such as team-size, experience, knowledge of the various programming environment lie in between that of organic and embedded. The projects classified as Semi-Detached are comparatively less familiar and difficult to develop compared to the organic ones and require more experience and better guidance and creativity. E.g.: Compilers or different Embedded Systems can be considered of Semi-Detached type.
3. Embedded – A software project with requiring the highest level of complexity, creativity, and experience requirement fall under this category. Such software requires a larger team size than the other two models and also the developers need to be sufficiently experienced and creative to develop such complex models.

Estimation of Effort: Calculations

$$E = a(KLOC)^b$$

Following the principles of the Basic Model

The above formula is used for the cost estimation of for the basic COCOMO model, and also is used in the subsequent models. The constant values a and b for the Basic Model for the different categories of system:

The effort is measured in Person-Months and as evident from the formula is dependent on Kilo-Lines of code. These formulas are used as such in the Basic Model calculations, as not much consideration of different factors such as reliability, expertise is taken into account, henceforth the estimate is rough.

Software Project	a_b	b_b	c_b	d_b
organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
embedded	3.6	1.20	2.5	0.32

So there is a requirement to calculate the cocomo effort which is the lines of code; to determine an estimation of the total lines of code; we have estimated the total lines of code using plugins LineCount in Visual Studio Code and ProjectCost in PHP Storm.

EXTENSION NAME: linecount

EXTENSION VERSION: 0.1.7

Count time: 2019-03-28 16:51:17

Count workspace:
c:\xampp\htdocs\astuasyst

Total files: 386

Total code lines: 97062

Total comment lines: 5353

Total blank lines: 7822

We can see that the very total lines of code is morethan 97 thousand, but excluding the CDN generated files or composer install files like package.json, gulpfile.js, phpmailer.php about 36,000 lines of code is exluded. So we are left with 61,062 lines of code. So by calculating it with the given formula and also online COCOMO calculator tools (http://www.edtechnology.in/cocomo/ and https://strs.grc.nasa.gov/repository/forms/cocomo-calculation/) the following results are obtained.

COCOMO RESULTS for ASTU ASYST

MODE	"A" variable	"B" variable	"C" variable	"D" variable	KLOC	EFFORT, (in person-months)	DURATION, (in months)	STAFFING, (recommended)
organic	2.4	1.05	2.5	0.38	61.062	179.999	17.986	10.008

Explanation: The coefficients are set according to the project mode selected on the previous page, (as per Boehm). The final estimates are determined in the following manner:

effort =a*KLOC^b, in person-months, with KLOC = lines of code, (in thousands), and:

staffing =effort/duration

where a has been adjusted by the factors:

Effort = $a*loc^b$

Duration = $c*effort^d$

Staffing = effort/duration

	Organic	Semi-detached	Embedded
Variable A	2.4	3	3.6
Variable B	1.05	1.12	1.2
Variable C	2.5	2.5	2.5
Variable D	0.38	0.35	0.32
KLOC	61	61	61
Effort (In Person / Month)	179.80740300356436	299.7027099654665	499.6872898523508
Duration (In months)	17.979055981832182	18.398471447596062	18.260954129971772
Staffing (Recommended)	10.000936822559513	16.289543988428754	27.363701058325983

So the organic type matching this projects properties would estimate having an Effort of 179.80 Person/Month, Duration of about 17 months and a recommended staffing of 10 people.

Additionally, the PHP Strom plugin COCOMO Project Cost generated the following report after the workspace is analyzed.

```
Basic COCOMO, using Software Project ASTU ASYST class: Organic
Total lines of code  = 96930 (96.930 kLOC)
Effort Applied   (E) = 175.444 [person-months] (2.4 * kLOC ^ 1.05)
Development Time (D) =  17.153 [months] (2.5 * E ^ 0.38)
People Required  (P) =  10.29 [number of] (E / D)
```

Summary

Therefore, the COCOMO cost estimation can be summarized as follows:

Effort ~ 175 person-months

Development ~ about 17 months

People requires ~ about 10 people