Extension of COCOMO II Schedule Estimation

Introduction

The Center for Software Engineering at the University of Southern California is conducting research to update the software development cost estimation model called COCOMO. The project name is COCOMO II and is led by Dr. Barry W. Boehm.

A fundamental requirement for such research is real-world software development project data. This data will be used to test hypotheses and verify the model's postulations. In return the model will be open and made available to the public. The contribution of your data will ensure the final model is useful.

The data that is contributed is important to us. We will safeguard your contribution so as not to compromise company proprietary information. Some Affiliates have an active collection program, and make the data from past projects available under strict non-disclosure terms for the COCOMO II data collection efforts.

This questionnaire addresses only a project level of data granularity. The project level of granularity is data that is applicable for the whole project. This includes things like application type and development activity being reported.

This questionnaire has two sections. The first section includes general and project-level COCOMO II related questions. The second section is for an extension of COCOMO II, COPSEMO (**CO**COMO **Phase S**chedule and **E**ffort **Mo**del). If you have not submitted regular COCOMO-II data on this project yet, a copy of the form is available from the Points of Contact identified below.

The data collection activity for the COCOMO II research effort started in November 1994. The first calibration was published in 1997 based on 83 datapoints collected. It became popular as COCOMO II.1997 and produced estimates within 30% of the actuals 52% of the time for effort. The second calibration was published in 1998 based on 161 datapoints. It is known as COCOMO II.1998 and produces estimates within 30% of the actuals 71% of the time for effort. The aim of the COCOMO II research team is to continually update the existing COCOMO II database and to publish annual calibrations of the COCOMO II model. Hence by submitting your data to us, you play a significant role in the model calibration.

COCOMO II Points of Contact

For questions on the COCOMO II Model and its extensions, data definitions, or project data collection and management, contact:

A Winsor Brown (Research Scientist)	Voice: (213) 740-6599, Fax: (213) 740-4927
Cyrus Fakharzadeh (Research Assistant)	Voice: (213) 740-5703, Fax: (213) 740-4927
Barry Boehm (Project Leader)	Voice: (213) 740-8163, Fax: (213) 740-4927
Internet Electronic-Mail	*cocomo-info@sunset.usc.edu*

COCOMO II Data Submission Address:

COPSEMO Data Submission
Center for Software Engineering
Department of Computer Science
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941 W. 37th Place
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U.S.A.

1. Project Level Information

[1] Constructive Cost Modeling (COCOMO) is defined in Software Engineering Economics by Barry W. Boehm, Prentice Hall, 1981

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As described in the Introduction section of this questionnaire, project level information is applicable for the whole project. This includes things like application type and development activity being reported. As this is a questionnaire, fill in the appropriate information in the spaces provided.

1.A. General Information

1.A.1. Affiliate Identification Number Each separate software project contributing data will have a separate file identification number of the form XXX. XXX will be one of a random set of three-digit organization identification numbers, provided by USC Center for Software Engineering to the Affiliate.

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1.A.2. Project Identification Number The project identification is a three digit number assigned by the organization. Only the Affiliate knows the correspondence between YYY and the actual project. The same project identification must be used with each data submission.

_____

1.A.3. Date prepared This is the date the data elements were collected for submission.

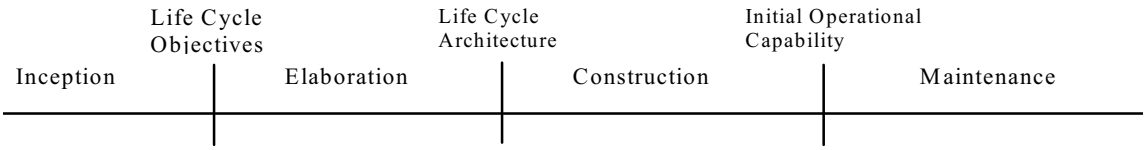
_____

1.B. Schedule Year of development. For reporting of historical data, please provide the year in which the software development was completed. For periodic reporting put the year of this submission or leave blank.

_____

1.C.1. Schedule Months. For reporting of historical data, provide the number of calendar months from the time the development began through the time it completed, i.e. from Life-Cycle Objectives through Initial Operation Capability. For periodic reporting, provide the number of months in this development activity.

Circle the life-cycle phases that the schedule covers:

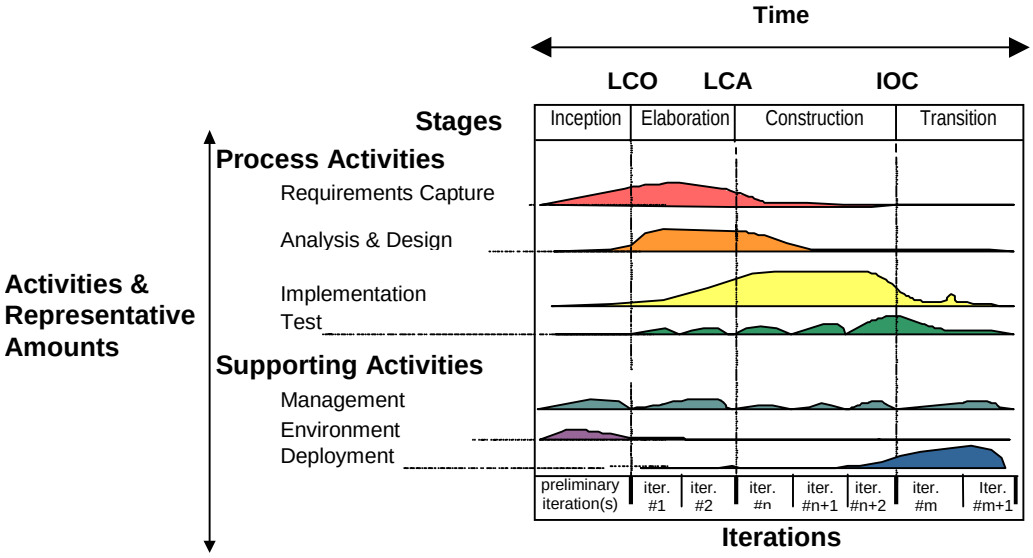


See the Appendix A for definitions of the LCO, LCA, and IOC milestones. The COCOMO II model covers the effort required from the completion of the LCO to IOC. If you are using a waterfall model, the corresponding milestones are the Software Requirements Review, Preliminary Design Review, and Software Acceptance Test.

Schedule in months: _____

2. COCOMO Phase Schedule and Effort MODEL (COPSEMO)

COPSEMO is based on the lifecycle anchoring concepts discussed by Boehm[2]. The anchor points are defined as Life Cycle Objectives (LCO), Life Cycle Architecture (LCA), and Initial Operational Capability (IOC). An enhanced version of an illustration from Rational Corporation[3] showing the phases around the anchor points is shown below.



The correspondence between COPSEMO's Phases, COCOMOII's submodels and the life cycle anchor points is shown in the following table along with an indication of the relative amounts of the different activities.

COCOMO II Submodel Usage	**Early Design**		**Post-Architecture**	**Maintenance**
	LCO	**LCA**	**IOC**	
Activities \ Phase	**Inception**	**Elaboration**	**Construction**	**Transition**
Requirements Capture	Some usually	Most, peaks here	Minor	None
Analysis & Design	A little	Majority, mostly constant effort	Some	Some, for repair during ODT&E
Implementation	Practically none	Some, usually for risk reduction	Bulk; mostly constant effort	Some, for repair during ODT&E
Test	None	Some, for prototypes	Most for unit, integration and qualification test.	Some, for repaired code.

COCOMOII's effort and schedule estimates are focused on Elaboration and Construction (the phases between LCO and IOC. Inception corresponds to the COCOMO's "Requirements" activity in a waterfall process model. COCOMO's effort for the "Requirements" activity is an additional, fixed percentage of the effort calculated by COCOMO for the development activities. The table also indicates the areas in which the COCOMO II Early Design and Post-Architecture submodels are normally used.

Allocations

[2] Barry W. Boehm, "Anchoring the Software Process," *IEEE Software,* 13, 4, July 1996, pp. 73-82

[3] Rational Corp., "Rational Objectory Process 4.1 – Your UML Process", available at http://www.rational.com/support/techpapers/toratobjprcs/.

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2.A.1. Percentage Effort per Phase. Allocate the effort (person months) used in each of the phases as a percentage of the total effort during Elaboration and Construction. The sum of the percentages of Elaboration and Construction should be 100%. The effort during Inception (as a percentage of total Elaboration and Construction) is added to get the Total IE&C which should be greater than 100%.

	LCO	LCA	IOC		
Phase	**Inception**	**Elaboration**	**Construction**	**Total E & C**	**Total I E & C**
%Effort				**100%**	

2.A.2. Percentage Schedule per Phase. Allocate the schedule (calendar months) for each of the phases as a percentage of the total schedule during Elaboration and Construction. The sum of Elaboration and Construction should be 100%. The schedule during Inception (as a percentage of total Elaboration and Construction) is added to get the Total IE&C which should be greater than 100%.

	LCO	LCA	IOC		
Phase	**Inception**	**Elaboration**	**Construction**	**Total E & C**	**Total I E & C**
%Schedule				**100%**	

2.A.3. Person-Power per Phase. Indicate the average number of people actually working during this period of each of the phases. If the loading was not approximately constant during the period except for typical, limited ramp-ups, please indicate the degree of variation by providing the Persons-Max and Persons-Min, and the number of months with that number of people (max and min, respectively). NOTE: summing persons across phases is illogical and incorrect.

	LCO		LCA		IOC			
Phase	**Inception**		**Elaboration**		**Construction**		**Total E & C**	**Total I E & C**
Persons-Ave.							**X**	**X**
	Heads	Mon.	Heads	Mon.	Heads	Mon.	**X**	**X**
Persons-Max							**X**	**X**
Persons-Min							**X**	**X**