CoCoMo Metric for the Pac-Man Game

Pac-Man Game Description

Pac-Man is a maze chase game in which the player guides his character through a maze. The goal of the game is to collect all of the dots in the maze while avoiding four colored ghost characters — Blinky (red), Pinky (pink), Inky (cyan), and Clyde (orange) — who chase after and kill Pac-Man. When Pac-Man consumes all of the dots, the game concludes with Pac-Man as the winner. Pac-Man will lose a life if he is caught by a ghost; the game ends when all lives are lost. A few large "power pellets" are scattered among the pellets along the maze's paths. Eating these causes the ghosts to become afraid of the Pac-Man, causing them to flee. Pac-Man can eat the scared ghosts for extra points; when a ghost is eaten, it returns to the maze's Center box, where it "regenerates" and resumes its normal activity. Eating several scared ghosts in a row increases their point value. After a certain amount of time, the scared ghosts revert to their original form, and the Pac-Man loses its ability to eat the ghosts, requiring it to move away from the ghosts. Before the game begins, the player can adjust the difficulty level, which alters parameters such as the speed of the ghost and the duration of the power effect from eating the power pellets.

CoCoMo Model for the worst-case scenario

For the worst-case scenario, I have used the values explained in the slides of the professor’s lecture.

Monte Carlo Risk Off
Auto Calculate Off

COCOMO II - Constructive Cost Model

Software Size Sizing Method Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	1200						
Reused	0	0	0				
Modified	0						

Software Scale Drivers

Precedentedness	Very Low	Architecture / Risk Resolution	Very Low	Process Maturity	Very Low
Development Flexibility	Very Low	Team Cohesion	Very Low		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Very High	Analyst Capability	Very Low	Time Constraint	Extra High
Data Base Size	Very High	Programmer Capability	Very Low	Storage Constraint	Extra High
Product Complexity	Extra High	Personnel Continuity	Very Low	Platform Volatility	Very High
Developed for Reusability	Extra High	Application Experience	Very Low	**Project**	
Documentation Match to Lifecycle Needs	Very High	Platform Experience	Very Low	Use of Software Tools	Very Low
		Language and Toolset Experience	Very Low	Multisite Development	Extra High
				Required Development Schedule	Very High

Maintenance Off

Software Labor Rates

Cost per Person-Month (Dollars) 4000

Calculate

Results

Software Development (Elaboration and Construction)

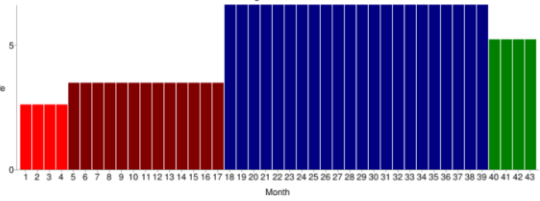
Effort = 194.9 Person-months
Schedule = 35.9 Months
Cost = $779446

Total Equivalent Size = 1200 SLOC
Effort Adjustment Factor (EAF) = 53.00

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	11.7	4.5	2.6	$46767
Elaboration	46.8	13.5	3.5	$187067
Construction	148.1	22.4	6.6	$592380
Transition	23.4	4.5	5.2	$93534

Staffing Profile



Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	1.6	5.6	14.8	3.3
Environment/CM	1.2	3.7	7.4	1.2
Requirements	4.4	8.4	11.8	0.9
Design	2.2	16.8	23.7	0.9
Implementation	0.9	6.1	50.4	4.4
Assessment	0.9	4.7	35.5	5.6
Deployment	0.4	1.4	4.4	7.0

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_52_38_487268.txt

Created by Ray Madachy at the Naval Postgraduate School. For more information contact him at rjmadach@nps.edu.

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resl, Very_Low
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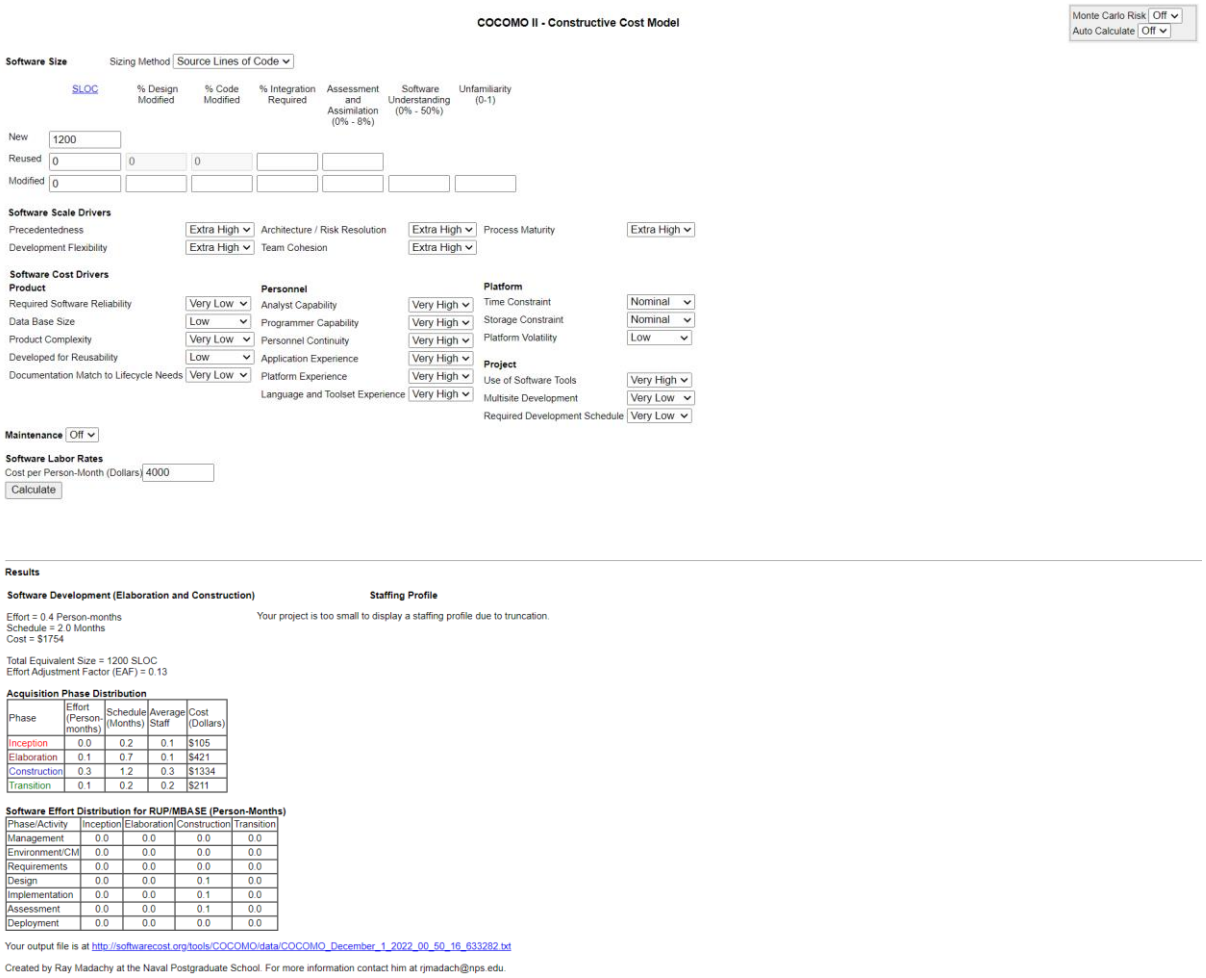
CoCoMo Model for the best-case scenario

For the best-case scenario, I have used the values explained in the slides of the professor's lecture.



COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	1200						
Reused	0	0	0				
Modified	0						

Software Scale Drivers

Precedentedness	Extra High	Architecture / Risk Resolution	Extra High	Process Maturity	Extra High
Development Flexibility	Extra High	Team Cohesion	Extra High		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Very Low	Analyst Capability	Very High	Time Constraint	Nominal
Data Base Size	Low	Programmer Capability	Very High	Storage Constraint	Nominal
Product Complexity	Very Low	Personnel Continuity	Very High	Platform Volatility	Low
Developed for Reusability	Low	Application Experience	Very High	**Project**	
Documentation Match to Lifecycle Needs	Very Low	Platform Experience	Very High	Use of Software Tools	Very High
		Language and Toolset Experience	Very High	Multisite Development	Very Low
				Required Development Schedule	Very Low

Maintenance Off

Software Labor Rates
Cost per Person-Month (Dollars): 4000
Calculate

Results

Software Development (Elaboration and Construction)

Effort = 0.4 Person-months
Schedule = 2.0 Months
Cost = $1754

Total Equivalent Size = 1200 SLOC
Effort Adjustment Factor (EAF) = 0.13

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.0	0.2	0.1	$105
Elaboration	0.1	0.7	0.1	$421
Construction	0.3	1.2	0.3	$1334
Transition	0.1	0.2	0.2	$211

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.0	0.0	0.0	0.0
Environment/CM	0.0	0.0	0.0	0.0
Requirements	0.0	0.0	0.0	0.0
Design	0.0	0.0	0.1	0.0
Implementation	0.0	0.0	0.1	0.0
Assessment	0.0	0.0	0.1	0.0
Deployment	0.0	0.0	0.0	0.0

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_50_16_633282.txt

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resl, Extra_High
team, Extra_High
acap, Very_High
pcap, Very_High
pcon, Very_High
apex, Very_High
pexp, Very_High
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pmat, Extra_High
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pvol, Low
tool, Very_High
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software_schedule, 2.0
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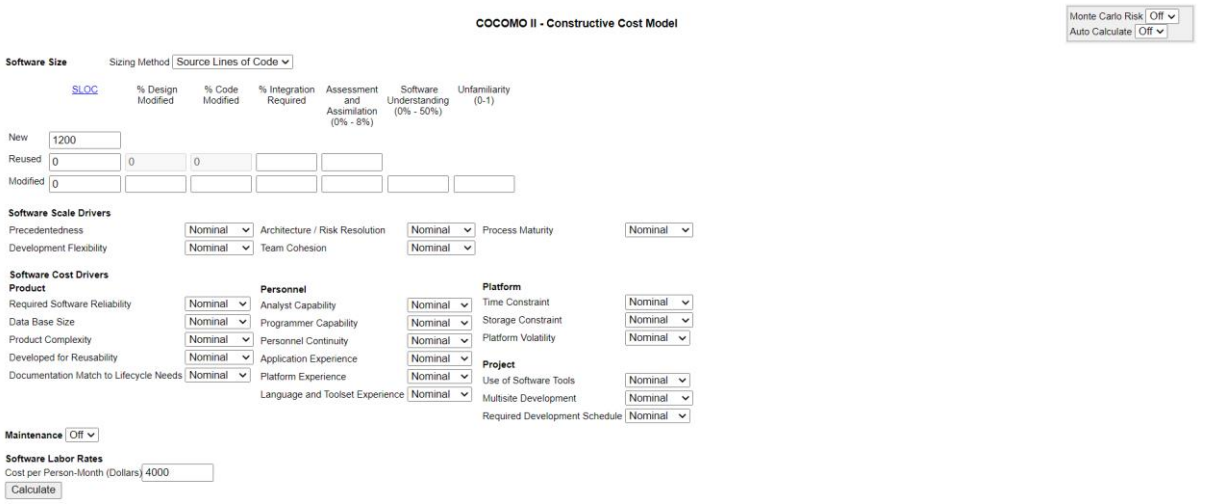
CoCoMo Model for the Nominal Scenario

For the nominal scenario, I have used the values explained in the slides of the professor's lecture.



COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	1200						
Reused	0	0	0				
Modified	0						

Software Scale Drivers

Precedentedness	Nominal	Architecture / Risk Resolution	Nominal	Process Maturity	Nominal
Development Flexibility	Nominal	Team Cohesion	Nominal		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Nominal	Analyst Capability	Nominal	Time Constraint	Nominal
Data Base Size	Nominal	Programmer Capability	Nominal	Storage Constraint	Nominal
Product Complexity	Nominal	Personnel Continuity	Nominal	Platform Volatility	Nominal
Developed for Reusability	Nominal	Application Experience	Nominal	**Project**	
Documentation Match to Lifecycle Needs	Nominal	Platform Experience	Nominal	Use of Software Tools	Nominal
		Language and Toolset Experience	Nominal	Multisite Development	Nominal
				Required Development Schedule	Nominal

Maintenance: Off

Software Labor Rates

Cost per Person-Month (Dollars): 4000

Calculate

Results

Software Development (Elaboration and Construction)

Effort = 3.6 Person-months
Schedule = 5.5 Months
Cost = $14370

Total Equivalent Size = 1200 SLOC
Effort Adjustment Factor (EAF) = 1.00

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.2	0.7	0.3	$862
Elaboration	0.9	2.1	0.4	$3449
Construction	2.7	3.4	0.8	$10922
Transition	0.4	0.7	0.6	$1725

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.0	0.1	0.3	0.1
Environment/CM	0.0	0.1	0.1	0.0
Requirements	0.1	0.2	0.2	0.0
Design	0.0	0.3	0.4	0.0
Implementation	0.0	0.1	0.9	0.1
Assessment	0.0	0.1	0.7	0.1
Deployment	0.0	0.0	0.1	0.1

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_58_37_163891.txt

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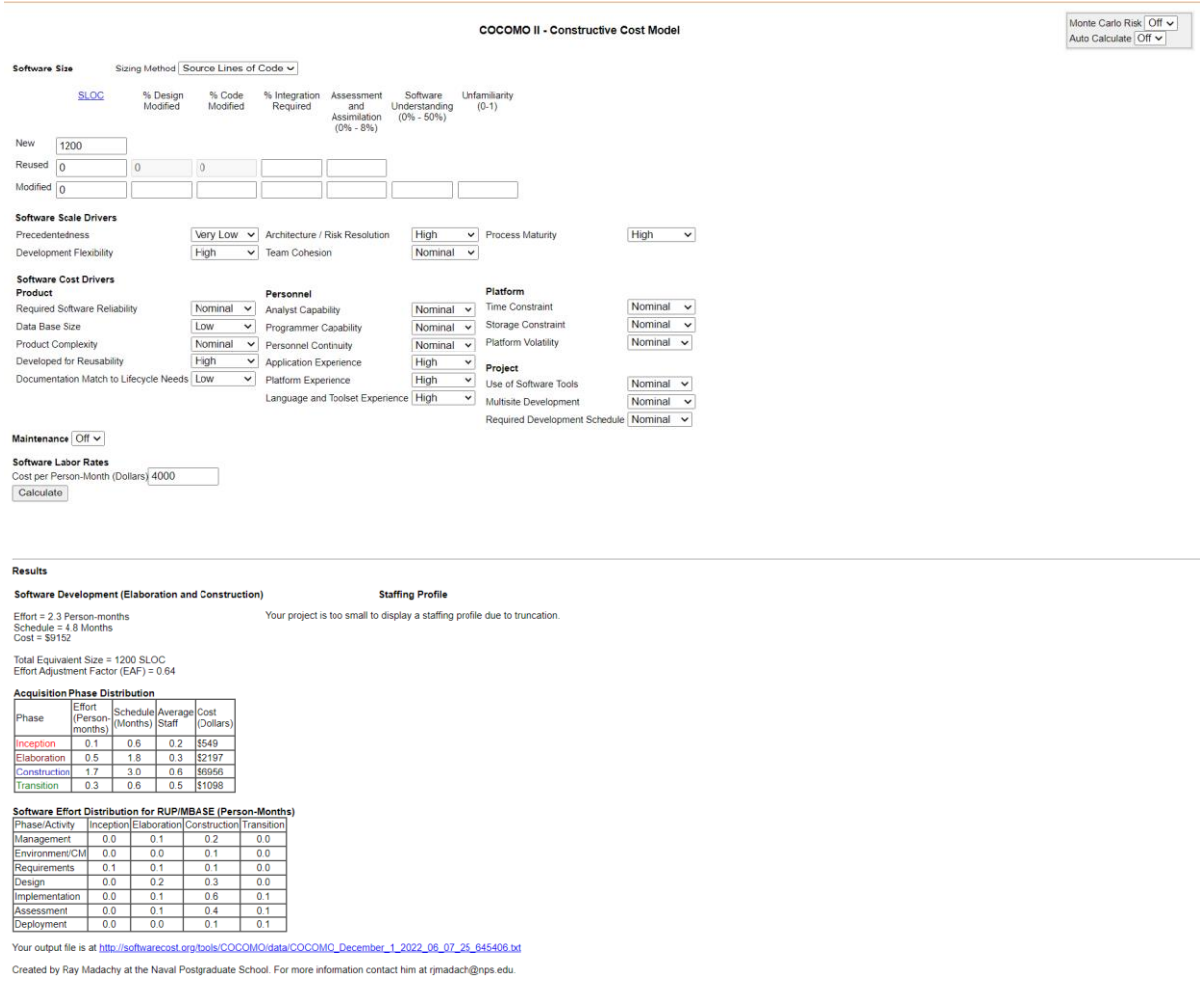
software_schedule, 5.5
```

CoCoMo Model for my Real Guess Scenario

For the real guess scenario,

- I have considered most of my factors to be nominal (taking into account a real-world scenario where there might be a mix of experience in teams).
    a. But I have considered a few factors which I could consider could be modified.
    b. I have considered some factors like flexibility, risk resolution, process maturity to be high but not very high as this is not an ideal case.
    c. Similarly, I have set other factors to some different values as I saw fit.

Making these assumptions for the factors and considering the cost per person per month to be $4000, I got an estimate cost of $11990.



COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	1200						
Reused	0	0	0				
Modified	0						

Software Scale Drivers

Precedentedness	Very Low	Architecture / Risk Resolution	High	Process Maturity	High
Development Flexibility	High	Team Cohesion	Nominal		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Nominal	Analyst Capability	Nominal	Time Constraint	Nominal
Data Base Size	Low	Programmer Capability	Nominal	Storage Constraint	Nominal
Product Complexity	Nominal	Personnel Continuity	Nominal	Platform Volatility	Nominal
Developed for Reusability	High	Application Experience	High	**Project**	
Documentation Match to Lifecycle Needs	Low	Platform Experience	High	Use of Software Tools	Nominal
		Language and Toolset Experience	High	Multisite Development	Nominal
				Required Development Schedule	Nominal

Maintenance Off

Software Labor Rates
Cost per Person-Month (Dollars): 4000
Calculate

Results

Software Development (Elaboration and Construction)

Effort = 2.3 Person-months
Schedule = 4.8 Months
Cost = $9152

Total Equivalent Size = 1200 SLOC
Effort Adjustment Factor (EAF) = 0.64

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.1	0.6	0.2	$549
Elaboration	0.5	1.8	0.3	$2197
Construction	1.7	3.0	0.6	$6956
Transition	0.3	0.6	0.5	$1098

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.0	0.1	0.2	0.0
Environment/CM	0.0	0.0	0.1	0.0
Requirements	0.1	0.1	0.1	0.0
Design	0.0	0.2	0.3	0.0
Implementation	0.0	0.1	0.6	0.1
Assessment	0.0	0.1	0.4	0.1
Deployment	0.0	0.0	0.1	0.1

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_06_07_25_645406.txt

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Conclusion

- The overall cost in a best-case scenario is $1754 and the overall cost in a worst-case scenario is $779446 and for the nominal scenario is $14370 and for the real guess scenario is $9152.
- From these results you can see that there is a difference of more than $700000 between the worst-case scenario and other scenarios. This makes a huge difference for the business.
- Again, observed from the results, the effort for the worst-case scenario is 194.9 person-months and for the best-case scenario is 0.4 which is almost 500 times more. Similarly comparing the effort resulted in the worst-case scenario is 50 times more than the effort resulted for the nominal scenario.
    a. This means that when working with a team having low skill sets and expertise, the time, efforts and manpower, the total efforts have increased exponentially.
- Now comparing the results obtained for the scenario, that I have taken in my real guess scenario, I got a $9152 overall cost which is less than the nominal cost but again 9 times over the best-case scenario which I think is still a good case.

Overall, COCOMO is a very useful tool for analysing and estimating efforts when the various involved factors are understood. It's very useful to see how these values change depending on the type of skills, platform, software metrics, and cost for each of the parameters.

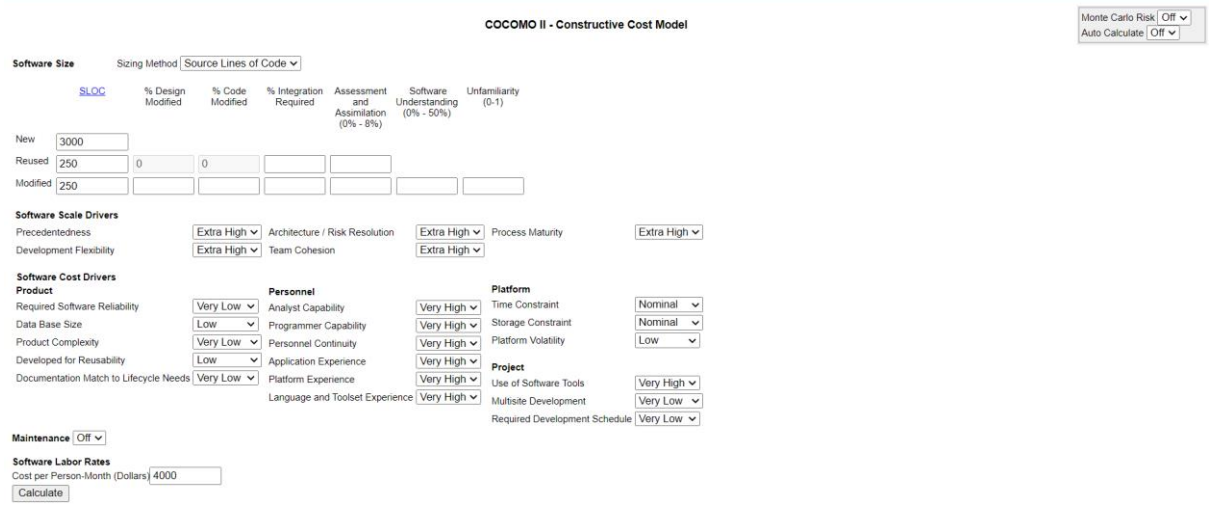
CoCoMo Metric for the SNU-Treats Application

SNU-Treats Application Description

SNU-Treats is a ReactJS, NodeJS, and PostgreSQL-based progressive web application. So, on the Shiv Nadar University campus, there are a variety of eateries where students can get food and drinks in between classes. However, because students are unaware of the current traffic at these tuck shops, they frequently go and get stuck in long lines. This also affected me and my

classmates. So, as part of my second-year Software Engineering course, we were required to create and present any software application. So, my friends and I developed an application to assist Shiv Nadar University (SNU) students in pre-booking their snack orders from any one or multiple different tuck shops of their choice. So, when a student requests a specific order, that order request is sent to the various shops, where the person at their end can accept or decline the order. If there is no response from the person at the shop, the student's order is declined for a timeout reason. Similarly, if the shopkeeper declines the order, the order is declined and the reason for the decline is displayed to the user. In this regard, if the students' order is accepted completely or partially, an estimated waiting time for each item will be displayed to the student. Finally, if an item from the student's order is ready, the shop employee will notify the student and the item will be placed on hold for 15 minutes.

CoCoMo Model for my Best-Case Scenario



Results

Software Development (Elaboration and Construction)

Effort = 1.0 Person-months
Schedule = 2.5 Months
Cost = $4040

Total Equivalent Size = 3000 SLOC
Effort Adjustment Factor (EAF) = 0.13

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.1	0.3	0.2	$242
Elaboration	0.2	0.9	0.3	$970
Construction	0.8	1.6	0.5	$3071
Transition	0.1	0.3	0.4	$485

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.0	0.0	0.1	0.0
Environment/CM	0.0	0.0	0.0	0.0
Requirements	0.0	0.0	0.1	0.0
Design	0.0	0.1	0.1	0.0
Implementation	0.0	0.0	0.3	0.0
Assessment	0.0	0.0	0.2	0.0
Deployment	0.0	0.0	0.0	0.0

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_47_55_58348.txt

Created by Ray Madachy at the Naval Postgraduate School. For more information contact him at rjmadach@nps.edu.

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resl, Extra_High
team, Extra_High
acap, Very_High
pcap, Very_High
pcon, Very_High
apex, Very_High
pexp, Very_High
ltex, Very_High
pmat, Extra_High
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stor, Nominal
pvol, Low
tool, Very_High
site, Very_Low
sced, Very_Low
software_maintenance, Off
software_labor_cost_per_PM, 4000
submit2, Calculate
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schedule_exponent, 0.280
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```

CoCoMo Model for my Worst-Case Scenario

COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	3000						
Reused	250	0	0				
Modified	250						

Software Scale Drivers

Precedentedness	Very Low	Architecture / Risk Resolution	Very Low	Process Maturity	Very Low
Development Flexibility	Very Low	Team Cohesion	Very Low		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Very High	Analyst Capability	Very Low	Time Constraint	Extra High
Data Base Size	Very High	Programmer Capability	Very Low	Storage Constraint	Extra High
Product Complexity	Extra High	Personnel Continuity	Very Low	Platform Volatility	Very High
Developed for Reusability	Extra High	Application Experience	Very Low	**Project**	
Documentation Match to Lifecycle Needs	Very High	Platform Experience	Very Low	Use of Software Tools	Very Low
		Language and Toolset Experience	Very Low	Multisite Development	Extra High
				Required Development Schedule	Very High

Maintenance Off

Software Labor Rates
Cost per Person-Month (Dollars): 4000
Calculate

Results

Software Development (Elaboration and Construction)

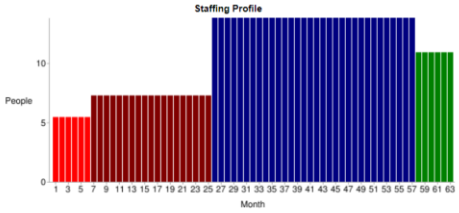
Effort = 599.4 Person-months
Schedule = 52.7 Months
Cost = $2397400

Total Equivalent Size = 3000 SLOC
Effort Adjustment Factor (EAF) = 53.00

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	36.0	6.6	5.5	$143844
Elaboration	143.8	19.8	7.3	$575376
Construction	455.5	33.0	13.8	$1822024
Transition	71.9	6.6	10.9	$287688

Staffing Profile



Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	5.0	17.3	45.6	10.1
Environment/CM	3.6	11.5	22.8	3.6
Requirements	13.7	25.9	36.4	2.9
Design	6.8	51.8	72.9	2.9
Implementation	2.9	18.7	154.9	13.7
Assessment	2.9	14.4	109.3	17.3
Deployment	1.1	4.3	13.7	21.6

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_55_03_658235.txt

Created by Ray Madachy at the Naval Postgraduate School. For more information contact him at rjmadach@nps.edu.

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AA_reused,
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IM_modified,
AA_modified,
SU_modified,
UNFM_modified,
prec, Very_Low
flex, Very_Low
rely, Very_High
data, Very_High
cplx, Extra_High
ruse, Extra_High
docu, Very_High
resl, Very_Low
team, Very_Low
acap, Very_Low
pcap, Very_Low
pcon, Very_Low
apex, Very_Low
pexp, Very_Low
ltex, Very_Low
pmat, Very_Low
time, Extra_High
stor, Extra_High
pvol, Very_High
tool, Very_Low
site, Extra_High
sced, Very_High
software_maintenance, Off
software_labor_cost_per_PM, 4000
submit2, Calculate
software_EAF, 53.00
size_exponent, 1.2262
schedule_exponent, 0.343
software_effort, 599.4
software_schedule, 52.7
```

CoCoMo Model for my Nominal Scenario

COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	3000						
Reused	250	0	0				
Modified	250						

Software Scale Drivers

Precedentedness	Nominal	Architecture / Risk Resolution	Nominal	Process Maturity	Nominal
Development Flexibility	Nominal	Team Cohesion	Nominal		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Nominal	Analyst Capability	Nominal	Time Constraint	Nominal
Data Base Size	Nominal	Programmer Capability	Nominal	Storage Constraint	Nominal
Product Complexity	Nominal	Personnel Continuity	Nominal	Platform Volatility	Nominal
Developed for Reusability	Nominal	Application Experience	Nominal	**Project**	
Documentation Match to Lifecycle Needs	Nominal	Platform Experience	Nominal	Use of Software Tools	Nominal
		Language and Toolset Experience	Nominal	Multisite Development	Nominal
				Required Development Schedule	Nominal

Maintenance Off

Software Labor Rates
Cost per Person-Month (Dollars): 4000

Calculate

Results

Software Development (Elaboration and Construction)

Effort = 9.8 Person-months
Schedule = 7.6 Months
Cost = $39363

Total Equivalent Size = 3000 SLOC
Effort Adjustment Factor (EAF) = 1.00

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.6	0.9	0.6	$2362
Elaboration	2.4	2.8	0.8	$9447
Construction	7.5	4.7	1.6	$29917
Transition	1.2	0.9	1.2	$4724

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.1	0.3	0.7	0.2
Environment/CM	0.1	0.2	0.4	0.1
Requirements	0.2	0.4	0.6	0.0
Design	0.1	0.9	1.2	0.0
Implementation	0.0	0.3	2.5	0.2
Assessment	0.0	0.2	1.8	0.3
Deployment	0.0	0.1	0.2	0.4

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_00_57_09_455362.txt

Created by Ray Madachy at the Naval Postgraduate School. For more information contact him at rjmadach@nps.edu.

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startCOCOMO, 1
MonteCarlo, MonteCarlo_Off
AutoCalculate, Off
size_type, SLOC
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IM_reused,
AA_reused,
modified_size, 250
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SU_modified,
UNFM_modified,
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ruse, Nominal
docu, Nominal
resl, Nominal
team, Nominal
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pcap, Nominal
pcon, Nominal
apex, Nominal
pexp, Nominal
ltex, Nominal
pmat, Nominal
time, Nominal
stor, Nominal
pvol, Nominal
tool, Nominal
site, Nominal
sced, Nominal
software_maintenance, Off
software_labor_cost_per_PM, 4000
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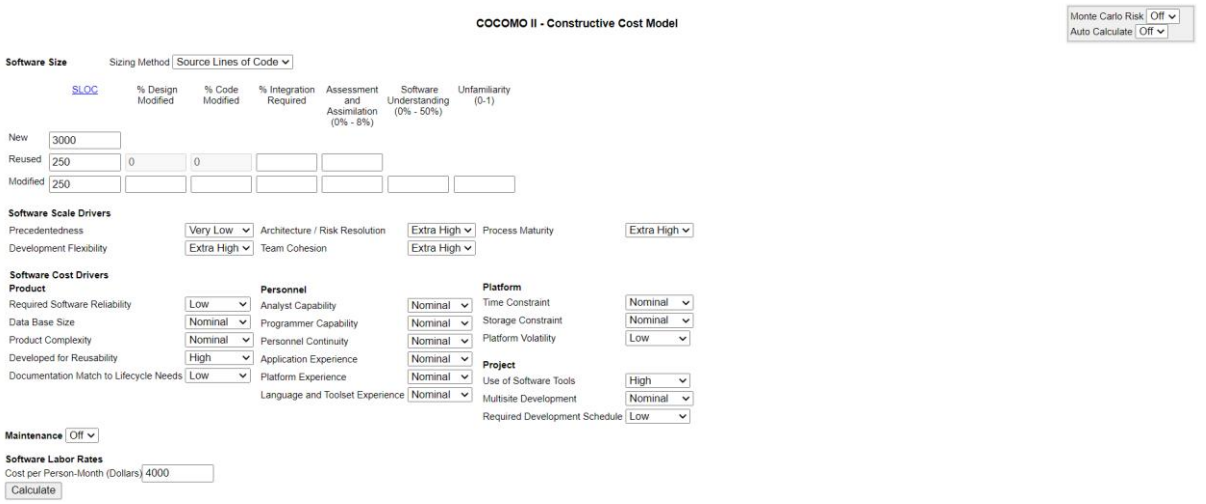
software_EAF, 1.00
size_exponent, 1.0997
schedule_exponent, 0.318
software_effort, 9.8
software_schedule, 7.6
```

CoCoMo Model for my Real Guess Scenario

For this application, I'm implying that my team is in their second year of a bachelor's degree program. As a result, the values I've assigned in this real-world scenario imply that. As a result, I set most of the factors to be nominal, but I set factors like flexibility and team cohesion to be extra high because this team was made up of friends and the application was a semester-long academic project. And, given the inexperience of my team, I have assigned a very low precedence. Other factors, such as Developed for Reusability, are also set to High because this was an academic project developed solely for that purpose, rather than for future reusability. Taking all these assumptions, into consideration and with $4000 as cost per person per month, I got an estimate overall cost of $27355. Also, the LOC for this project is 3000.



COCOMO II - Constructive Cost Model

Monte Carlo Risk: Off
Auto Calculate: Off

Software Size — Sizing Method: Source Lines of Code

	SLOC	% Design Modified	% Code Modified	% Integration Required	Assessment and Assimilation (0% - 8%)	Software Understanding (0% - 50%)	Unfamiliarity (0-1)
New	3000						
Reused	250	0	0				
Modified	250						

Software Scale Drivers

Precedentedness	Very Low	Architecture / Risk Resolution	Extra High	Process Maturity	Extra High
Development Flexibility	Extra High	Team Cohesion	Extra High		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Low	Analyst Capability	Nominal	Time Constraint	Nominal
Data Base Size	Nominal	Programmer Capability	Nominal	Storage Constraint	Nominal
Product Complexity	Nominal	Personnel Continuity	Nominal	Platform Volatility	Low
Developed for Reusability	High	Application Experience	Nominal	**Project**	
Documentation Match to Lifecycle Needs	Low	Platform Experience	Nominal	Use of Software Tools	High
		Language and Toolset Experience	Nominal	Multisite Development	Nominal
				Required Development Schedule	Low

Maintenance Off

Software Labor Rates
Cost per Person-Month (Dollars): 4000
Calculate

Results

Software Development (Elaboration and Construction)

Effort = 6.8 Person-months
Schedule = 5.3 Months
Cost = $27355

Total Equivalent Size = 3000 SLOC
Effort Adjustment Factor (EAF) = 0.80

Staffing Profile

Your project is too small to display a staffing profile due to truncation.

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	0.4	0.7	0.6	$1641
Elaboration	1.6	2.0	0.8	$6565
Construction	5.2	3.3	1.6	$20790
Transition	0.8	0.7	1.2	$3283

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.1	0.2	0.5	0.1
Environment/CM	0.0	0.1	0.3	0.0
Requirements	0.2	0.3	0.4	0.0
Design	0.1	0.6	0.8	0.0
Implementation	0.0	0.2	1.8	0.2
Assessment	0.0	0.2	1.2	0.2
Deployment	0.0	0.0	0.2	0.2

Your output file is at http://softwarecost.org/tools/COCOMO/data/COCOMO_December_1_2022_06_36_17_155793.txt

Created by Ray Madachy at the Naval Postgraduate School. For more information contact him at rjmadach@nps.edu.

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startCOCOMO, 1
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AutoCalculate, Off
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new_size, 3000
reused_size, 250
IM_reused,
AA_reused,
modified_size, 250
DM_modified,
CM_modified,
IM_modified,
AA_modified,
SU_modified,
UNFM_modified,
prec, Very_Low
flex, Extra_High
rely, Low
data, Nominal
cplx, Nominal
ruse, High
docu, Low
resl, Extra_High
team, Extra_High
acap, Nominal
pcap, Nominal
pcon, Nominal
apex, Nominal
pexp, Nominal
ltex, Nominal
pmat, Extra_High
time, Nominal
stor, Nominal
pvol, Low
tool, High
site, Nominal
sced, Low
software_maintenance, Off
software_labor_cost_per_PM, 4000
submit2, Calculate
software_EAF, 0.80
size_exponent, 0.9720
schedule_exponent, 0.292
software_effort, 6.8
software_schedule, 5.3
```

Conclusion

- The overall cost in a best-case scenario is $4040 and the overall cost in a worst-case scenario is $2397400and for the nominal scenario is $39363and for the real guess scenario is $27355.
- From these results you can see that there is a difference of more than $2000000 between the worst-case scenario and other scenarios. This makes a huge difference for the business.
- Again, observed from the results, the effort for the worst-case scenario is 599.4 person-months and for the best-case scenario is 1 which is 600 times more. Similarly comparing the effort resulted in the worst-case scenario is 60 times more than the effort resulted for the nominal scenario.
    a. This means that when working with a team having low skill sets and expertise, the time, efforts and manpower, the total efforts have increased exponentially.
- Now comparing the results obtained for the scenario, that I have taken in my real guess scenario, I got a $27355 overall cost which is less than the nominal cost but again 7 times over the best-case scenario which I think is still a good case.

COCOMO may not be a very useful tool for analysing and estimating efforts because this is a small-scale academic project. Though not entirely useful in this case, the time and effort estimates are consistent with the observed behaviour. It's interesting to see how these values change depending on the type of skills, platform, software metrics, and cost for each parameter.