Politecnico di Milano
A.A. 2015-2016
Software Engineering 2

Project Plan

Giuseppe Canonaco, Andrea Di Giosaffatte

02 February 2016 – Version 1.0

Table of Contents

1. Introduction

1.1. Purpose

This document aims at giving a plan through which it schedules all the tasks to be accomplished in order to complete the MyTaxiService project. At the same time in this document is addressed the cost estimation of the entire project using the function points and the COCOMO models.

1.2. List of Definitions and Abbreviations

- **RASD:** The MyTaxiService RASD document

- **DD:** The MyTaxiService DD document

- **ILF:** Internal Logic Files

- **EIF:** External Interface Files

- **EO:** External Output

- **EI:** External Input

- **EQ:** External Inquiries

- **COCOMO:** Constructive Cost Model

- **PM:** Person per Month

- **UFP:** Unadjusted Function Points

- **LOC:** Lines Of Code

- **SLOC:** Source Lines Of Code

- **KSLOC:** Thousands of Lines Of Code

2. Project Size Estimation: Function Points

2.1. Function Points

To address this task we used the following tables:

Table 2. FP Counting Weights

For Internal Logical Files and External Interface Files

Record Elements	Data Elements		
	1 - 19	20 - 50	51+
1	Low	Low	Avg.
2 - 5	Low	Avg.	High
6+	Avg.	High	High

For External Output and External Inquiry

File Types	Data Elements		
	1 - 5	6 - 19	20+
0 or 1	Low	Low	Avg.
2 - 3	Low	Avg.	High
4+	Avg.	High	High

For External Input

File Types	Data Elements		
	1 - 4	5 - 15	16+
0 or 1	Low	Low	Avg.
2 - 3	Low	Avg.	High
3+	Avg.	High	High

Table 3. UFP Complexity Weights

Function Type	Complexity-Weight		
	Low	Average	High
Internal Logical Files	7	10	15
External Interfaces Files	5	7	10
External Inputs	3	4	6
External Outputs	4	5	7
External Inquiries	3	4	6

Which can be retrieved here:

http://csse.usc.edu/csse/research/COCOMOII/cocomo2000.0/CII_modelman2000.0.pdf

All the objects listed below are evaluated against the table 2 using the RASD or the DD as a guide for the evaluation itself.

ILF:

Cab Catcher Profile → 1 record element and 8 data elements (first name, last name, username, password, sex, phone number, date of birth, email), so Low

Reservations → 1 record element 4 data elements (meeting time, meeting date, origin of the ride, destination of the ride), so Low

ELF:

Cab Driver Profiles → 1 record element 7 data elements (username, password, email, first name, last name, license number and sex), so Low

EI:

Log-in → 1 file type 2 data elements (username and password), so Low
Password recovery → 1 file type 2 data elements (password and security code), so Low

Sign-up → 1 file type 8 data elements (the data submitted at registration moment), so Low

Edit profile → 1 file type 6/8 data elements (user's profile information submitted at registration time), so Low

Set availability → 0 file types (this is due to the fact that the availability is a runtime information) it doesn't use more than 15 data elements, so Low

Decline arrangement → 0 file types (deals with runtime information) and doesn't use more than 15 data elements, so Low

Accept arrangement → 0 file types (deals with runtime information) and doesn't use more than 15 data elements, so Low

Reservation → 1 file types 4 data elements, so Low

Request → 0 file types (deals with runtime information) and doesn't use more than 15 data elements, so Low

Delete arrangement → at most 1 file type and no more than 4 data elements, so Low

Delete designated arrangement → 0 file types and no more than 15 data elements, so Low

API request → 0 file types (deals with runtime information) and doesn't use more than 15 data elements, so Low

API reservation → 1 file type and around 4 data elements, so Low

API delete arrangement → at most 1 file types and no more than 15 data elements, so Low

EO:

Get programmatic interface → 0 file types and no more than 19 data elements involved, so Low

EQ:

Check status → at most 1 file type and no more than 19 data elements involved, so Low

Function type	Value
Internal Logic Files	14
External Interface Files	5
External Input	42
External Output	4
External Inquiries	3
UFP	68

UFP to Java LOC Conversion Ratio = 53 → You can retrieve this value here:

http://csse.usc.edu/csse/research/COCOMOII/cocomo2000.0/CII_modelman2000.0.pdf

LOC = UFP * 53 = 3604

3. Project Effort & Cost Estimation: COCOMO

In this section, the COCOMO technique is used to estimate the effort required to develop the project, measured in PM. Through this result, the COCOMO approach makes also an estimation of the duration of the whole project, measured in Months.

In order to properly estimate the effort and the duration of the project, the evaluation of some drivers (scale drivers & cost drivers) is needed.

3.1. Scale Drivers

Scale Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC	thoroughly unprecedented	largely unprecedented	somewhat unprecedented	generally familiar	largely familiar	thoroughly familiar
SF_j:	6.20	4.96	3.72	2.48	1.24	0.00
FLEX	rigorous	occasional relaxation	some relaxation	general conformity	some conformity	general goals
SF_j:	5.07	4.05	3.04	2.03	1.01	0.00
RESL	little (20%)	some (40%)	often (60%)	generally (75%)	mostly (90%)	full (100%)
SF_j:	7.07	5.65	4.24	2.83	1.41	0.00
TEAM	very difficult interactions	some difficult interactions	basically cooperative interactions	largely cooperative	highly cooperative	seamless interactions
SF_j:	5.48	4.38	3.29	2.19	1.10	0.00
PMAT	The estimated Equivalent Process Maturity Level (EPML) or					
	SW-CMM Level 1 Lower	SW-CMM Level 1 Upper	SW-CMM Level 2	SW-CMM Level 3	SW-CMM Level 4	SW-CMM Level 5
SF_j:	7.80	6.24	4.68	3.12	1.56	0.00

- Precedentedness: Since we have no experience in this kind of projects, this value will be set to Low.

- Development Flexibility: For this project only general conformities have been set, so this value will be set to High.

- Risk Resolution: This value will be set to Nominal (see section 4 of this document).

- Team Cohesion: Since we have already worked together in a previous big project (no problems occurred), this value will be set to Extra High.

- Process Maturity: The process has been well planned and documented. Since we have often addressed issues reactively, this value will be set to Nominal.

The final value needed by the COCOMO algorithm is the sum of all the scale factors associated with the assigned values. We will call this value SD:

SD = PREC + FLEX + RESL + TEAM + PMAT = 4,96 + 2,03 + 4,24 + 0,00 + 4,68 = 15,64

3.2. Cost Drivers

RELY Descriptors:	slight inconven-ience	low, easily recoverable losses	moderate, easily recoverable losses	high financial loss	risk to human life	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.82	0.92	1.00	1.10	1.26	n/a

- Required Software Reliability: This value will be set to Nominal (easily recoverable, moderate losses).

DATA* Descriptors		Testing DB bytes/Pgm SLOC < 10	10 ≤ D/P < 100	100 ≤ D/P < 1000	D/P ≥ 1000	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.90	1.00	1.14	1.28	n/a

- Data Base Size: In case of intensive application usage, there could be many information to be stored, so this value will be set to High.

Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.73	0.87	1.00	1.17	1.34	1.74

- Product Complexity: Since we have also an API Architecture in our project, this value will be set to High.

RUSE Descriptors:		none	across project	across program	across product line	across multiple product lines
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.95	1.00	1.07	1.15	1.24

- Required Reusability: Since we have some reusable components across the project (see Design Document), this value will be set to Nominal.

DOCU Descriptors:	Many life-cycle needs uncovered	Some life-cycle needs uncovered.	Right-sized to life-cycle needs	Excessive for life-cycle needs	Very excessive for life-cycle needs	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.81	0.91	1.00	1.11	1.23	n/a

- Document Match to Life-Cycle Needs: Since the provided documentation is right-sized to the life-cycle needs, this value will be set to Nominal.

TIME Descriptors:			≤ 50% use of available execution time	70% use of available execution time	85% use of available execution time	95% use of available execution time
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	n/a	1.00	1.11	1.29	1.63

- Execution Time Constraint: Since this parameter is not relevant for our case, this value will be set to Very Low.

STOR Descriptors:			≤ 50% use of available storage	70% use of available storage	85% use of available storage	95% use of available storage
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	n/a	1.00	1.05	1.17	1.46

- Main Storage Constraint: Since this parameter is not relevant for our case, this value will be set to Very Low.

PVOL Descriptors:			Major change every 12 mo.; Minor change every 1 mo.	Major: 6 mo.; Minor: 2 wk.	Major: 2 mo.;Minor: 1 wk.	Major: 2 wk.;Minor: 2 days	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.87	1.00	1.15	1.30	n/a

- Platform Volatility: Since the considered platforms (the operating system, the web browser and the data base) shouldn't change too often, this value will be set to Low.

ACAP Descriptors:	15th percentile	35th percentile	55th percentile	75th percentile	90th percentile	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.42	1.19	1.00	0.85	0.71	n/a

- Analyst Capability: This value will be set to High (see RASD and Design Document).

PCAP Descriptors	15th percentile	35th percentile	55th percentile	75th percentile	90th percentile	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.34	1.15	1.00	0.88	0.76	n/a

- Programmer Capability: This value will be set to Nominal, due to our lack of ability, efficiency and thoroughness in software development.

APEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 years	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.22	1.10	1.00	0.88	0.81	n/a

- Application Experience: Since this is the first project of this kind, this value will be set to Very Low.

PLEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.19	1.09	1.00	0.91	0.85	n/a

- Platform Experience: Since our experience with databases is equal to 1 year, this value will be set to Nominal.

LTEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.20	1.09	1.00	0.91	0.84	

- Language & Tool Experience: This value will be set to Low, since the language and the tools used to cope with the project has been seen this semester.

PCON Descriptors:	48% / year	24% / year	12% / year	6% / year	3% / year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.29	1.12	1.00	0.90	0.81	

- Personnel Continuity: Since the available time for this project is less then a year, this value will be set to Very Low.

TOOL Descriptors	edit, code, debug	simple, frontend, backend CASE, little integration	basic life-cycle tools, moderately integrated	strong, mature life-cycle tools, moderately integrated	strong, mature, proactive life-cycle tools, well integrated with processes, methods, reuse	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.17	1.09	1.00	0.90	0.78	n/a

- Usage of Software Tools: Since we will use NetBeans as development kit and GitHub for the repository management, this value will be set to Nominal.

SITE: Collocation Descriptors: SITE: Communications Descriptors:	Inter-national Some phone, mail	Multi-city and Multi-company Individual phone, FAX	Multi-city or Multi-company Narrow band email	Same city or metro. area Wideband electronic communicat ion.	Same building or complex Wideband elect. comm., occasional video conf.	Fully collocated Interactive multimedia
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.22	1.09	1.00	0.93	0.86	0.80

- Multisite Development: Since we have used phones, mail and Skype, this value will be set to Extra High.

SCED Descriptors	75% of nominal	85% of nominal	100% of nominal	130% of nominal	160% of nominal	
Rating Level	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multiplier	1.43	1.14	1.00	1.00	1.00	n/a

- Required Development Schedule: Since the effort is equally distributed during all the development phases, this value will be set to Nominal.

The final value needed by the COCOMO algorithm is the product of all the effort multipliers associated with the assigned values. We will call this value CD:

CD = RELY * DATA * CPLX * RUSE * DOCU * TIME * STOR * PVOL * ACAP * PCAP * APEX * PLEX * LTEX * PCON * TOOL * SITE * SCED = 1,00 * 1,14 * 1,17 * 1,00 * 1,00 * 1,00 * 1,00 * 0,87 * 0,85 * 1,00 * 1,22 * 1,00 * 1,09 * 1,29 * 1,00 * 0,80 * 1,00 = 1,3536

3.3. Effort Equation

After computing all the needed drivers, it is possible to estimate the project effort through the following equation:

$$EFFORT = A * CD * (KSLOC)^E$$

Where:

A = 2,94 (for COCOMO II)
KSLOC = 3,604 (estimated lines of code using the FP analysis)
E = 0,91 + 0,01 * SD (for COCOMO II)

With these parameters it is possible to compute the effort value:

EFFORT = 2,94 * 1,3536 * (3,604)^(091 + 0,01 * 15,64) = 15,6170 PM

3.4. Schedule Equation

After computing the estimated effort, it is possible to estimate also the number of months required to complete the project through the following equation:

DURATION = 3,67 * (EFFORT)^F

Where:

F = 0,28 + 0,2 * (E – 0,91) (for COCOMO II)

With these parameters it is possible to compute the duration value:

DURATION = 3,67 * (15,6170)^[0,28 + 0,2 * (0,01 * 15,64)] = 8,634 Months

Finally, given the values of EFFORT and DURATION, it is possible to compute the number of required people for the project:

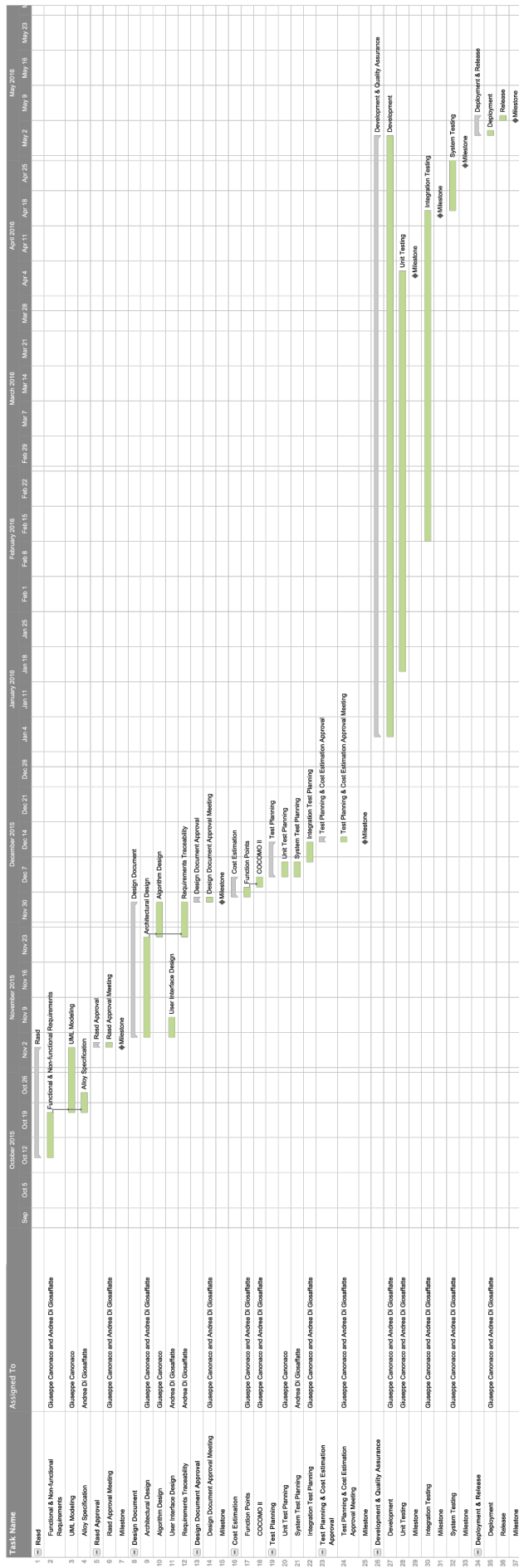PEOPLE = EFFORT / DURATION = 15,6170 / 8,634 = 1,81 ≅ 2 Person

This result, since we are actually a team of two persons, is coherent with the reality of the development environment.

4. Project Schedule & Resource Allocation

4.1. Project Schedule & Resource Allocation

In the figure below are shown all the project tasks and their assignation to the members of the project team.

MyTaxiService

#	Task Name	Assigned To
1	Read	
2	Functional & Non-functional Requirements	Giuseppe Canonaco and Andrea Di Gioaffiatte
3	UML Modeling	Giuseppe Canonaco
4	Alloy Specification	Andrea Di Gioaffiatte
5	Read Approval	
6	Read Approval Meeting	Giuseppe Canonaco and Andrea Di Gioaffiatte
7	Milestone	
8	Design Document	
9	Architectural Design	Giuseppe Canonaco and Andrea Di Gioaffiatte
10	Algorithm Design	Giuseppe Canonaco
11	User Interface Design	Andrea Di Gioaffiatte
12	Requirements Traceability	Andrea Di Gioaffiatte
13	Design Document Approval	
14	Design Document Approval Meeting	Giuseppe Canonaco and Andrea Di Gioaffiatte
15	Milestone	
16	Cost Estimation	
17	Function Points	Giuseppe Canonaco and Andrea Di Gioaffiatte
18	COCOMO II	Giuseppe Canonaco and Andrea Di Gioaffiatte
19	Test Planning	
20	Unit Test Planning	Giuseppe Canonaco
21	System Test Planning	Andrea Di Gioaffiatte
22	Integration Test Planning	Giuseppe Canonaco and Andrea Di Gioaffiatte
23	Test Planning & Cost Estimation Approval	
24	Test Planning & Cost Estimation Approval Meeting	Giuseppe Canonaco and Andrea Di Gioaffiatte
25	Milestone	
26	Development & Quality Assurance	
27	Development	Giuseppe Canonaco and Andrea Di Gioaffiatte
28	Unit Testing	Giuseppe Canonaco and Andrea Di Gioaffiatte
29	Milestone	
30	Integration Testing	Giuseppe Canonaco and Andrea Di Gioaffiatte
31	Milestone	
32	System Testing	Giuseppe Canonaco and Andrea Di Gioaffiatte
33	Milestone	
34	Deployment & Release	
35	Deployment	Giuseppe Canonaco and Andrea Di Gioaffiatte
36	Release	
37	Milestone	

5. Risk Analysis

5.1. Risk Analysis

Project Risks:

Key staff are ill at critical times in the project → Reorganize team so that there is more overlap of work and people therefore understand each other's jobs.

Requirements changes → Traceability mechanisms must be used so that requirement changes can be easier executed and the impact can be properly assessed. Of course information hiding must be maximized within the project.

Underestimated development time → Try to organize an early release with only the main functionalities.

Technical Risks:

Bad Software Design → Try to assign the development of all the software pieces according to the background of each team member in order to avoid this problem. If this risk becomes real then ask for help to more experienced people before attempting to fix the damage on your own.

Business Risks:

Building an excellent product or system that no one really wants → To prevent this outcome lots of survey activities are to be performed in order to properly tailor every aspect of the application.

Budget reduction → If this risk looms over the project, prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business and presenting reasons why cuts to the project budget would not be cost effective. If this doesn't work then try proposing to chop some secondary functionalities.

6. Used Tools

6.1. Used Tools

The tools used to create the Test Plan document are:

-   Microsoft Office Word 2011: to redact and to format this document.

For redacting and writing this document we have spent **10 hours** per person.