SPM Lab Activity-04

Project Estimation using Function Point Analysis

1. Understanding Software Estimation Techniques

1.1 Introduction

Once a project is found to be feasible, software project managers undertake project planning. Project planning is undertaken and completed even before any development activity starts. Estimating the following attributes of the project is an essential activity of project planning.

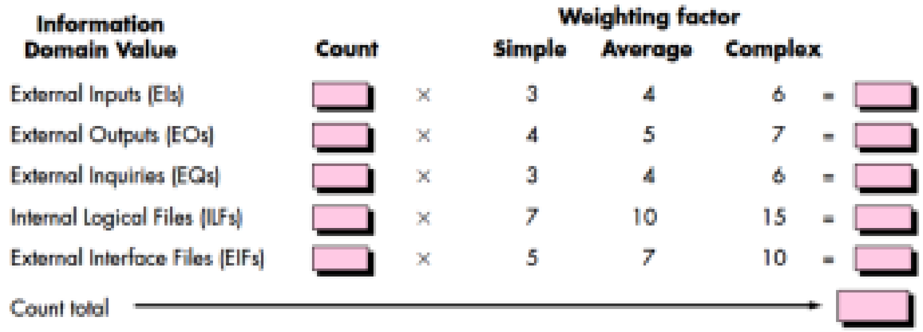
1. ***Project size***: *What will be problem complexity in terms of the effort and time required to develop the product?*
2. ***Cost***: *How much is it going to cost to develop the project?*
3. ***Duration***: *How long is it going to take to complete development?*
4. ***Effort***: *How much effort would be required?*

1.2 Function point (FP)

Function point metric was proposed by Albrecht [1983]. This metric overcomes many of the shortcomings of the LOC metric. Since its inception in late 1970s, function point metric has been slowly gaining popularity. One of the important advantages of using the function point metric is that it can be used to easily estimate the size of a software product directly from the problem specification.

This is in contrast to the LOC metric, where the size can be accurately determined only after the product has fully been developed. The conceptual idea behind the function point metric is that the size of a software product is directly dependent on the number of different functions or features it supports. A software product supporting many features would certainly be of larger size than a product with less number of features. Each function when invoked reads some input data and transforms it to the corresponding output data.

The size of a product in function points (FP) can be expressed as the weighted sum of these five problem characteristics. The weights associated with the five characteristics were proposed empirically and validated by the observations over many projects. Function point is computed in two steps. The first step is to compute the **unadjusted function point** (UFP).



Information Domain Value	Count		Weighting factor				
			Simple	Average	Complex		
External Inputs (EIs)	□	×	3	4	6	=	□
External Outputs (EOs)	□	×	4	5	7	=	□
External Inquiries (EQs)	□	×	3	4	6	=	□
Internal Logical Files (ILFs)	□	×	7	10	15	=	□
External Interface Files (EIFs)	□	×	5	7	10	=	□
Count total							□

Number of inputs: Each data item input by the user is counted. Data inputs should be distinguished from user inquiries. Inquiries are user commands such as print-account-balance. Inquiries are counted separately. It must be noted that individual data items input by the user are not considered in the calculation of the number of inputs, but a group of related inputs are considered as a single input.

Number of outputs: The outputs considered refer to reports printed, screen outputs, error messages produced, etc. While outputting the number of outputs the individual data items within a report are not considered, but a set of relate data items is counted as one input.

Number of inquiries: Number of inquiries is the number of distinct interactive queries which can be made by the users. These inquiries are the user commands which require specific action by the system.

Number of files: Each logical file is counted. A logical file means groups of logically related data. Thus, logical files can be data structures or physical files.

Number of interfaces: Here the interfaces considered are the interfaces used to exchange information with other systems. Examples of such interfaces are data files on tapes, disks, communication links with other systems etc.

Once the unadjusted function point (UFP) is computed, the **technical complexity factor** (TCF) is computed next. TCF refines the UFP measure by considering fourteen other factors such as high transaction rates, throughput, and response time requirements, etc. Each of these 14 factors is assigned from 0(not present or no influence) to 5 (strong influence). The resulting numbers are summed, yielding the total degree of influence (DI).

The Di (i = 1 to 14) are value adjustment factors (VAF) based on responses to the following questions [Lon02]:

1. Does the system require reliable backup and recovery?
2. Are specialized data communications required to transfer information to or from the application?
3. Are there distributed processing functions?
4. Is performance critical?
5. Will the system run in an existing, heavily utilized operational environment? 6. Does
the system require online data entry?
7. Does the online data entry require the input transaction to be built over multiple screens or operations?
8. Are the ILFs updated online?
9. Are the inputs, outputs, files, or inquiries complex?
10. Is the internal processing complex?
11. Is the code designed to be reusable?
12. Are conversion and installation included in the design?
13. Is the system designed for multiple installations in different organizations? 14. Is the
application designed to facilitate change and ease of use by the user?

Now, TCF is computed as(0.65+0.01*DI).
As DI can vary from 0 to 70, TCF can vary from 0.65 to 1.35.
Finally, FP=UFP*TCF.

Example
Compute function point value for a project with the following domain characteristics: No. of I/P = 30 (Simple), No. of O/P = 50 (Average) , No. of user Inquiries = 24(Average), No. of files = 12 (Simple),No. of external interfaces = 3(Complex) and Σ Di = 45.

Sr. No.	Project Characteristics	Count	Type			Weighing factor			Value
				Simple		S	A	C	
1	Inputs	30	30	0	0	3	4	6	90
2	Outputs	50	0	50	0	4	5	7	250
3	User Inquiries	24	0	24	0	3	4	6	96
4	Files	12	12	0	0	7	10	15	84
5	External Interfaces	3	0	0	3	5	7	10	30
						UFP			550

Total Complexity Factor (TCF)= 0.65+0.01***45= 1.1**

Total Function Points= TCF * UFP = 1.1* 550 =605

Lab Activity:

(a) List out the following five project characteristics for the mini-project undertaken by you.

List of Inputs:

Sr. no	Input Name	Nature of Input	Justification (if required)
1	User Profiles	Simple	Information about job seekers
2	Education Level	Simple	Highest level of education attains by user
3	Skills	Simple	Previous work experience and job history
4	Location	Average	Preferred work location

List of Outputs:

Sr. no	Output Name	Nature of Input	Justification (if required)
1	Application Status	Average	Status of job application submitted by user
2	Employer Contact Info	Simple	Information to connect with potential employers
3	Job Recommendation	Complex	Suggested job based on user preferences
4	Interview Invitation	Average	Invitations from employers for job interviews

List of Inquires:

Sr. no	Inquiry Name	Nature of Input	Justification (if required)
1	Job Search	Simple	Search for specific job positions
2	Employer Details	Simple	Request details about potential employers
3	Employer Requirements	Average	Requirements that employer need for the work
4	Interview Schedule	Average	To schedule the interview for best employee to select

List of Internal Logical Files/Tables:

Sr. no	Files/Table Name	Nature of Input	Justification (if required)
1	User Profiles	Simple	Information storage for user profile
2	Application Forms	Average	Forms submitted by users when applying for the job
3	Employer Profile	Simple	Information repository for employer profiles
4	User Skills	Simple	Database storing specific skills of job seekers

List of Interfaces:

Sr. no	Interface Name	Nature of Input	Justification (if required)
1	User Registration	Simple	Interface for users to create a user account and profiles
2	Job Posting	Complex	Interface for employers to post job vacancies
3	User Login	Simple	Interface to login a employer and job seekers
4	Profile Update	Average	Interface for an update an profile of job seekers and employer

(b)Calculate unadjusted function points based on above information.

Sr. No.	Project Characteristics	Count	Type			Weighing factor			Value
			Simple	Average	Complex	S	A	C	
1	Inputs	4	3	1	0	3	4	6	13
2	Outputs	4	1	2	1	4	5	7	21
3	User Inquiries	4	2	2	0	3	4	6	14
4	Files	4	3	1	0	7	10	15	31
5	External Interfaces	4	2	1	1	5	7	10	27
						UFP			106

(c) Assume suitable values (0 to 5) for each of following 14 complexity factors and find DI. Calculate TCF using formula 0.65+0.01*DI and Total Function Points (FP).

Sr. No.	**Complexity factor**	**Rate (0-5)**
1	Does the system require reliable backup and recovery?	4
2	Are specialized data communications required to transfer information to or from the application?	3
3	Are there distributed processing functions?	2
4	Is performance critical?	2
5	Will the system run in an existing, heavily utilized operational environment?	2
6	Does the system require online data entry?	5
7	Does the online data entry require the input transaction to be built over multiple screens or operations?	3
8	Are the ILFs updated online?	4
9	Are the inputs, outputs, files, or inquiries complex?	1
10	Is the internal processing complex?	1
11	Is the code designed to be reusable?	3
12	Are conversion and installation included in the design?	2
13	Is the system designed for multiple installations in different organizations?	2
14	Is the application designed to facilitate change and ease of use by the user?	4
	Total DI	38

Total Complexity Factor (TCF)= 0.65+0.01***38= 1.03**

Total Function Points= TCF * UFP = 1.03* 106 =109.18

(d) Assume suitable value for one function point and find size of project size (in terms KLOC).

Project Size = Total Function Points * 1000 = 109.18 * 1000 = 109180 lines of code (KLOC)