Software Project Management

Lecture 17

Complexity Level

For ILF and EIF			
Record Elements	Data Elements		
	1 - 19	20 - 50	51+
1	Low	Low	Avg
2 – 5	Low	Avg	High
6+	Avg	High	High

Complexity Level

For EO and EQ			
File Type	Data Elements		
	1 – 5	6 - 19	20+
0 – 1	Low	Low	Avg
2 – 3	Low	Avg	High
4+	Avg	High	High

Complexity Level

For EI			
File Types	Data Elements		
	1 – 4	5 - 15	16+
0 – 1	Low	Low	Avg
2 – 3	Low	Avg	High
3+	Avg	High	High

Weighting Factors

	Low	Average	Complex
Internal logical files	7	10	15
External interface files	5	7	10
External inputs	3	4	6
External outputs	4	5	7
External inquiries	3	4	6

Un-adjusted function points are computed using

UFP = $\sum \sum X_i W_j$ where i=1..5, j=1..3

Environment Complexity Factor

- Is data communication required?
- Are there distributed processing functions?
- Is performance critical?
- Will the system run in an existing, heavily utilized environment?
- Does the system require online data entry?
- Is application designed to facilitate the ease of use by user?
- Are inputs, outputs or inquiries complex?

- Are the master files updated online?
- Is the internal processing complex?
- Is the code designed to be reusable?
- Are conversation and installation included in the design?
- Does the system require reliable backup?
- Is the system designed for multiple installations on different sites?
- Is the application designed to facilitate the change?

ECF

Not Present	0
Insignificant Influence	1
Moderate	2
Average	3
Significance	4
Strong Influence	5

$$N = \sum ECF_i \text{ where } i=1..15$$

$$CAF = 0.65 + 0.01 * N$$

$$AFP = CAF * UFP$$

Determine Effort and Time

- Effort = AFPC / Productivity
- Productivity
  - Well Specified & Familiar System 1.5 FP/Man Day
  - Poorly Specified but Familiar System 1.1 FP/Man Day
  - Well Specified but Unfamiliar System 0.7 FP/Man Day
  - Poorly Specified & Unfamiliar System 0.5 FP/Man Day
  - Average Productivity 0.8 FP/Man Day
- Time = AFPC / Delivery Rate$^{0.5}$
- Delivery Rate = 0.45 * AFPC

Example - Employee-Job database

- Need to track employees and their work
  - Add, change, delete, queries, and reports
  - Two types of employees, salaried and hourly
- Employees can have more than one job assignment
- Standard job descriptions are retained by system
- Employees can have more than one location and locations can have more than one employee
  - Another system stores the location data

Example - ILFs and EIFs

- Employee - entity type
  - Employee name
  - SSN
  - Number of dependents
  - Type (salary or hourly)
  - Location name (foreign key)
- Salaried employee - entity subtype
  - Supervisory level
- Hourly employee - entity subtype
  - Standard Hourly rate
  - Collective Bargaining Unit Number

Example - ILFs and EIFs

- Job - entity type
  - Job name
  - Job number
  - Pay grade
- Job Assignment - entity type
  - Effective Date
  - Salary
  - Performance Rating
  - Job Number (foreign key)
  - Employee SSN (foreign key)

- Job Description
  - Job Number (foreign key)
  - Line number (not known to users)
  - Description line

- Job Description not an entity type -- maintained separately for system convenience

Example - ILFs and EIFs

- Location - entity --maintained in another system
  - Location Name
  - Address
  - Employee SSN (foreign key)

- COUNTING STEPS:
  - Count number of ILFs and EIFs
  - Assign them a complexity weighting

Counting ILFs and EIFs

- Three (3) ILFs:
  - Employee
  - Job
  - Job Assignment
  - not Job Description (logically part of Job)
  - not Location (an EIF)
  - not Salaried Employee (a Record Element Type)
  - not Hourly Employee (a Record Element Type)

- One (1) EIF:
  - Location

Counting ILFs/EIFs - Complexity

Record Element Types (RETs)	Data Element Types (DETs)		
	1-19	20-50	51+
<2	Low	Low	Average
2-5	Low	Average	High
>5	Average	High	High

Three ILFs:

- **Employee - 8 DETs and 2 RETs**
- **Job - 4 DETs and 1 RET**
- **Job Assignment - 5 DETs and 1 RET**

One EIF: Location - 3 DETs and 1 RET

ILF and EIF Unadjusted FPs

	Low	Average	High
External Input	_x3	_x4	_x6
External Output	_x4	_x5	_x7
Logical Internal File	3 x7	_x10	_x15
External Interface File	1 x5	_x7	_x10
External Inquiry	_x3	_x4	_x6

Counting EIs - Raw Data

- Employee Maintenance
  - Add, change, delete Employee
  - Employee Inquiry; Employee Report
- Job Maintenance
  - Add, change, delete Job
  - Job Inquiry; Job Report
- Job Assignment Maintenance
  - Assign Employee to Job
  - Job Assignment Inquiry; Job Assignment Report
  - Transfer Employee
  - Evaluate Employee
  - Delete Assignment
- Location Reporting
  - Location Inquiry; Location Report

Counting EIs - Complexity

File Types Referenced (FTRs)	Data Element Types (DETs)		
	1-4	5-15	+15
<2	Low	Low	Average
2	Low	Average	High
>2	Average	High	High

Example EIs (3 of 10):

- **Create Employee- 10 DETs, 2FTRs (Employee and Location) => Average**
- **Delete Employee- 3 DETs and 1 FTR=> Low**
- **Assign Employee to Job - 6 DETs and 3 FTRs (Employee, Job and Job Assignment)=> High**

External Input (EI) Unadjusted FPs

	Low	Average	High
External Input	6 x3	2 x4	2 x6
External Output	_x4	_x5	_x7
Logical Internal File	_x7	_x10	_x15
External Interface File	_x5	_x7	_x10
External Inquiry	_x3	_x4	_x6

Counting EOs - Raw Data

- Employee Maintenance
  - Add, change, delete Employee
  - Employee Inquiry; Employee Report - 6-19 DETs
- Job Maintenance
  - Add, change, delete Job
  - Job Inquiry; Job Report- 5 DETs
- Job Assignment Maintenance
  - Assign Employee to Job
  - Job Assignment Inquiry; Job Assignment Report 6-19 DETs
  - Transfer Employee
  - Evaluate Employee
  - Delete Assignment
- Location Reporting
  - Location Inquiry; Location Report- 6-19DETs

Counting EOs - Complexity

File Types Referenced (FTRs)	Delta Element Types (DETs)		
	1-5	6-19	20+
<2	Low	Low	Average
2-3	Low	Average	High
>3	Average	High	High

Example EOs :

- **Employee Report- 6-19 DETs, 2FTRs (Employee and Location) => Average**
- **Job Report-5 DETs and 1 FTR=> Low**
- **Job Assignment Report - 6-19 DETs, 3 FTRs (Employee, Job and Job Assignment)=> Average**

External Output Unadjusted FPs

	Low	Average	High
External Input	_x3	_x4	_x6
External Output	1 _x4	3 _x5	_x7
Logical Internal File	_x7	_x10	_x15
External Interface File	_x5	_x7	_x10
External Inquiry	_x3	_x4	_x6

Counting EQs

- Employee Maintenance
  - Employee Inquiry- 2 FTRs and 9 DETs (output)
- Job Maintenance
  - Job Inquiry - 1 FTR and 4 DETs (output)
- Job Assignment Maintenance
  - Job Assignment Inquiry- 1 FTR and 5 DETs (output)
- Location Reporting
  - Location Inquiry - 2 FTRs and 5 DETs (output)

- RESULT - Use EI and EO matrices => 3 low complexity and 1 average (employee)

EQ Unadjusted FPs

	Low	Average	High
External Input	_x3	_x4	_x6
External Output	_x4	_x5	_x7
Logical Internal File	_x7	_x10	_x15
External Interface File	_x5	_x7	_x10
External Inquiry	3 x3	1 x4	_x6

Total Unadjusted Function Points

	Low	Average	High
External Input	6 x3	2 x4	2 x6
External Output	1 x4	3 x5	_x7
Logical Internal File	3 x7	_x10	_x15
External Interface File	1 x5	_x7	_x10
External Inquiry	3 x3	1 x4	_x6

Total = 96 Unadjusted FPs

Reading

- Capers Jones, “By popular demand: Software estimation rules of thumb” IEEE Computer March 1996, pp.116-118.
- F.P. Brooks, Jr., “The Mythical Man-Month”, Datamation, December 1974, pp.44-52.
  - The Mythical Man-Month, F.P. Brooks Jr., (Book)
  - Software Engineering Project Management, Ed. R.H. Thayer (Book)

Q&A