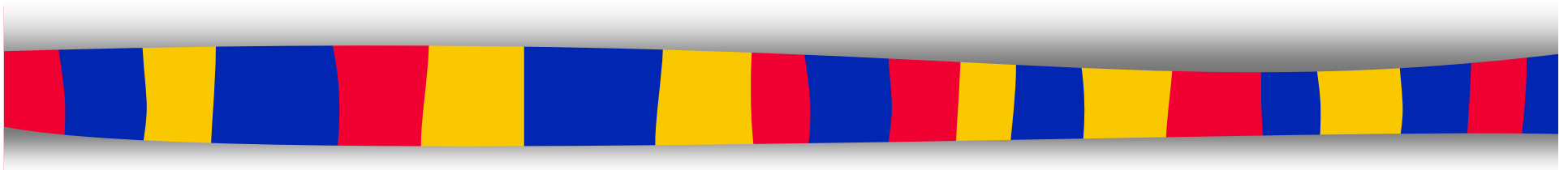


# **CISC 322**

## Software Architecture



### **Example of COCOMO-II**

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# Function Point Table

<i>Number of FPs</i>	Complexity		
	Low	Average	High
External user type			
External input type	3	4	6
External output type	4	5	7
Logical internal file type	7	10	15
External interface file type	5	7	10
External inquiry type	3	4	6

# Example of FPA

- An inventory system that needs to
  - ‘Add a record’
  - ‘Delete a record’,
  - ‘Display a record’,
  - ‘Edit a record’, and
  - ‘Print a record’
  - will have
    - 3 external input types
    - 1 external output type
    - 1 external inquiry type

# Object Point Analysis - Screen

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Number and source of data tables			
Number of views contained	Total < 4 (<2 server, <2 client)	Total < 8 (2-3 server, 3-5 client)	Total 8+ (>3 server, >5 client)
< 3	Simple	Simple	Medium
3 – 7	Simple	Medium	Difficult
8+	Medium	Difficult	Difficult

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# Object Point Analysis - Reports

Number and source of data tables			
Number of sections contained	Total < 4 (<2 server, <2 client)	Total < 8 (2-3 server, 3-5 client)	Total 8+ (>3 server, >5 client)
< 2	Simple	Simple	Medium
2 or 3	Simple	Medium	Difficult
> 3	Medium	Difficult	Difficult

# Object Point Analysis – Complexity Weighting

Type of object	Complexity		
	Simple	Medium	Difficult
Screen	1	2	3
Report	2	5	8
3GL component	N/A	N/A	10

# Object Point Analysis – Productivity Rate

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	Very low	Low	Nominal	High	Very High
Developer's experience and capability	4	7	13	25	50
CASE maturity and capability	4	7	13	25	50

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# COCOMO II

$$\text{Effort} = \text{Constant} \times (\text{Size})^{\text{scale factor}} \\ \times \text{Effort Multiplier}$$

- Effort in terms of person-months
- Constant: 2.45 in 1998
- Size: Estimated Size in KLOC
- Scale Factor: combined process factors
- Effort Multiplier (EM): combined effort factors



# System to be built

- An airline sales system is to be built in C:
  - Back-end database server has already been built.
- We will use object point estimation technique for high level estimates and FP for detailed estimates

# Object Point Analysis

- Application will have 3 screens and will produce 1 report:
  - A booking screen: records a new sale booking
  - A pricing screen: shows the rate for each day and each flight
  - An availability screen: shows available flights
  - A sales report: shows total sale figures for the month and year, and compares figures with previous months and years

# Rating of system

- Booking screen:
  - Needs 3 data tables (customer info, customer history table, available seats)
  - Only 1 view of the screen is enough. So, the booking screen is classified as simple.
- Similarly, the levels of difficulty of the pricing screen, the availability screen and the sales report are classified as simple, simple and medium, respectively. There is no 3GL component.

# Rating Results

Name	Objects	Complexity	Weight
Booking	Screen	Simple	1
Pricing	Screen	Simple	1
Availability	Screen	Medium	2
Sales	Report	Medium	5
		Total	9

- Assessment of the developers and the environment shows:
  - The developers' experience is very low (4)
  - The CASE tool is low (7). So, we have a productivity rate of 5.5.
- According to COCOMO II, the project requires approx. 1.64 (=  $9/5.5$ ) person-months.

# Function Point Estimation (FP->KLOC)

<b>Name</b>	<b>External user types</b>	<b>Complexity</b>	<b>FP</b>
Booking	External output type	Low	4
Pricing	External inquiry type	Low	3
Availability	External inquiry type	Medium	4
Sales	External output type	Medium	5
		Total	16

# FP->LOC

- Total function points = 16
- Published figures for C show that:
  - 1 FP = 128 LOC in C
- Estimated Size
  - $16 * 128 = 2048 = 2 \text{ KLOC}$

# Scale Factor Estimation

Name	Very low (0.05)	Low (0.04)	Nominal (0.03)	High (0.02)	Very High (0.01)	Extra High (0.00)	Assessment	Value
Precedentedness	Thoroughly unprecedented	Largely unprecedented	Somewhat unprecedented	Generally familiar	Largely familiar	Thoroughly familiar	<b>Very high</b>	<b>0.01</b>
Flexibility	Rigorous	Occasional relaxation	Some relaxation	General conformity	Some conformity	General goals	<b>Very high</b>	<b>0.01</b>
Significant risks eliminated	Little (20%)	Some (40%)	Often (60%)	Generally (75%)	Mostly (90%)	Full (100%)	<b>Nominal</b>	<b>0.03</b>
Team interaction process	Very difficult	Some difficult	Basically cooperative	Largely cooperative	Highly cooperative	Seamless interactions	<b>High</b>	<b>0.02</b>
Process maturity	Level 1	Level 2	Level 2+	Level 3	Level 4	Level 5	<b>Low</b>	<b>0.04</b>
							<b>Add</b>	<b>1.01</b>
							<b>Total</b>	<b>1.13</b>

# Effort Adjustment Factors (EAF)

Identifier	Name	Ranges (VL – EH)	Assessment VL/L/N/H/VH/EH	Values
RCPX	product Reliability and ComPleXity	0.5 – 1.5	low	0.75
RUSE	required reusability	0.5 – 1.5	nominal	1.0
PDIF	Platform DIfficulty	0.5 – 1.5	high	1.1
PERS	PERSonnel capability	1.5 – 0.5	high	0.75
PREX	PeRsonnel EXperience	1.5 – 0.5	very high	0.65
FCIL	FaCILities available	1.5 – 0.5	nomial	1.0
SCED	SChEDule pressure	1.5 – 0.5	low	1.2
			Product	0.4826

- Effort =  $2.45 \times (2.048)^{1.13} \times 0.4826 = 2.66$  person-months



# References

- Hughes, B., and Cotterell, M. (1999) *Software project management*, 2<sup>nd</sup> ed., McGraw Hill
- Pfleeger, S.L. (1998) *Software Engineering: Theory and Practice*, Prentice Hall
- Royce, W. (1998) *Software Project Management: A Unified Framework*, Addison Wesley
- Center for Software Engineering, USC (1999) *COCOMO II Model Definition Manual*.