PROBE

The PSP Size Estimating Approach

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Goals and Outline of Presentation

Goals

An overview Proxy Based Estimating (PROBE) in the Personal Software Process (PSP) context

- What they are & how PROBE works
- Principles behind PROBE
- PROBE's particular advantages
- How PROBE fits in PSP

Outline

- What is PSP – Context for PROBE
- PROBE
- Conclusions

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What is PSP – Context for PROBE
Overview

A process for individuals to use

Applies to structured personal tasks

- Writing small programs or documents
- Defining requirements or processes
- Conducting reviews or tests, etc.

Introduced

- In steps
- With small software problems

Is a discipline for software engineering

Provides an effective foundation for large scale development practices

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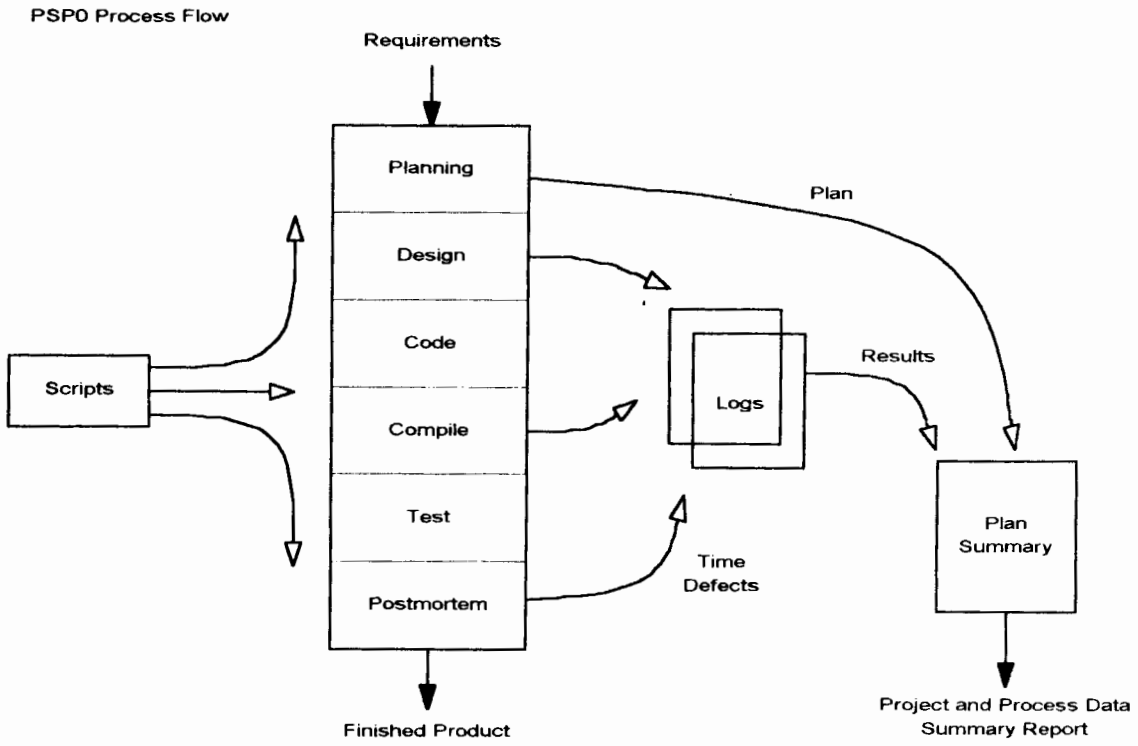
What is PSP – Context for PROBE

PSP0 Process Flow (Framework)



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What is PSP – Context for PROBE

PSP0.1 Project Plan Summary

Student _____ Date _____

Program _____ Program # _____

Instructor _____ Language _____

Program Size (LOC)	***Plan***	***Actual***	***To Date***
Base(B)		_____ (Measured)	
Deleted (D)		_____ (Counted)	
Modified (M)		_____ (Counted)	
Added (A)		_____ (T-B+D-R)	
Reused (R)		_____ (Counted)	_____
Total New & Changed (N)	_____	_____ (A+M)	_____
Total LOC (T)		_____ (Measured)	_____
Total New Reused		_____	_____

Time in Phase (min.)	***Plan***	**Actual**	**To Date**	**To Date %**
Planning	_____	_____	_____	_____
Design	_____	_____	_____	_____
Code	_____	_____	_____	_____
Compile	_____	_____	_____	_____
Test	_____	_____	_____	_____
Postmortem	_____	_____	_____	_____
Total	_____	_____	_____	_____

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PSP0.1 Project Plan Summary (cont.)

Defects Injected	Actual	To Date	To Date %
Planning			
Design			
Code			
Compile			
Test			
Total Development			

Defects Removed	Actual	To Date	To Date %
Planning			
Design			
Code			
Compile			
Test			
Total Development			
After Development			

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What is PSP – Context for PROBE

PSP0.1 Process Time Recording Log

Student _____ **Date** _____

Instructor _____ **Program #** _____

Date	Start	Stop	Interruption Time	Delta Time	Phase	Comments

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Defect Types	
10 Documentation	60 Checking
20 Syntax	70 Data
30 Build, Package	80 Function
40 Assignment	90 System
50 Interface	100 Environment

What is PSP – Context for PROBE

PSP Defect Recording Log

Student _____ Date _____

Instructor _____ Program # _____

Date	Number	Type	Inject	Remove	Fix Time	Fix Defect

Description: _____

Date	Number	Type	Inject	Remove	Fix Time	Fix Defect

Description: _____

Date	Number	Type	Inject	Remove	Fix Time	Fix Defect

Description: _____

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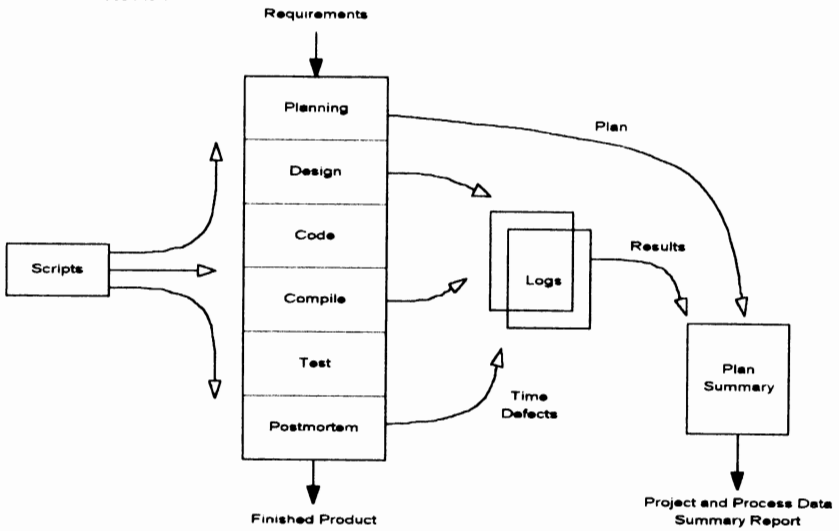
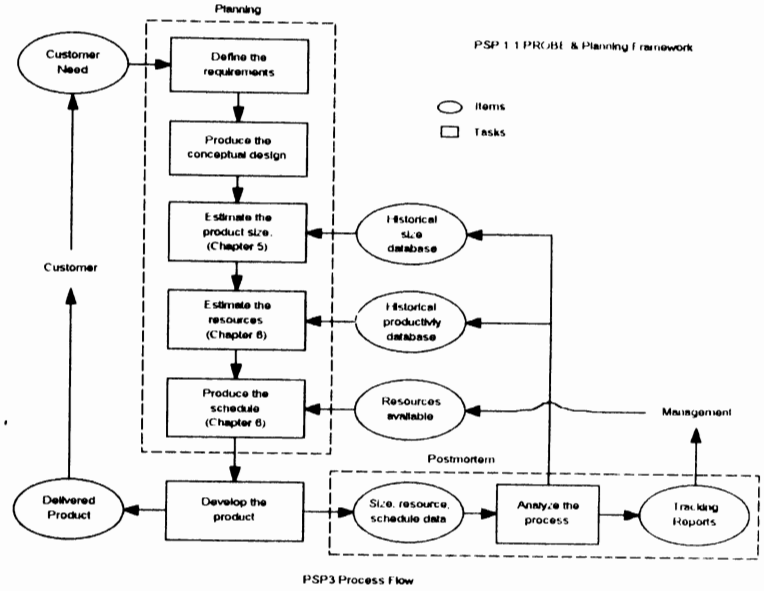
What is PSP – Context for PROBE

PSP Processes

PSP0 Process Flow



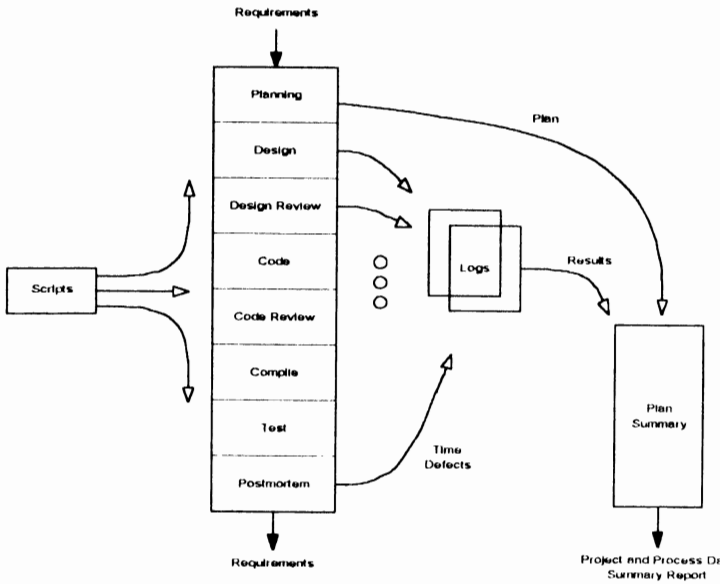


PSP1.1 PROBE & Planning Framework

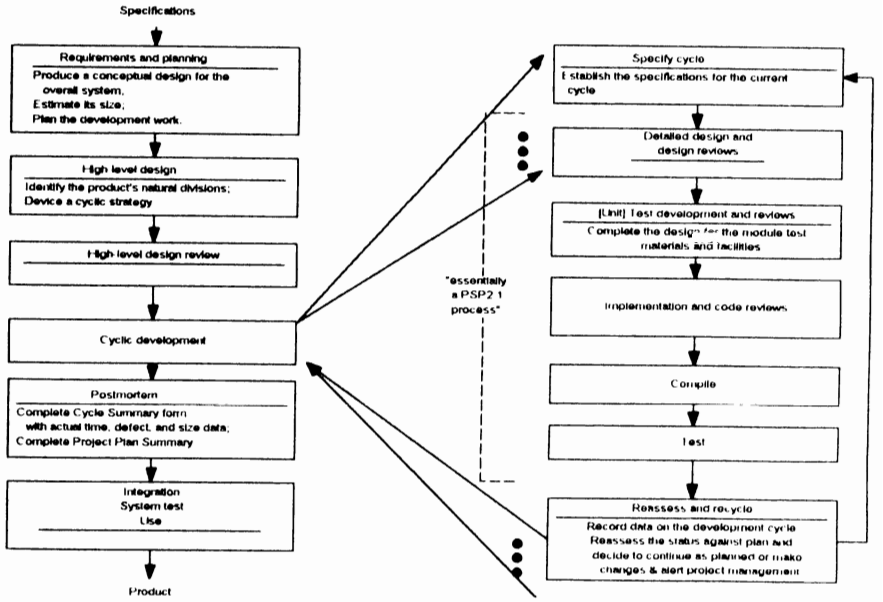
Items

Tasks

PSP2 Process Flow



PSP3 Process Flow



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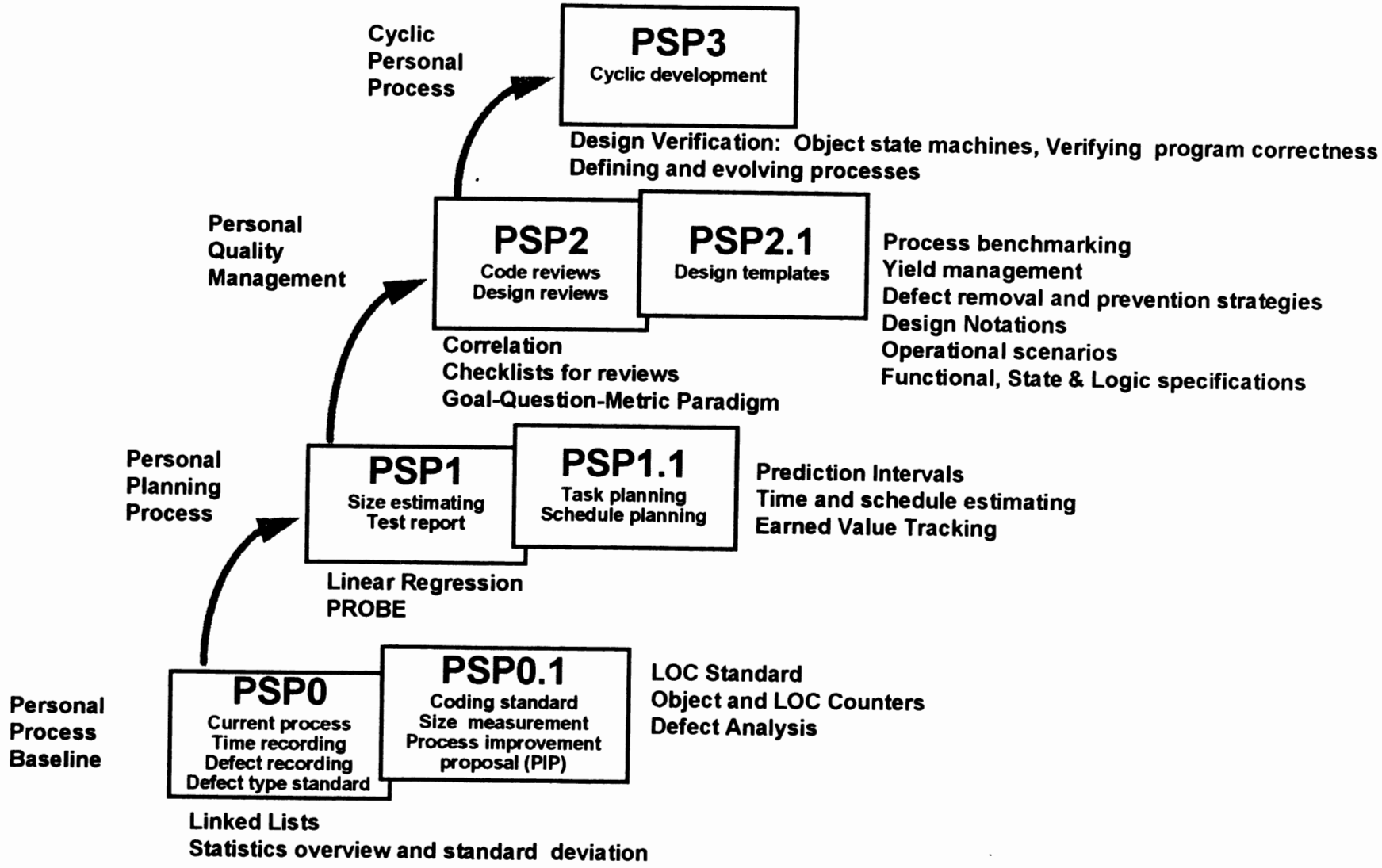
What is PSP – Context for PROBE

PSP Methods, Techniques and Technologies



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What is PSP – Context for PROBE

PSP Size Estimating Approaches Discussed

Fuzzy logic

- Divide historical product size data into size ranges and characteristics
- Compare the planned product with these prior products
- Based on this comparison, select the size that seems most appropriate for the new product

Function points

Standard Components

Delphi

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What is PSP – Context for PROBE

PSP Size Estimating Approaches Discussed (cont.)

Standard Components

- Historical Data
  - Establish the principal product size levels (components, modules, screens, etc.)
  - Determine typical sizes of each level
- New Product
  - Determine the component level at which estimation is practical
  - Estimate how many of those components will likely be in the product
  - Determine the maximum and minimum numbers possible
  - Calcuate the maximum, minimum and likely sizes as total of
    - o number of components of each type
    - o times typical sizes of each type
  - Calculate size = (maximum + 4*likely + minimum)/6

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PSP Size Estimating Approaches Discussed (cont.)

Delphi

- Uses several estimators
  - each makes an independent estimate
  - each submits estimate to a coordinator
- Coordinator
  - calculates average estimate
  - enters on form: average, other estimates (anonymously), and previous estimate
- When reestimates stabilizes
  - average is the estimate
  - range is range of *original* estimates

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PROBE – The PSP Size Estimating Approach Outline

What is PSP – Context for PROBE

⇒ **PROBE** ⇐

Conclusions

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PROBE Process Details
PROxy Based Estimates – Proxies

Basic issues

- Good size measures are detailed
- Early estimators can rarely think in detail

Alternatives

- Delay estimate until detail available
- Make best guess – use Fuzzy Logic? Standard Components? Delphi?
- identify a suitable proxy

Good proxies

- Correlate closely to development costs
- Are easy to visualize early in development
- Should be physical entity that can be counted

Example Proxies

- Function points
- Objects
- Product elements (components; screens, reports, scripts, files; chapters)

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PROBE Process Details
PROxy Based Estimates – Objects as Proxies

Correlation with development hours

- Numbers of objects correlate reasonably well
- Object lines of code (LOC) correlate very closely

Object LOC: estimated using the standard component estimating method

Total LOC: estimated from historical relationship Object_LOC::Total_LOC

Objects (as application entities) – can be visualized early in development
[Functions and procedures can often be estimated the same way]

Counting can be automated for

- Objects, and their LOC
- Functions and procedures, and their LOC

What's Needed

- Object and LOC counter(s)
- Historical data for standard component object LOC
- Historical relationship of Object_LOC to Program_LOC
- Rules for when to apply

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PROBE Process Details
Historical Data

LOC & LOC per Object Counters

- Personal Coding and Line of Code counting standards:
  developed as Report Exercises 1 & 2 in PSP course
- LOC and LOC per Object counters:
  developed as Programming Exercises 2 & 3
- LOC and LOC per Object results for Programming Exercises 1..3:
  called for as "test results" from Proramming Exercise 3

Program Number	Object Name	Number of Methods	Object LOC	Total Program LOC
1A	ABC	3	86	
	DEF	2	8	
	GHI	4	92	
				212
2A	...			

Historical data for standard component object LOC

Historical relationship of Estimated Object_LOC to Actual Program_LOC:
Linear Regression Parameters calculated by Programming Ex. 4

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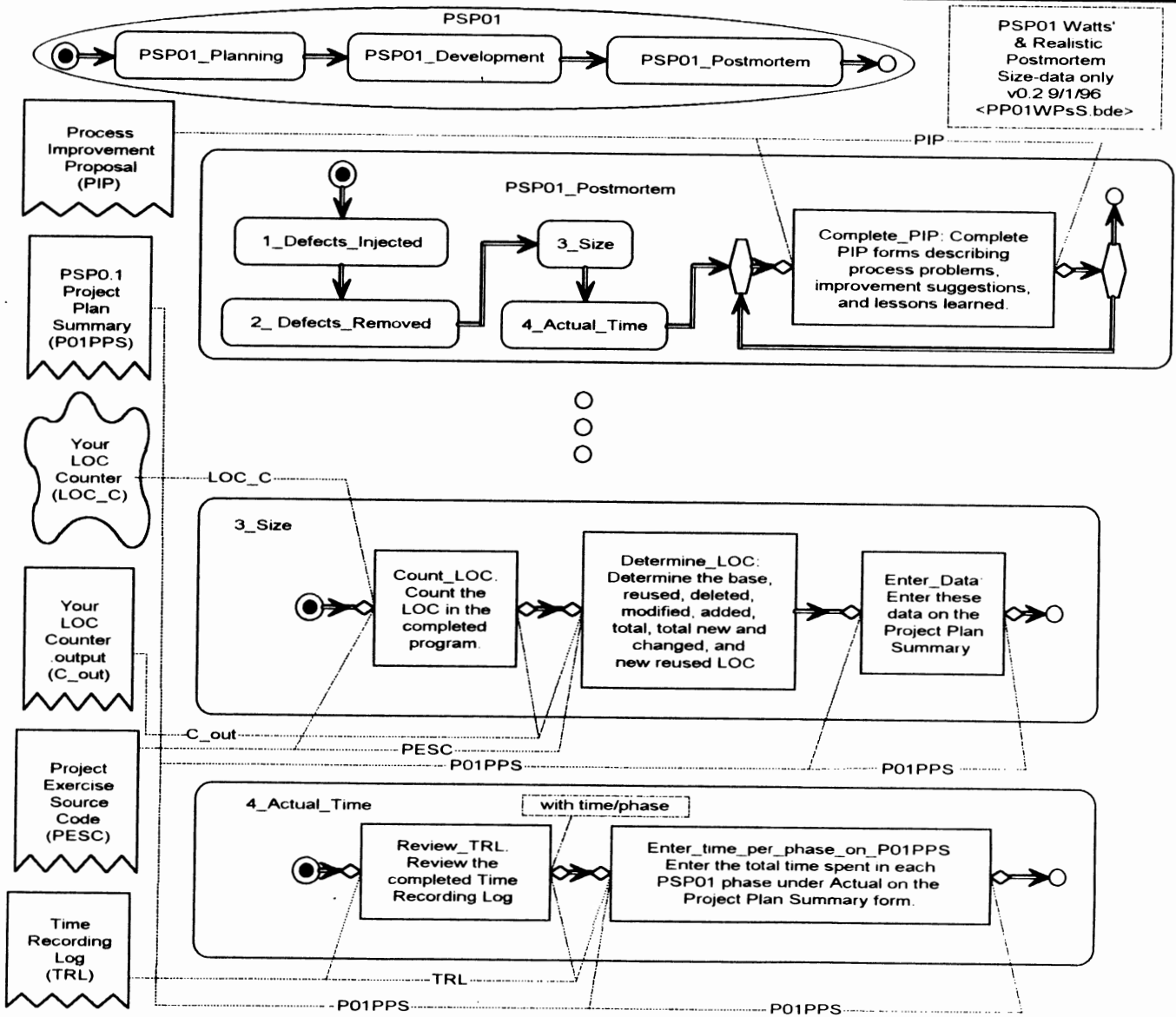
PROBE Process Details

PSP0.1 Postmortem Process – Size Data



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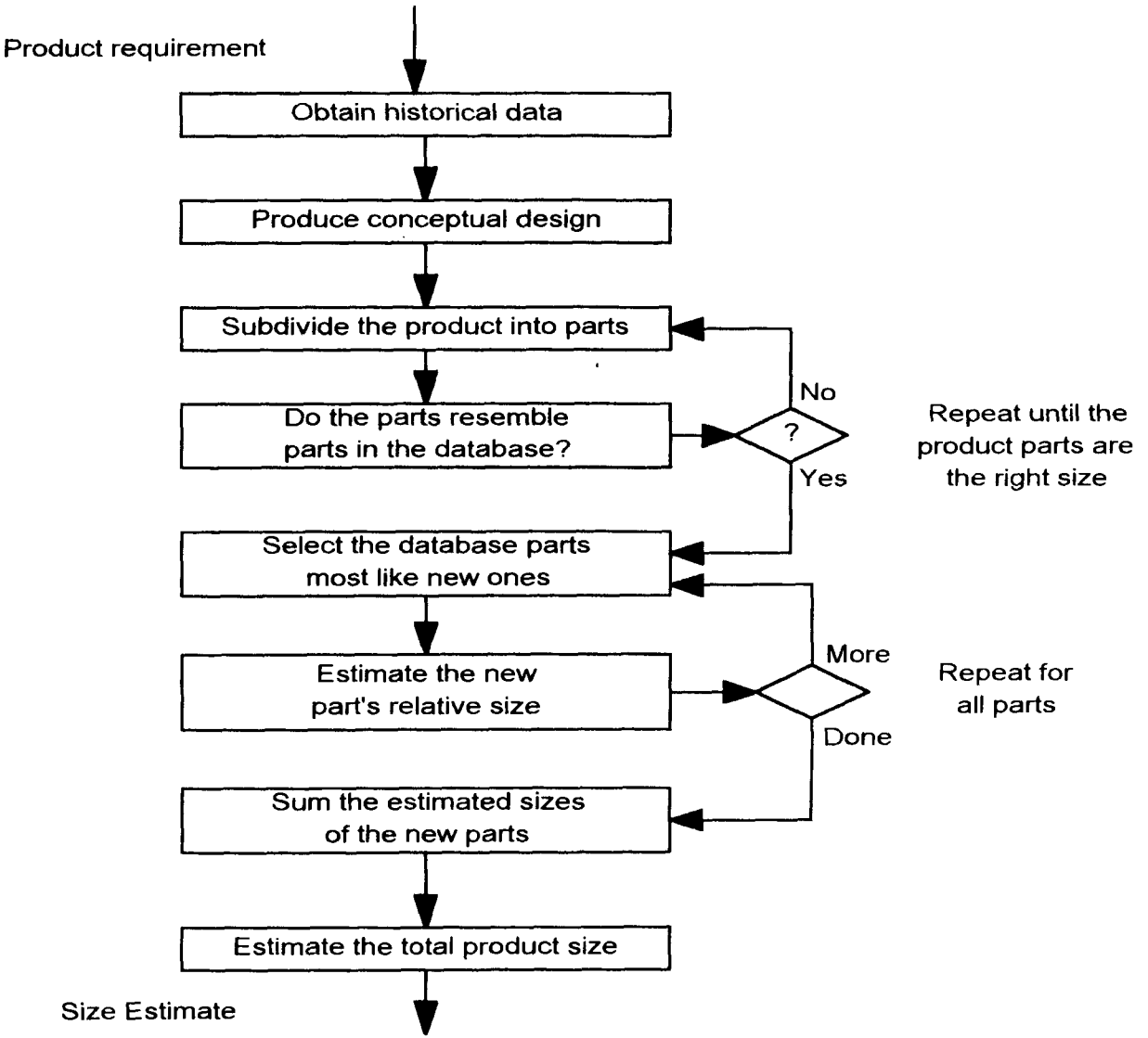
PROBE Process Details
Size Estimating Overview



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PROBE Process Details

PSP Size Estimating Template

Student _____ Date _____

Instructor _____ Program # _____

BASE PROGRAM LOC

BASE SIZ E (B) => => => => => => => => => => _____

LOC DELETED (D) => => => => => => => => => => _____

LOC MODIFIED (M) => => => => => => => => => => _____

PROJECTED LOC

BASE ADDITIONS:	TYPE	METHODS	REL. SIZE	LOC
TOTAL BASE ADDITIONS (BA) => => => => => =>				

NEW OBJECTS:	TYPE[1]	METHODS	REL. SIZE	LOC (NewReuse*)
TOTAL NEW OBJECTS (NO) => => => => => => =>				

[1] L-Logic, I-I/O, C-Calculation, T-Text, D-Data, S-Set-up

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PROBE Process Details

PSP Size Estimating Template (cont.)

REUSED PROGRAMS

LOC

REUSED TOTAL (R) => => => => => => => => =>	
Projected LOC: P = BA+NO	
Regression Parameter: β_0	
Regression Parameter: β_1	
Estimated New and Changed LOC: N = β_0 + β_1*(P+M)	
Estimated Total LOC: T = N + B - D - M + R	
Estimated Total New Reused (sum of * LOC):	
Prediction Range: Range	
Upper Prediction Interval: UPI = N + Range	
Lower Prediction Interval: LPI = N - Range	
Prediction Interval Percent:	

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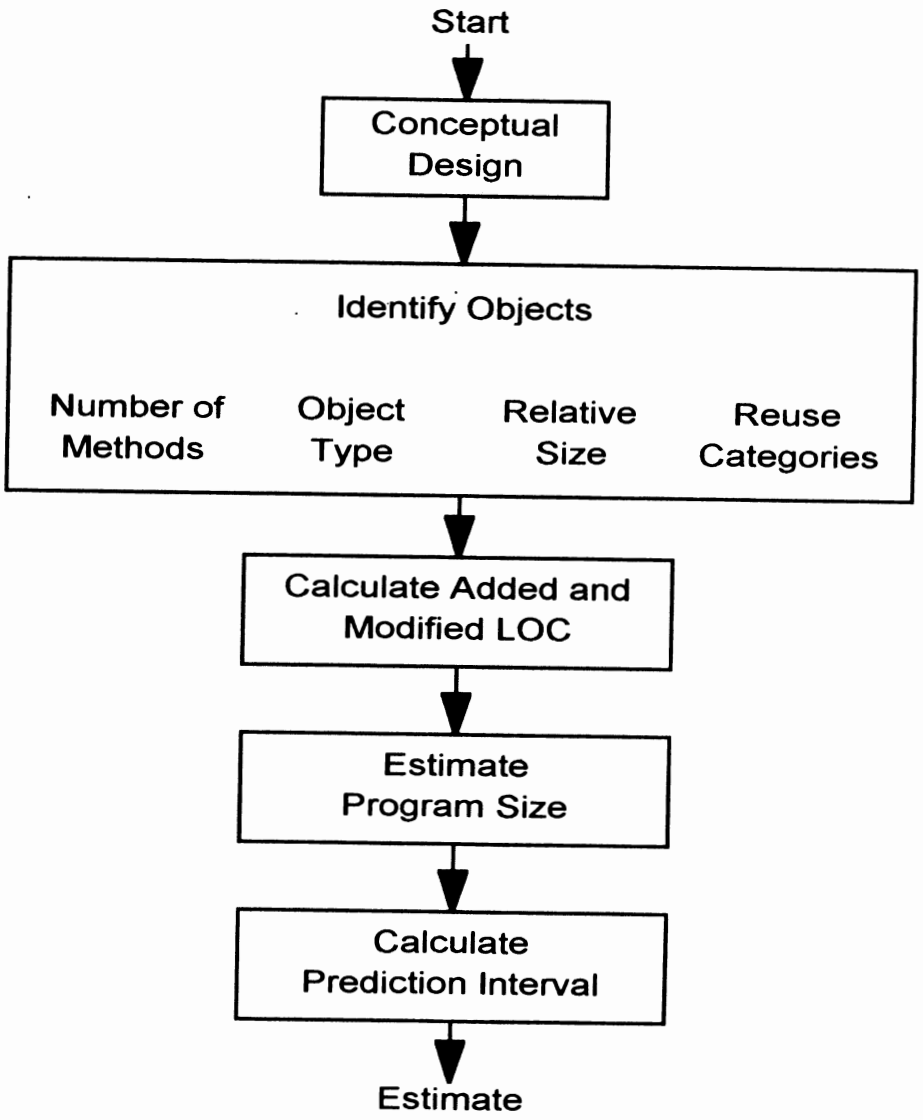
PROBE Process Details
Estimating Method



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PROBE Process Details
Process and Statistical Refinements

Historical data on object LOCs

- Highly variable
  - language & design style influences
  - helps to normalize by number of methods
- Divided into basic types:
  logic, control, I/O, files, display, data, text, calculation, set-up, error handling
- Size range for object types based on log-normal distribution

Prediction Intervals – Reality check

- 70% and 90% likely range around the estimate
- Calculated from same data used to calculate the regression factors
- Uses the student-t

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Outline

What is PSP – Context for PROBE

PROBE

⇒ **Conclusions** ⇐

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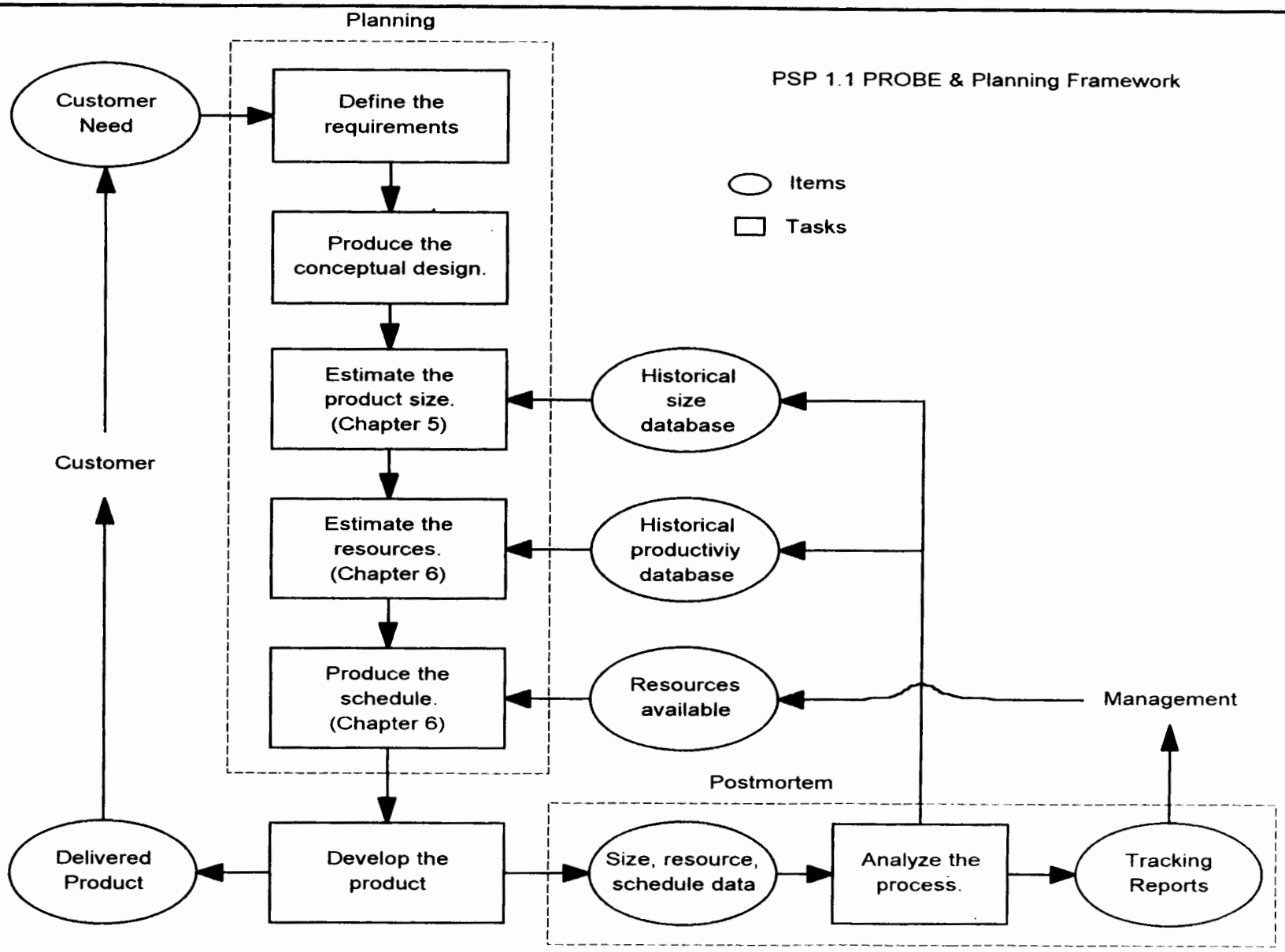
PROBE Process Details

PSP1 Framework



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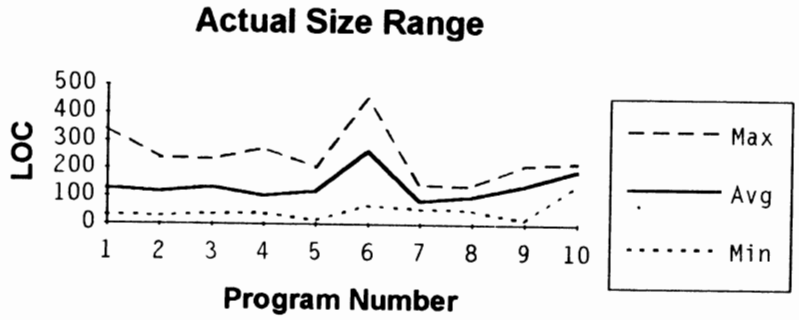
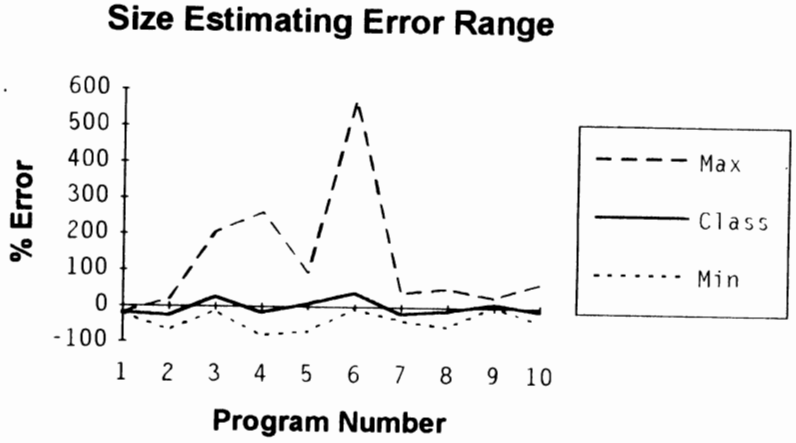
Conclusions
Actual Results – Estimating Error

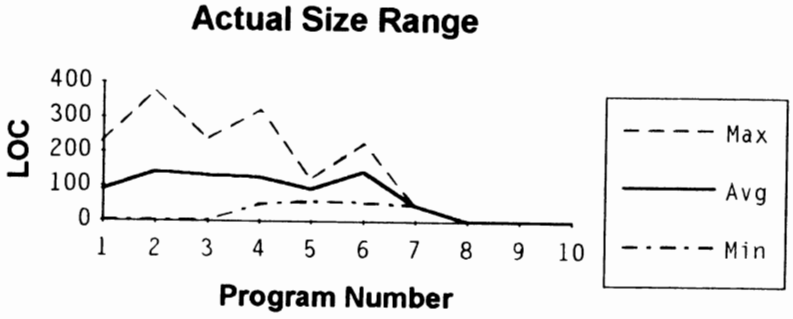
UNISYS PSP Class



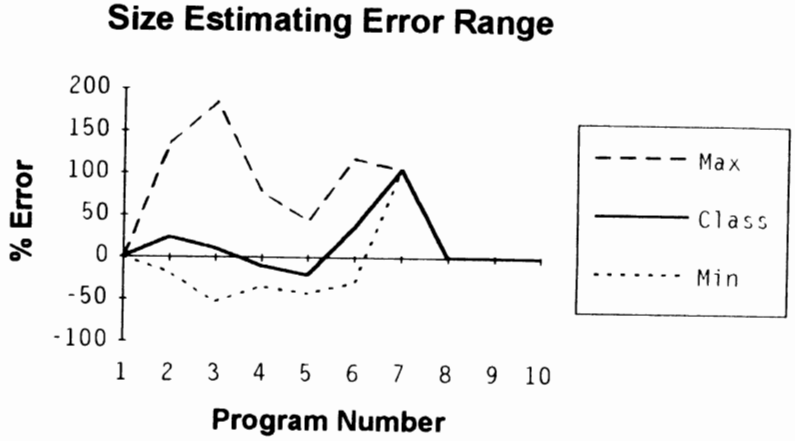
UNISYS PSP Class



WCU PSP OC2



WCU PSP OC2



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Conclusions

Teachable

Practical

Actual results indicate: Improvement over time

Improvable?: regression based on % error rather than absolute error

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