Basic Tool Set for Object-Oriented Development

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Cyclomatic Complexity	*Traditional*
Lines of Code	
Comment Percentage	
Weighted Methods per Class	*Architecture*
Response for a Class	
Lack of Cohesion of Methods	
Coupling Between Objects	
Depth of Inheritance	*Tree Structure*
Number of Children	

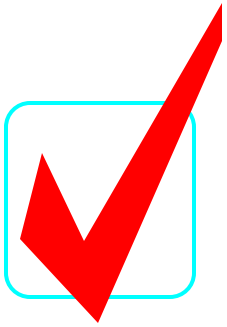
Automated Code Analysis

SATC's Tool for Object Oriented Metrics - TOOM

Input is ready-to-compile source code - either Java or C++. Pre-compiled not required.

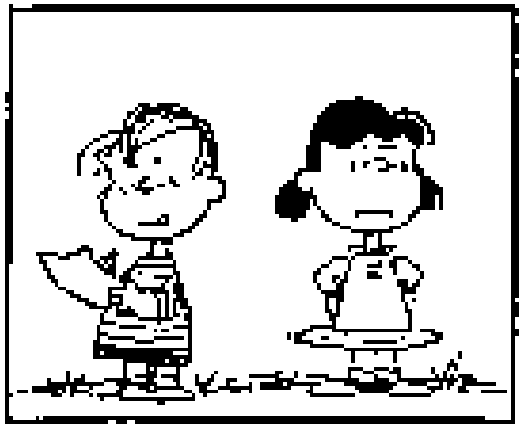
Output is one-class-at-a-time or comma delimited files

Over 20,000 NASA OO classes have been analyzed to date.



(Validation of results and compilation of data are currently in progress.)

I WANT TO KNOW ABOUT SOFTWARE COMPLEXITY
I WANT SOME REAL ANSWERS....



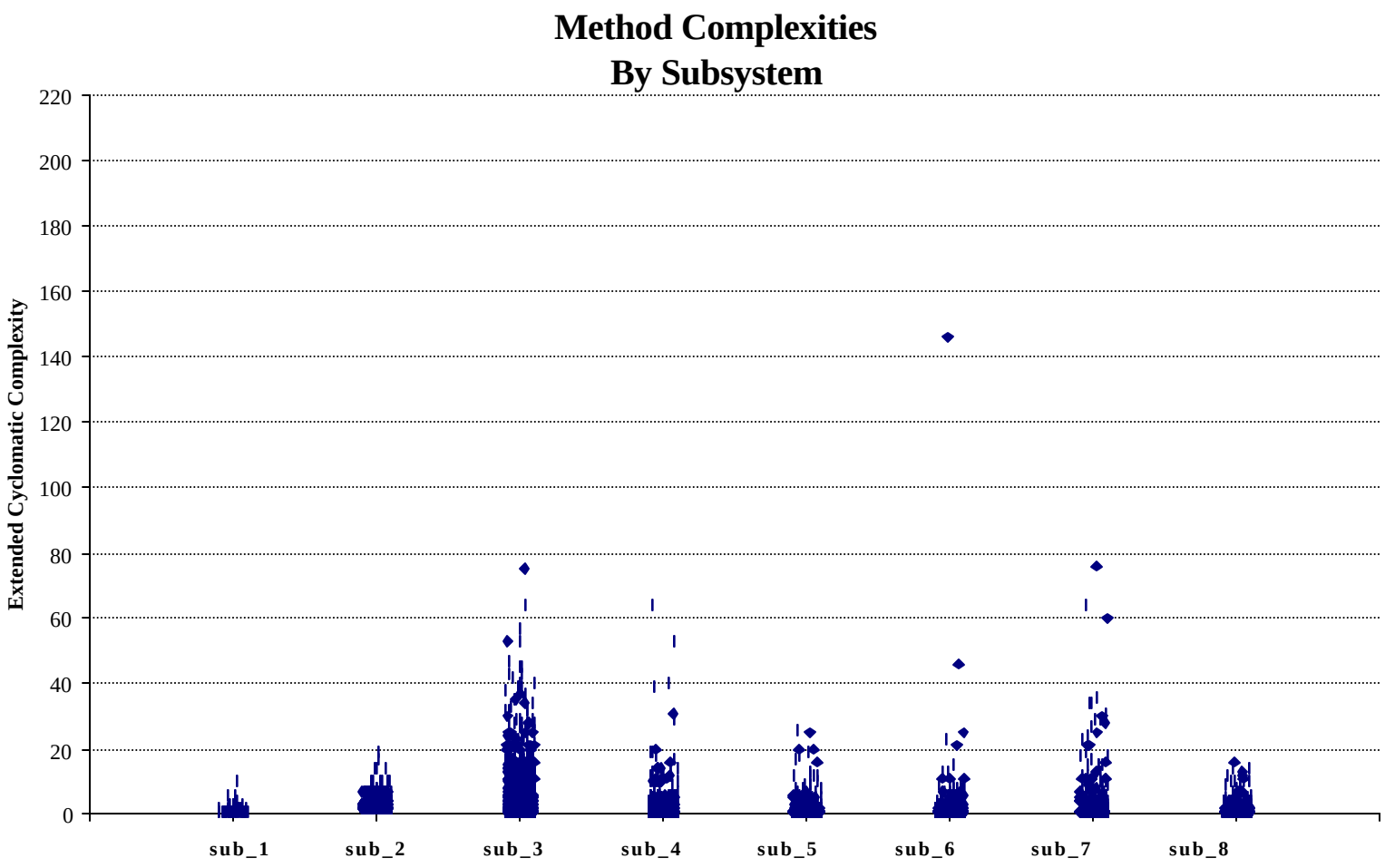
EIGHT
EIGHT ?!

I THOUGHT THAT WAS A PRETTY GOOD ANSWER?

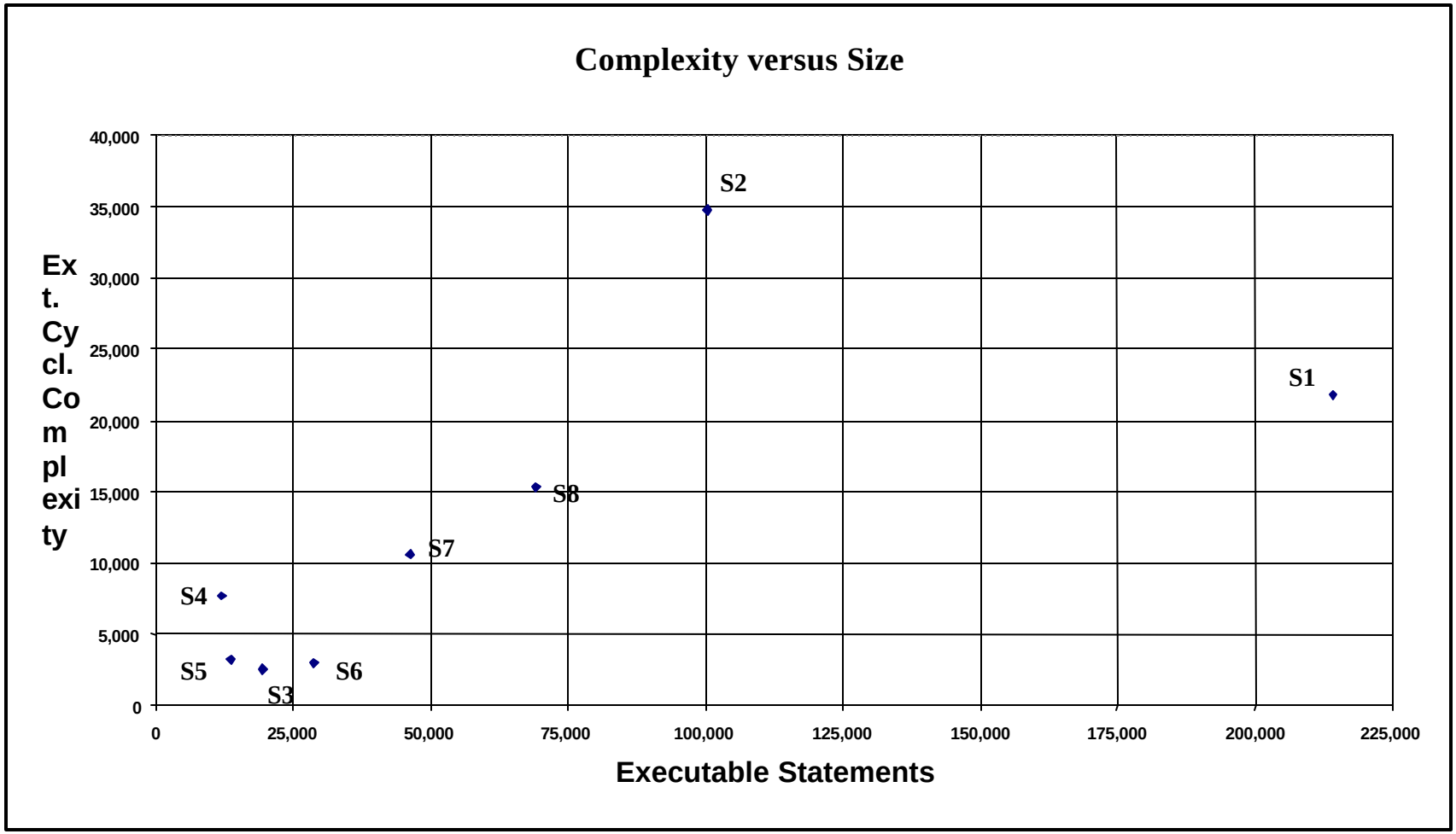
"Traditional" Metrics for Object-Oriented Systems

- The **Cyclomatic Complexity** (McCabe) is used to evaluate the application of an algorithm.
- Various **Line Counts** can be applied to methods. These include counting all physical lines of code, the number of statements and the number comment lines. Thresholds vary greatly depending on the language.
- **Comment Percentage** is calculated by the number of on-line and stand alone comments divided by the total lines of code less the number of blank lines.

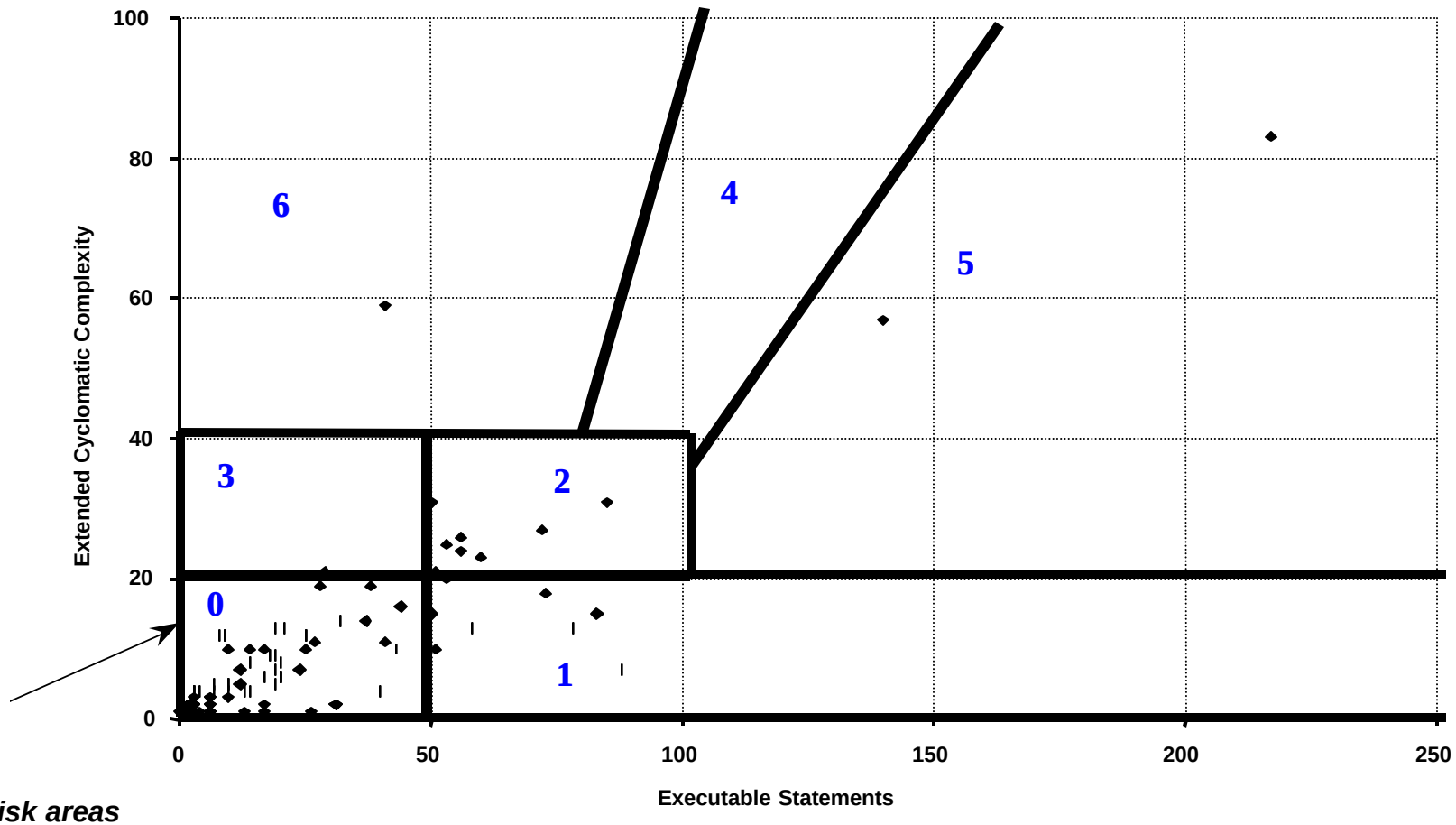
Complexity


Method Complexities
By Subsystem
Extended Cyclomatic Complexity
220
200
180
160
140
120
100
80
60
40
20
0
sub_1
sub_2
sub_3
sub_4
sub_5
sub_6
sub_7
sub_8

Complexity & Size



Size to Complexity: Components at Risk

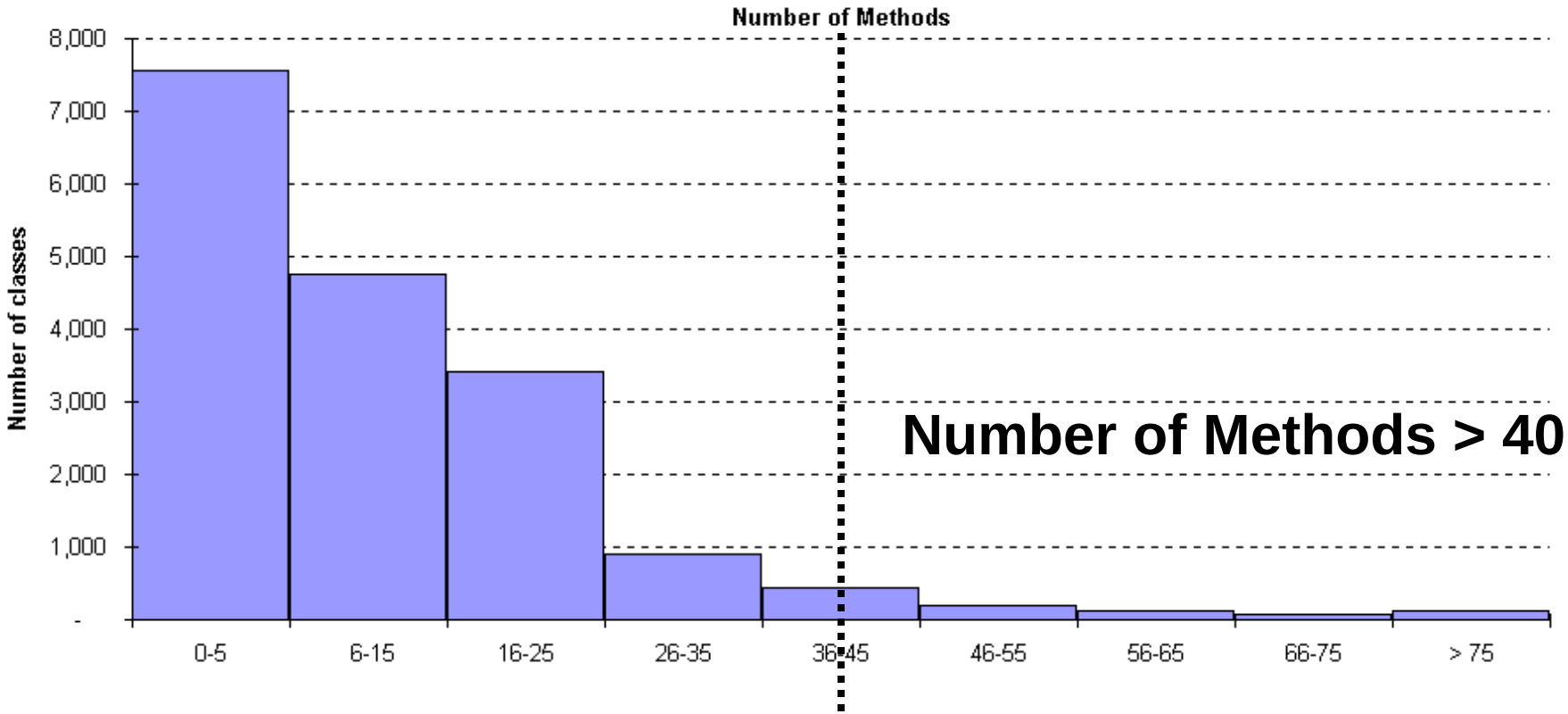


Lower Risk areas

Architectural Metrics for Object-Oriented Systems

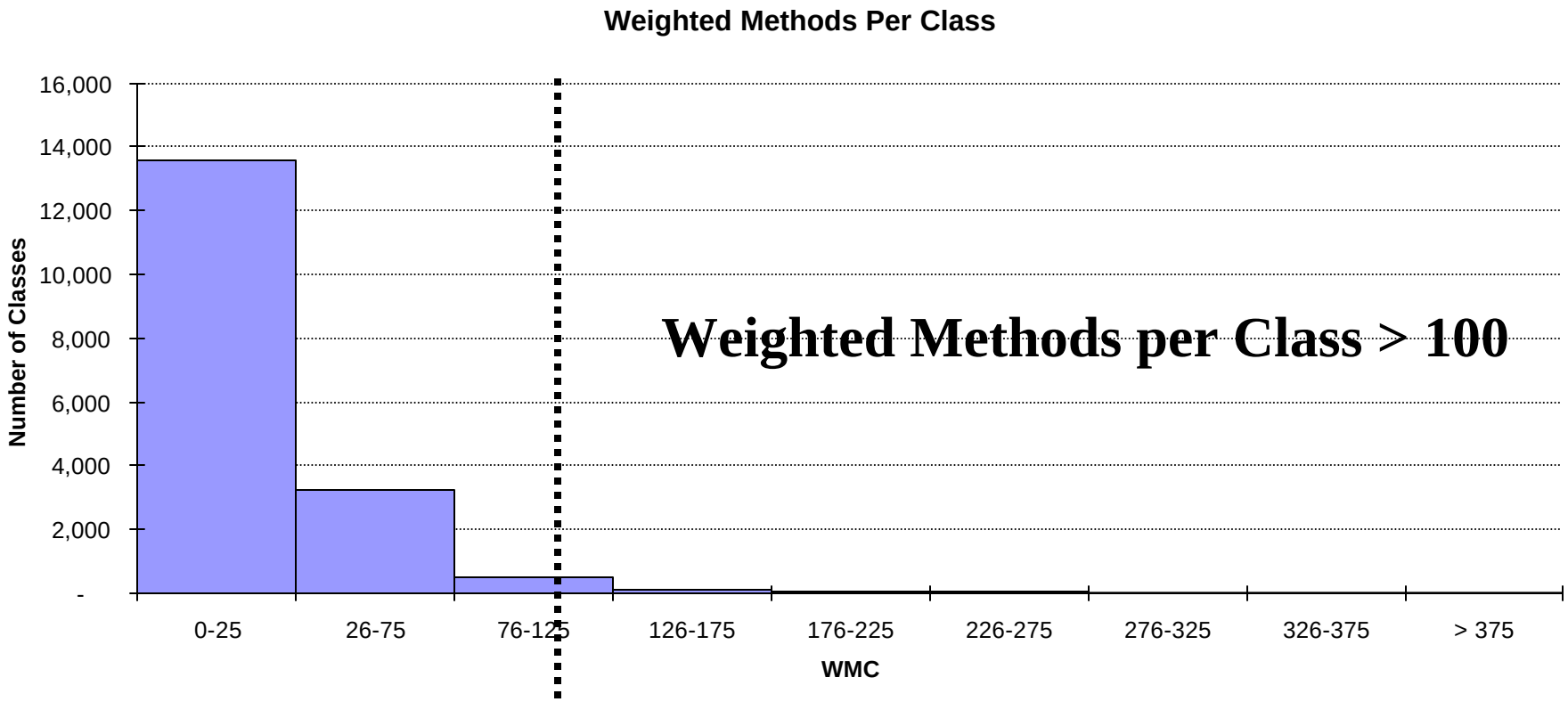
- The **Weighted Methods per Class (WMC)** is a count of the methods implemented within a class or the sum of the complexities of the methods (cyclomatic complexity).
- The **Response for a Class (RFC)** is the cardinality of the set of all methods that can be invoked in response to a message to an object of the class or by some method in the class.
- **Coupling Between Object Classes (CBO)** is a count of the number of other classes to which a class is coupled. It is measured by counting the number of distinct non-inheritance related class hierarchies on which a class depends.

Number of Methods



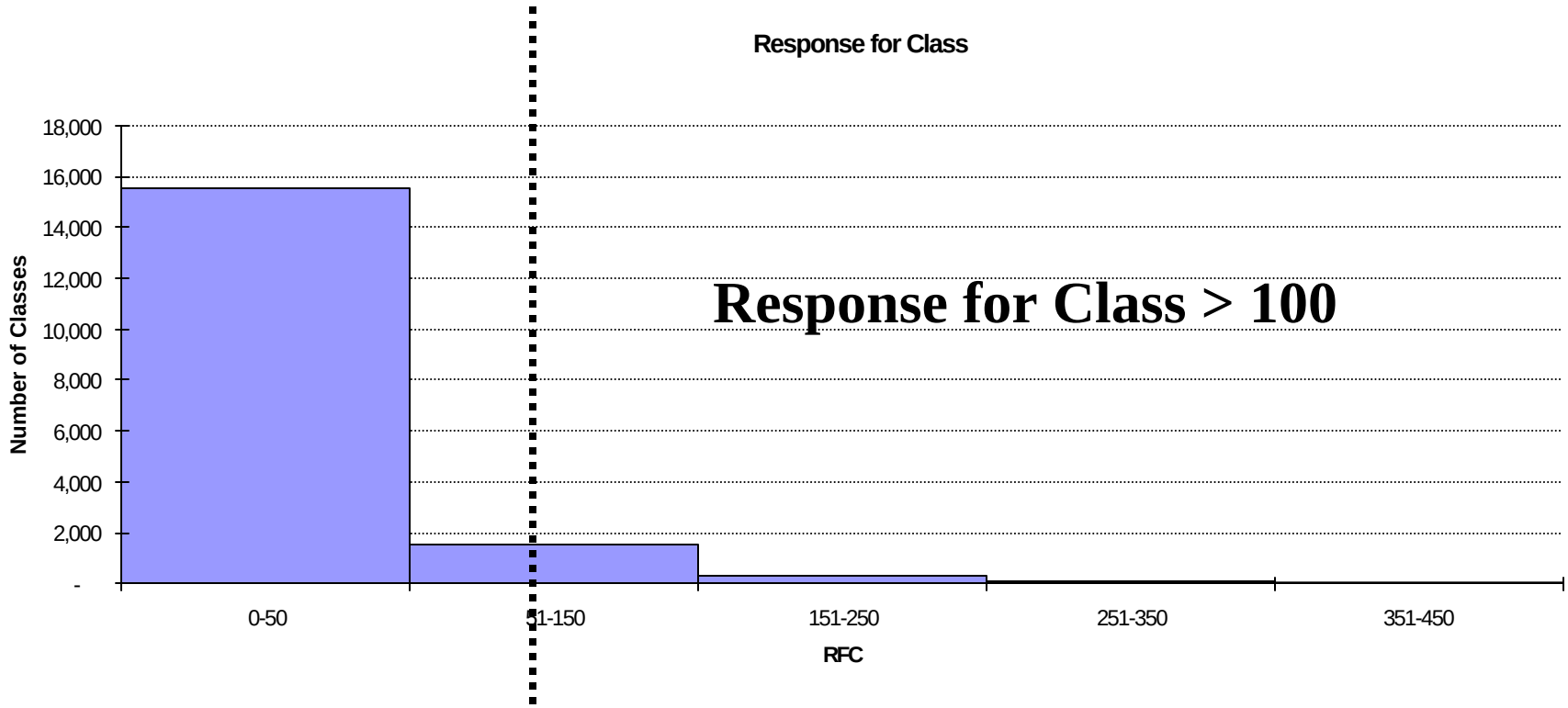
High number of methods may have greater impact on children through inheritance
May also indicate application specific, decreasing reusability.

Weighted Methods per Class



Complexity of a method ==> 1-5, 10 acceptable
Number of methods in a class ==> 1- 20
WMC ==> < 100 (5 complexity * 20 methods) ; should not exceed 200 (10 * 20)

Response for Class I



Response for a Class < 50 , acceptable up to 100.
> 100 ==> greater complexity and decreased understandability
changes very difficult due to the potential for a ripple effect.