A Study on Optimizing the Coupling Metric in Object Oriented Systems

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Abstract: **In the Object Oriented paradigm of systems, the design criteria is most important and it plays a vital role. With the incremental activity of Object Orientation the design scheme is becoming poor due to lack of concentration on design among larger systems. Also the interdependency between the classes (coupling) is increasing in this regard. Lot of research articles had been proposed up to now on coupling. In the present work we are taking a graph based model to show the importance of coupling by minimizing the coupling aspect to some extent.**

Keywords: **coupling, Object Oriented metrics, UML.**

Introduction

The importance of the Object Oriented systems is becoming just like the need of the hour in the recent days, which requires the analytical aspect of the object oriented software monitoring with respect to its internal attributes like coupling and cohesion etc.

The Object Oriented system has certain principles like inheritance, polymorphism, data abstraction and message passing, which plays a major role in the design of object oriented code, good software design will have low coupling factor [5,7,8].

Coupling is expressed as the fundamental metric to measure the performance of software at design or implementation phase [3,4]

The next section of the paper is detailed as follows. Section II emphasizes on the Cons of the Present system. Section III depicts about the proposed metrics of coupling. Section IV analyses our proposed metrics and Section V describes the experimental results and the minimizing of the coupling aspect. Section VI presents the conclusion and the future work aspects.

II CONS OF PRESENT SYSTEM

Various types of metrics are proposed by various researchers on behalf of the coupling with respect to class category, but many of them fail to control and coordinate the coupling. Chidamber and kemerer[] and Li and Henrey[] has proposed a set of metrics for object oriented systems including Coupling Between Objects (CBO) and Message Passing Coupling(MPC). CBO aims at measuring the collaboration among various classes in a system.MPC (Message Passing Coupling) addresses the number of messages that are outgoing from a class. If a message invokes several procedures as a response, the class is said to be complex and lot of testing and debugging activities are required.

In this paper we depict an example scenario in the form of a graph to show the Degree of Metric (DC) along with Incoming Message Coupling (IMC) which are efficient than MPC (Message Passing Coupling).

III. PROPOSED METRICS

We propose a metric called as IMC(Incoming Message Coupling) which is used along with DC(Degree of Coupling) to detect the flaws and bugs at the early stage in the design of the systems, which is a better aspect when compared to MPC alone.

1. **Incoming Message Coupling(IMC)**
   It is defined as the number of incoming messages or mapping requests that are coming to a class from other classes.

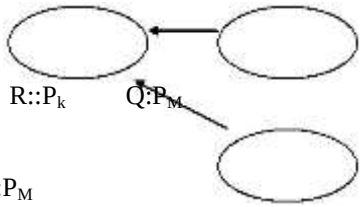
   IMC=number of statements received by a class
2. **Degree of Coupling(DC)**
   Is defined as the ratio of number of the statements received to a class to the number of the statements sent from a class.

   DC=IMC/MPC
   In the computation of the above metric if the experimental result of DC is less than 0.5 and is greater than 2 then, we have to redesign those classes only.

IV ANALYSIS OF PROPOSED METRICS

We formulate a Procedure Calling Graph(PCG) as a part of our proposed model of metrics. This graph mainly depicts the relationship among various classes in the graph

The nodes in the graph and their relationship among one another is given as follows:



Q:P_M

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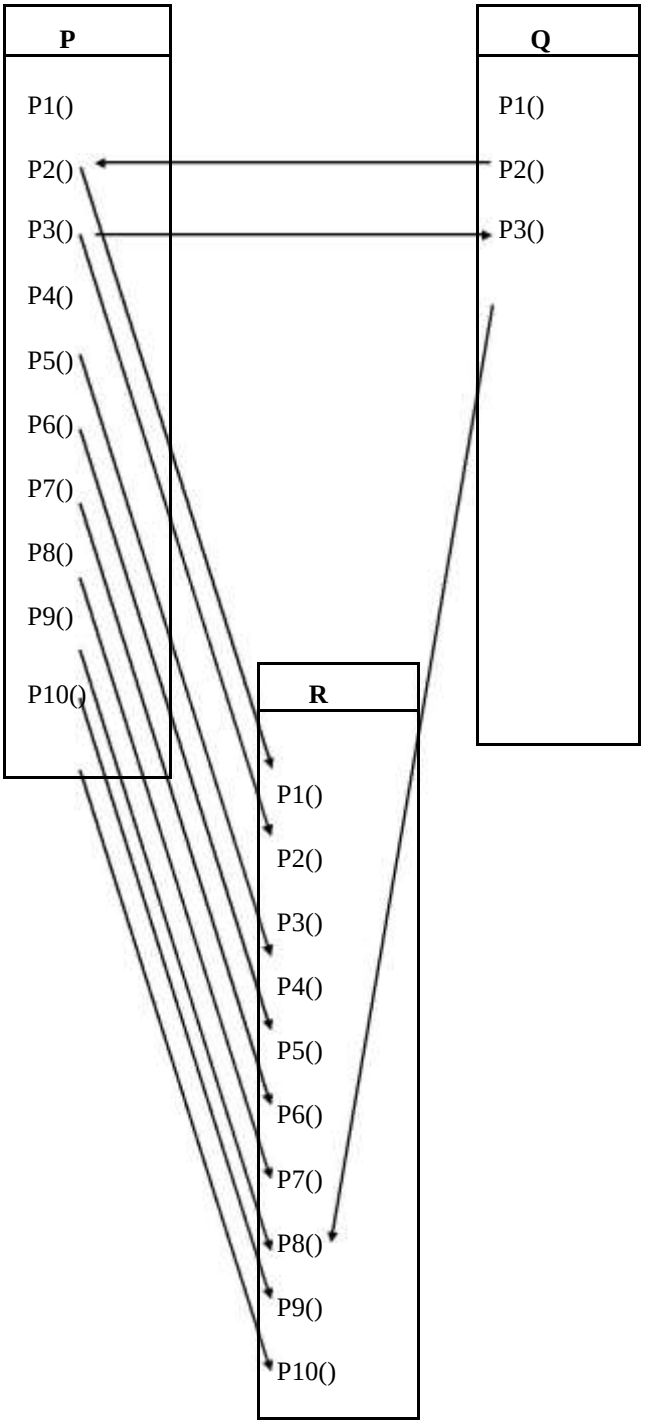

Now we compute MPC, IMC and DC values for each class:

CLASS P: Class P has 10 methods, now we compute DC value for class P
MPC for class P is 9, and IMC for class P is 1 therefore DC value for class P is given by the ratio of MPC of Class P to the ratio of IMC of class P i.e 1/9=0.11

Class Q: Class Q has 3 methods, now we compute DC value for class Q
MPC for class Q is 1 and IMC for class Q is 1 DC value for class Q is given as ½=0.5

Class R: Class R has 10methods, now DC value has to be evaluated for class R
MPC for class R is 0, IMC for class R is 9 DC for class R is 9/0=∞.

V. EXPERIMENTAL RESULTS

Table1: Class level Metrics

Class	Object-Oriented Metrics		
	MPC	**IMC**	**DC**
P	9	1	0.11
Q	2	1	0.5
R	0	9	∞

According to the above table and based on the above calculations of DC we have to check the classes whose DC value is less than 0.5 and greater than 2 those classes has to be redesigned .i.e the classes P and R need to be modified or redesigned.

VI. CONCLUSION

In our present work we have shown the importance of coupling with respect to the graph, and its minimization factor in relevance to the taken classes and in future these computations may be useful in the designing of systems to detect the flaws in the early design.

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