CISQ

Consortium for Information & Software Quality ™

List of Weaknesses Included in the CISQ Automated Source Code Performance Efficiency Measure

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Overview of Structural Quality Measurement in Software

Measurement of the structural quality characteristics of software has a long history in software engineering. These characteristics are also referred to as the structural, internal, technical, or engineering characteristics of software source code. Software quality characteristics are increasingly incorporated into development and outsourcing contracts as the equivalent of service level agreements. That is, target thresholds based on structural quality measures are being written into contracts as acceptance criteria for delivered software. This specification provides automated measures for four structural quality characteristics listed in the ISO/IEC 25010 software quality model that can be calculated from source code—Reliability, Security, Performance Efficiency, and Maintainability.

Recent advances in measuring the structural quality of software involve detecting violations of good architectural and coding practice from statically analyzing source code. Good architectural and coding practices can be stated as rules for engineering software products. Violations of these rules will be called weaknesses to be consistent with terms used in the Common Weakness Enumeration which lists the weaknesses used in these measures.

The four Automated Source Code Quality Measures are calculated from counts of what industry experts have determined to be most severe weaknesses. Consequently, they provide strong indicators of the quality of a software system and the probability of operational or cost problems related to each measure's domain.

The weaknesses comprising each CISQ Automated Source Code Quality Measure are grouped by measure in a table. This document lists the weaknesses in the Performance Efficiency measure. The Common Weakness Enumeration repository (an ITU standard) has recently been expanded to include weaknesses from quality characteristics beyond security. All weaknesses included in these measures are identified by their CWE number from the repository. The title and description of CWEs is taken from information in the online CWE repository (cwe.mitre.org). Each weakness will be described as a 'quality measure element' to remain consistent with the structure of software quality measures enumerated in ISO/IEC 25020.

Some weaknesses drawn from the CWE repository (parent weaknesses) have related weaknesses listed as 'contributing weaknesses' ('child weaknesses' in the CWE). Contributing weaknesses represent variants of how the parent weakness can be instantiated in software. In the following table the cells containing CWE IDs for parents are presented in a darker blue than the cells containing contributing weaknesses. Based on their severity, not all children were included in this standard. Compliance to the CISQ measures is assessed at the level of the parent weakness. A technology must be able to detect at least one of the contributing weaknesses to be assessed compliant on the parent weakness.

Automated Source Code Performance Efficiency Measure Element Descriptions

The quality measure elements (weaknesses violating software quality rules) that compose the CISQ Automated Source Code Performance Efficiency Measure are presented in the table. This measure contains 15 parent weaknesses and 3 contributing weaknesses (children in the CWE) that represent variants of these weaknesses. The CWE numbers for contributing weaknesses is presented in light blue cells immediately below the parent weakness whose CWE number is in a dark blue cell.

Table: Quality Measure Elements for Automated Source Code Performance Efficiency Measure

CWE #	Descriptor	Weakness Description
CWE-404	**Improper Resource Shutdown or Release**	The program does not release or incorrectly releases a resource before it is made available for re-use.
CWE-401	**Improper Release of Memory Before Removing Last Reference ('Memory Leak')**	The software does not sufficiently track and release allocated memory after it has been used, which slowly consumes remaining memory.
CWE-772	**Missing Release of Resource after Effective Lifetime**	The software does not release a resource after its effective lifetime has ended, i.e., after the resource is no longer needed.
CWE-775	**Missing Release of File Descriptor or Handle after Effective Lifetime**	The software does not release a file descriptor or handle after its effective lifetime has ended, i.e., after the file descriptor/handle is no longer needed. When a file descriptor or handle is not released after use (typically by explicitly closing it), attackers can cause a denial of service by consuming all available file descriptors/handles, or otherwise preventing other system processes from obtaining their own file descriptors/handles.
CWE-424	**Improper Protection of Alternate Path**	The product does not sufficiently protect all possible paths that a user can take to access restricted functionality or resources. When data storage relies on a DBMS, special care shall be given to secure all data accesses and ensure data integrity.
CWE-1042	**Static Member Data Element outside of a Singleton Class Element**	The code contains a member element that is declared as static (but not final), in which its parent class element is not a singleton class - that is, a class element that can be used only once in the 'to' association of a Create action.
CWE-1043	**Data Element Aggregating an Excessively Large Number of Non-Primitive Elements**	The software uses a data element that has an excessively large number of sub-elements with non-primitive data types such as structures or aggregated objects. (default threshold for the maximum number of aggregated non-primitive data types is 5, *alternate threshold can be set prior to analysis*).

CWE-1046	**Creation of Immutable Text Using String Concatenation**	This programming pattern can be inefficient in comparison with use of text buffer data elements. This issue can make the software perform more slowly. If the relevant code is reachable by an attacker, then this performance problem might introduce a vulnerability.
CWE-1049	**Excessive Data Query Operations in a Large Data Table**	The software performs a data query with a large number of joins and sub-queries on a large data table. (default thresholds are 5 joins, 3 sub-queries, and 1,000,000 rows for a large table, *alternate thresholds for all three parameters can be set prior to analysis*).
CWE-1050	**Excessive Platform Resource Consumption within a Loop**	The software has a loop body or loop condition that contains a control element that directly or indirectly consumes platform resources, e.g. messaging, sessions, locks, or file descriptors. (default threshold for resource consumption should be set based on the system architecture *prior to analysis*).
CWE-1057	**Data Access Operations Outside of Expected Data Manager Component**	The software uses a dedicated, central data manager component as required by design, but it contains code that performs data-access operations that do not use this data manager. Notes: · The dedicated data access component can be either client-side or server-side, which means that data access components can be developed using non-SQL language. · If there is no dedicated data access component, every data access is a weakness. · For some embedded software that requires access to data from anywhere, the whole software is defined as a data access component. This condition must be identified as input to the analysis.
CWE-1060	**Excessive Number of Inefficient Server-Side Data Accesses**	The software performs too many data queries without using efficient data processing functionality such as stored procedures. (default threshold for maximum number of data queries is **5**, *alternate threshold can be set prior to analysis*).
CWE-1067	**Excessive Execution of Sequential Searches of Data Resource**	The software contains a data query against a SQL table or view that is configured in a way that does not utilize an index and may cause sequential searches to be performed. (default threshold for a weakness to be counted is a query on a table of at least 500 rows, or an alternate threshold recommended by the database vendor. No weakness should be counted under conditions where the vendor recommends an index should not be used. An *alternate threshold can be set prior to analysis*).

CWE-1072	**Data Resource Access without Use of Connection Pooling**	The software accesses a data resource through a database without using a connection pooling capability. (the use of a connection pool is technology dependent; for example, connection pooling is disabled with the addition of 'Pooling=false' to the connection string with ADO.NET or the value of a 'com.sun.jndi.ldap.connect.pool' environment parameter in Java).
CWE-1073	**Non-SQL Invokable Control Element with Excessive Number of Data Resource Accesses**	The software contains a client with a function or method that contains a large number of data accesses/queries that are sent through a data manager, i.e., does not use efficient database capabilities. (default threshold for the maximum number of data queries is 2, *alternate threshold can be set prior to analysis*).
CWE-1089	**Large Data Table with Excessive Number of Indices**	The software uses a large data table (default is 1,000,000 rows, *alternate threshold can be set prior to analysis*) that contains an excessively large number of indices. (default threshold for the maximum number of indices is 3, *alternate threshold can be set prior to analysis*).
CWE-1091	**Use of Object without Invoking Destructor Method**	The software contains a method that accesses an object but does not later invoke the element's associated finalize/destructor method.
CWE-1094	**Excessive Index Range Scan for a Data Resource**	The software contains an index range scan for a large data table, (default threshold is 1,000,000 rows, *alternate threshold can be set prior to analysis*) but the scan can cover a large number of rows. (default threshold for the index range is 10, *alternate threshold can be set prior to analysis).*

The cells containing CWE IDs for parents are presented in a dark blue.
The cells containing contributing weaknesses are presented in a light blue.

Master list of quality measure weaknesses: https://www.it-cisq.org/coding-rules/index.htm
Master list PDF: https://www.it-cisq.org/pdf/cisq-weaknesses-in-ascqm.pdf