

Halstead measures applied to Dodd-Frank

Assignment: Use the Halstead (1976) measures of complexity and apply them to the Dodd-Frank regulation text.

1 Halstead complexity metrics

Halstead complexity metrics is established for measuring program complexity with emphasis on computational complexity. Halstead metric, directly measure the complexity from the source code and based on four numeric values as followed:

1. $n1$: Number of non-repetitive operators
2. $n2$: Number of non-repetitive operands
3. $N1$: Number of all operators
4. $N2$: Number of all operands

Further Length and Vocabulary serve as the basis for finding out Volume, Potential Volume, Difficulty and finally effort by using equations:

1. Length $N = N1 + N2$
2. Vocabulary $n = n1 + n2$
3. Volume $V = n \log_2^n$
4. Potential Volume $V^* = (2 + 2n) \log_2^{2+2n}$
5. Difficulty $D = V^*/V$
6. Effort $E = V/D$

1.1 Operands

Software:

1. IDENTIFIER all identifiers that are not reserved words
2. TYPENAME

3. TYPESPEC (type specifiers) Reserved words that specify type: bool, char, double, float, int, long, short, signed, unsigned, void. This class also includes some compiler specific nonstandard keywords.
4. CONSTANT Character, numeric or string constants.

Dodd-Frank:

1. DEFINITIONS (multiple, simple, from other Act)
2. NUMBER OF BULLETS (first level)

1.2 Operators

Software:

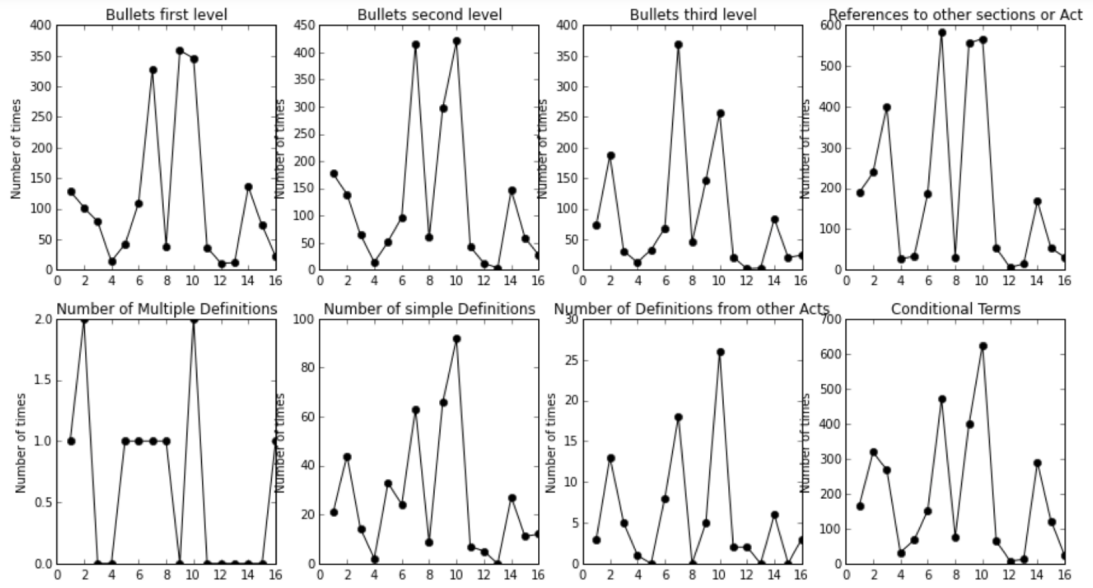
1. SCSPC (storage class specifiers) Reserved words that specify storage class: auto, extern, inline, register, static, typedef, virtual, mutable.
2. TYPE_QUAL
3. RESERVED Other reserved words of C++: asm, break, case, class, continue, default, delete, do, else, enum, for, goto, if, new, operator, private, protected, public, return, sizeof, struct, switch, this, union, while, namespace, using, try...
4. OPERATOR

Dodd-Frank:

1. CONDITIONAL TERMS: count the occurrences of the following conditional terms: if, except, but, provided, when, where, whenever, unless, notwithstanding, in no event, and in the event.
2. NUMBER OF BULLETS (second and third level)
3. NESTED DEFINITION: Definitions which depends of other definitions
4. REFERENCES TO OTHER SECTIONS.

1.3 Results

Figure 1: Different features for the Dodd-Frank regulation by Title. x-axis: Title number



2 Appendix

Example of Operands and Operators in Dodd-Frank

Definition:

Simple

(2) AGENCY ADMINISTRATOR.—The term “agency administrator” means the head of an agency.

Regex: means

Multiple

“(2) HEDGE FUND; PRIVATE EQUITY FUND.—The terms ‘hedge fund’ and ‘private equity fund’ mean an issuer that would be an investment company, as defined in the Investment Com-

Regex: mean

From other Acts

(6) COMMODITY FUTURES TERMS.—The terms “futures commission merchant”, “swap”, “swap dealer”, “swap execution facility”, “derivatives clearing organization”, “board of trade” “commodity trading advisor”, “commodity pool”, and “commodity pool operator” have the same meanings as given the terms in section 1a of the Commodity Exchange Act (7 U.S.C. 1 et seq.).

Regex: have the same meaning

Bullets

- First level → (a) IN GENERAL.—For purposes of this title, unless the context otherwise requires, the following definitions shall apply:
- Second level → (1) BANK HOLDING COMPANY.—The term “bank holding company” has the same meaning as in section 2 of the Bank Holding Company Act of 1956 (12 U.S.C. 1841). A foreign bank or company that is treated as a bank holding company for purposes of the Bank Holding Company Act of 1956, pursuant to section 8(a) of the International Banking Act of 1978 (12 U.S.C. 3106(a)), shall be treated as a bank holding company for purposes of this title.
- (2) CHAIRPERSON.—The term “Chairperson” means the Chairperson of the Council.
- (3) MEMBER AGENCY.—The term “member agency” means an agency represented by a voting member of the Council.
- Third level → (4) NONBANK FINANCIAL COMPANY DEFINITIONS.—
- (A) FOREIGN NONBANK FINANCIAL COMPANY.—The term “foreign nonbank financial company” means a company

Regex first level: (Lower case letter) UPPERCASE words

Regex second level: (number) UPPERCASE words

Regex third level: (Upper case letter) UPPERCASE words

References to other sections or Act

(B) “Federal banking agencies” means all of the agencies referred to in subparagraph (A), collectively.

~~that are covered by, and~~
(ii) predominantly engaged in, including through a branch in the United States, financial activities, as defined in paragraph (6).

as in subsection (a) of the first section of the Clayton Act, except that such term includes section 5 of the Federal Trade Commission Act, to the extent that such section 5 applies to unfair methods of competition.

Regex: subparagraph (or paragraph (or subsection (