Metrics

M. Halstead: *The Elements of Software Science*

Based on these two quantities characteristics of any program:

n1 = the number of distinct operators in the program
n2 = the number of distinct operands in the program

They correspond to the keywords and data objects in a program.

Halstead length: H = n1 * logn1 + n2 * logn2, measures program complexity, therefore can predict defect rates.

N1 = actual operator count
N2 = actual operand count

N = N1 + N2, is the number of tokens in the program.

For most programs, H is very close to N.

Total number of defects in a program:

B = [(N1 + N2) * log2 (n1 + n2)]/3000

McCabe Cyclomatic Complexity:

Looks at the program's control flow graph as a measure of its complexity.

M = L - N + 2P, where:

L = the number of links in the control flow graph
N = the number of nodes in the control flow graph
P = the number of disconnected parts in the control flow graph.

Or, more intuitively:

M = C + 1, where:

C = the number of binary decisions in the control flow graph, if it has only one entry and one exit.

McCabe correlation with defect density, says that with complexities greater than 10 seem to have higher defect rates.

Function Point Counting

Allan Albrecht from IBM, 1979 (software sizing based on function point concept).

They generally apply to IS type of application.

Factors taken in consideration for function point calculation:

Elements	*Count Weights*					
	Low		Average		High	Total
EI	X 3	+	X 4	+	X 6	=
EO	X 4	+	X 5	+	X 7	=
EQ	X 3	+	X 4	+	X 6	=
ILF	X 7	+	X 10	+	X 15	=
EIF	X 5	+	X 7	+	X 10	=

Total unadjusted function points _____

EI (external inputs)
EO (external outputs)
EQ (external inquiry)
ILF (internal logic files)
EIF (external logic files)

Input Complexity Matrix

FTRs	1 - 4 DETs	5 - 15 DETs	26+ DETs
0 - 1	Low	Low	Average
2	Low	Average	High
3+	Average	High	High

FTR (file types (user data groups) referenced
DET (data element type (field)
RET (record element type)

Output Complexity Matrix

FTRs	1 - 5 DETs	6 - 19 DETs	20+ DETs
0 - 1	Low	Low	Average
2 - 3	Low	Average	High
4+	Average	High	High

Note: EQs use the higher of the input/output side

File Complexity Matrix

FTRs	1 - 19 DETs	20 - 50 DETs	1+ DETs
0 - 1	Low	Low	Average
2 - 5	Low	Average	High
6+	Average	High	High

The 14 general system characteristics (GSC) that are used to calculate the value adjustment factor (VAF):

data communication, distributed function, performance, heavily used configuration, transaction rates, on-line data entry, design for user efficiency, on-line update, complex processing, reusability, installation ease, operational ease, multiple sites, facilitate change.

Application function point count is:

[.65 + (.01 X GSC total)] X [unadjusted function point count] = adjusted function points

OO

Association complexity:

AC = A - C + 2P, where:

A = the number of associations in the class diagram
C = the number of classes in the class diagram
P = the number of disconnected parts in the class diagram.