Software Quality Metrics

What does software quality mean? and
How is it measured?
Factors in Software Quality

Factor Criteria Metric

Maintainability

Simplicity

Nesting Level

Modularity

Modules that exceed size 100

Conciseness

Percentage of modules > 200loc
Elements of Software Science

- Halstead’s Program length - Measure of design or modularity

\[
\begin{align*}
X &:= +3; \\
\text{IF } X > B \text{ THEN} & N_1 = 10 (\# \text{ of operands}) \\
A &:= B; & N_2 = 10 (\# \text{ of operators}) \\
B &:= X; & n_1 = 4 (\# \text{ of unique operands}) \\
\text{ELSE } A &:= X; & n_2 = 4 (\# \text{ of unique operators}) \\
\text{ELSE } A &:= X; \\
N & = N_1 + N_2
\end{align*}
\]

Threshold Value: 350
Elements of Software Science

• Halstead’s Difficulty - measure of how difficult the component was to create

  Program Volume(V) = N\log_2 n

  Potential volume(V*) = (2+n_2)\log_2(2+n_2)

  Program level(L) = \frac{V^*}{V}

  Effort = \frac{V^2}{V^*}  \quad \text{Threshold Value: 50}
Complexity Metrics

• **Cyclomatic number** - measures the difficulty and feasibility of testing
  – A measure of the number of testable paths in a module
  – Threshold value: 15

• **Essential complexity** - measures the structure of testable paths in a component
  – A graph should contain only the four basic simple structured constructs
  – Threshold value: 7
Complexity Metrics

• **Design Complexity** - Measures the control flow implemented by the design
  – measures the minimum number of integration tests
  – Threshold value: 10
Software Quality

• Do the metrics provide indicators of software quality?
• Design versus Code metrics
• Commercial products and generated code
• Language dependencies
• Source Lines of Code
Follow on Topics

• Object Oriented design metrics
• Other quality frameworks
• Design metrics
• Software reusability