

# Quality Management

Software Engineering 2  
(3103313-1)

Amirkabir University of Technology  
Fall 1399-1400

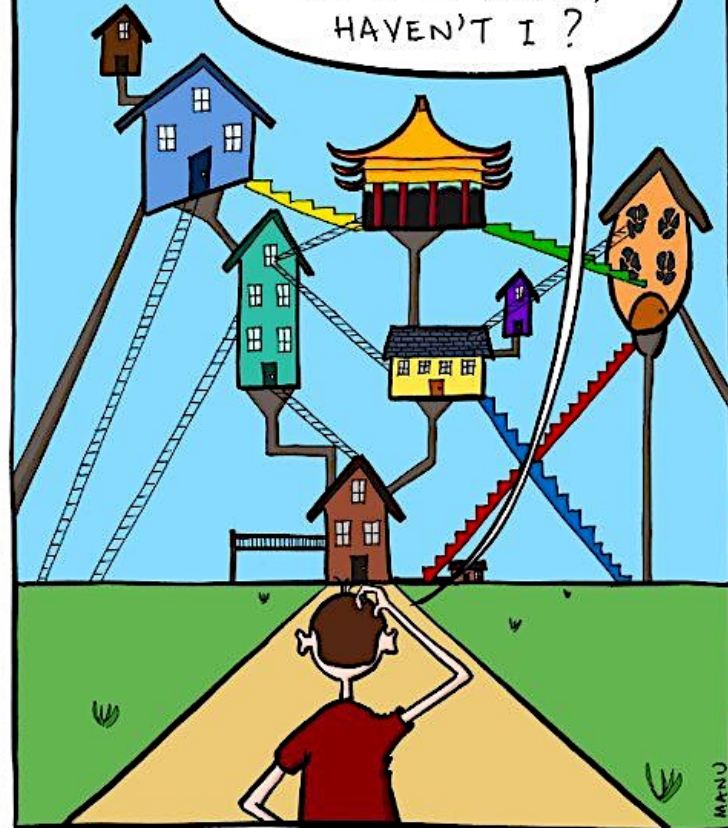
THE LIFE OF A SOFTWARE  
ENGINEER.

CLEAN SLATE. SOLID  
FOUNDATIONS. THIS TIME  
I WILL BUILD THINGS THE  
RIGHT WAY.



MUCH LATER...

OH MY. I'VE  
DONE IT AGAIN,  
HAVEN'T I ?





# Software Quality

# What is Quality?

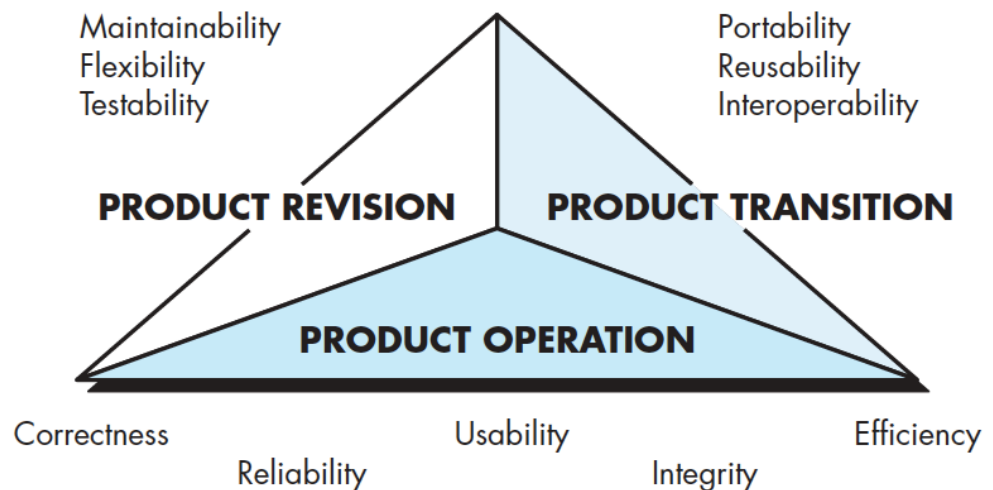
## Quality Factors and Dimensions?

## Quality Dilemma

# Software Quality

“An **effective software process** applied in a manner that creates a **useful product** that provides **measurable value** for those who *produce* it and those who *use* it.”

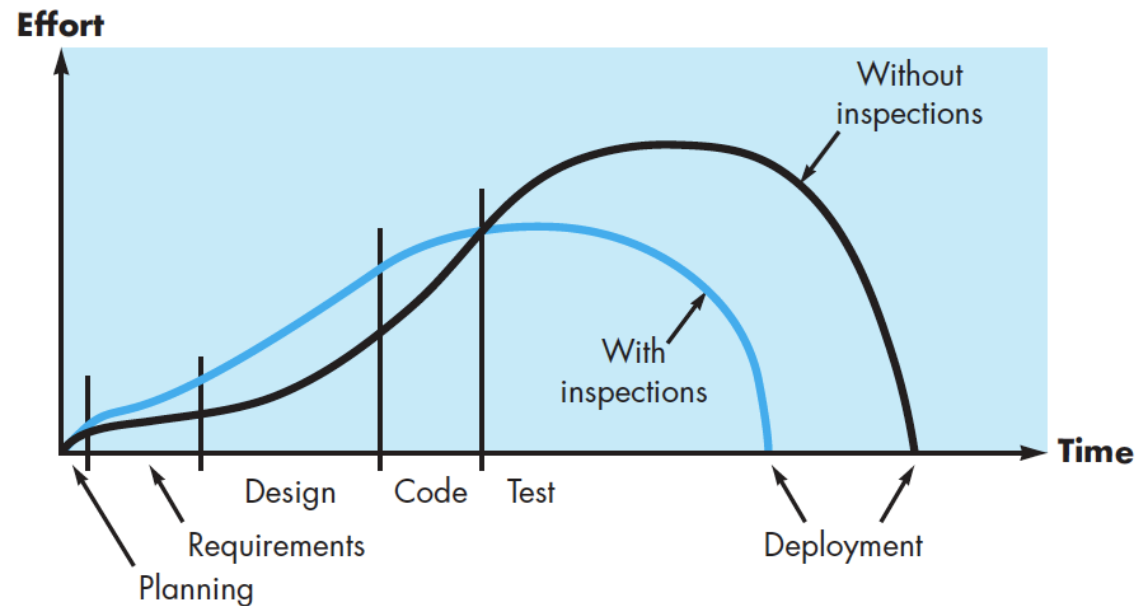
- Multidimensional Viewpoint



McCall's software quality factors

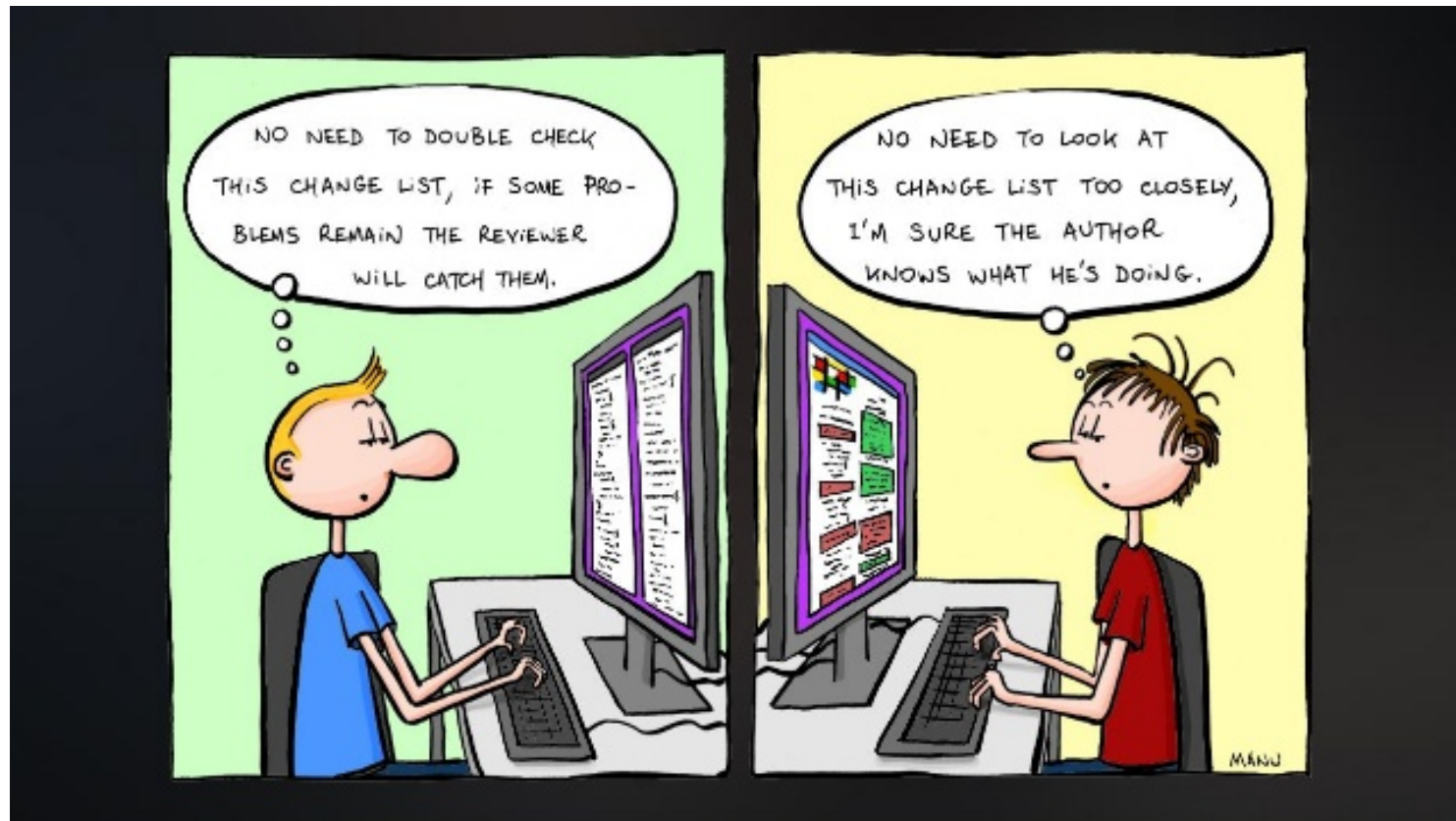
# Challenges

- “Good Enough” Software
- Quantitative View
- Cost of Quality



# Achieving Software Quality

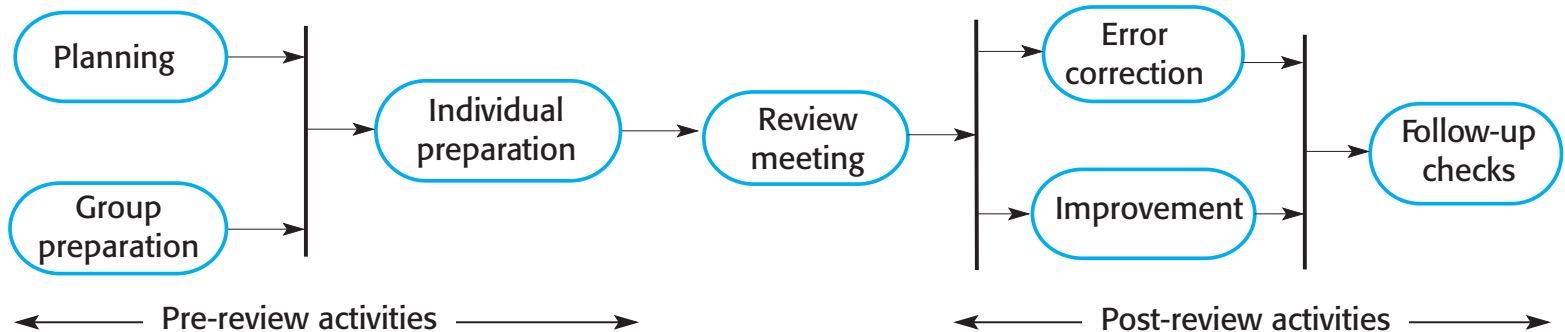
- Software Engineering Methods/Methodologies
- Project Management Techniques
- Quality Assurance
  - establishes the **infrastructure** that supports solid software engineering methods, rational project management, and quality control actions
- Quality Control
  - a set of software engineering **actions** that help to ensure that each work product meets its quality goals.



# Reviews and Inspections

# Reviews

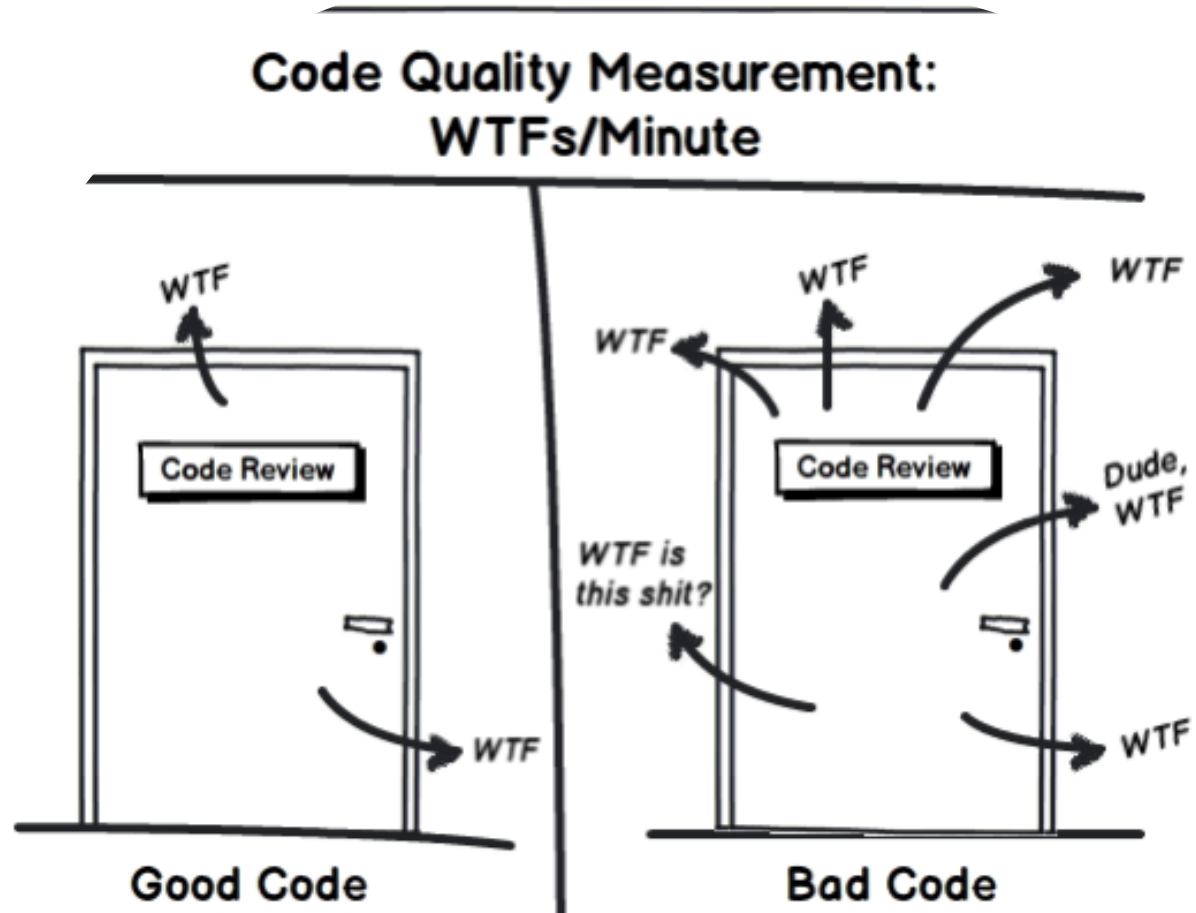
- Informal Reviews
  - A simple desk check or a casual meeting
- Technical or Peer Reviews
  - Casual reviews, walkthroughs, and inspections
  - Sample-driven Reviews



[Sommerville, 2014]



# Software Measurement



# Code Quality Tools

- Code Linting Errors
  - ESLint
  - JSLint
  - PyLint
- Automated Code Analysers
  - SonarQube
  - CodeFactor
  - CodeClimate
  - Simplecov



# Code Quality Tools

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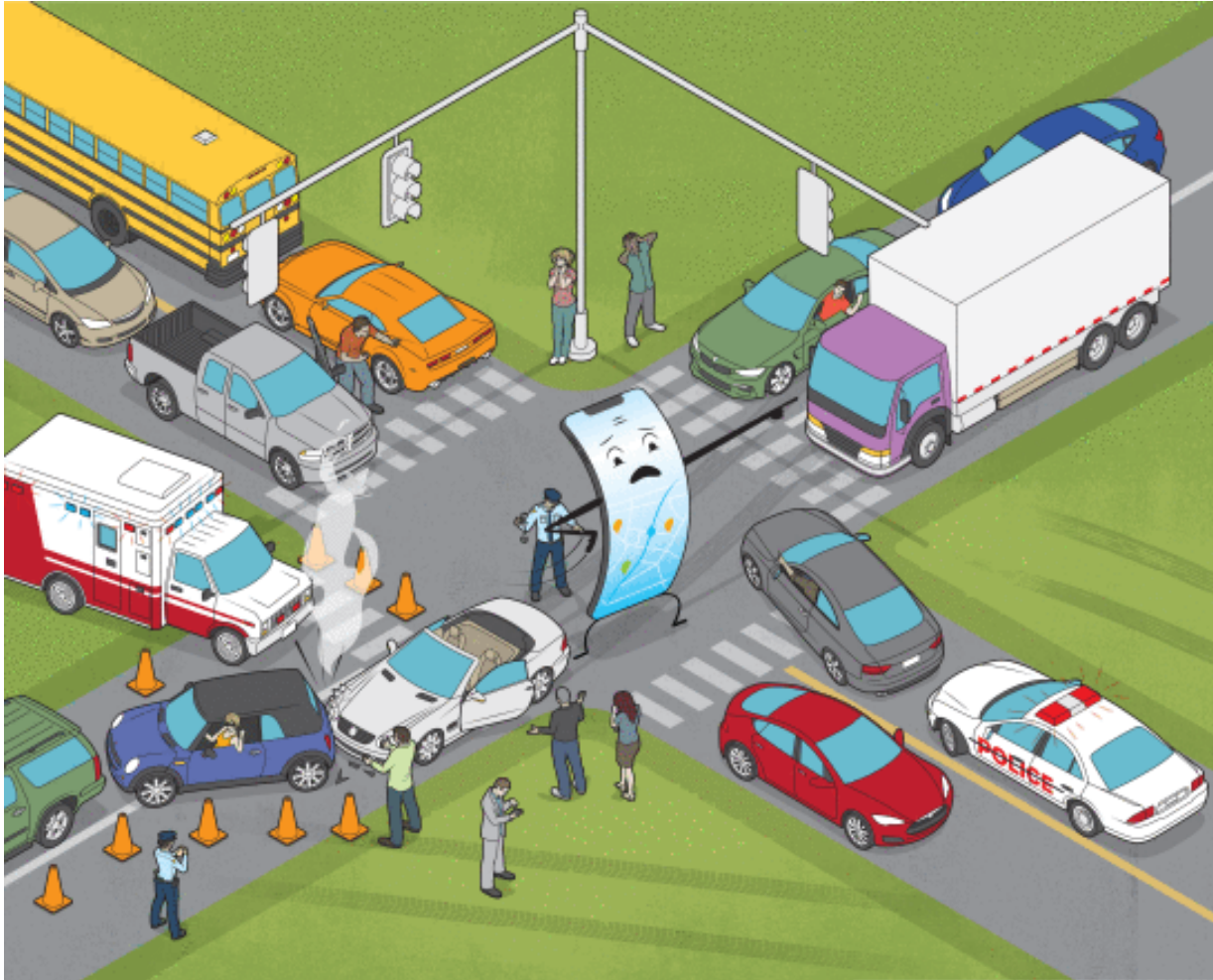
- Automated Code Analysers

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break





# WHEN APPS RULE THE ROAD

THE PROLIFERATION OF NAVIGATION  
APPS IS CAUSING TRAFFIC CHAOS.  
IT'S TIME TO RESTORE ORDER

By Jane Macfarlane

J. Macfarlane, "[When apps rule the road: The proliferation of navigation apps is causing traffic chaos. It's time to restore order](#)," in IEEE Spectrum, vol. 56, no. 10, pp. 22-27, Oct. 2019.

# Metrics and Measurements

Measure, Measurement, and Metrics

# Good Attributes and Metrics

- Simple
- Measureable
- Relevant
- Objective
- Easily obtainable
- ...



- For hard to measure attributes (e.g., customer satisfaction) we may need to use **indirect** measurements.

# Things to Measure

## **Directly Measurable (Objective)**

- Cost
- Effort
- Defect Rates
- Lines of Code (LOC)
- Pages of Doc.
- ...

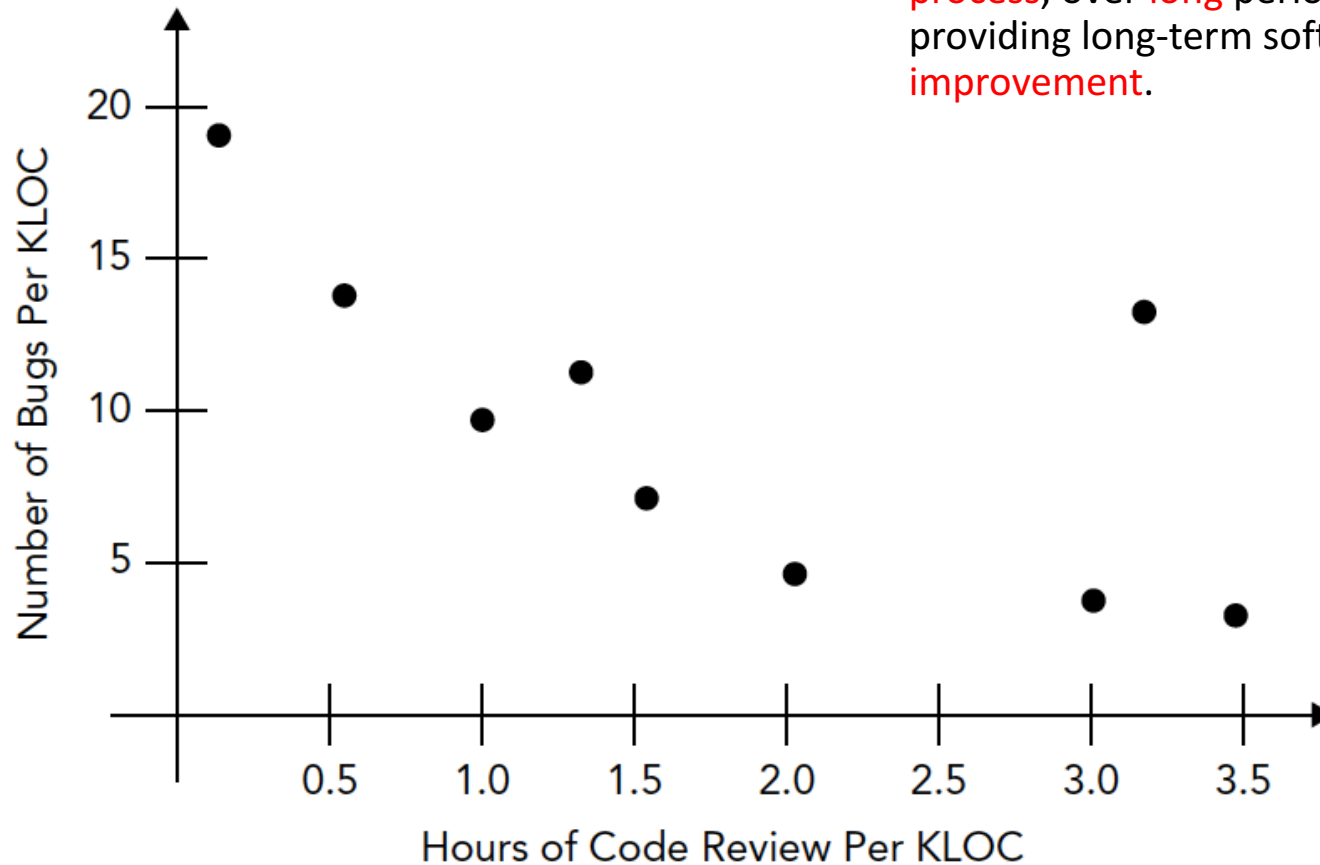
## **Hard to Measure (Subjective)**

- Functionality
- Complexity
- Efficiency
- Maintainability
- Reliability
- Availability
- ...



# Process Metrics

Measure organization's development **process**, over **long** periods of **time**, providing long-term software process **improvement**.



# Product Metrics

- **Predictor** metrics used to quantify **internal** attributes of a software system.
- Dynamic
- Static
- Requirements
- Design and Architecture
- Source Code
- Tests
- ...

# Product Metrics

- Size-Oriented
- Function-Oriented
- OO Metrics
- Application-Specific
  - Web, Mobile, ...

Project	LOC	Effort	\$(000)	Pp. doc.	Errors	Defects	People
alpha	12,100	24	168	365	134	29	3
beta	27,200	62	440	1224	321	86	5
gamma	20,200	43	314	1050	256	64	6
•	•	•	•	•	•		
•	•	•	•	•	•		
•	•	•	•	•	•		

Information Domain Value	Count	Weighting factor				
		Simple	Average	Complex		
External Inputs (EIs)	<input type="text"/>	3	4	6	=	<input type="text"/>
External Outputs (EOs)	<input type="text"/>	4	5	7	=	<input type="text"/>
External Inquiries (EQs)	<input type="text"/>	3	4	6	=	<input type="text"/>
Internal Logical Files (ILFs)	<input type="text"/>	7	10	15	=	<input type="text"/>
External Interface Files (EIFs)	<input type="text"/>	5	7	10	=	<input type="text"/>
Count total						<input type="text"/>

# Product Metrics

## *Static Software Product Metrics*

- Fan-in/Fan-out
- Length of code
- Cyclomatic complexity
- Length of identifiers
- Depth of conditional nesting
- Fog index
  - the average length of words and sentences in documents

## *CK Object-Oriented Metrics Suite*

- Weighted methods per class (WMC)
- Depth of inheritance tree (DIT)
- Number of children (NOC)
- Coupling between object classes (CBO)
- Response for a class (RFC)
- Lack of cohesion in methods (LCOM)

# Software Quality Assurance

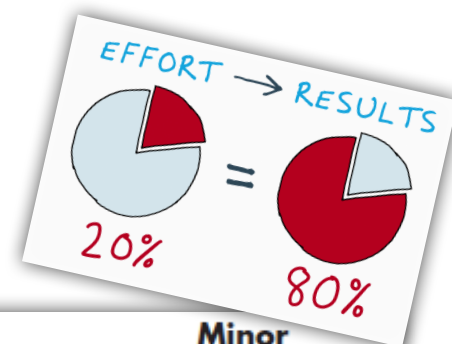
- Broad range of concerns and activities
- Management of software quality

# Software Quality Assurance

- SQA Process
  - e.g., CMMI and ISO 9000
- Elements
  - Standards
  - Reviews and Audits
  - Testing
  - Error/defect collection and analysis
  - Change management
  - Education
  - Vendor management
  - Security management
  - Safety
  - Risk management

# Statistical SQA

*Spend your time focusing on things that really matter, but first be sure that you understand what really matters!*



Error	Total		Serious		Moderate		Minor	
	No.	%	No.	%	No.	%	No.	%
IES	205	22%	34	27%	68	18%	103	24%
MCC	156	17%	12	9%	68	18%	76	17%
IDS	48	5%	1	1%	24	6%	23	5%
VPS	25	3%	0	0%	15	4%	10	2%
EDR	130	14%	26	20%	68	18%	36	8%
ICI	58	6%	9	7%	18	5%	31	7%
EDL	45	5%	14	11%	12	3%	19	4%
IET	95	10%	12	9%	35	9%	48	11%
IID	36	4%	2	2%	20	5%	14	3%
PLT	60	6%	15	12%	19	5%	26	6%
HCI	28	3%	3	2%	17	4%	8	2%
<u>MIS</u>	<u>56</u>	<u>6%</u>	<u>0</u>	<u>0%</u>	<u>15</u>	<u>4%</u>	<u>41</u>	<u>9%</u>
Totals	942	100%	128	100%	379	100%	435	100%