SENG 11232 · Engineering Foundation
STUDENT PRE-LECTURE NOTES · LECTURE 09

Measurement, Metrics & Quality Engineering

Module 3 — Engineering Process & Design

HOW TO USE Read these notes BEFORE the lecture. Highlight terms you don't recognise. Bring your questions to class. Use the blank spaces for your own notes.

Learning Objectives

By the end of this lecture, you should be able to:

- 1. Explain why measurement is essential to engineering and apply it to software
- 2. Calculate cyclomatic complexity and code coverage
- 3. Describe the testing pyramid and explain each level
- 4. Define SLAs, SLOs and error budgets

Software Metrics

Key Metrics

- Cyclomatic Complexity (CC): number of independent execution paths
  - CC = Edges - Nodes + 2 × Connected Components
  - CC ≤ 10: low risk; 11-20: moderate; > 20: high risk
- Defect Density: defects per 1000 lines of code (KLOC)
- Code Coverage: (lines tested / total lines) × 100%

KEY Goodhart's Law: when a measure becomes a target, it ceases to be a good measure. Measure to understand, not to game.

Your notes:

Testing Pyramid & SLAs

Testing Pyramid (Mike Cohn)

- Unit tests (base): test individual functions in isolation — fast, cheap, many
- Integration tests: test interactions between components — medium speed
- E2E tests (top): simulate user journeys — slow, expensive, few

NOTE Anti-pattern: ice cream cone (many E2E, few unit) — slow CI/CD, brittle tests, low confidence.

SLA, SLO & Error Budget

- SLA: formal contract defining service levels

- SLO: specific measurable target within the SLA
  - Example: "API availability ≥ 99.9% per calendar month" = 43.8 min downtime/month
- Error Budget: total allowed failures = 1 - SLO. Spent on deployments, maintenance, incidents.

Your notes:

_____

_____

_____

Key Terms for This Lecture

Term	Your Definition (fill in during/after lecture)
Cyclomatic Complexity	
Defect Density	
Code Coverage	
Mutation Testing	
Unit Test	
Integration Test	
E2E Test	
TDD	
SLA	
SLO	
Error Budget	
MTBF	
MTTR	

Self-Check Questions

Answer these after the lecture to test your understanding:

- Q1. A function has 6 edges, 5 nodes, and 1 connected component. Calculate its cyclomatic complexity.

Answer: _____

- Q2. What is the difference between line coverage and branch coverage? Which is more rigorous?

Answer: _____

- Q3. Explain the Red-Green-Refactor cycle of TDD.

Answer: _____

- Q4. A system has 99.5% monthly availability SLO. How many minutes of downtime are allowed per month?

Answer: _____

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