

# *Test Estimation*

*Seeing the Future of Your Test Effort*



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# *How Long Will Testing Take*

- ❖ What makes an estimate a *good* one?
  - ❖ Accurately predicts and guides the project's future
  - ❖ Realistic: All tasks included, accurately estimated, risks understood and mitigated
  - ❖ Actionable: Clear ownership by committed individual contributors, assigned resources, known dependencies
- ❖ Estimation process
  - ❖ Ask experts and owners
  - ❖ Consult metrics and industry averages
  - ❖ Negotiate with managers and stakeholders



## *Manager and Stakeholder Expectations*

- ☑ Cover the test basis completely, regardless of cost and schedule implications
- ☑ Cover the test basis as completely as possible within schedule constraints (cost not an issue)
- ☑ Cover the test basis as completely as possible within schedule and cost constraints
- ✘ Break the iron triangle (ignore interaction of schedule, budget, quality, features)

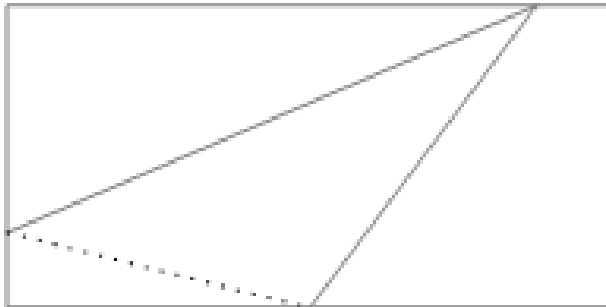
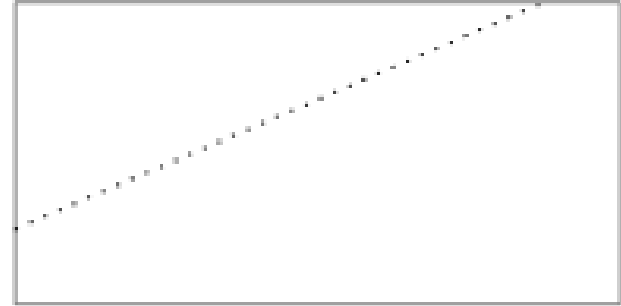


# *Iron Box and Triangle*

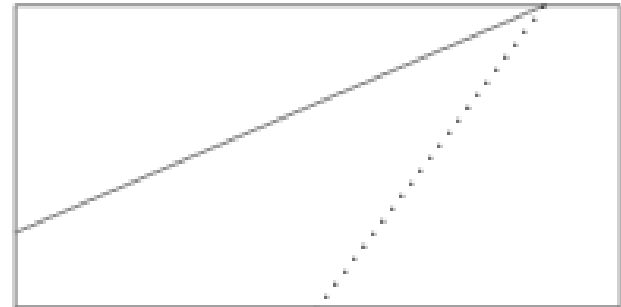
Define Features



Select Schedule



Accept Quality?



Select Cost



# *Developing a Work-Breakdown-Structure*

- ⊕ What are the major stages of a testing subproject?
  - ⊞ Planning
  - ⊞ Staffing (if applicable)
  - ⊞ Test environment acquisition and configuration
  - ⊞ Test development
  - ⊞ Test execution
- ⊕ Break down to discrete tasks within each stage
- ⊕ What test suites are required for the critical risks?
  - ⊞ E.g., functionality, performance, error handling, etc.
- ⊕ For each suite, what tasks are required?
- ⊕ Tasks should be short in duration (e.g., a few days)
  - ⊞ “Inch-pebbles” as well as “milestones”



# *Tapping the Team's Wisdom for Estimation*

## Delphic Oracle Technique

1. Gather estimates from each team member
2. Ask high and low estimators to explain estimates
3. Repeat twice, then use average

## Three-Point Technique

1. Have team estimate best-case, worst-case, and expected-case
2. Use expected-case
3. Variances between best and worst useful to gauge estimate accuracy

These techniques can be combined (which is called the *Wideband technique*) and also used with other sources of estimation like historical project data, expert advice, and rules of thumb



# *Understanding Dependencies*

## Assign Dependencies

1. Identify tasks with no predecessors
  2. Identify tasks dependent only on previously-identified tasks
  3. Repeat step two until dependencies all identified
- ① Small projects: Can use project management tools (e.g., MS Project)
  - ① Medium to large projects: Use index cards or sticky notes and whiteboard

## Analyze Critical Paths

- ✦ A set of dependent tasks where delay in any task delays the project end
- ✦ Near-critical paths exist where significant delays will delay project end
- ✦ What affects phase entry and exit criteria?
- ✦ During test execution: How many test passes, releases, and cycles?
- ✦ External dependencies: a frequent cause of delay



# Assigning Resources

## People

- ✦ Test engineers and test technicians, contractors and employees, outside test resources
- ✦ Using less-skilled people increases task effort, duration
- ✦ People's skill with a given task or tool determines estimate accuracy

## Test environments

- ✦ Hardware, software, networks, facilities, etc.
- ✦ Especially important to include expensive or long-lead-time items like large servers, test tools, lab space

## Test tools

- ✦ Custom
- ✦ Commercial off-the-shelf

- ⊘ Assume two people can get the job done in half the time
- ⊘ Overload tools or the test environment
- ⊘ Forget setup and support tasks for environments and tools





# *Predicting Test Execution Time*

- ⊕ When will you be done *executing the tests*?
- ⊕ Part of the answer is when you'll have run all the planned tests once
  - ⊞ Total estimated test time (sum for all planned tests)
  - ⊞ Total person-hours of tester time available per week
  - ⊞ Time spent testing by each tester
- ⊕ The other part of the answer is when you'll have found the important bugs and confirmed the fixes
- ⊕ Estimate total bugs to find, bug find rate, bug fix rate, and closure period (time from find to close) for bugs
  - ⊞ Historical data really helps
  - ⊞ Formal defect removal models are even more accurate



# *How Long to Run the Tests?*

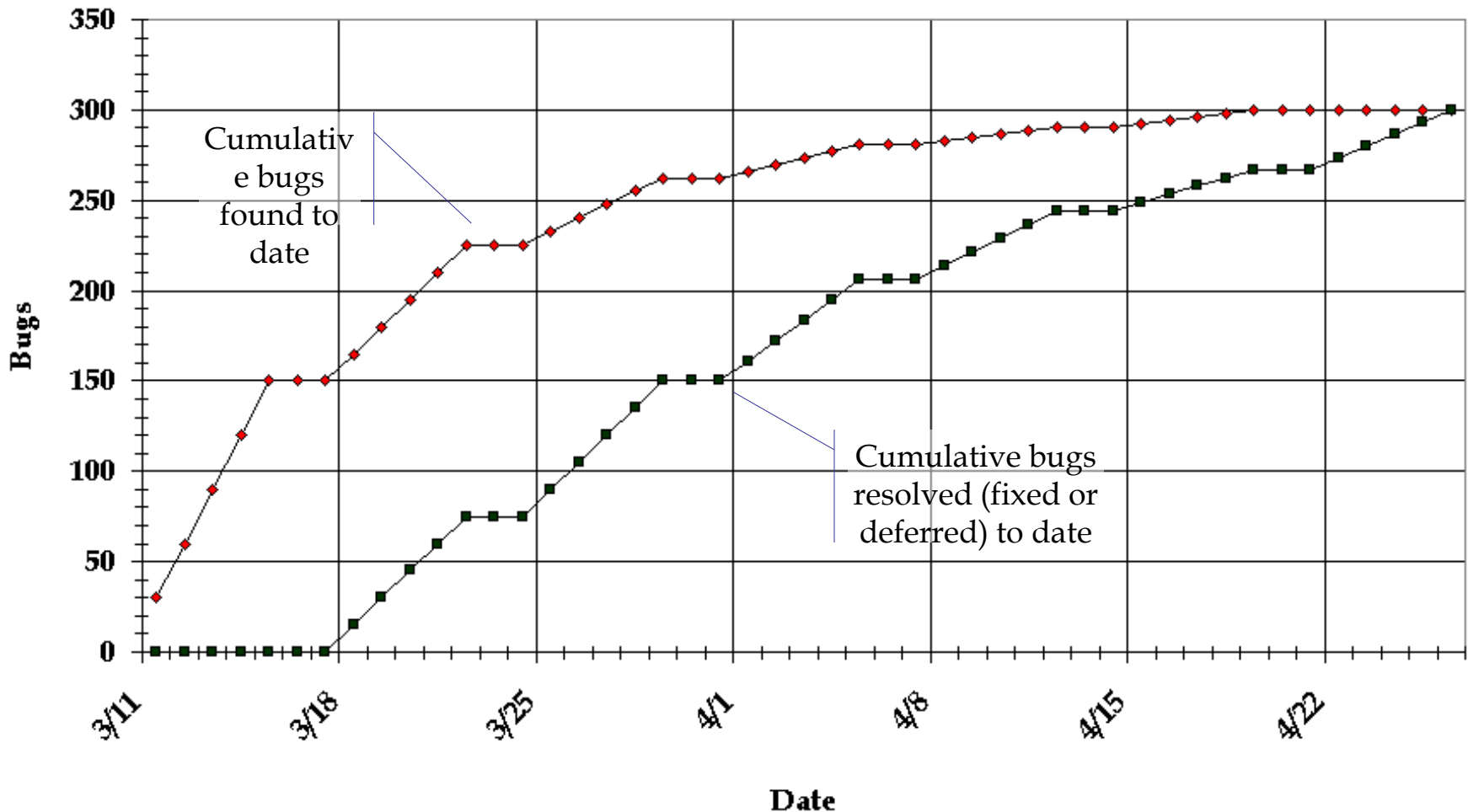
- ✦ It depends a lot on how you run tests
  - ❖ Scripted vs. exploratory
  - ❖ Regression testing strategy (repeat tests or just run once?)
- ✦ What I often do
  - ❖ Plan for consistent test cycles (tests run per test release) and passes (running each test once)
  - ❖ Realize that buggy deliverables and uninstallable builds slow test execution...and plan accordingly
  - ❖ Try to understand the amount of confirmation testing, as a large number of bugs leads to lots of confirmation testing
  - ❖ Check number of cycles with bug prediction
- ✦ Testers spend less than 100% of their time testing
  - ❖ E-mail, meetings, reviewing bugs and tests, etc.
  - ❖ I plan six hours of testing in a nine-to-ten hour day (contractor)
  - ❖ Four hours of testing in an eight hour day is common (employee)





# *How Long to Get the Bugs Out?*

- ✦ Using historical data and test cycle model, you can develop a simple model for bugs
- ✦ Predicting the total number bugs is hard
  - ❖ Subject to many factors and nonlinear effects
  - ❖ Common techniques: bugs per developer-day, thousands of source lines of code (KSLOC), or function point (FP)
  - ❖ Project size is usually the easiest factor to estimate
- ✦ Bug injection rates, fix rates, and closure periods are beyond the test team's control
  - ❖ You can predict, but document assumptions
  - ❖ The more historical data you have for similar (size, staff, technology, etc.) projects, the more accurate and confident you can be



I created this chart in about one hour using historical data from a couple projects and some simplified models of bug find/fix rates. The more data you have, the more accurate your model can be, and the more you can predict the accuracy.



## *Conclusions*

- ❖ Test estimation is one of the most difficult parts of software estimation
- ❖ Without good test estimation, insufficient testing will usually occur
- ❖ Therefore, test managers need to master proper estimation techniques
- ❖ It is possible to properly estimate test effort and duration, by applying known estimation best practices and historical data



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