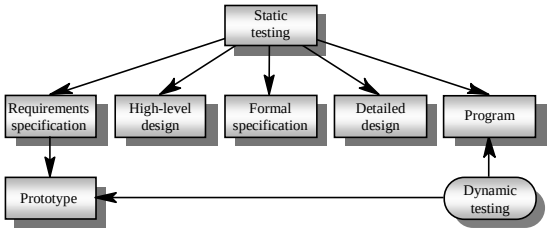
Static and dynamic Testing



Static testing

- Verifying the conformance of a software system and its specification without executing the code (by a computer)
- static testing = human testing

Static testing

- Involves analyses of source text by humans
- Can be carried out on ANY documents produced as part of the software process
- Discovers errors early in the software process
- Usually more cost-effective than testing for defect detection at the unit and module level
- Allows defect detection to be combined with other quality checks

Static testing effectiveness

- More than 60% of program errors can be detected by informal program inspections (Meyers: 30 - 70 %)
- More than 90% of program errors may be detectable using more rigorous mathematical program verification
- The error detection process is not confused by the existence of previous errors

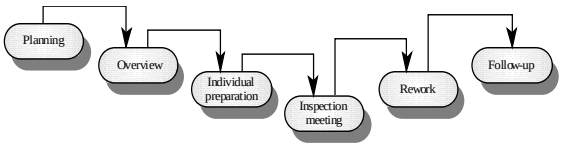
Program inspections

- Formalised approach to document reviews
- Intended explicitly for defect DETECTION (not correction)
- Defects may be logical errors, anomalies in the code that might indicate an erroneous condition (e.g. an uninitialised variable) or non-compliance with standards
- group code reading → team-based quality

Inspection pre-conditions

- A precise specification must be available
- Team members must be familiar with the organisation standards
- Syntactically correct code must be available
- An error checklist should be prepared
- Management must accept that inspection will increase costs early in the software process
- Management must not use inspections for staff appraisal

The inspection process



Inspection procedure

- System overview presented to inspection team
- Code and associated documents are distributed to inspection team in advance
- Inspection takes place and discovered errors are noted, no repair
- Modifications are made to repair discovered errors
- extension of checklists
- Re-inspection may or may not be required

Inspection teams

- Made up of at least 4 members
- Author of the code being inspected
- Reader who reads the code to the team
- Inspectors who finds errors, omissions and inconsistencies
- Moderator who chairs the meeting and notes discovered errors
- Other roles are Scribe and Chief moderator
- no superior

Inspection rate

- 500 statements/hour during overview
- 125 source statement/hour during individual preparation
- 90-125 statements/hour can be inspected
  Meyers: 150 statements/hour
  Balzert: 1 page/hour
- Inspection is therefore an expensive process
- Inspecting 500 lines costs about 40 man/hours effort = £2800

Inspection checklists

- Checklist of common errors should be used to drive the inspection
- Error checklist may be programming language dependent
- Complement static semantics checks by compiler + static analyser
- The 'weaker' the type checking, the larger the checklist
- Coding standard / programming guidelines

Inspection checks

Fault class	Inspection check
Data faults	Are all program variables initialised before their values are used? Have all constants been named? Should the lower bound of arrays be 0, 1, or something else? Should the upper bound of arrays be equal to the size of the array or Size -1? If character strings are used, is a delimiter explicitly assigned?
Control faults	For each conditional statement, is the condition correct? Is each loop certain to terminate? Are compound statements correctly bracketed? In case statements, are all possible cases accounted for?
Input/output faults	Are all input variables used? Are all output variables assigned a value before they are output?
Interface faults	Do all function and procedure calls have the correct number of parameters? Do formal and actual parameter types match? Are the parameters in the right order? If components access shared memory, do they have the same model of the shared memory structure?
Storage management faults	If a linked structure is modified, have all links been correctly reassigned? If dynamic storage is used, has space been allocated correctly? Is space explicitly de-allocated after it is no longer required?
Exception management faults	Have all possible error conditions been taken into account?