

Agenda

- Lecture
 - Testing
 - Orders of Ignorance

Announcement

- No class on Tuesday, October 29

Taxonomy Based on Test Stages

- Unit Testing
 - Same as Module Testing
- Integration Testing
- System Testing
- Acceptance Testing
- Installation Testing

Taxonomy Based On Information

- Black box testing
 - a.k.a. functional or specification-based testing
 - Test cases derived from the specification, i.e. without knowledge of implementation details
- White box testing
 - a.k.a. structural or program-based testing
 - Test cases derived using knowledge of implementation details and program internals
- Gray box testing
 - Hybrid between the two

Taxonomy Based on Adequacy Criteria

- **Test Adequacy Criterion**
 - Requirements for the testing process
 - Used as a stopping rule, measurement, or test case generator
- **Coverage-Based Techniques**
 - Test requirements specified in terms of coverage of software work product to be tested
 - Example: 80% statement coverage
- **Fault-Based Techniques**
 - Test requirements specified in terms of identifying some proportion of faults in the software work product
- **Error-Based Techniques**
 - Test requirements specified in terms of typical, known errors

Quality Factors

Product Operation <ul style="list-style-type: none"> •Correctness •Reliability •Efficiency •Integrity •Usability 	Does it do what I want? Does it do it accurately all of the time? Will it run my hardware as well as it can? Is it secure? Can I run it?
Product Revision <ul style="list-style-type: none"> •Maintainability •Testability •Flexibility 	Can I fix it? Can I test it? Can I change it?
Product Transition <ul style="list-style-type: none"> •Portability •Reusability •Interoperability 	Will I be able to... ...use it on another machine? ...reuse some of the software? ...interface it with another system?

Importance of Ignorance

- Everyone is ignorant about something-- often many things
- The first step in becoming an intelligent ignoramus is to understand ignorance

Armour's Orders of Ignorance

- **Zeroth Order Ignorance (0OI): Lack of ignorance.**
 - I have 0OI when I provably know something.
- **First Order Ignorance (1OI): Lack of knowledge.**
 - I have 1OI when I do not know something.
- **Second Order Ignorance (2OI): Lack of awareness.**
 - I have 2OI when I do not know that I do not know something.
- **Third Order Ignorance (3OI): Lack of Process.**
 - I have 3OI when I do not know of a suitably efficient way to find out that I do not know that I do not know something.
- **Fourth Order Ignorance (4OI): Meta ignorance.**
 - I have 4OI when I do not know about the Five Orders of Ignorance.

Zeroth Order Ignorance (0OI)

- **Lack of Ignorance**
 - I have Zeroth Order Ignorance (0OI) when I know something and can demonstrate my lack of ignorance in some tangible form.
 - 0OI is provable and proven knowledge that is deemed “correct” by some qualified agency. In software this means that the knowledge is invariably factored into usable form. In all forms of knowledge there must be some external “proof” element that qualifies the knowledge as being correct.
 - Examples
 - Trivia
 - Building a system that satisfies the user
 - Ability to sail

First Order Ignorance (1OI)

- **Lack of Knowledge**
 - I have First Order Ignorance (1OI) when I do not know something and I can readily identify that fact. 1OI is basic ignorance or lack of knowledge.
 - Example
 - Speaking Russian

Second Order Ignorance (2OI)

- **Lack of Awareness**
 - I have Second Order Ignorance (2OI) when I do not know that I do not know something. That is to say, not only am I ignorant of something (I have 1OI), I am unaware of what it is I am ignorant about. I do not know enough to know what it is that I do not know.
 - Example
 - I cannot give a good example of 2OI, of course.
 - Do you need a will or a trust?

Third Order Ignorance (3OI)

- **Lack of Process**
 - I have Third Order Ignorance (3OI) when I do not know of a suitably efficient way to find out that I do not know that I do not know something, which is lack of a suitable knowledge-gathering process.
 - This presents me with a major problem: If I have 3OI, I do not know of a way to find out that there are things that I do not know that I do not know. Therefore, I cannot change those things that I do not know that I do not know into either things that I know, or at least things that I know that I do not know, as a step toward converting the things that I know that I do not know into things that I know.
 - Example
 - Design
 - Investigative journalism

Fourth Order Ignorance (4OI):

- Meta Ignorance
 - I have Fourth Order Ignorance (4OI) when I do not know about the Five Orders of Ignorance.
 - I do not have this kind of ignorance, and now neither do you.
 - Knowledge is highly and intrinsically recursive-- to know about anything, you must first know about other things which define what you know.

Asking Questions

- Reveals
 - Ignorance
 - Intelligence
- Reduces
 - Ignorance
 - Assumptions
- Examples
 - Richard Feynman
 - Dan Berry