EE4800-03
Embedded Systems Design

Lesson 2
Structured Design, Documentation, and Laboratory Notebooks

Revised: Dec 15, 2003
Overview - Structured Design

- If this worth my time - a parable
- The “divide-and-conquer” technique
- Requirements
- Partitioning - “The Black Box”
- Structure Chart
- Pseudo (Fake) Code
- Implementation Techniques
- Testing Techniques
- Documentation
- Unified Modeling Language (UML)
If this worth my time - a parable

• Long, long ago in a graduate program far, far away...
  – needed to learn C
  – couldn’t pass entrance quiz
  – took prereq course is Pascal
  – course was supposed to be Pascal & data structures
    • discussed structured design techniques!?
  – my view changed!
The “divide-and-conquer” technique

• Paper writing/Book writing
  – Solid outline allows “big picture” view
  – Write project a paragraph at a time

• Use same technique in SW/HW design
  – divide project into understandable, doable pieces
  – A.K.A.: top-down-design, bottom-up-implementation...
Requirements

• Overall goal of structured design is to provide tools to transform system requirements into a plan into implement a system

• Your responsibility to ensure you understand requirements
  – iterative process with customer
Partitioning - “The Black Box”

• Break a large, complex system into a hierarchical description of “black boxes”
  – “black box”: small definable pieces
    • know inputs, outputs, general details of function
  – define relationship between “black boxes”
    • use a graphical tools relationship
    • Structure Chart provides big picture
Structure Chart

initialize system
- variables
- PORTs

preamp on sequence

3 second delay

process switch input

audio input

process remote input

audio input

process valid input

preamp off

change input

mute toggle
Pseudo (Fake) Code

• Once hierarchy is defined begin working out details of black box.
• Develop functional relationship between the boxes’ inputs and outputs
• Use pseudocode to defer details
  – not trying to avoid details
  – defer until higher level details worked out
Implementation Techniques

• Incremental Approach - get a little bit working at a time
• Top-down: implement top module (e.g. menu software)
  – lower level code simulated with stubs (empty modules)
• Bottom-up: implement module at lowest level.
  – Higher level code simulated with drivers
• Hybrid: use of mixture of both techniques and meet in the middle
Testing Techniques

- Compile time errors
- Run Time errors
- Everything is O.K. except project completed to incorrect requirements!!!
- Test Plan
Documentation

• External documentation - support information
  – Structure Chart

• Internal documentation
  – Comments
  – Self-documenting code - wise choice of variable, function names
  – Program Formatting - “pretty printing” - use blank spaces to help illustrate the control structure of the program
Unified Modeling Language (UML)

- Standardized set of graphical tools to model a complex system prior to implementation
  - fundamental property -- communication!
- Used to describe object-oriented design
- Activity Diagram -- UML-compliant flow chart
Unified Modeling Language (UML)
Laboratory Notebooks

• Legal document - may be used in court to establish ownership of an idea

• Mechanics
  – Use ink
  – Number each page consecutively
  – Sign and date each page
  – Glue additional figures into notebook - sign and date
  – “Z” out unused space
  – Do not remove incorrect material - “Z” it out