Design Defects and Restructuring

LECTURE 04

SAT, SEP 14, 2019

Software Development Basics

Data Sources

- Files
- Databases
- Web Services
- User Inputs
- Configuration

Process Controls

- Run a Program
- Based on Schedulers
    - Event Based
    - Time Based

Definition of Coupling

Coupling is the degree of interaction between two modules

There are six kinds of module coupling

- Content Coupling
- Common Coupling
- External Coupling
- Control Coupling
- Stamp Coupling
- Data Coupling

Content Coupling

Two or more modules exhibit **content coupling** if one refers to the “inside” – the “internal” or “private” part – of the other in some way

Common Coupling

Two or more modules exhibit **common coupling** if they refer to the same global data area – that is, to something that corresponds to a data store on a DFD or a “register” that must be shared by several processes

External Coupling

Two or more modules exhibit **external coupling** if they share direct access to the same I/O device or are “tied to the same part of the environment external to software” in some other way

Control Coupling

Two modules exhibit **control coupling** if one (“module A”) passes to the other (“module B”) a piece of information that is intended to control the internal logic of the other

- This will often be a value used in a test for a case statement, if-then statement, or while loop, in module B’s source code

Stamp Coupling

Two modules (“A” and “B”) exhibit **stamp coupling** if one passes directly to the other “composite” piece of data – that is, a piece of data with meaningful internal structure – such as a record (or structure), array, or (pointer to) a list or tree

Data Coupling

Two modules exhibit **data coupling** if one calls the other directly and they communicate using "parameters" – a simple list of inputs and outputs

- The modules exhibit stamp coupling if "composite" data types are used for parameters as well

Ideally, this **data coupling** is the usual type of interaction between modules that need to communicate at all

Definition of Cohesion

Cohesion refers to the strength of a method as it relates to the routines within it

There are following categories of cohesion

- Functional
- Sequential
- Communicational
- Temporal
- Procedural
- Logical
- Coincidental

Functional Cohesion

A method has strong functional cohesion when it does just one thing

Examples

- Compute cosine of angle
- Read transaction record
- Determine customer mortgage repayment
- Calculate net employee salary
- Assign seat to airline customer

Sequential Cohesion

A method has sequential cohesion when it depends on another method being called first AND it shares data with the first method

A sequentially cohesive module is one whose elements are involved in activities such that output data from one activity serves as input data to the next

Examples (Repaint a car)

- Clean car body
- Fill in holes in car
- Sand car body
- Apply primer

Communicational Cohesion

A method is said to have communicational cohesion when it does more than one unrelated thing on the same data

A communicational cohesive module is one whose elements contribute to activities that use the same input or output data

Examples (Book)

- Find title of book
- Find price of book
- Find publisher of book
- Find author of book

Procedural Cohesion

A method is said to have procedural cohesion when all the routines within the method need to occur in a specified order and the routines don’t share data

A procedurally cohesive module is one whose elements are involved in different and possibly unrelated activities in which control flows from each activity to the next

- Remember that in a sequentially cohesive module data, not control, flows from one activity to the next

Procedural Cohesion

Example

- Clean utensils from previous meal
- Prepare chicken for roasting
- Make phone call
- Take shower
- Chop vegetables
- Set table

Temporal Cohesion

A method is said to have temporal cohesion when all the routines within the method need to occur at the same time, but not necessarily in order

A temporally cohesive module is one whose elements are involved in activities that are related in time

Example

- Put out milk bottles
- Put out cat
- Turn off TV
- Brush teeth

Logical Cohesion

A method is said to have logical cohesion when the routines within the method are not related, don’t share data, and the routine is selected by a flag either passed in as a parameter or, worse, existing outside the method

Logical Cohesion

A logically cohesive module is one whose elements contribute to activities of the same general category in which the activity or activities to be executed are selected from outside the module

Example

- Go by car
- Go by train
- Go by boat
- Go by plane

Coincidental Cohesion

A method is said to have coincidental cohesion when the routines within the method are not related, and don’t share data

- This is a nice term which means the method does not have cohesion (or the cohesion is weak)

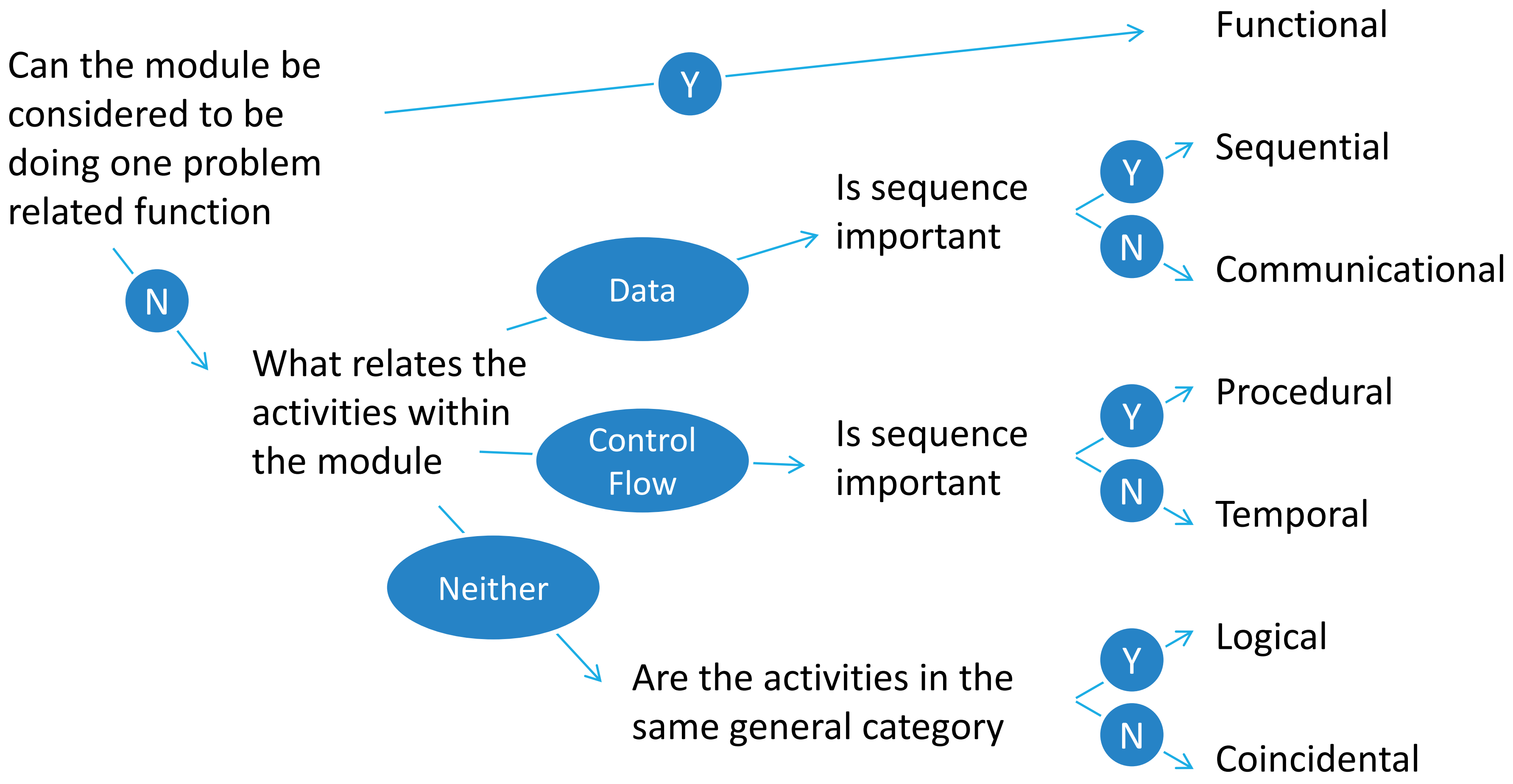
Coincidental Cohesion

A coincidental cohesive module is one whose elements contribute to activities with no meaningful relationship to one another

Example

- Fix car
- Bake cake
- Walk dog
- Fill out application form
- Have a lunch
- Get out of bed
- Go to the movies

Decision Tree for Module Cohesion


Can the module be considered to be doing one problem related function
Y
Functional
N
What relates the activities within the module
Data
Is sequence important
Y
Sequential
N
Communicational
Control Flow
Is sequence important
Y
Procedural
N
Temporal
Neither
Are the activities in the same general category
Y
Logical
N
Coincidental

Comparison of Level of Cohesion

Cohesion Level	Coupling	Cleanliness of Implementation	Modifiability	Understandability	Effect on Overall System Maintainability
Functional	Good	Good	Good	Good	Good
Sequential	Good	Good	Good	Good	Fairly Good
Communicational	Medium	Medium	Medium	Medium	Medium
Procedural	Variable	Poor	Variable	Variable	Bad
Temporal	Poor	Medium	Medium	Medium	Bad
Logical	Bad	Bad	Bad	Poor	Bad
Coincidental	Bad	Poor	Bad	Bad	Bad

Summary of Module Cohesion

A module may exhibit any of seven levels of cohesion depending on how the activities within the module are related

In sequence from best to worst, these seven levels are

Functional: Elements contribute to a single, problem related activity

Sequential: Activities within the module are connected in that the output from one serves as the input to another

Communicational: Activities share the same input or output

Procedural: Activities share the same procedural implementation

Temporal: Activities can be carried out at the same time

Logical: Activities appear to belong to the same general category

Coincidental: Activities have no relationship to one another