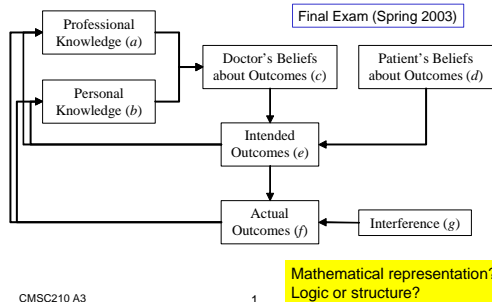


Conceptual Framework



CMSC210 A3

1

Module A Evaluation Workshop

- Tue., Sep. 16, class time (one week from today)
- Review the relevant part of the syllabus and the on-line handbook
- Prepare a manila folder or a large envelope
- Complete and bring "Take-Home Exercise Self-Evaluation Form" (distributed today) along with exercises
- Exercise A3 will be returned that day. Include it in the pile then.
- Complete and bring "Module A Comprehensive Exercises" (available on-line)
- Group evaluation sessions (open book): 20 min \times 3
- "Comprehensive Exercise Self-Evaluation Forms" will be distributed that day (no need to print in advance)
- Submit all materials at the end of the session

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2

A3: Structures

Today

- Analyze structures for similarity and difference
 - String vs. primitive counting
 - Primitive counting vs. Max
 - More structure examples
- Take-home exercises
 - Addition vs. Multiplication, Drug Trafficking

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3

Section 1

String vs. Primitive Counting

- String
 - Set of strings: e.g., "I", "scream", empty string, etc.
 - "Concatenation" operation: e.g., "I" + "scream" = "Iscream"
- Primitive counting
 - Set of primitive numbers: 0, 1, 2, ∞
 - "Addition" operation: $1 + 1 = 2$, $1 + 2 = \infty$, etc.

Group Task: Similar or different

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4

Analysis of Properties

- Properties shared by String and Primitive Counting
 - For any x, y, z , $(x + y) + z = x + (y + z)$ [associative]
 - There is an element x such that $x + y = y + x = y$ for any y . [identity element]
- These structures are *fairly similar*.
- Property not shared by String
 - For any x, y , $x + y = y + x$ [commutative]

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5

Section Summary

- Different-looking phenomena may have similar structures.
- Similar structures can be processed by similar procedures.

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6

Primitive Counting vs. Max

- Primitive counting
 - Set of primitive numbers: $0, 1, 2, \infty$
 - “Addition” operation: $1 + 1 = 2, 1 + 2 = \infty$, etc.
- Max
 - Set of integers (neither the smallest nor the greatest integer)
 - “Max” operation: e.g., $\max(1, 2) = 2, \max(-2, -2) = -2$

Group Task: Similar or different

Analysis of Properties

- Property of Primitive Counting not shared by Max
 - There is an element x such that $x + y = y + x = y$ for any y . [identity element]
- These structures are substantially different.
 - Properties/procedure applicable to Primitive Counting may not apply to Max.

Section Summary

- Similar-looking phenomena may have different structures.
- Different structures require different procedures to process.

Examples

- Find the fastest route (map/GPS)
- Represent corporate organizations for management
- Represent database for efficient data processing
- Represent programming languages for compilation
- Represent digital circuits for simplification

Graphs vs. Trees

- Graphs
 - (roughly) Arbitrary connection of points
- Trees
 - Special case of a graph
 - Connected, no loops
- Consequence
 - Procedures for a graph can be used for a tree, but not vice versa.

Classification of Structures

- Operational, relational, or other
 - **Operational**: a set and **operation(s)** [i.e., functions] on the set
 - **Relational**: a set and **relation(s)** on the set
 - Other: some mixture of the above
- Applicable properties
 - Associativity
 - Existence of identity element
 - Connectedness, existence of a loop

Section Summary

- Structures can be classified based on
 - Components: sets, relations, functions
 - Properties
- By giving properties (as logical statements), desired structures can be specified.

Summary Exercise

- Explain how to identify similarities and/or differences between two given structures.
- [Questions/Comments/Suggestions](#)