Final Study Guide

COSC 290 Spring 2018

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1 Data Structures

1.1 Sets

Definition: A set is an unordered collection of objects.

- $Fruits := \{banana, apple, pear\}$
- Membership: $apple \in Fruits$ is True
- Subset: $\{banana, pear\} \subset Fruits$
- Cardinality: $|Fruits| = 3$
- Enumeration: $SingleDigitOdds := \{1, 3, 5, 7, 9\}$
- Abstraction: $SingleDigitOdds := \{2x + 1 : x \in Z \text{ and } 0 \leq x \leq 4\}$

Powerset: The powerset of a set S is the set of all subsets of S

1.2 Sequences

Definition: A sequence is an ordered collection of objects. (Also known as lists or tuples.)

- Example: MWF course schedule ⟨COSC 290, Math 260, CORE 151 D⟩.
- Order matters, can have duplicates, represented using angle brackets.

Cartesian Product: Takes two sets and generates a set of ordered pairs (sequences of length two).

- $A \bigtimes B := \{\langle a, b\rangle : a \in A \text{ and } b \in B\}$
- $A \bigtimes B \bigtimes C := \{\langle a, b, c\rangle : a \in A \text{ and } b \in B \text{ and } c \in C\}$

1.3 Functions

Definition: A function f from X to Y, written $f : X \to Y$, assigns each input value $x \in X$ to a unique output value $y \in Y$.

- All $x \in X$ must be mapped to a y, and no x can be mapped to more than one y.
- One-to-one: for every $y \in Y$, there is at most one $x \in X$ such that $f(x) = y$.
- Onto: for every $y \in Y$, there is at least one $x \in X$ such that $f(x) = y$.
- Bijective: both one-to-one and onto.

2 Logic

2.1 Propositions

Definition: A proposition is a sentence that is either true or false.

- $3 + 4 = 6$
- My middle name is Gerald or my dog's name is Rufus.
- A single proposition is called an **atomic proposition**, while a **compound proposition** is made up of several atomic propositions.

Name	*Symbol*	*Meaning*
Negation	$\neg p$	"not p"
Conjunction	$p \wedge q$	"p and q"
Disjunction	$p \vee q$	"p or q"
Exclusive or	$p \oplus q$	"p or q, but not both"
Implies	$p \implies q$	"if p, then q"
Mutual implication	$p \iff q$	"p if and only q"

Two sentences are **logically equivalent** if they have identical truth tables.
A proposition is a **tautology** if it is true under every assignment of its variables.
A **literal** is an atomic proposition or the negation of an atomic proposition (either p or $\neg p$ for some variable p).

3 Counting and Combinations

4 Probability