CS 245 - F22
Logic and Computation
Rough Course Summary

With Prof Lila Kari

A very rough list I compiled before studying for the final. Marginally helpful if you don't want
to dig for the most important stuff yourself! Not my best work.

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CS245 STUDY

Question Types

- ✓ ① Arguement Validity: [Contradiction / Counterexample]
- ✓ ② Between Tautological implication and Formal implication.
- ✓ ③ Inconsistency/Consistency (Midterm Q5)
- ✓ ④ DPP full procedure (A3 Q5) (Midterm Q7)
- ✓ ⑤ Parse Trees (ANY BOOLEAN ONLY)(A4 Q1)
- ✓ ⑥ Translate english to FOL (A4 Q2)
- ✓ ⑦ FOL resolution full procedure (A4 Q5)
- ✓ ⑧ Turing Machines: when to reduce what to what.
- ✓ ⑨ Peano Arithmetic (A5)
- ✓ ⑩ Hoare: Partial + Total correctness ← (proving) (A6 Q1, Q2, Q3)
- ✓ ⑪ Structural Induction (Property definition)(base case)[inductive step $(\neg)(\circledast)(IH)$] (POSI)
  - ↑ binary connective

(right margin, vertical) Principle of Structural Induction

Notes to memorize:

Atom: $\neg p$
*Literal: p
▸ Term: $f(a, g(b,c))$ (a variable in your language)   non-boolean
Soundness: $\vdash \to \vDash$
Completeness: $\vDash \to \vdash$
function: returns Symbol
Relation: returns boolean
Decidable: (terminating algo exists) reduce it to Decidable
UnDecidable: reduce a Undecidable to it
partial correctness: it's correct when it terminates.
total correctness: Partial correctness PLUS it always terminates
$A \vdash B$: "B is formally provable from A"
Inconsistent: (wrt H) iff there exists B such that $\Sigma \vdash B$ & $\Sigma \vdash \neg B$
Consistent: (wrt H) Not inconsistent.
Satisfiable: evalutes to 1 under some truth valuation
Unsatisfiable: never evaluates to 1.
reduce : if I can show I can solve it using another, I've reduced it to that.
symbol : a person, or smth.
5-Tuple: (currstate, currnum, newstate, newnum, direction) [eg] $(q_1, 0, q_2, 1, R)$
Sholemization: $\forall x \forall y \exists z (A(y) \land B(z,x)) \longrightarrow \forall x \forall y (A(y) \land B(f(x,y), x))$ ← for prenex normal form
Resolution Steps: ① ∃-free PNF ② Quantifier-free clauses ③ "formal" proof using assignments (x := 5)
  ① CNF prenex normal form ② DPP! all them at crazy sex party → don't abandon kids

Cracked Strats:

- ■ Proving w/formal logic?
  - ↳ add negation of conc. to premise; use $(\neg \to)$
- ■ Proving program correctness?
  - ↳ work from the bottom up
- ■ Proving w/formal logic?
  - ↳ use $(\lor \to)$ to finish it off.
- ■ Don't forget to define your symbols + relations
- ■ Proving w/ FOL?
  - ↳ Start without quantifiers. Introduce them Late and Smartly

(distributed negation,) no → or ↔