**Week 8 - Natural Deduction**

| Review Questions |
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| Q. Where is deduction used?  Q. Prove statements using Natural Deduction  [Logic Tutor WebApp →](http://soitpa01157.srv.sydney.edu.au:8080/list_questions) |
| Prove, Prove, & Prove in ND |

| What is deduction? |
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| Prove statements from assumptions. |

| Where is deduction used? |
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| Software testing   * deduction forms the basis of an approach to software reliability called **Formal Methods**   Proving theorems   * deduction is used in automated reasoning systems.   Programming Languages   * e.g. Prolog (work by proving things)   Humans   * improve reasoning skills : produce logically correct arguments |

| Formal Proofs |
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| Formal proofs is a deductive system that provides rules for constructing syntactical proofs.   * ensures that the proven statement is true (given assumptions are true) * can be implemented by computers (highly disciplined) * based entirely on rewriting formulas - no semantics involved |

| Natural Deduction |
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| deductive system used for reasoning propositions   * uses connectives **∧, ∨, ¬, →,** and the constant **⊥.** * each connective has introduction and elimination rules |

| Natural Deduction - Rules of Inference | |
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| ∧ Introduction  ∧ Elimination | **(H ∧ R) ⊢ (R ∧ H)** |
| → Introduction  → Elimination | **(H → R), (R → W), H ⊢ (H → W)** |
| ∨ Introduction  ∨ Elimination | **A ⊢ (A ∨ B)**    **(A ∨ B), (A → C), (B → C) ⊢ C** |
| ⊥ Introduction  ¬ Introduction  ¬ Elimination | **F ⊢ ¬¬F**    **¬¬F ⊢F** |

| Tutorial Q5 - De Morgan’s Law |
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| (¬A∨¬B) ⊢ ¬(A∧B) ¬(A∨B) ⊢ (¬A∧¬B) |

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