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**Mathematical Methods for Computer Science I**

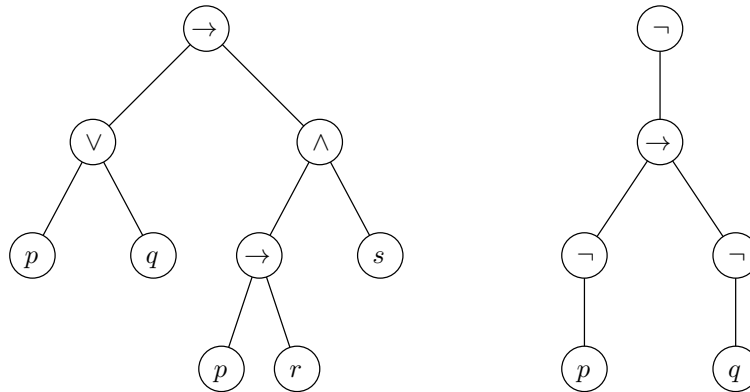
Fall 2020

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Series 8 – Hand in before Monday, 16.11.2020 - 12.00

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1. Determine the propositions with the following parse trees.



2. For each of the following propositional formulas, answer the following two questions: is the formula a tautology? Is the formula satisfiable?
- $A = p \rightarrow (q \rightarrow p)$
  - $B = (p \vee q \vee r) \wedge (p \vee q \vee \neg s) \wedge (\neg p \vee q \vee \neg r)$
3. Prove the following equivalences.
- $(A \rightarrow B) \simeq (\neg B \rightarrow \neg A)$
  - $(A \rightarrow B) \simeq (\neg A \vee B)$
  - $(A \vee B) \simeq (\neg A \rightarrow B)$
4. Simplify the following propositions (that is, find a simpler equivalent proposition).
- $(A \rightarrow B) \wedge A$
  - $(A \rightarrow B) \rightarrow B$
  - $(A \rightarrow B) \rightarrow A$
  - $A \rightarrow (A \wedge B)$
5. Which valuations  $v: \{p_1, \dots, p_n\} \rightarrow \{0, 1\}$  satisfy the following formulas?
- $C = (p_1 \rightarrow p_2) \wedge (p_2 \rightarrow p_3) \wedge \dots \wedge (p_{n-1} \rightarrow p_n)$
  - $D = C \wedge (p_n \rightarrow p_1)$