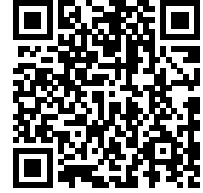


Worksheet: L05 – Propositional Calculus

CSCI-534: Robot Planning & Manipulation

Spring 2020

<http://www.neil.dantam.name/rpm/B05-prop.pdf>

1. **Boolean Expressions:** Write the S-expression and draw the abstract syntax tree for the following expressions:

(a) $(a \wedge b) \implies c$

(b) $\neg(a \wedge b) \vee c$

(c) $\neg a \vee \neg b \vee c$

2. **Horn Clauses:** Construct a Horn clause knowledge base for the course prerequisites shown in Figure 1.

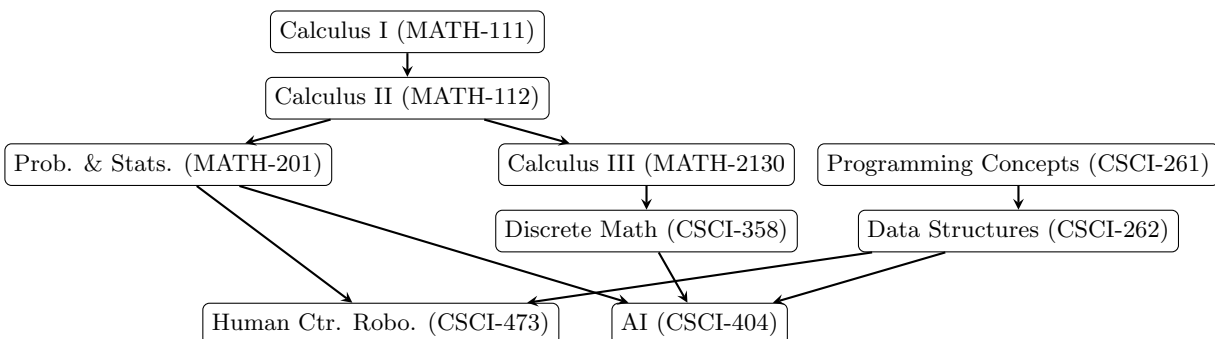


Figure 1: Course Prerequisites for Robotics B.S.E

Name:

3. **Forward Chaining:** Use forward chaining to show whether CSCI-473 requires MATH-213.

4. **Backward Chaining:** Use backward chaining to show whether CSCI-473 requires MATH-213.

Name:

5. **Knowledge Bases:**

(a) Write pseudocode to index a Horn clause knowledge base for the forward chaining algorithm:

(b) Write pseudocode to index a Horn clause knowledge base for the backward chaining algorithm:

6. **Conjunctive Normal Form:** Convert the following formulae to conjunctive normal form:

(a) $\neg(a \vee b) \implies c$

(b) $\neg(a \wedge b) \vee (a \wedge c)$

(c) $\neg(a \vee b) \oplus (a \wedge c)$

Name:

7. **Unit Propagation:** Propagate the unit clauses in the following formulae:

(a) $\neg a \wedge (a \vee b \vee c)$

(b) $(a \vee \neg b) \wedge b \wedge (b \vee c)$

(c) $(a \vee \neg b \vee \neg c) \wedge (b \vee \neg c) \wedge c$

(d) $a \wedge (\neg a \vee b) \wedge (\neg a \vee \neg b)$

8. **DPLL:** Apply DPLL to the following formulae:

(a) $(a \vee b) \wedge (\neg b \vee c)$

(b) $(a \vee b) \wedge (\neg b \vee c) \wedge (\neg a \vee \neg c)$

(c) $(a \vee b) \wedge (\neg a \vee \neg b) \wedge (\neg a \vee b)$

(d) $(a \vee b) \wedge (\neg a \vee \neg b) \wedge (\neg a \vee b) \wedge (a \vee \neg b)$

(e) $(\neg a \vee c) \wedge (a \vee c) \wedge (b \vee \neg c) \wedge (\neg b \vee \neg c)$