

Assignment 5

A RESOLUTION DERIVATION

Given the collection of 8 clauses

- a.* $\{P, Q\}$ *b.* $\{P, \neg S\}$ *c.* $\{Q, \neg R\}$ *d.* $\{R, \neg S\}$
e. $\{\neg P, S\}$ *f.* $\{\neg Q, R\}$ *g.* $\{\neg R, S\}$ *h.* $\{\neg P, \neg Q\}$

fill in the reasons for the steps in the following resolution derivation of the empty clause:

1. $\{\neg P, S\}$ _____	(e)	8. $\{\neg R, S\}$ _____
2. $\{P, Q\}$ _____		9. $\{\neg Q, S\}$ _____
3. $\{Q, S\}$ _____	1, 2	10. $\{Q, \neg R\}$ _____
4. $\{P, \neg S\}$ _____		11. $\{R, \neg S\}$ _____
5. $\{\neg P, \neg Q\}$ _____		12. $\{Q, \neg S\}$ _____
6. $\{\neg Q, \neg S\}$ _____		13. $\{S\}$ _____
7. $\{\neg Q, R\}$ _____		14. $\{\neg S\}$ _____
		15. $\{\}$ _____

Is it possible to find an assignment of truth values for the propositional variables P, Q, R, S that will satisfy the original eight clauses?

Given the collection of 6 clauses

1. $\{P, Q\}$ 2. $\{P, \neg S\}$ 3. $\{Q, \neg R\}$
 4. $\{R, \neg S\}$ 5. $\{\neg P, S\}$ 6. $\{\neg Q, R\}$

fill in the reasons for the steps in the following resolution derivation:

7. $\{P, \neg P\}$ _____	12. $\{Q, S\}$ _____
8. $\{Q, \neg Q\}$ _____	13. $\{Q\}$ _____
9. $\{R, \neg R\}$ _____	14. $\{R\}$ _____
10. $\{S, \neg S\}$ _____	15. $\{P, R\}$ _____
11. $\{Q, \neg S\}$ _____	16. $\{R, S\}$ _____
	17. $\{Q, R\}$ _____

Can you obtain any other clauses by resolution?

What does this say about the satisfiability of clauses 1–6?

Apply the Davis-Putnam Procedure to the First Problem, showing just the \mathcal{S}'_i and \mathcal{U}_i steps (as done in the resolution on Q).

Resolution on Q :

$$\mathcal{S}'_1: \quad \begin{array}{cccccccc} (1) & & (2) & & (3) & & (4) \\ \{P, Q\} & \{P, \neg S\} & \{Q, \neg R\} & \{R, \neg S\} & \{\neg P, S\} & \{\neg Q, R\} & \{\neg R, S\} & \{\neg P, \neg Q\} \end{array}$$

$$\mathcal{U}_1: \quad \begin{array}{cccc} (1, 3) & (1, 4) & (2, 3) & (2, 4) \\ \{P, R\} & \{P, \neg P\} & \{R, \neg R\} & \{\neg P, \neg R\} \end{array}$$

Resolution on R :

$$\mathcal{S}'_2:$$

$$\mathcal{U}_2:$$

Resolution on P :

$$\mathcal{S}'_3:$$

$$\mathcal{U}_3:$$

Resolution on S :

$$\mathcal{S}'_4:$$

$$\mathcal{U}_4:$$

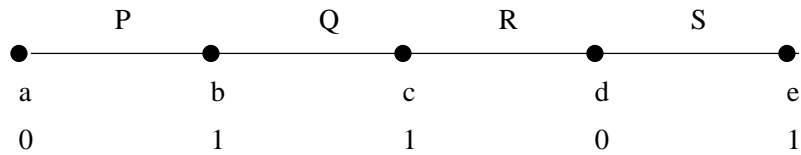
Given the collection of five Horn clauses

1. $\{P, \neg Q\}$ 2. $\{\neg P, S\}$ 3. $\{\neg R, \neg S\}$ 4. $\{Q\}$ 5. $\{R\}$

find all clauses that can be derived using unit resolution:

	Clause	Reason
6.	_____	_____
7.	_____	_____
8.	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

Write out the graph clauses associated with the labelled graph:



Clauses(a) _____

Clauses(b) _____

Clauses(c) _____

Clauses(d) _____

Clauses(e) _____

Use Tseitin's theorem to determine if this collection of clauses is satisfiable.