

5CCS2FC2: Foundations of Computing II

Tutorial Sheet 7

- 7.1 Use the greedy SAT algorithm to find a variable assignment that maximises the number of clauses satisfied from the following set:

$$(P \vee Q), \quad (P \vee \neg Q), \quad (\neg P \vee Q \vee R), \\ (\neg P \vee R), \quad (P \vee \neg Q \vee R), \quad (P \vee Q \vee R).$$

- 7.2 Use the DPLL Algorithm to decide whether the following set of clauses is satisfiable? If so, what is a satisfying assignment?

$$(P \vee Q), \quad (1) \quad (\neg P \vee R \vee \neg S), \quad (5)$$

$$(P \vee R \vee S), \quad (2) \quad (\neg P \vee \neg R), \quad (6)$$

$$(\neg Q \vee \neg R \vee S), \quad (3) \quad (\neg P \vee \neg Q \vee \neg S), \quad (7)$$

$$(\neg Q \vee \neg R \vee \neg S), \quad (4) \quad (P \vee \neg Q \vee R \vee \neg S). \quad (8)$$

- 7.3 Consider the following instance of 2SAT:

$$F = (P \vee Q) \wedge (\neg R \vee S) \wedge (\neg Q \vee S) \wedge (\neg P \vee \neg S) \wedge (\neg S \vee \neg Q).$$

- (i) Construct the *implication graph* for F ,
- (ii) Decide whether the F is satisfiable or not?
- (iii) [Bonus] If F is satisfiable, can you identify a satisfying assignment?
Does the structure of the implication graph help you?

- 7.4 Using just the Unit Propagation and Pure Literal Elimination rules, decide whether the following set of Horn clauses is satisfiable

$$(P \vee \neg Q \vee \neg S), \quad (\neg P \vee \neg S \vee T), \quad (\neg Q \vee \neg R \vee \neg S \vee \neg W), \\ (P \vee \neg R), \quad (Q), \quad (T \vee \neg W), \quad (\neg Q \vee S), \quad (\neg P \vee \neg R \vee \neg T \vee \neg W).$$