

# CSC236, Summer 2004, Assignment 3, marking scheme

1. Parts (a), (b), and (c) were each worth 5.

BASE CASE: 0.5 marks. -0.5 for not justifying observations.

SETTING UP INDUCTION: 1 mark

INDUCTION STEP: 3 marks. -2.5 for assuming without proof that the number of parentheses is even. -1 for not using (or not pointing out where you use) the induction hypothesis. -1 for omitting the case  $e = \neg e_1$  (parts (a) and (c) only). -0.5 for not justifying observations.

CONCLUSION: 0.5 marks.

REMARK E1: (PART B ONLY): No marks deducted. You should explain why every element in  $F^+PV$  is contained in the set considered in the basis and induction steps (see sample solution).

2. Part (a) was marked out of 3, part (b) was marked out of 2, part (c) was marked out of 5, and part (d) was marked out of 5. Here are some common errors:

UNSPECIFIED LAWS: If the relevant laws weren't cited, part (a) was reduced to 2 marks, and parts (c) and (d) were reduced to 3 marks.

JUMPING TO CONTRADICTIONS: Formulas must be shown to be equivalent to a contradiction without resort to truth tables (-1 mark).

3. 3(a) was worth 4 for a correct truth table, 3(b) and 3(c) were each worth 2 for correct CNF/DNF formulas, and 3(d) was worth 7, as follows:

2 MARKS: State explicitly that the truth table lists all possible truth assignments to propositional variables and extends them to the formulas.

2 MARKS: Correct truth table.

2 MARKS: State explicitly that each truth assignments either falsifies or satisfies both formulas (equivalently both formulas agree on every truth assignment).

1 MARK: Conclude that logically equivalent formulas make the biconditional a tautology.

4. Parts (a) and (c) were worth 5, part (b) was worth 3, and part (d) is worth 2.

4(A) ERRORS:

C1: Not making an argument about there being a smallest element in  $W$  (-1).

C2: No discussion in terms of logical structure of  $F$ , for example that the only way for  $F$  to be false is for its antecedent to be true and its consequent false (-1).

C3: Not citing that  $W$  is non-empty for  $F$  to be false (-1).

C4: Arguing over a specific interpretation (-4).

4(B) ERRORS:

C1: Not giving an example interpretation (-1).

C2: No discussion in terms of logical structure of  $F$  (-1).

C3: Arguing about  $R$  instead of  $W$  (-1).

4(C) ERRORS:

C1: Not citing that  $W$  is non-empty for  $F$  to be false (-1).

C2: No discussion in terms of logical structure of  $F$  (-1).

C3: Not handling case  $x \in W$  and also case  $x \notin W$  (-1).

5. This question was marked out of 5, then weighted by a factor of 3.

Mark	features
1	blank, or English definition only
2	major mis-match between English definition and predicate
3	some part of definition not implemented, or serious flaw in predicate
4	small flaw in predicate

REDUNDANT SUB-FORMULAS: Since  $S(x, y)$  and  $P(x, y, z)$  are symmetrical in the first two arguments, one mark deducted for making the formula more complicated by listing multiple permutations of these arguments.

MISSING SCOPE: One mark off for omitting parentheses when this changes the scope of quantified variables.

QUANTIFYING PARAMETERS: This predicate takes two arguments, so they should be left as free variables.

→ MISUSE: Saying some predicate  $\rightarrow C(x, y)$  leaves open the possibility that every false predicate implies that  $x$  and  $y$  are cousins.