MTH210 – MID-SEM EXAMINATION – 20221020

TIME: 60 MINUTES **MAXIMUM MARKS: 50**

NB: You may use any known result (i.e. theorems, propositions and lemmas, and tutorial problems) without proof; however, it should be identified clearly. This does not apply if you have been asked to prove a known result. Marks will depend on the correctness and completeness of your proofs. All questions have equal marks.

RUBRIC

List of Common Errors and Marks Deductions:

1. Using an undefined symbol.
2. Writing an equation in which the LHS and RHS are not comparable. For example, the LHS is a set, and the RHS is an integer.
3. Writing a meaningless or completely illogical statement.

Deduct 1 mark for each occurrence of an error of the above type. **However, the total marks for any question should remain non-negative.**

Q1. a) Correct Hasse diagram $\rightarrow$ 3 marks. If there is only one error $\rightarrow$ 1 mark. If more than one error $\rightarrow$ 0 marks.
b) $\alpha(P) = 3 \rightarrow$ 1 mark. $\omega(P) = 5 \rightarrow$ 1 mark.
c) Decomposition listed correctly and explicitly $\rightarrow$ 2 marks. If there is any error $\rightarrow$ 0 marks.
d) NO $\rightarrow$ 1 mark. Justification $\rightarrow$ 2 marks.

Q2. Showing that $a \vee b$ has a complement: defining the complement (c in the solution) correctly $\rightarrow$ 2 marks; proving equation 1. in the solution correctly $\rightarrow$ 3 marks; proving equation 2 in the solution correctly $\rightarrow$ 3 marks; if there is any incorrect step in the calculation $\rightarrow$ 0 marks for that equation. Showing that $a \wedge b$ has a complement $\rightarrow$ 2 marks; at least the complement should be defined or it should be demonstrated how the statement is the dual. If only stated by duality $\rightarrow$ 1 mark.

Q3. ***Method 1*** – Strong induction: correct proof $\rightarrow$ 10 marks; if incorrect or incomplete proof, following partial credit may be awarded: base case $\rightarrow$ 1 mark; inductive hypothesis correctly stated $\rightarrow$ 2 marks; if the proof is correct, but the case that n is a power of 2 itself is not clearly explained, **deduct** $\rightarrow$ 3 marks.

Method 2: Correct answer → 10 marks. If the idea is correct, but the answer is wordy or vague, or if is not clearly shown how distinct powers of 2 are involved, partial credit may be awarded → 2 marks (maximum).

Q4. a) Correct answer → 2 marks; any error at all → 0 marks.
b) Correct answer → 2 marks; any error at all → 0 marks.
c) Correct number of inversions → 1 mark. Showing the calculations → 2 marks (***only if numerical answer is correct***). .
d) Correct value of the term → 1 mark. Showing the calculations → 2 marks (***only if numerical answer is correct***). .

Q5. Correct answer → 4 marks; correct justification → 6 marks. If the result from TUT06 is used without proof or ***without proper citation*** → 2 marks. Marks for justification to be awarded only if the ANSWER IS CORRECT.