COMP9020 18s1

Week 2 Problem Set
Logic

Foundations of Computer Science

[Show with no answers] [Show with all answers]

Before you start:

Download and read a short essay on Good Mathematical Writing and write up your solutions to the following exercises with these guidelines in mind.

1. (Entailment)

   Prove that $\neg N$ follows logically from $H \wedge \neg R$ and $(H \wedge N) \Rightarrow R$.

   [show answer]

2. (Reasoning about requirements)

   See pages 41–43 of the lecture slides week 2 and answer the two questions.

   [show answer]

3. (Mathematical proofs)

   Prove that $\lfloor \frac{n}{2} \rfloor + \lceil \frac{n}{2} \rceil = n$ for all integers n.

   Hint: Give a proof by cases.

   [show answer]

4. (Logical modelling and reasoning)

   The country of Mew is inhabited by two types of people: liars always lie and "truars" always tell the truth. At a cocktail party the newly appointed Australian ambassador to Mew talked to three inhabitants. Peter remarked that Joan and Shane were liars. Shane denied he was a liar, but Joan said that Shane was indeed a liar. Now the ambassador wondered how many of the three were liars.

   Use propositional logic formulae to help the ambassador.

   [show answer]

5. **Challenge Exercise**

   Prove that $8 \mid (n^2 - 1)$ for every odd number n (that is, for every $n \in \mathbb{Z}$ such that $2 \nmid n$).

   [show answer]