CSE 311: Foundations of Computing I — Spring 2026

Quiz Section 2: Proofs

Task 1 – Simple Formal Proofs

a) Given $(a \to b)$, $(c \to b)$, $a \lor (c \land d)$, show that b holds.

b) Given $\neg(\neg r \lor k)$, $\neg q \lor \neg s$ and $(p \to q) \land (r \to s)$, show that $\neg p$ holds.

Task 2 – Direct Proofs

a) Show that $\neg k \to s$ follows from $k \lor q$, $q \to r$ and $r \to s$ with a formal proof.

b) Show that $r \to p$ follows from $p \lor \neg q$, $(r \lor s) \to (q \lor s)$, and $\neg s$.

Task 3 – Predicate Logic Proofs

a) Given $\forall x\,(T(x) \to M(x))$, prove $(\exists x\, T(x)) \to (\exists y\, M(y))$.

b) Given $\exists x\,(T(x) \to \forall y\, S(y,x))$, prove $\forall y\, \exists x\,(T(x) \to S(y,x))$.

Task 4 – English Proofs

Let domain of discourse be the integers. Consider the following claim:

$$\forall x\, \forall y\, ((\text{Even}(x) \wedge \text{Odd}(y)) \to \text{Odd}(x+y))$$

In English, this says that, for any even integer x and odd integer y, the integer $x+y$ is odd.

a) Write a **formal proof** that the claim holds.

b) Translate your formal proof to an **English proof**.

Keep in mind that your proof will be read by a *human*, not a computer, so you should explain the algebra steps in more detail, whereas some of the predicate logic steps (e.g., Elim $\exists$) can be skipped.