

Answer the questions in the space provided below. You may use the back of the page if you need more space. Time: 15 minutes.

Name and section: \_\_\_\_\_

1. Is the following propositional form: (50)

$$((p \wedge q \vee r) \rightarrow r) \wedge (\neg s \rightarrow s) \wedge ((t \oplus t) \vee \neg s) \wedge (k \leftrightarrow l)$$

satisfiable? If it is, present a truth assignment which makes it true. Otherwise, justify your answer.

2. Consider the predicate  $P(x, y, z) = x + y < z$ .

(a) Is the proposition  $\forall z \exists x \exists y P(x, y, z)$  true, where the domain of discourse is  $\mathbb{N}$ , the set of natural numbers? Justify your answer. (25)

(b) Is the proposition  $\exists z \forall x \exists y P(x, y, z)$  true, where the domain of discourse is  $\mathbb{Z}$ , the set of integers? Justify your answer. (25)