Discrete Structures, Fall 2023, Homework 3

You must write the solutions to these problems legibly on your own paper, with the problems in sequential order, and with all sheets stapled together.

1. Complete the following proofs using the framework discussed in class. Each line of your proof must be justified with a rule of inference or logical equivalence and appropriate line numbers.

   (a)

P1	$s \wedge e$
P2	$e \to b$
P3	$(b \wedge \sim m) \to \sim s$
Prove:	m

   (b)

P1	$(p \to q) \wedge (r \to s)$
P2	y
P3	$(s \wedge q) \to \sim y$
Prove:	$\sim p \vee \sim r$

   (c)

P1	$p \to q$
P2	$\sim q \vee r$
P3	$s \vee (y \wedge \sim r)$
Prove:	$\sim s \to \sim(p \vee \sim y)$

   (d)

P1	$a \wedge \sim d$
P2	$b \to (e \to d)$
Prove:	$(a \to b) \to \sim e$

2. Translate each of the following English sentences into formal language – that is, using the symbols $\forall, \exists, \in$, etc. Use the following predicates:

   $B(s)$ means "s is an business major,"
   $C(s)$ means "s is a computer science major," and
   $M(s)$ means "s is a math major."

   Use the domain S = the set of all students at Rhodes College.

   (a) There is an business major who is also a math major.
   (b) Every computer science major is also an business major.
   (c) No computer science majors also major in business.
   (d) Some people majoring in CS are also majoring in math.
   (e) Some computer science majors are business majors as well, but some are not. (Think carefully; this is tricky.)