Please hand in your answers to the following problems. Problem numbers, where indicated, are from the seventh edition of the Rosen text:

1. (3 points) Consider the argument consisting of the two premises “The sun rises in the east” and “The sun does not rise in the east”, and the conclusion “You will get an A in the course”.

Write the argument form (i.e., “premises imply conclusion”) for this by using appropriate propositional variables. Show that this argument form is valid by establishing an appropriate tautology (you may use a truth table). Does this mean that the conclusion is true? Justify your answer briefly.

2. (4 points) p. 78, #4 parts (a) through (d). It is sufficient to just state the name of the inference rule that applies in each case.

3. (6 points) p. 79, #10 parts (a), (b), (f). Use appropriate propositional variables to express each statement. State what conclusion(s) can be reached and the inference rule used to reach each conclusion. If no conclusion can be reached, then just state so.

4. (5 points) p. 78, #6. Express the given statements using the propositional variables listed below. Then give a stepwise proof that the conclusion follows from the premises, justifying each step clearly. (See Examples 6 and 7 on pages 73–74, as well as the examples done in class.)

Let $r$ stand for “It is raining”, $f$ for “It is foggy”, $s$ for “The sailing race will be held”, $d$ for “The lifesaving demonstration will be held”, and $t$ for “The trophy will be awarded”.

5. (6 points) On a popular sports talk show in the Twin Cities, the host makes the following argument ($P_1$–$P_4$ are the premises and $C$ is the conclusion):

$P_1$: If the Packers and Bears lose, then the Lions or Vikings (or both) make the playoffs.
$P_2$: If the Vikings or Bears (or both) win, then the Vikings will not get a high draft pick.
$P_3$: If the Vikings lose then the Packers lose.
$P_4$: The Vikings do not make the playoffs.

$C$: If the Lions do not make the playoffs, then the Vikings do not get a high draft pick.

Your goal is to prove that the conclusion follows from the premises. Do this stepwise, following the guidelines given in Problem 4 above. Assume that there are no ties, so a team either wins or loses.

Let $p$ stand for “The Packers lose”, $b$ for “The Bears lose”, $v$ for “The Vikings lose”, $d$ for “The Vikings make the playoffs”, and $l$ for “The Lions make the playoffs”. Express each of $P_1$–$P_4$ and $C$ using these variables before beginning your proof.

Note: In doing your proof, you may find it helpful to include a portion of the conclusion as a premise. (Recall the “useful result” discussed in class.)

Over $\implies$
6. (4 points) p. 54, #20, parts (c), (e). For simplicity, assume that the universe (or domain) consists of just the integers $-3, -1, 1$. (This will save you some writing :-) Simplify the final expression as much as possible.

7. (4 points) p. 54, #24, parts (b), (d).

8. (3 points) p. 55, #36, all parts. If there is no counterexample, then just state so.