COMP 681 Formal Methods Spring 2009 Assignment 3

1. Consider the following conditional.

```
if P and Q then S1
else if R and T then  {
  if P then S1
  if Q then S2
}
else  {
  if T then S1
  else S2
```

In the language of propositional logic, write the conditions under which each of the statements S_1 and S_3 is executed. Simplify, at least move all ¬'s inward so they apply only to primes and factor out common terms.

2. A group of experts from different departments decides that procedure S_1 is done when P is true, that S_2 is done if P is false but R is true, and that S_3 is done Q is true but R is false.

a. Write a GCL alternation statement that captures these requirements. (The conditions won't be mutually exclusive at this point.)

b. You point out to the experts that their conditions are not mutually exclusive. They decide among themselves that S_1 should take priority over the other two statements and that S_2 should take priority over S_3. Rewrite the conditions so that they are mutually exclusive and respect these priorities.

c. For the cases not covered in **b**, add another alternative whose guard covers the remaining cases yet is disjoint from each of the other three guards. The command associated with this guard should be `skip`.

d. Translate the alternative statement in c into the language used in section 3.3 Minimize the number of primes that must be evaluated.

3. Convert the following into DNF.

a. $\neg p \wedge q \Leftrightarrow p \Rightarrow \neg q \vee r$

b. $(\neg p \vee q \Rightarrow r \wedge s) \wedge (p \vee \neg r \Rightarrow q)$

4. Convert the following into CNF.

$(\neg p \vee q \Rightarrow r \vee s) \vee (\neg p \vee r \Rightarrow \neg q)$

5. Convert the following CNF wff into the normal form with implications but no negations.

$(p \vee q \vee r) \wedge (\neg q \vee \neg r)$

6. Use the technique in Sec. 3.4.4 to convert the following in DNF to CNF. Simplify where possible.

$(p \wedge q \wedge \neg r) \wedge (\neg p \wedge q \wedge r)$