

1. Consider the following conditional.

```

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

```

- a. 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 \neg 's inward so they apply only to primes and factor out common terms.
- b. Rewrite the conditional by filling in the following blanks.

```

if P then {
  if _____ then S2
  else S1
}
else if _____ then S1
else if _____ then S2
else S1

```

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

- 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_3 should take priority over the other two statements and that S_2 should take priority over S_1 . 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 CNF.

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

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

4. Convert the CNF wffs you get in problem 3 into the normal form with implications but no negations.

5. Convert the following into DNF.

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

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

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