CPSC 121 - Models of Computation

Tutorial - Module 04

1. Define the following propositions:

   - a: I will visit Ankara.
   - p: I will visit Prague.
   - v: I will visit Vienna.
   - u: I will bring an umbrella.
   - e: I will visit Europe.
   - w: I will travel in the winter.
   - s: I will travel in the summer.

   Translate the following English sentences into corresponding propositional logic expressions.

   (a) I will visit Ankara but I will not visit Prague.

   (b) I will visit Vienna only if I will travel in the summer.

   (c) It is sufficient for me to visit Prague or Vienna to visit Europe.

   (d) I will visit Ankara if and only if I will travel in the summer.

   (e) I will not visit Vienna in the winter unless I bring an umbrella.

2. Kevin has bizarre powers of observation, and noticed the following facts while studying with his friends:

   - Alice and Bob did not both eat sandwiches.
   - If Charlie forgot to bring his lunch, then either Alice ate a sandwich, or David did not eat an orange (or both).
   - Bob ate a sandwich.

- If Eve forgot to eat her banana and Alice did not eat a sandwich, then Charlie forgot to bring his lunch.
- If Alice did not eat a sandwich, then David ate an orange.

Kevin thinks that Eve did not forget to eat her banana, but he is not certain.

(a) Name each simple proposition above

(b) Rewrite the bulleted statements using propositional logic and your propositions from the previous part.

(c) Using your statements in the previous part as premises, prove that Eve did not forget to eat her banana. Be sure to list and number your steps and to give a justification for each step, citing the previous step(s) it depended on.

3. Prove b using a formal propositional logic proof given the five numbered premises below.

   1. $(\sim p \vee q) \rightarrow p$
   2. $\sim r \rightarrow \sim p$
   3. $\sim(r \wedge \sim a)$
   4. $\sim a \vee b$
   5. $(q \vee s) \rightarrow t$

4. Prove that the following argument is valid.

   1. a
   2. $c \rightarrow b$
   3. $(a \vee d) \rightarrow \sim b$
   4. $\sim b \rightarrow \sim d$

   $\therefore \sim(c \rightarrow d)$

5. Decide whether the following argument is valid or not. If you think it is invalid, provide a truth value assignment that proves your claim. Otherwise prove that the argument is valid.

   1. $p \rightarrow q$
   2. $m \vee s$
   3. $\sim s \rightarrow \sim r$
   4. $\sim q \vee s$
   5. $\sim s$
   6. $(\sim p \wedge m) \rightarrow u$

   $\therefore \sim u$

6. A CPSC 121 student had to prove if the following argument was valid or invalid.

   1. $r \vee \sim p$
   2. $\sim s \rightarrow \sim q$
   3. $r \rightarrow q$
   4. $p \wedge \sim s$

   $\therefore \sim p$

   The student decides that the argument in invalid and gives this proof:

01.	$r \vee \sim p$	
02.	$\sim s \rightarrow \sim q$	
03.	$r \rightarrow q$	
04.	$p \wedge \sim s$	
05.	p	Specialization from 04

   Is the student correct? If not, give the correct answer and explain why the student's proof is wrong.