CSc 245 Discrete Structures - Summer 2020

Quiz #2

Due: June 23rd, 2020 by 11:59 pm (MST)

1. **Quantifiers**(6pts): Consider the following predicate:

- $P(x, y)$: x can program in language y, $x \in$ People,$y \in$ Programming Languages
- $C(a)$: a is a CS major, $a \in$People
- $A(b)$: b is a popular language, $b \in$Programming Languages

(a) Convert the following statements into logic:

i. All CS majors can program in a popular language.

$\forall x \exists y\ C(x) \rightarrow (P(x, y) \wedge A(y))$ $x \in$ People, $y \in$ Programming Languages

ii. Sarah can program in exactly one language.

$\exists y\ (P(\text{Sarah}, y) \wedge \forall z(P(\text{Sarah}, z) \rightarrow (y = z)))$ $y, z \in$ Programming Languages

(b) Convert the following statements into English:

i. $(C(Tony) \wedge \neg P(Tony, Haskell)$

Tony is a CS major but he cannot program in Haskell.

ii. $\exists x, \exists y(\neg C(x) \wedge A(y) \wedge P(x, y))$

Someone who is not a CS major can program in a popular language.

2. **Arguments** (4pts): Consider the following premises and conclusion. First identify the propositions, assign them labels and convert the following statements into logic. Then use the Rules of Inference to prove that the conclusion must follow from the premises. Label the rule used at each step!

   David does not go swimming.
   If David does not go swimming or it is snowing, then it is cold outside.
   If David goes running, then it is not cold outside.
   If David does not go swimming and he does not go running, then he does not workout.

   David does not workout.

   s : David goes swimming.
   n : It is snowing.
   c : It is cold outside.
   r : David goes running.
   w : David works out.

(1)	$\neg s$	(Given)
(2)	$(\neg s \vee n) \rightarrow c$	(Given)
(3)	$r \rightarrow \neg c$	(Given)
(4)	$(\neg s \wedge \neg r) \rightarrow \neg w$	(Given)
(5)	$(\neg s \vee n)$	(Addition with (1))
(6)	c	(Modus Ponens (2) and (5))
(7)	$\neg r$	(Modus Tollens (6) and (3))
(8)	$\neg s \wedge \neg r$	(Conjunction of (1) and (7))
(9)	$\therefore \neg w$	(Modus Ponens (4) and (8))