CS 100 - Homework 6

Deadline:

11:00 am (the beginning of class) on MONDAY, October 15, 2018.

Purpose:

To practice thinking about propositional logic operations, and to practice using truth tables to determine the validity of arguments written in propositional logic form.

How to submit:

- Submit your work for this homework **ON PAPER** (with answers legibly hand-written or typed)
 - I will accept your work on paper ONLY, unless special arrangement is made. You may turn it in at the beginning of class, or into the Math/Computer Science department office (on the 3rd Floor of BSS, with instructions to place it into my mailbox) BEFORE the due date and time, in order to receive credit.
 - Make sure your name is at the top of each page of the document!

Problem 1 - 10 points

(adapted from course text, Exercise 10.1)

ASSUME for the sake of this problem the following:

- p = TRUE
- q = TRUE
- r = TRUE
- w = FALSE
- x = FALSE
- y = FALSE

For each of the following expressions, write the expression, and then determine and write whether it is TRUE or FALSE

- 1-1. $p^{\wedge}q$
- 1-2. p^{w}
- 1-3. x^{y}
- 1-4. $r \wedge q$
- 1-5. $x^{\wedge}r$
- 1-6. $w^{\wedge}y$

Problem 2 - 15 points

(adapted from course text, Exercise 10.2)

Determine the validity of the following arguments using truth tables. For each, you are required to:

- Write out the argument as given below.
- Make an appropriate truth table for that argument.
- ADD an asterisk by-or-above the column heading of each PREMISE in the truth table.
- ADD a C or (C) by-or-above the column heading of the CONCLUSION in the truth table.
- In the truth table, CROSS OUT the rows that you should for this process.
- Write your resulting determination whether the argument is valid or invalid after your truth table that has the appropriate rows crossed out.

2-1. p q $\therefore p^{n}q$ 2-2. $p^{n}q$ $\therefore q$ 2-3. r $\therefore q^{n}s$ 2-4. r $\therefore s$ 2-5. $r^{n}s$ $\therefore r$

Problem 3 - 10 points

(adapted from course text, Exercise 10.3)

ASSUME for the sake of this problem the following:

- a = TRUE
- b = TRUE
- c = TRUE
- x = FALSE
- y = FALSE
- z = FALSE

For each of the following expressions, write the expression, and then determine and write whether it is TRUE or FALSE

- 3-1. $\sim a^{\wedge} b$
- 3-2. $\sim x^{\wedge} \sim y$
- 3-3. $\sim (x \wedge y)$
- 3-4. $\sim (a \wedge b)$
- 3-5. $\sim z^{\wedge} \sim c$

Problem 4 - 20 points

(adapted from course text, Exercise 10.3)

Determine the validity of the following arguments using truth tables. For each, you are required to:

- Write out the argument as given below.
- Make an appropriate truth table for that argument.
- ADD an asterisk by-or-above the column heading of each PREMISE in the truth table.
- ADD a C or (C) by-or-above the column heading of the CONCLUSION in the truth table.
- In the truth table, CROSS OUT the rows that you should for this process.
- Write your resulting determination whether the argument is valid or invalid after your truth table that has the appropriate rows crossed out.

4-1.
$$\sim p$$

 q
 $\therefore \sim p^{\wedge} q$
4-2. $\sim p$
 $\sim q$
 $\therefore \sim (p^{\wedge} q)$
4-3. $\sim p^{\wedge} \sim q$
 $\therefore \sim (p^{\wedge} q)$
 q
4-4. $\sim (p^{\wedge} q)$
 p
 $\therefore \sim q$
4-5. $\sim (p^{\wedge} q)$
 $\sim p$
 $\therefore \sim q$

Problem 5 - 10 points

(adapted from course text, Exercise 10.4)

ASSUME for the sake of this problem the following:

- a = TRUE
- b = TRUE
- c = TRUE
- x = FALSE
- y = FALSE
- z = FALSE

For each of the following expressions, write the expression, and then determine and write whether it is TRUE or FALSE

5-1. $a \wedge b \wedge c$

- 5-2. $\sim (a \wedge b) \wedge c$
- 5-3. $(a^{h})^{h} \sim c$
- 5-4. $(b^{\land}x)^{\land}a$
- 5-5. $b^{\wedge} \sim (x^{\wedge} y)$

Problem 6 - 10 points

(adapted from course text, Exercise 10.6)

ASSUME for the sake of this problem the following:

- a = TRUE
- b = TRUE
- c = TRUE
- x = FALSE
- y = FALSE
- z = FALSE

For each of the following expressions, write the expression, and then determine and write whether it is TRUE or FALSE. (**Note**: "v" is the OR symbol)

6-1. $(c \to a) \lor (z \to c)$ 6-2. $\sim (b \to c) \land (\sim x \to \sim a)$ 6-3. $(a \to y) \to y$ 6-4. $(\sim z \to x) \to (\sim a \to \sim c)$ 6-5. $\sim (\sim c \to y) \to \sim (\sim b \to \sim z)$

Problem 7 - 25 points

(adapted from course text, Exercise 10.6)

Determine the validity of the following arguments using truth tables. For each, you are required to:

- Write out the argument as given below.
- Determine and write out the simple expressions in the argument, and assign letters to them.
- Rewrite the argument in propositional logic form.
- Make an appropriate truth table for that argument.
- ADD an asterisk by-or-above the column heading of each PREMISE in the truth table.
- ADD a C or (C) by-or-above the column heading of the CONCLUSION in the truth table.
- In the truth table, CROSS OUT the rows that you should for this process.
- Write your resulting determination whether the argument is valid or invalid after your truth table that has the appropriate rows crossed out.
- 7-1. If Bert is taking a bath, then Ernie is taking a bath. Ernie is not taking a bath. So, Bert is not taking a bath.

- 7-2. If the balloon can't float, then there is no helium in the balloon. The balloon can float. So, there is helium in the balloon.
- 7-3. If Lisa passed the final exam, then she passed the course. Lisa did not pass the final exam. So, she did not pass the course.
- 7-4. If the groundhog sees its shadow, then spring is coming in six weeks. So, if the groundhog doesn't see his shadow, then spring isn't coming in six weeks.
- 7-5. The game is on if the sun shines. The game is on and the team is excited. So, the sun must be shining.