# CS 2510 FALL 2020

**Homework #1, part 2 for 61 pts**

(to submit on iCollege)

Note: Homework #1, part 1 is on zyBooks – submit through there, for 39 pts

Please keep the format of the HW as given here: 1 problem per 1 page (but several subproblems are ok on 1 page).

Reminder: HW needs to be typed and submitted as pdf file (you can save as -> pdf)

# #1. [10 pts; 5 pts each]

Several forms of **negation** are given for each statement. Which are correct if any? Explain why and how you figured it out.

1. The carton is sealed or the milk is sour.
   1. The milk is not sour or the carton is not sealed.
   2. The carton is not sealed and also the milk is not sour.
   3. If the carton is not sealed, then the milk will be sour.

1. If you build it, they will come.
   1. If you build it, then they won’t come.
   2. You don’t build it, but they do come.

3. You build it, but they don’t come.

Solution:

a: 2nd is correct form of negation because of De Morgan’s law’s accurate application.

**b:** None of the are the exact opposite, as none of the statements state that not building implies not coming.

# #2. [12 pts; 2 pts for each of 6 subproblems]

Which rule of inference is used in each argument below?

1. Alice is a Math major. Therefore, Alice is either a Math major or a CSI major.

Addition.

1. Jerry is a Math major and a CSI major. Therefore, Jerry is a Math major.

Simplification.

1. If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed.

Modus ponens.

1. If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today.

Modus tollens.

1. If I go swimming, then I will stay in the sun too long. If I stay in the sun too long, then I will sunburn. Therefore, if I go swimming, then I will sunburn.

Hypothetical syllogism.

1. l go swimming or eat an ice cream. I did not go swimming. Therefore, I eat an ice cream.

Disjunctive syllogism

**#3. [16 pts; 2 pts for each of 8 steps explained]** You are given proof sequence. Justify each step in it (meaning, write down what rule was used to derive it, and from which previously obtained step(s) if applies).

Argument is: (s’  c)  (w → s) (w’ → t)  (t → h)→ h

**Proof sequence** *(you should substitute “?” with your reasoning)*

# StepReason

1. s’  c Hypothesis

1. w → s Hypothesis

1. w’ → t Hypothesis

1. t → h Hypothesis

1. s’ 1, Simplification

1. w ’ 2, 5 Modus tollens

1. t 4, Addition and Disjunctive Syllogism

1. h 7, Modus ponens

**#4. [23pts]** Use propositional logic to prove the following argument is valid.

If Alice gets the office position and works hard, then she will get a bonus. If she gets a bonus, then she will go on a trip. She did not go on a trip. Therefore, either she did not get the office position or she did not work hard or she was late too many times.

* 1. Define your propositions [2 points]:

O = “Alice gets the office position”

W = “If Alice works hard”

B = “She will get a bonus”

T = “She will go on a trip”

L = “She was late too many times”

O’ = “Alice did not get the office position.”

W’ = “Alice did not work hard”

B’ = “She will not get a bonus”

T’ = “She will not go on a trip”

L’ = “She was not late too many times”

* 1. Write down the logical *argument* [8 points]:

(O  W) 🡪 B  (B 🡪 T)  T’ 🡪 (O’ V W’ V L)

* 1. Proof sequence [13 points]:

Steps: Reason:

1. (O  W) 🡪 B Hypothesis

2. B 🡪 T Hypothesis

3. T’ Hypothesis

4. B’ 2, 3 Modus tollens

Let (O  W) = U

5. U 🡪 B  B’ 1,4 Substitution

6. U’ 5, Modus Tollens

7. O’ V W’ 6, De Morgan’s law

8. (O’ V W’ V L) 7, Addition