Guideline

Homework for Week 02

Please submit your solutions as a single PDF on Brightspace.

Multiple submissions are allowed before the due time; the last submission will be graded.

Grading Criteria

- Grading will be *highly strict*, with minimal tolerance for mistakes or misconduct.
- Factual grading errors will be corrected, but partial grading decisions will not be negotiable.
- If the solution appears to be plagiarized or AI-generated, the issue will be reported to the instructor.

Exercise 1 (points = 10)

Prove that the following are equivalent using truth tables:

1. **Distributive Law**
    - $p \wedge (q \vee r)$
    - $(p \wedge q) \vee (p \wedge r)$
2. **Absorption Law**
    - $p \vee (p \wedge q)$
    - p

Exercise 2 (score = 30)

Use truth tables to determine whether the arguments below are valid. Explanation is needed (e.g. based on the truth table).

(1)

- Premises: p -> q, ~p -> ~q
- Conclusion: p \/ q

(2)

- Premises: p \/ q, p -> ~q, ~r -> ~p
- Conclusion: r

(3)

- Premises: p, ~q -> ~p, ~q \/ r
- Conclusion r

(4)

- Premises: p/\q -> ~r, p \/ ~q, ~q -> p
- Conclusion: ~r

(5)

- Premises: p -> r, q -> r
- Conclusion: (p \/ q) -> r

(6)

- Premises: p -> (q \/ r), ~q \/ ~r
- Conclusion: ~p \/ ~r

Exercise 3 (points = 50)

Below are some arguments. For each argument, determine whether or not it is valid. If it is valid, your answer needs to be "Valid", and the name of the rule needs to be given. If it is invalid, your answer needs to be "Invalid" and explanation is not needed in that case.

A.

1. If Jane has a cat, then Jane has a pet
2. Jane has a cat
3. Therefore, Jane has a pet

B.

1. If Jane has a cat, then Jane has a pet
2. Jane has a pet
3. Therefore, Jane has a cat

C.

1. If Jane has a cat, then Jane has a pet
2. It is not the case that Jane has a pet
3. Therefore, it is not the case that Jane has a cat

D.

1. If Jane has a cat, then Jane has a pet
2. It is not the case that Jane has a cat
3. Therefore, it is not the case that Jane has a pet

E.

1. If pigs fly, then hell has frozen over
2. Pigs fly
3. Therefore, hell has frozen over

F.

1. I like chocolates
2. Therefore, we like chocolates

G.

1. If the Professor is sick, the class will be canceled
2. If the class is canceled, the students will be happy
3. Therefore, if the Professor is sick, students will be happy

H.

1. If Rufus is a human being, then Rufus has a right to life
2. It is not the case that Rufus is a human being
3. Therefore, it is not the case that Rufus has a right to life

I.

1. Amy joins the Army, or Mary joins the Marines
2. It is not the case that Mary joins the Marines
3. Therefore, Amy joins the Army

J.

1. I like Bulgogi
2. Therefore, I like Bibimbap and Bulgogi

Exercise 4 (points = 10)

Use inference rules to show the following argument is valid. To assist your writing, you can provide a list of sentences that look like this: `From "...", we have "..." following "..."`. Example: From premises "p" and "p->q", we have "q" following the inference rule "Modus Ponens".

Premises

- p ∨ q
- q -> r
- p ∧ s -> t
- ~r
- ~q → u ∧ s

Conclusion

- t