Guideline

Homework for week 02. Due: 23h59 on Thursday, 2023-09-14.

Please submit your solutions in a single PDF on Brightspace.

Typewriting is preferred; If you're writing by hand, please ensure your handwriting is legible.

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

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 = 20)

Determine whether the arguments below are valid. Explanation is needed based on the truth table.

(1)

- premises: p -> q, q
- conclusion: p

(2)

- premises: p-> q, ~p
- conclusion: ~q

(3)

- premises: p-> q, p
- conclusion: q

(4)

- premises: p-> q, ~q
- conclusion: ~p

Exercise 3 (score = 10)

Prove the two statement forms below are logically equivalent using equivalence laws only. State at each step the law used. Be patient because it may involve much calculation.

- (p -> q) /\ (q -> r) /\ (r -> p)
- (~p /\ ~q /\ ~r) \/ (p /\ q /\ r)

Exercise 3 (score = 60)

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