Intro logic: midterm exam 2025

Version 2 – for makeup exam

INSTRUCTIONS: (1) Please note that there are exam questions on the front and the back of this sheet. (2) You have 80 minutes to complete the exam. (3) Please write your **name** and **preceptor's name** and **honor pledge** on the front of the exam booklet. (4) The only resource you may consult is your prepared page of notes. (5) You may use additional exam booklets to write scratch work.

A. Translation

Translate the following sentences into propositional logic. In each case, clearly indicate what letters you are assigning to atomic sentences. (2 points each)

1. Either Bob gets a front-row seat, or if Bob does not go with friends then Bob will not enjoy the concert.

2. If David does not exercise regularly or does not eat healthy meals, then David will not maintain good health.

3. Carla will increase her chances of admission only if Carla submits her application early and asks for strong recommendation letters.

B. Semantics (truth tables)

1. For each of the following sentences, state whether it is a tautology, contingency, or inconsistency, and justify your claim in terms of truth tables. (3 points each)

   (a) $P \to (Q \to (R \to (S \to P)))$

   (b) $(P \wedge Q) \vee (\neg P \wedge \neg Q)$

2. For each of the following arguments, state whether it is valid or invalid, and justify your claim in terms of truth tables. (3 points each)

   (a) $P \to Q \vdash P \to (Q \wedge R)$

   (b) $Q \to R \vdash (P \vee Q) \to (P \vee R)$

C. Proofs

Prove the following. Besides the basic rules, you may also use cut and replacement, but only if you include a proof of the relevant "lemma" in your exam booklet. (4 points each)

1. $P, \neg P \vdash Q$
2. $P \vee Q, \neg P \vdash Q$
3. $\neg P \to Q \vdash P \vee Q$
4. $(\neg P \vee Q) \to (P \vee Q) \vdash P \vee Q$

D. Conceptual

1. Is there a correctly written proof with the following line fragment? Justify your answer by showing that the relevant argument is valid or invalid, and by invoking soundness or completeness. The symbol "$\varnothing$" means no dependency numbers. (4 points)

   $\varnothing \quad (n) \quad ((P \to Q) \to \neg P) \to \neg P$

2. Suppose that φ and ψ are contingencies. Can $\varphi \to \psi$ be a tautology, contingency, or inconsistency? Justify your answers. (4 points)

END