

Surname: _____

First Name: _____

INSTRUCTIONS This exam covers units 1-6 and is weighted with a maximum of **42 points (pt)** from a total of **100 pt** in the whole course (Unit 7 is not covered in the exam and weights 8 pt). For the test, use the original statement sheet and avoid corrections or unclear marking (ask for a new blank sheet if needed). **Completion time = 2 hours.**

— EXAM —

Exercise 1 (20pt). Each question may have $n \geq 1$ correct answers. For each question: Checking all correct answers = **5pt**; Checking only correct answers, but not all = **3pt**; Checking an incorrect answer = **-3pt**; Leaving blank = **0pt**. A total negative score in Exercise 1 counts as 0% in the rest of the exam.

1.1) Mark those formulas below that are tautologies in classical propositional logic:

- $p \rightarrow (p \rightarrow p)$
- $(p \rightarrow p) \rightarrow p$
- $q \wedge \neg p \leftrightarrow \neg(p \rightarrow q)$
- $p \wedge \neg p \rightarrow q$

1.2) Mark those clauses that “occur in” (that is, can be derived from) the transformation of $(p \wedge \neg q \leftrightarrow r)$ into Conjunctive Normal Form (CNF)

- $\neg p \vee q \vee r$
- $\neg r \vee p$
- $\neg r \vee q$
- $p \vee \neg q \vee r$

1.3) Given the following logic program $\boxed{p :- \text{not } q, r. \quad r :- \text{not } p.}$

- the reduct with respect to $\{q\}$ is the program $\boxed{p :- r. \quad r.}$
- the reduct with respect to \emptyset is the program $\boxed{p :- \text{not } q, r. \quad r :- \text{not } p.}$
- the reduct with respect to $\{p\}$ is the program $\boxed{p :- r.}$
- the reduct with respect to $\{p\}$ is the program $\boxed{p :- r. \quad r.}$
- the reduct with respect to $\{p, q\}$ is the program $\boxed{\quad}$

1.4) Which of the following interpretations satisfy the formula $p \rightarrow \neg q$ in the logic of Here-and-There:

- $H = \emptyset, T = \{p\}$
- $H = \{p\}, T = \emptyset$
- $H = \{q\}, T = \{q\}$
- $H = \{p\}, T = \{p, q\}$

Exercise 2 (5pt). A logic program contains an extensional database with facts for two predicates with the following meanings: `teaches(P,C)` = “professor P teaches course C”; `enrolled(S,C)` = “student S is enrolled in course C”. Write a rule (**without aggregates**) to obtain in `query(S)` the students S enrolled to more than one course taught by professor `enrique`.

```
query(S) :-
```

Exercise 3 (5pt). A logic program is used to compute several answer sets with a predicate `assigned(C,R,N)` meaning that course C is assigned classroom R for N hours. Write a `#minimize` clause to minimize the total number of hours assigned to classroom 25.

Exercise 4 (12pt). A player of straight **poker** receives 5 cards at the beginning of the game. Write an ASP program that generates all possible initial hands (for a single player) with a **full house**, that is, three cards with the same rank x , plus other two cards with the same rank y different from x . Use predicate `hand(R,S)` meaning that we get a card with rank R for suit S. For instance `hand(2,diamonds)` means we got the 2 of diamonds.

```
suit(club;diamond;spade;heart).  
rank(2..10;jack;queen;king;ace).
```

```
#show hand/2.
```