

1DV517 — Assignment 3 — Theoretical Tasks (2021)

- Please submit your solutions in a single .pdf file in addition to the commented Prolog files. Submit each file separately in **uncompressed** format. Only typed solutions will be accepted. The deadline for submissions is **20 May 2021**.
- *Reports that do not comply with the aforementioned requirements will not be considered.*

Problem 1 (20 points) There are five boxes (A,B,C,D,E) in two colors: red or blue.

- Either C is blue or B is red.
- Either D or E but not both are red.
- If A is red, then D is not blue.
- E is red if and only if C is not blue.
- If B is red, then both A and C are red.

For this question, you should:

1. Specify each of the above statements in propositional logic (Write down the meaning of each proposition that you use in the specification).
2. Use resolution or truth table to determine the possible color of each box.

Problem 2 (30 points) **We define a program as a collection of methods invoking each other. Each program has exactly one entry point that is a method called by the user to run the program. An entry point cannot be invoked by other methods. A program should have some sinks that are accessible from the entry point. A sink is a method that may provide some output to the user. A program is invalid, if it does not satisfy any of the above conditions.**

1. Define required predicates to describe a program (You should identify the entities and the relations among them first). Write down the meaning of each predicate.
2. Formalize the bold sentences above in predicate logic.
3. An unused method is a method that cannot be accessed from the entry point. Write a formula in predicate-logic to describe an unused method (You may introduce a new predicate that is defined based on the predicates introduced in item 1).
4. Prove that any accessible method from an unused method is unused (Note that a method can be accessed directly or indirectly via several invocations).
5. Prove that if all sink methods are unused, then the program is invalid.

Problem 3 (20 points) Provide deductive proofs for the following exercises from the book:

1. Exercise 2.3- 9.d
2. Exercise 2.3-11.b
3. Exercise 2.3-11.c
4. Exercise 2.3-13.b