

QUESTIONNAIRE FOR STUDENTS

Name: \_\_\_\_\_

Do you speak English fluently? \_\_\_\_\_

What programming languages do you know? \_\_\_\_\_

What is your background (i.e., what and where did you study for your bachelor / specialist degree)?

PRELIMINARY (WITHDRAWAL) TEST

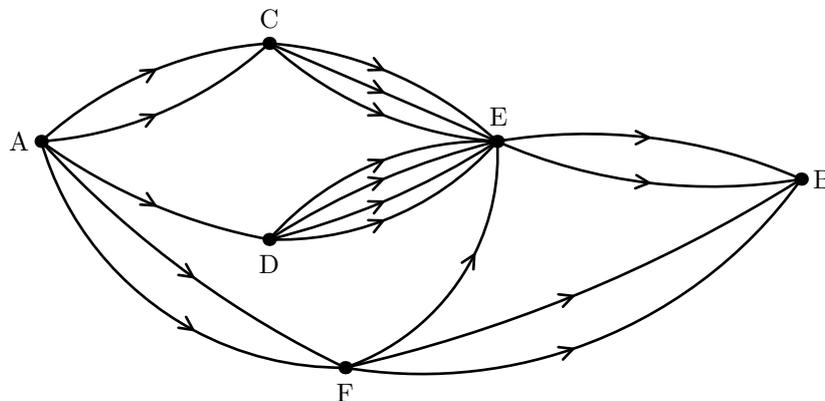
**1.a.** Rewrite the following formula in Conjunctive Normal Form:  $((r \rightarrow q) \rightarrow p) \rightarrow q$

**1.b.** Construct a propositional formula  $A$ , such that  $(p \rightarrow A) \equiv (q \rightarrow (\neg p \vee r))$  and  $((r \rightarrow q) \rightarrow p) \equiv (\neg p \rightarrow \neg A)$ .

**2.a.** Construct a first-order theory (set of closed formulae) in the signature  $\{=^2\}$ , that is true in all infinite interpretations and false in all finite ones.

**2.b.** Let  $T_1$  and  $T_2$  be first-order theories, and let  $T_1 \cup T_2$  be an inconsistent theory. Prove that in this case there exists such a formula  $A$ , that  $T_1 \vdash A$  and  $T_2 \vdash \neg A$ .

**3.a.** Count the number of ways to get from A to B on the following roadmap:



**3.b.** Seven schoolchildren were playing a chess tournament in one round (each plays one game with each). Before the lunch break Ivan played 6 games, Anatoly played 5 games, Alex and Dmitry played 3 games each, Simon and Ilya played 2 games each, and Eugene played only one game. Whom did Alex play with before the lunch break?

**4.a.** Describe the set defined by the following regular expression:  $a(a+b)^*a$ , and construct a deterministic finite automaton for this language.

**4.b.** Describe the language defined by the following context-free grammar:  $S \rightarrow SF, S \rightarrow FF, F \rightarrow aFb, F \rightarrow c$ .

**4.c.** Construct a context-free grammar for the following language:  $\{a^k b^{k+m} a^m \mid k, m \in \mathbb{N}\}$ .

**5.** Write a program in Python that asks the user for a string and answers whether it is a palindrome. (A *palindrome* is a string that reads the same forwards and backwards.)

*Hint:* a string in Python is a list.