

QUIZ 9 (MATH2301, 2025)

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

UID: \_\_\_\_\_

(1) (6 points) Select either true or false.

(a) The intersection of two regular languages is a regular language.

True

False

(b) If the intersection of two languages is regular, then both of those languages have to be regular.

True

False

(c) If the smallest DFA that recognises  $L$  has 100 states, then the pumping lemma says nothing about strings of length 90.

True

False

(d) If a language is recognised by a DFA with 4 states, then the Myhill-Nerode equivalence relation has 4 equivalence classes.

True

False

(e) Let  $L = \{0^n 1^n \mid n = 1, 2, 3, \dots\}$ . A pumping lemma argument implies that any 10-state DFA that accepts  $0^{11} 1^{11}$  must also accept  $0^{12} 1^{12}$ .

True

False

(f) Let  $L$  be a language and  $L^c$  its complement. If  $x \sim_L y$  then  $x \sim_{L^c} y$ .

True

False

(2) (4 points) Let  $L$  be the language on the alphabet  $\{0, 1\}$  consisting of strings that are at least 2 letters long and whose 2nd letter is 1.

(a) Is  $L$  regular?

Yes

No

(b) Write 4 strings that represent 4 distinct Myhill-Nerode equivalence classes for  $L$ .

## 1. SOLUTIONS

(1) True or false.

(a) True

(b) False (for example, take the empty language and a non-regular language).

(c) True.

(d) False (at most 4)

(e) False.

(f) True.

(2)

(a) Yes, it is regular (regex:  $(0|1)1(0|1)^*$ ).

(b)  $\epsilon, 0, 00, 01$ .

- $z = \epsilon$  distinguishes the fourth from the first three.
- $z = 1$  distinguishes 0 from  $\epsilon$  and 00.
- $z = 01$  distinguishes  $\epsilon$  from the later three.