

CS 302  
QUIZ 4

5 April 2023

ANSWERS

(a)(4 pts)  $L_1 := (w \in \{0,1\}^* \mid w = 0^n 1^m 0^k ; n, m, k > 0)$  is **regular** and is represented by the regular expression  $E_1 = 0.0^*.1.1^*.0.0^*$

(b)(6 pts)  $L_2 := (w \in \{0,1\}^* \mid w = 0^n 1^m 0^n ; n, m > 0)$  is **not regular**. To use PL let  $N > 0$  be given and choose  $w = 0^N.1.0^N \in L_2$  ;  $|w| = 2N+1 > N$  and therefore by PL  $w = xyz$  where  $|xy| \leq N$  ;  $|y| > 0$  and  $xy^jz \in L_2$  for  $j=0,1,2,\dots$  and in particular for  $j=0$  ,  $xz \in L_2$  .

Hence  $xy = 0^p$  for  $p \leq N$  ;  $y = 0^q$  for  $q > 0$  and thus  $x = 0^{p-q}$  and  $z = 0^{N-p} 1 0^N$  and so

$xz = 0^{p-q} 0^{N-p} 1 0^N = 0^{N-q} 1 0^N \notin L_2$  since  $q > 0$  and  $L_2$  is not regular as a consequence of the PL.