CS 181 HW9 2021 CS181

YIQIAO JIN

TOTAL POINTS

8 / 8

QUESTION 1

1 Classify language **8 / 8**

✓ **- 0 pts** **Correct or nearly correct**

- 8 pts L is not an FSL.

- 2 pts y cannot contain a 1

- 2 pts String needs to start at p+1, since y could have length p.

- 7 pts This string can be pumped arbitrarily

Homework 9

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L is NOT a finite state language. We prove by contradiction using the **Pumping Lemma**.

Suppose L is an FSL. There exists an integer p (the pumping length), such that for all $s \in L$ $|s| \geq p$, there exists $x, y, z \in \Sigma^*$, such that $s = xyz$, and

- $|xy| \leq p$
- $|y| \geq 1$
- For all $p \geq 0$: $xy^pz \in L$

Consider the string $s = 0^{(p+1)}10^p10^{(p-1)}1...10^210^1$. According to the **Pumping Lemma**, the substring xy must have length no greater than p. So xy is contained within the prefix $0^{(p+1)}$, and y must be all 0's. Thus y is a consecutive series of 0's that is one of $0^p, 0^{(p-1)}, ...0^2, 0^1$.

Using the **Pumping Lemma**, we can pump down on s to get $s' = xy^0z = xz$. If $s \in L$, we should also have $s' \in L$. But no matter what the length of y is, the first run of 0's that starts with x must have a length that falls in the range $[1, p]$ (one of $0^p, 0^{(p-1)}, ...0^2, 0^1$).

Since all the runs with length 1 up to p are already present in the later part of the string, pumping down on s must yield another run of length within the range $[1, p]$, which becomes a duplicate run of that length. Thus, $s' \notin L$. This contradicts the **Pumping Lemma**.

Therefore, L is NOT a finite state language.

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