

Problem Set 5

Due by 4:30 p.m. on Monday, April 2

Problem 1 (40 points)

Define a function **DCS** (for “disjoint, correlated substrings”) from $\{0,1\}^* \times \{0,1\}^*$ to $\mathcal{P}(\{0,1\}^*)$ by: for all $x, y \in \{0,1\}^*$, **DCS**(x, y) is the set of all $w \in \{0,1\}^*$ such that:

- for all $u, v \in \{0,1\}^*$, if $w = uxv$, then y is a substring of u or v ; and
- for all $u, v \in \{0,1\}^*$, if $w = uyv$, then x is a substring of u or v .

Use the functions/algorithms given in the book to define a function/algorithm **dcuDFA** $\in \{0,1\}^* \times \{0,1\}^* \rightarrow \mathbf{DFA}$ such that, for all $x, y \in \{0,1\}^*$:

- $L(\mathbf{dcuDFA}(x, y)) = \mathbf{DCS}(x, y)$; and
- $\mathbf{minimize}(\mathbf{dcuDFA}(x, y))$ is isomorphic to $\mathbf{dcuDFA}(x, y)$.

Problem 2 (25 points)

In the file `ps5.sml`, define a Forlan/SML function

```
val dcsDFA : str * str -> dfa
```

that implements your definition of **dcuDFA**. (It doesn’t matter what **dcuDFA** returns if one or both of its arguments isn’t in $\{0,1\}^*$.) Thoroughly test your definition of **dcuDFA**. (Include a transcript of your Forlan session.) Email a copy of `ps5.sml` to me, in addition to including a listing of it as part of your solution to the problem set.

Problem 3 (35 points)

Prove that your definition of **dcuDFA** is correct.