

Lab 6 Write-Up Questions

2.b.i

```
re ::= union
union ::= intersect | union '|' intersect
intersect ::= concat | intersect '&' concat
concat ::= not | concat not
not ::= '~' not | star
star ::= atom | star '*' | star '+' | star '?'
atom ::= '!' | '#' | '.' | 'c'
```

2.b.ii

The parser breaks because the terminal characters should propagate to the right, which means that the parser will reach a non-terminal symbol on every recursive call of 're'—the problem is not shrinking with left-recursion.

2.b.iii

```
re ::= union
union ::= intersect unions
unions ::=  $\epsilon$  | '|' intersect unions
intersect ::= concat intersects
intersects ::=  $\epsilon$  | '&' concat intersects
concat ::= not concats
concats ::=  $\epsilon$  | not concats
not ::= '~' not | star
star ::= atom stars
stars ::=  $\epsilon$  | '*' stars | '+' stars | '?' stars
atom ::= '!' | '#' | '.' | 'c'
```

2.c.i

Typing Rules:

TypeRegExprLiteral

$$\frac{}{\Gamma \vdash /^re\$/ : \text{RegExpr}}$$

TypeRegExprTest

$$\frac{\Gamma \vdash e1 : \text{RegExpr} \quad \Gamma \vdash e2 : \text{string}}{\Gamma \vdash e1.\text{test}(e2) : \text{bool}}$$

Small-Step Operational Semantics:

Search1

$$\frac{e1 \rightarrow e1'}{e1.\text{test}(e2) \rightarrow e1'.\text{test}(e2)}$$

Search2

$$\frac{e2 \rightarrow e2'}{re1.\text{test}(e2) \rightarrow re1.\text{test}(e2')}$$

DoRegExprTest

$$\frac{b = \text{retest}(re1, s2)}{re1.\text{test}(s2) \rightarrow b}$$

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For the mini project, my partner (Alex Doran) and I decided to focus on a topic we learned previously in the semester. Our video tutorial will cover grammars: what they are, how they're used in PL, and everything we have learned about ambiguity, left versus right recursion, and precedence. Our plan is to start with the basic anatomy of a grammar and then move on to discuss how to learn whether a sentence is in a language based on a derivation or parse tree. From there, we will discuss how to tell from the derivations and parse trees whether the grammar is ambiguous and left or right associative. We are working on coming up with our own examples of grammars to go through. The video will be a mix of voiced-over PowerPoint slides and whiteboard work.