Answers

Name: Ubayd Khan (ubayd.khan@kcl.ac.uk)

(BSc) / MSci Year: 3

Programming Languages: Java, Scala, Python, Prolog, Haskell, JavaScript and Typescript, C++, C#, Go

Question 3:

$nullable([c_1, c_2, \ldots, c_n]) \stackrel{def}{=}$ false

$nullable(r^+) \stackrel{def}{=}$ nullable (r . r+)

$nullable(r^?) \stackrel{def}{=}$ true

$nullable(r_1 \,\&\, r_2) \stackrel{def}{=}$ nullable (r1) && nullable (r2)

$nullable(r^{\{n\}}) \stackrel{def}{=}$ if n == 0 true
else nullable (r . r {n-1})

$nullable(r^{\{..m\}}) \stackrel{def}{=}$ if m >= 0 true
else false

$nullable(r^{\{n..\}}) \stackrel{def}{=}$ if n == 0 true
else nullable (r . r {n-1...})

$nullable(r^{\{n..m\}}) \stackrel{def}{=}$ if n == 0 true
else false

$nullable(\sim r) \stackrel{def}{=}$! (nullable (r))

$der\, c\, ([c_1, c_2, \ldots, c_n]) \stackrel{\text{def}}{=}$ if $[c_1 \ldots c_n]$.contains(c) 1 else 0

$der\, c\, (r^+) \stackrel{\text{def}}{=}$ (der (c, r)) $\{1..\}$

$der\, c\, (r^?) \stackrel{\text{def}}{=}$ der (c, r) + 1

$der\, c\, (r_1 \,\&\, r_2) \stackrel{\text{def}}{=}$ (der c r_1) & (der c r_2)

$der\, c\, (r^{\{n\}}) \stackrel{\text{def}}{=}$ if $n == 0$ 0
else der (c, r) · $r^{\{n-1\}}$

$der\, c\, (r^{\{..m\}}) \stackrel{\text{def}}{=}$ if $m == 0$ 0
else (der (c, r) · $r^{\{n-1\}}$) + 1

$der\, c\, (r^{\{n..\}}) \stackrel{\text{def}}{=}$ if $n == 0$ 1
else (der c r) · $r^{\{n-1..\}}$

$der\, c\, (r^{\{n..m\}}) \stackrel{\text{def}}{=}$ if $n == 0$ && $m == 0$ 0
else if $n \geq 0$ (der c r) · $r^{\{n-1..m-1\}}$
else (der c r) · $r^{\{n..m-1\}}$

$der\, c\, (\sim r) \stackrel{\text{def}}{=}$ ~ (der c r)

Question 4:

$nullable(CFUN(f)) \stackrel{\text{def}}{=}$ false

$der\, c\, (CFUN(f)) \stackrel{\text{def}}{=}$ if f(c) 1
else 0

$c \stackrel{\text{def}}{=} CFUN($ (_) ⇒ _ == c $)$

$[c_1, c_2, \ldots, c_n] \stackrel{\text{def}}{=} CFUN($ (c) ⇒ $[c_1 .. c_n]$.contains (c) $)$

$ALL \stackrel{\text{def}}{=} CFUN($ (_) ⇒ true $)$

Question 5 ('mathematical' notation):

$$((([a\text{-}z\ 0\text{-}9\_.\text{-}]^* \cdot "." \cdot [a\text{-}z.]^{\{2..6\}}) + [a\text{-}z.]^{\{0..4\}})$$

Question 6:

1) (Yes) / No **2)** (Yes) / No **3)** Yes / (No) **4)** (Yes) / No

Question 7:

	r_1	r_2
1.	yes	yes
2.	no	no
3.	no	yes