Coursework 1

6CCS3CFL

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Question 1-

The email used is ruihan.ji@kcl.ac.uk
I mainly have my classes in Campus

Question 2-

I mainly use Java as programming language, but I can code in C++, Python, Typescript languages and of course Scala.

Question 3 and 4-

```
// the nullable function: tests whether the regular
// expression can recognise the empty string
def nullable (r: Rexp) : Boolean = r match {
  case ZERO => false
  case ONE => true
  case CHAR(_) => false
  case ALT(r1, r2) => nullable(r1) || nullable(r2)
  case SEQ(r1, r2) => nullable(r1) && nullable(r2)
  case STAR(_) => true
  case NTIMES(r, i) => if (i == 0) true else nullable(r)
  case RANGE(_) => false
  case PLUS(r) => nullable(r)
  case OPTIONAL(_) => true
  case UPTO(_, _) => true
  case FROM(r, i) => if (i==0) true else nullable(r)
  case BETWEEN(r, n, m) => if(n==0) true else nullable(r)
  case NOT(r) =>  !(nullable(r))
  case CFUN(r) => false
}

// the derivative of a regular expression w.r.t. a character
def der(c: Char, r: Rexp) : Rexp = r match {
  case ZERO => ZERO
  case ONE => ZERO
  case CHAR(d) => if (c == d) ONE else ZERO
  case ALT(r1, r2) => ALT(der(c, r1), der(c, r2))
  case SEQ(r1, r2) =>
    if (nullable(r1)) ALT(SEQ(der(c, r1), r2), der(c, r2))
    else SEQ(der(c, r1), r2)
  case STAR(r) => SEQ(der(c, r), STAR(r))
  case NTIMES(r, i) => if (i == 0) ZERO else SEQ(der(c, r), NTIMES(r, i-1))
  case RANGE(cs) => if(cs.contains(c)) ONE else ZERO
  case PLUS(r) => ALT(der(c, r),SEQ(der(c,r),PLUS(r)))
  case OPTIONAL(r) => der(c,r)
  case UPTO(r, i) => if(i == 0) ZERO else ALT(der(c,r), UPTO(r, i-1))
  case FROM(r, i) => if(i == 0) SEQ(der(c,r),FROM(r,i)) else SEQ(der(c,r),FROM(r, i-1))
  case BETWEEN(r, n, m) => if(m == 0) ZERO else if(n == m) SEQ(der(c,r), BETWEEN(r , n-1, m-1)) else if(n == 0) ALT(der(c,r), BETWEEN(r, n, m-1)) else BETWEEN(r, n-1,m-1)
  case NOT(r) => NOT(der(c,r))
  case CFUN(r) => if(r == false) ZERO else ONE
}
```

Question 5-

(((1 + [a-z0-9_ , -]$^{+}$) · ('.' · [a-z.]$^{\{2,6\}}$)) + [a-z.] $^{\{0,4\}}$) + (1 + [a-z.] $^{\{0,1\}}$)

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Question 6-

1- Yes
2- Yes
3- No
4- Yes

Question 7-

1- Can be matched for r1 and r2
2- Cannot be matched for r1 and r2
3- Cannot be matched for r1 but can be matcher for r2