Assignment 5 solution

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Question 1 :

b)

Let us define the equivalence of high-order function g and its CPS version g$ as follows:

For any CPS-equivalent parameters f1…fn and f1$...fn$

(g$ f1$...fn$ cont) is CPS-equivalent to (cont (g f1…fn))

Following this definition, we show that pipe$ is equivalent to pipe, by induction on the size of the list.

Base: N=1

(cont (pipe(f1$))) = (cont f1$)

(pipe$ f1$ cont) = (cont (lambda (x cont2) (f1$ x cont2))) = (cont f1$)

Induction step:

Assuming (pipe$ f1$ … fn$ cont) = (cont (pipe f1$ … fn$))

(pipe$ (f1$ … fn$ fn+1$ cont)) =

(pipe$ f2$ … fn+1$ (lambda (f2-n$) (cont (lambda (x cont2) (f1$ x (lambda (res) (fn2-n$ res cont2))))))) =

(

(lambda (f2-n$) (cont (lambda (x cont2) (f1$ x (lambda (res) (fn2-n$ res cont2)))))) (pipe f2$ … fn+1$)

)

= (cont (lambda (x cont2) ((pipe f2$ … fn+1$) x (lambda (res) (fn2-n$ res cont2))))

= (cont (f2-n$ (pipe f1$ f2$ … fn+1$))

= (cont (pipe f1$ … fn+1$))

<u>Question 2 :</u>

d)

reduce1-lzl: for a reduce of a finite lazy list

reduce2-lzl: for a reduce of one specific prefix of a given infinite lazy list

reduce3-lzl: for a reduce of each prefix of an infinite lazy list (as the case of Q2e)

g) Advantage: can be applied for any approximation level, in contrast to pi-sum which is fixed to one given ‘b’ limit.

Disadvantage: generates a lot of closures.

3.3 Proof tree [10 points]

Draw the proof tree for the query:

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?- path(a,b, P)
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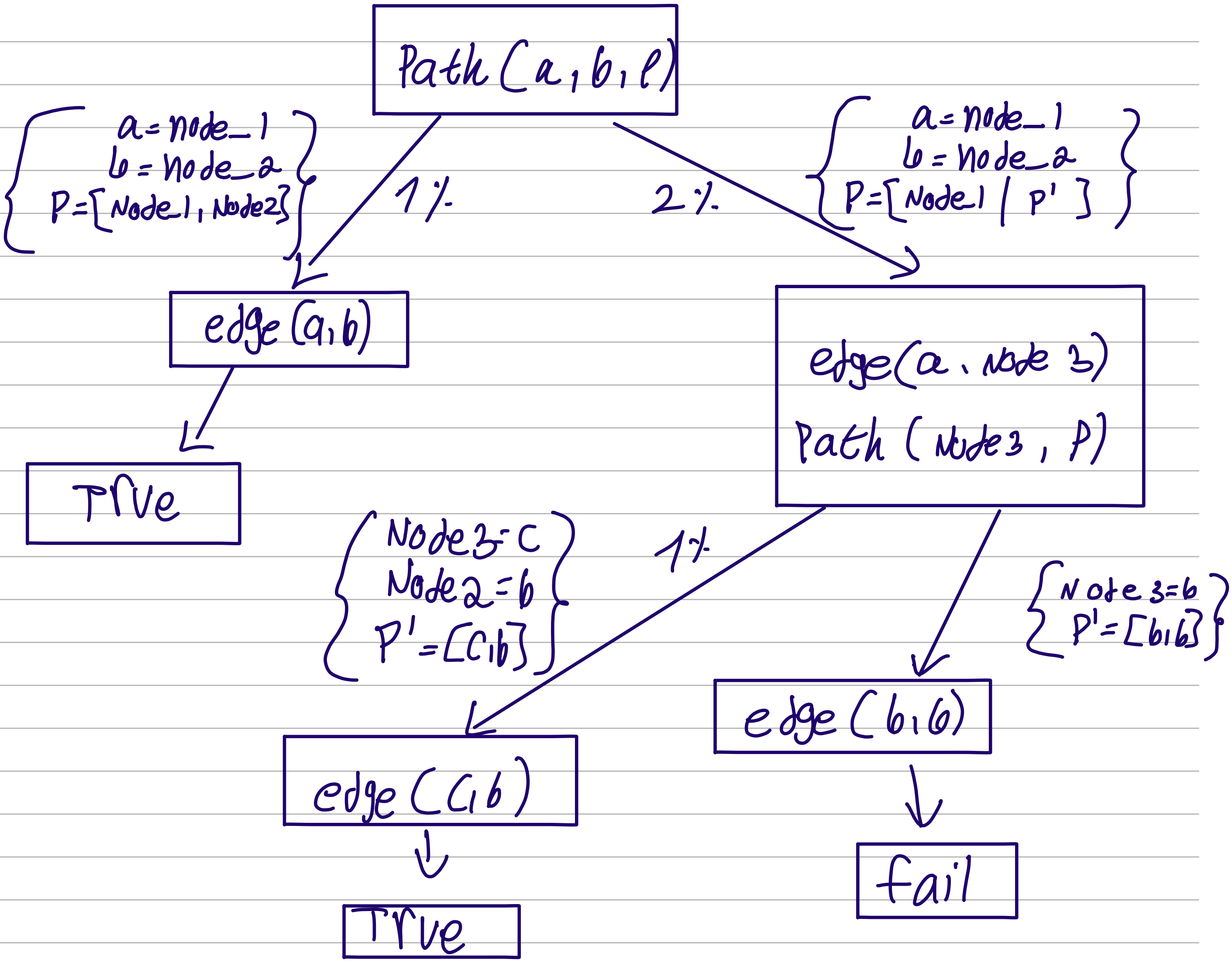
Is it a finite or an infinite tree?

Is it a success or a failure tree?



3.1 Unification [20 points]

What is the result of these operations? Provide algorithm steps, and explain in case of failure.

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1. unify[x(y(y), T, y, z, k(K), y), x(y(T), T, y, z, k(K), L)]

2. unify[f(a, M, f, F, Z, f, x(M)), f(a, x(Z), f, x(M), x(F), f, x(M))]

3. unify[t(A, B, C, n(A, B, C),x, y), t(a, b, c, m(A, B, C), X, Y)]

4. unify[z(a(A, x, Y), D, g), z(a(d, x, g), g, Y)]
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1) $S = \{\}$ $A = x(y(y), T, y, z, k(K), y)$

$B = x(y(T), T, y, z, k(K), L)$

(1) $S = S \circ \{T = y\} = \{T = y\}$

$A \circ S = x(y(y), y, y, z, k(K), y)$

$B \circ S = x(y(y), y, y, z, k(K), L)$

(2) $S = S \circ \{L = y\} = \{T = y, L = y\}$

$A \circ S = x(y(y), y, y, z, k(K), y)$

$B \circ S = x(y(y), y, y, z, k(K), y)$

Answer $S = \{T = y, L = y\}$

2) $S=\{\}$, $A=f(a,\mu,f,F,z,F,x(\mu))$, $B=(a,x(z),f,x(\mu),x(F),f,x(\mu))$

(1) $S=S\circ\{\mu=x(z)\}$

$A\circ S=f(a,x(z),f,F,z,f,x(x(z)))$

$B\circ S=f(a,x(z),f,x(x(z)),x(F),f,x(x(z)))$

(2) $S=S\circ\{F=x(x(z))\}$

$A\circ S=f(a,x(z),f,x(x(z)),z,f,x(x(z)))$

$B\circ S=f(a,x(z),f,x(x(z)),x(x(x,z))),f,x(x(z)))$

$S=S\circ\{x(x(x(z)))\}$

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4) $S=\{\}$, $f=z(a(A,x,y),D,g)$, $T=z(a(d,x,g),g,Y)$

(1) $S=S\circ\{a(d,x,g)=a(A,x,y)\}=\{d=A,\ g=y\}$

$f\circ S=z(a(A,x,y),D,Y)$

$T\circ S=z(a(A,x,y),Y,Y)$

(2) $S=S\circ\{y=D\}=\{d=A,\ g=D,\ Y=D\}$

$f\circ S=z(a(A,x,D),D,D)$

$T\circ S=z(a(A,x,D),\cancel{Y}D,D)$

Ans: $\{d=A,\ g=D,\ Y=D\}$

3) $S = \{\}$

$f = t(A, B, C, n(A, B, C), x, y)$

$g = t(a, b, c, M(A, B, C), x, y)$

(1) $S = S \circ \{a = A\}$

$f \circ S = t(A, B, C, n(A, B, C), x, y)$

$g \circ S = t(A, b, c, M(A, B, C), x, y)$

(2) $S = S \circ \{b = A\} = \{a = A, b = B\}$

$f \circ S = t(A, B, C, n(A, B, C), x, y)$

$g \circ S = t(A, B, c, M(A, B, C), x, y)$

(3) $S = S \circ \{b = A\} = \{a = A, b = B, c = C\}$

$f \circ S = t(A, B, C, n(A, B, C), x, y)$

$g \circ S = t(A, B, c, M(A, B, C), x, y)$

(4) $S = S \circ \{m(A, B, C) = n(A, B, C)\}$

$\Downarrow$

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Fail