Lazy List:

Q1- a-

Lazy list is defined by : LZl = EmptyLZl | Pair(T,Empty->LZl(T))

Two lazy lists : LZl1 ,LZl2 , are equivalent if:

1) if LZl1 is EmptyLZl => (LZl2 = LZl2) <=> LZl2 = EmptyLZl and vice versa

2) else:

LZl1 = Pair(x, Empty->L3)

LZl2 = Pair(y, Empty->L4)

than,

(LZl1 = LZl2) <=> (x=y) & ((Empty->L3 = Empty->L4 <=> L3 = L4))

Q1- b-

```
(define even-square-1
    (lzl-filter (lambda (x) (= (modulo x 2) 0))
        (lzl-map (lambda (x) (* x x))
            (integers-from 0))))
```

```
(define even-square-2
    (lzl-map (lambda (x) (* x x))
        (lzl-filter (lambda (x) (= (modulo x 2) 0))
            (integers-from 0))))
```

By the definition above even-square1 == even-square-2 if:

Lets mark : even-square-1 = Pair(x, Empty->Lzl1)

even-square-2 = Pair(y, Empty->Lzl2)

1) We'll show x=y:

(integers-from 0) returns a list (0, integers-from 1)
therefor, the computation ((x) (* x x)) on 0 will result in 0,
0%2 = 0, and therefor stands in the presicate and will be
included in the final list => x=0

(integers-from 0) returns a list (0, integers-from 1)
therefor, the computation x%2 on 0 will result in 0,
and after lzl-map we'll get that the first item in the final list is
0 since 0^2=0 => y=0

=> x=y

2) We'll show Empty->Lzl1 = Empty->Lzl2:

in even-square-1:

on each item x we'll get after calling next from (integers-from
x+1) ,

lzl-map will compute its square x^2 and after lzl-filter computation,the value
x^2 will return.

if and only if x^2%2 = 0, else, will compute the next value of lzl-map.

therefor the next item that return will be the square of the next even number in (integers-from x+1)

in even-square-2:
on each item y we'll get after calling next from (integers-from y+1) ,
lzl-filter will return y as the next value only if y is even (else will compute the next value from integers-from), after lzl-map computation,the value y^2 will return as the next value.
therefor the next item that return will be the square of the next even number in (integers-from y+1), we have already shown x=y => square of next even number in (integers-from y+1) and (integers-from x+1) are identical.

Q2- a-

For f:[x_1*..*x_n -> x_t] and f$:[$y_1$*..*$y_n$ * succ-cont * fail-cont -> y_t], a Success-Fail-Continuation version of it, we will say f=f$ iff:
For all x_1,..,x_n, and all succ,fail
(f$ x_1 … x_n succ fail) = (succ (f x_1 … x_n)) or (f$ x_1 … x_n succ fail) = (fail (f x_1 … x_n))

d-

Let assoc-list, key_x and succ-cont, fail-cont.
If key is in assoc-list:
There is pair in assoc-list <key_x,val_x>, and
(get-value assoc-list key_x) = val_x ⇔
(succ-cont (get-value assoc-list key_x)) = (succ-cont val_x)
And (get-value$ assoc-list key_x succ-cont fail-cont) = (succ-cont val_x)
So –
(succ-cont (get-value assoc-list key_x)) =
(get-value$ assoc-list key_x succ-cont fail-cont).
If key is not in assoc-list:
(get-value assoc-list key_x) will fail so the output will be
(fail-cont (get-value assoc-list key_x)), and get-value$ will fail, because it's the same list, so fail-cont will be activated so –
(fail-cont (get-value assoc-list key_x)) =
(get-value$ assoc-list key_x succ-cont fail-cont).

-Q3.1

a. Unify [t(s(s), G, H, p, t(E), s) , t(s(H), G, p, p, t(E), K)] :

Equations	Sub
~~t(s(s), G, H, p, t(E), s) = t(s(H), G, p, p, t(E), K)~~	{}

Equations	Sub
~~s(s) = s(H)~~	{}
G=G	
H = p	
p = p	
t(E)=t(E)	
s=K	

Equations	Sub
G=G	{}
H = p	
p = p	
t(E)=t(E)	
s=K	
s=H	

Equations	Sub
~~G=G~~	{}
H = p	
p = p	
t(E)=t(E)	
s=K	
s=H	

Equations	Sub
~~H = p~~	{ H = p }
p = p	
t(E)=t(E)	
s=K	
s=H	

Equations	Sub

~~p = p~~	{ H = p }
t(E)=t(E)	
s=K	
s=H	

Equations	Sub
~~t(E)=t(E)~~	{ H = p }
s=K	
s=H	
E=E	

Equations	Sub
~~s=K~~	{ H = p, K = s }
s=H	
E=E	

Equations	Sub
~~s=H~~	{ s = p, K = s, s=H}
E=E	

s=p is two different constant symbols, algorithm FAIL.

b. Unify [g(c, v(U), g, G, U, E, v(M)), g(c, M, g, v(M), v(G), g, v(M))]

Equations	Sub
~~g(c, v(U), g, G, U, E, v(M))= g(c, M, g, v(M), v(G), g, v(M))~~	{}

Equations	Sub
~~c=c~~	{}
v(U)=M	
G=v(M)	
U=v(G)	
E=g	
v(M)=v(M)	

Equations	Sub
~~v(U)=M~~	{M=v(U)}

G=v(M)	
U=v(G)	
E=g	
v(M)=v(M)	

Equations	Sub
~~G=v(M)~~	{M=v(U),G=v(v(U))}
U=v(G)	
E=g	
v(M)=v(M)	

Equations	Sub
~~U=v(G)~~	{M=v(U),G=v(v(U)),U=v(v(v(U)))}
E=g	
v(M)=v(M)	

U=v(v(v(U))) is fail due to the Occurs-check, recursive definition of U.

c. Unify [s([v|[[v|V]|A]]), s([v|[v|A]])]

<table>
<tr><th>Equations</th><th>Sub</th></tr>
<tr><td>~~s([v|[[v|V]|A]]) = s([v|[v|A]])~~</td><td>{}</td></tr>
</table>

<table>
<tr><th>Equations</th><th>Sub</th></tr>
<tr><td>~~[v|[[v|V]|A]] = [v|[v|A]]~~</td><td>{}</td></tr>
</table>

<table>
<tr><th>Equations</th><th>Sub</th></tr>
<tr><td>~~v= v~~</td><td>{}</td></tr>
<tr><td>[[v|V]|A] = [v|A]</td><td></td></tr>
</table>

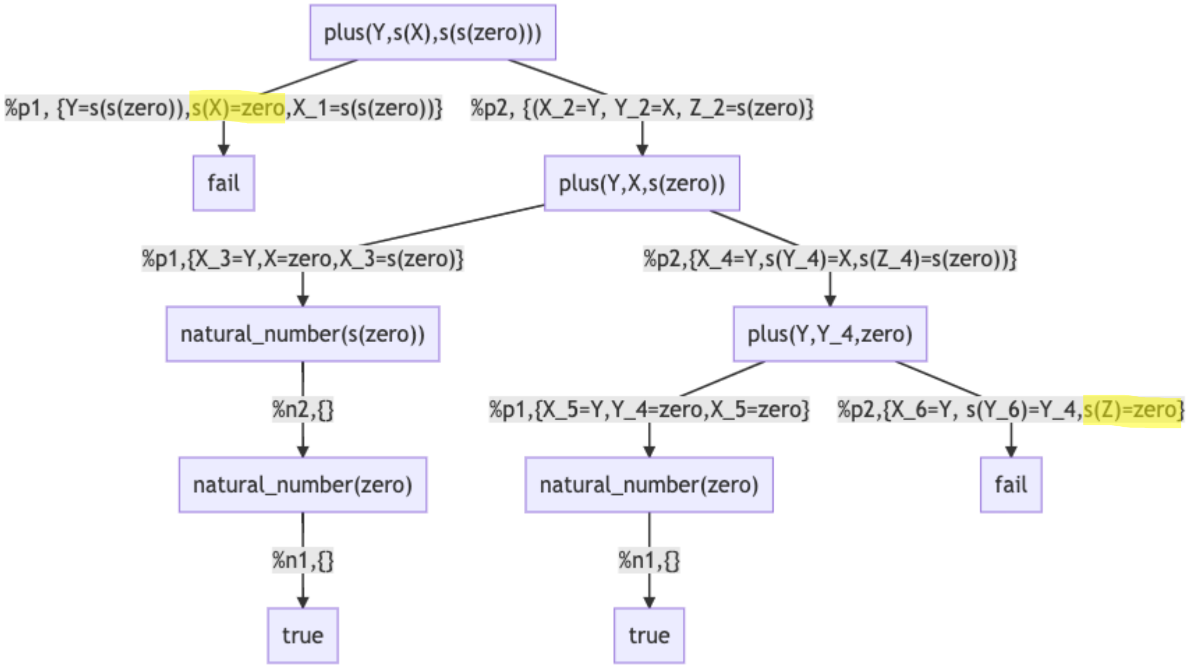
<table>
<tr><th>Equations</th><th>Sub</th></tr>
<tr><td>~~[[v|V]|A] = [v|A]~~</td><td>{}</td></tr>
</table>

<table>
<tr><th>Equations</th><th>Sub</th></tr>
<tr><td>~~[v|V] = v~~</td><td>{}</td></tr>
<tr><td>A=A</td><td></td></tr>
</table>

v=[v|V] is fail due to the Occurs-check, recursive definition of v.

Q3.3

a-



** There is no assignment of X that will satisfies the equation ‘s(X)=zero’.

b- The answers for the query ?-plus(Y,s(X),s(s(zero))) is:
{<Y=zero, X=s(zero)>, <Y=s(zero), X=zero>}.

c- This is a success tree, because it has at least one path that leads to “true” node.

d- The tree is finite, all its paths are ending in a leaf, no infinite paths.