Question 2:

a) Two generators will be equivilent to each other iff for each step i and 2 values V_1, V_2 generated in the 2 generator in the ith step, $V_1 = V_2$.

c) We will proof by induction on i the number of steps:

Base Case i=1:

In Fib1 res = 1 in the first step. Therfore Fib1.next.value = 1.

In Fib2 the value is $\frac{\varphi^1 - \psi^1}{\sqrt{5}} = \frac{\frac{1+\sqrt{5}}{2} - \frac{1-\sqrt{5}}{2}}{\sqrt{5}} = 1$. Base Case holds

We will assume the claim holds for the jth steps $j < i$.

In Fib1, res = num1 + num2 = fib1(i-2) + Fib1(i-1)

In Fib2, value: $\frac{\varphi^i - \psi^i}{\sqrt{5}} \overset{*}{=} \frac{\varphi^{i-1} + \varphi^{i-2} - (\psi^{i-1} + \psi^{i-2})}{\sqrt{5}} =$

$\frac{\varphi^{i-1} - \psi^{i-1}}{\sqrt{5}} + \frac{\varphi^{i-2} - \psi^{i-2}}{\sqrt{5}} = \text{Fib2}(i-2) + \text{Fib2}(i-1)$

* By identity $\varphi^i = \varphi^{i-1} + \varphi^{i-2}$, $\psi^i = \psi^{i-1} + \psi^{i-2}$

By I.A Fib1(i-1) = Fib2(i-1) and Fib1(i-2) = Fib2(i-2).

Therfore, Fib1(i) = Fib1(i-1) + Fib1(i-2) = Fib2(i-1) + Fib2(i-2) = Fib2(i) ∎

```
(define append$
  (lambda (x y cont)
    (if (empty? x)
      (cont y)
      (append$ (cdr x) y
        (lambda (append_res)
          (cont (cons (car x) append_res)
```

Question 3

(b) We'll prove that (append$ lst1 lst2 cont) = (cont (append lst1 lst2)) using induction on lst1 length

Base Case: lst1 = '()

for any lst2:

(append$ '() lst2 cont) = (cont (lst2)) = (cont (append '() lst2))

Assumption: Assume that for lst1 in length n<k and any lst2 (append$ lst1 lst2 cont) = (cont (append lst1 lst2)) holds. (k>0)

Induction Step: We'll prove that the claim holds when lst1 length is k.

(append$ lst1 lst2 cont) =

length of cdr lst1 = k-1 < k and therefore the assumption is valid

= (append$ (cdr lst1) lst2

(lambda (append_res) (cont (cons (car lst1) append-res)))) =

= (lambda (append_res) (cont (cons (car lst1) append_res)))

(append (cdr lst1) lst2)) =

= (cont (cons (car lst1) (append (cdr lst1) lst2))) =

= (cont (append lst1 lst2))

As required.

Question 5.1

a) $Unify[t(s(S), G, s(U), p, t(K), S), t(s(G), G, K, p, t(K), U)]$

$t(s(S), G, s(U), p, t(K), S)$

$t(s(G), G, K, p, t(K), U)$

$\downarrow$

	subtitution
$s(S) = s(G)$ $G = G$ $s(U) = K$ $p = p$ $t(K) = t(K)$ $S = U$	$\{\}$
פסלן אותו → $G = G$ $s(U) = K$ $p = p$ $t(K) = t(K)$ $S = U$	$\{G = S\}$
$s(U) = K$ $p = p$ $t(K) = t(K)$ $S = U$	$\{G = S\} \circ \{K = s(U)\}$
פסלן אותו → $p = p$ פסלן אותו → $t(K) = t(K)$ $S = U$	$\{G = S, K = s(U)\}$
	$\{G = S, K = s(U)\} \circ \{U = S\}$ $\Downarrow$

$MGU = \{G = S, U = S, K = s(S)\}$

b) unify[p([[W|V]|[V|K]]), p([[v|V]|W])]

substitution

$[[W|V]|[V|K]] = [[v|V]|W]$ $\qquad \{\}$

↓ היפוך

$[W|V] = [v|V]$ $\qquad \{\}$

$[V|K] = W$

↓ היפוך

$W = v$ $\qquad \{\}$

$V = V$

$[V|K] = W$

פשוט [illegible] $V = V$ $\qquad \{W = v\}$

$[V|K] = W$

↓ הצבה

$[V|K] = v$

סתירה, v הוא אטומי ולא יכול לייצג רשימה. //