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

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

* 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//