Popl Arignment 2 190530005 Aryan Agarwal (dy.y) (dy.yy) (ax.xa) (=) (23) (28. Ah) (4x. xa) - [: B-reduction replace y with of 99] =) (2y.yy) (2x. 29) C. B. reduction replace y with Ax. 29] =) (dx. xa) (dx. xa) [-. B. Teduction replace I with 12.20] 2) (Ax · 29) a [-, b-reduction raplace x with a] na a (13-3) (-13-33) (23-33) コ)(より)(より)(より) [: B reduction steplace z with dz. 23] 3 23 (24.38) [. p-neduction replace z with 2.29]

(. B-reduction replace z with 2.39) =) (3·33)y [. B reduction replace z with y] (da a) 6 2) (qx.fy. xyg) (xo.a) 6 [. B-Mediction replace or with 19.9] >) Ay. (da.9) yy) b [: B-reduction replace y with 6] (1a.a) 66 [: B-reduction replace a with 6] (d) (dx.dy. xya) (dy.g)y = (1x. 79. x32) (43.3) B [: J - Convoision Mensume 2) (Ax. 2a. xaa) (dy.g) g .. [B-reduction replace re with of y]

3 (43 39) (43 34)

3 (da (Hy y) aa) y [. B reduction replace a custing] =) (49 9) 99 [B-Meduction replace of with y] @ (Ax. (Ag. (xg)) y)z >) (dx-(2y.(xy))y)y [-d - Convolsion rename y to.a] \$ [4x.(4a.(29))8)3 [: . B - neduction replace & with 3]) (da. (ya))y [: B-reduction replace a with y] (12.7x) (1y.yx) 3 J (4x. 1(x) (4y. 4x) 3 [: B-reduction replace & with 29.92]

a) (49.9x) (25 3) C.: B-reduction gyla replace y with 2) J XXZ 100 det add 5xg it iszero y else f (succ x) (pred y) $0 Y = df \cdot (dx \cdot f(xx)) (dx \cdot f(xx))$ Yadd = add (xadd) = df. dx. dy. (if isgoro y then x else. f (succ x) (predy)) (Yadd) [. B-neduction replace of with (Yadd) = 17.7y. (it is yero y then x else (Yadd)
(Succ x) (pred y)) The function we derived takes & and y as parameters. We have to make it concrete and me will do that by evaluating above function with concrete values 1 and 1

[... B-reduction replace of with Ly. yx]

2(49.9x) (49.9x) 3

Yadd 11: add (Yada) 11 - If. Ix by lit iszero y then x else f (succz) (predy)) (Yadd) 11 Substitution replace of with Yadd - Lx. Ly (if issero y then x else (Yadd) (succ x) (pred y)) 11 [. B-reduction replace is with 1]. =) 19 (if iszero y men 1 else Yadol (suecl) (bredy))1 [. p. reduction replace y with () = (if ibzono / Then I else Y add (Succ)) (pred)). c (it is good I then I else Y add 20) [: " pred 4 = 0] [Jucc 1 = 2] = Yadd 20 = add (Yadd)20 = If. Ix. Iy (if iszero y then redoe f (succ x) (pred y)) Yadd 20

= dx.dy. (if issproy then x else fadd (succ x (pred y))20
: [by preduction replacing of with fadd)
= (it isrger o than 2 else Y add (succe) (pred 0))
(by (i) B-neduction replacing & with 2 (ii) B-neduction neplacing y with 0)
= (it isgers 0 then 2 else tadd 3-1) = 2
(((() (dg. (dx. ((fx) (gx)))) (dm.(dx. (nm)))) (dm.(dx. (nm))))
C. B. neduction replace of with (Im. Can. Con
=) (((dg.(dx.(((dm.(dn.(dn m)))x)(gx)))) (dn.3)
[Breduction g with (dng)]
=) ((dx. (((dm. (dh. (nm)))x)((dn. y)x))) b) (B-reduction replace n with x in)]
C. B-reduction replace in with it in]

-) ((dx. (((dm. (dn. (nm)))x) 3)/b) [... B-neduction replace m with x in J (Cdx. (Cdn. (2x)1)3)) [: p-reduction replace in with 3] =) ((dx.(3x)/b) [. B-reduction neplace x custs b] 3 3 p