141 Reasoning About Program 2019 Exam

1 a Nd Nd Box NdBoxBox Box

b i P BoxAtte tr BT PchHPCtr PNd t tr VfiBT.PE

ii httBTQCBox 4 AVh.triBTLVth.BEQth ti A Qtr 4 Vt'iBTQNd t ta t

Vt B1ft'sBT Qu t

c CA is a special case of B when t Hi

B becomesa UtiBT check t t e t rev t

UtiBT check t t Palin I UtiBT checkPalin t PalinCts UtiBT Palin checkPalin t 1

Noticethat i check e t E checkPalin l Proof is as followsi

when t Box checkPalin Baxc True Bydef of checkpalin

checkBoxBox True Bydefof check when te Nd tr th checkPalin Nd th th check tr th Bydefcheckpalin

check Nd th th Nd EL th

checkt2 t2 check EL te Bydefof check check th th By def of operator

since check tr th check th te we proved that B A

This could be significantly shortened d To show that VE t BT check t t e Es rev E we need to

prove Vt'sBTCcheck Box tk Box rev e A 04 4 BT ftBTcheck title 4 rev 4 AVEBT check tr tie tearer e'I VEeBT checkcarde 4 E

e Nd e tr rents

Base eases to show Vt BTCcheck Box tk Box rev e

Take a random t EBT if E Box by definition both sides hold

by th Tf teNd tr tr by definition both sides are false

Hence they are equivalent to each other and base case holds Inductive steps Induction hypothesis T4 12 BThttBTcheck title 4 rev t AVeleBT

check tr tie tearer e'I

We need to show Vt'eBT checkcard4 4 E Nd t rent

Take a random t ti tr Ez tye BT

If t Box check Nd tr tr Box False

row Box Box Nd t tr fRevBox

Hence both sides are false If t Nd to trya cheek and 4 tr Nd to try

check 4 tee check e ta By def check Ct row to Cts rowtry By Inducetypo Ct row 4189 Ctr routs By Ez Ndte ez Nd Ger te vents By defBT Nd tr tr now Nd e ties By def row s Nd tr toner e By TENDto 4 Hence both sides are equivalent to each other The inductive seeps hold Hence B holds E Q pts E Veh tr CBTBT dem th tr opts 4 rev to

where dem i list means i is in list or when list

is empty this function is always false 2 a fibNacci 6,4 i b Given

i rat cut at is a length N

I 0 3 c o o o 2 NEZ 3 OE i en Z l 3 1,1 i i 4 VKELo.nlEach i

neh bnC5D 3 I 3 2,2 2 I 5 i Zn 4 2 3 4,43,2 G r a o J 4 3 8,76,4 To show r fibn n 6 8 3 it 14,138 Proof From 3 and 5 we know C i V 3 N l Cnt that ien rien hence i n

ii INV a length NAN32 From 4 we can acquire that n i r OEi en n occntEN In al aEoold AEDEnnfibnG fibnch by A Aont a a cutJoldrafentI aouttval definition of fibula function

From G we know that r a o

fbath which hasfinishedthe proof

d Given D a length N 6 a ont is a cutTold

2 N32 7 alert1 acuttval

3 OE ich 8 cut 3 N I

4 OcontEN I 9 ACND Val 5 Valeateold 10 i iold 11 Toshow D a length \_N

2 N 32

3 OEi En 4 V kt o.n ak3 z.IE ehfibnC5De.V nEEz Ntl fiber n 2 2