

Appendix V: The Program

The following pages are an English printout of the program, using the Macro Assembly Program for the TX-O.¹⁰ The first three pages contain the definitions for simple macro instructions which are used throughout the regular program.

The following table lists the areas of memory which are used for some important data or work tables:

Starting Location	Contents
g-60	Point descriptions
g	Line descriptions
g+114	Move table
g+214	Line sums
g+330	Machine's three in a row
g+331	Opponent's three in a rows
g+340	Machine's two in a rows
plt	Limit of lookahead
ply	Present depth of lookahead
ply+1	Moves made and progress at each ply
h	Possible forcing moves for machine at each ply

Several major routines and the function performed by each are listed in Table V.

Table V: Major Routines In The Program

<u>Name or Starting Location</u>	<u>Function</u>
bck	Compute initial line sums
fnf	Find unoccupied points on the line described by the address in the accumulator. Store the points in table from ppl plus 1.
tstsum	Test the line sum in the accumulator under condition specified by spl. Go to A if win, B if too many blocks, C if possible win. Store new forces starting in g plus 340.
lineup	Update the line sums for the move stored in the accumulator. Value of update is stored in spl plus one. Test each line with tstsum.
lookup	Perform a lookahead update of one ply, testing for a win. If no more moves at this ply downdate the moves at the previous ply.
lookwin	Store win which was found in lookahead. Downdate all moves made during lookahead.
decision	Check board for wins, blocks, or lookahead win in progress.
listcheck	Check for limit of lookahead and immediate win if so. Check for block and force. If limit and no win or block and no force downdate last ply. Prepare list of forces for next ply if neither of above.
listen	Receive two octal digits from flexowriter and decode as six binary digits.
genmove	Generate next legal move from move table. If no more legal moves leave accumulator negative.
tststl	Test move according to values stored beginning at ncd.
reverse	Reverse opponent's and machine's pieces.
stratl	Generate best move from possible moves.
abc	Assign ratings, modify ratings, and change strategy as a function of ratings.
c	Perform lookahead for opponent.

BASIC MACROS=no program

```
cry=opr 12
anl=opr 305
ana=opr 325
orl=opr 105
ora=opr 125
lcc=lac+com-opr | -lr to accum
mz=opr 51 | add -0 and clear lr and com
lal=cla+cry-opr | lac followed by cyl
```

```
define
  modify A,B
  cla
  add A
  add B
  sto A
  terminate
```

```
define
  bymodi A,B
  cla
  add A
  add B
  sto A
  terminate
```

```
define
  mask A
  llr (A
  ana
  terminate
```

```
define
  five P
  P
  P
  P
  P
  P
  terminate
```

```
define
  sixx P
  five P
  P
  terminate
```

```
define
  load A,B
  llr (A
  slr B
  terminate
```

```
define
  write X
```

```
add (X
pnt
pnt
pna
terminate
```

```
define
  subrut X
  llr (tra .+2
  tra X
  terminate
```

```
define
  switch A,B
  llr A
  slr B
  terminate
```

```
define
  perform
  sto .+2
  cla
  0
  terminate
```

```
define
  bkkeep
  cla
  add .-2
  add (1
  sto .-4
  terminate
```

```
define
  zero A
  amz
  trn A
  terminate
```

```
define
  clad X
  cla
  add X
  terminate
```

```
define
  add s X,Y
  add (X
  sto Y
  terminate
```

```
define
  wait
  lro
  lcc
  trn .-1
  terminate
```

```
define
    acmk Z
    llr Z
    ana
    lac
    terminate
```

```
define
    tadd A,B,C
    cla
    add A
    add (B
    sto C
    terminste
```

```
define
    dadd V
    add (V
    sto .+2
    cla
    0
    terminate
```

```
define
    split X,Y
    trn X
    tra Y
    terminate
```

```
define
    branch X,Y
    cla
    add X
    trn Y
    terminate
```

```
define
    trif X,Y
    add (-X
    trn Y
    terminate
```

```
define
    godo A,B,C
    llr (tr .+3
    slr A
    tr B
    llr (C
    slr A
    terminate
```

```
start 14000
```

1=initial line sum.

20	401010	00
	11	01
	12	02
	511213	03
	21	04
	00	05
	04	06
	25	07
	22	10
	04	11
	00	12
	26	13
	610623	14
	15	15
	16	16
	700767	17
	01	20
	20	21
	24	22
	05	23
	10	24
	402461	25
	512525	26
	13	27
	14	30
	612632	31
	702726	32
	17	33
	05	34
	23	35
	27	36
	01	37
	02	40
	24	41
	20	42
	06	43
	14	44
	704665	45
	614721	46
	17	47
	10	50
	514466	51
	404522	52
	13	53
	06	54
	27	55
	23	56
	02	57
	707214	60
	15	61
	16	62
	617017	63
	25	64
	03	65
	07	66
	21	67

26	70
07	71
03	72
22	73
516427	74
11	75
12	76
406563	77
0001	
0401	
1001	
1401	
2001	
2401	
3001	
3401	
4001	
4401	
5001	
5401	
6001	
6401	
7001	
7401	
0004	
0104	
0204	
0304	
2004	
2104	
2204	
2304	
4004	
4104	
4204	
4304	
6004	
6104	
6204	
6304	
0020	
0120	
0220	
0320	
0420	
0520	
0620	
0720	
1020	
1120	
1220	
1320	
1420	
1520	
1620	
1720	
0005	
2005	
4005	
6005	

| start of diag

0303
2303
4303
6303
0024
0124
0224
0324
1414
1514
1614
1714
0021
0421
1021
1421
0317
0717
1317
1717
0025
0323
1415
1713

```
60q  
bck, load slr g+340,two  
      load slr g+331,his  
      load add g,ent  
      load g+214,x+4  
      cla  
ent,  add g  
      llr (77  
      anl  
      sixx shr  
      adds add g+114,x  
      lad  
      sto x+1  
      lad  
      sto x+2  
      lad  
      sto x+3  
      cla  
x,   five 0  
      com  
      trn upl  
      llr ent  
      adds tr .+3, .+2  
      0  
      tr two | sum = zero  
      tra err  
      tra err  
      tra his  
      tra upl  
      tra upl  
      tra win  
      tra err  
      tra los  
      tra upl
```



```

tra upl
tra upl
tra won
err, cla
write flex A
write flex dd
write flex err
write flex or

tra beg
won, cl
write flex I
write flex wo
write flex n

tra beg
los, cla
write flex I
write flex lo
write flex st

tra flm
win, slr g+330
tra upl
his, slr g+331
bkkeep
tra upl
two, slr g+340
bkkeep
upl, modify ent,1
modify x+4,1
trif g+327,ent-1
branch g+330,vcd
load 1,ppl
subrut fnd
cla
write flex I
write flex wi
write flex n a
write flex t
add ppl+1
subrut bnp
cla
write flex

```

```

tr fwm
vcd, branch g+331,pft
clad pft+dff
split .+2,pft
clad g+331
load 1,ppl
subrut fnd
clad ppl+1
subrut wrm
clad ppl+1
load -3,ppl
subrut upm
tra sr1+rsp

```

```
res, slr .+13
      switch ppl, .+4
      llr ppl+1
      clc
      0
      add .-1
      adds 1, .-2
      lad
      trn .-6
      0
k,    cla | illegal move
      write flex
      write flex I
      write flex lle
      write flex g-1
      write flex mo
      write flex ve

      trn sri+rsp
fnd, slr lve | find point
      load ppl+1, vca
      llr (77
      perform
      anl
      sixx shr
      adds add g+114, .+3
      cla
vcb, 0
      trn vcc
      clad .-2
      trif add g+114, .+3
      tra .+2
      com
vca, sto ppl+1
      modify ppl, -1
      trn lve
      modify vca, 1
vcc, lac
      add vcb
      tra vcb-2
lve, 0
wrm, slr wro | write my move
      sto ppl
      cla
      write flex M
      write flex y m
      write flex ove
      write flex is
      write flex
      add ppl
      subrut bnp
      cla
      write flex

wro, 0
upm, slr .+14 | up move
      adds g+114, .+11
      doad add
```

trn k
clad ppl
0
cla
0
0

bnp,

start beg

2=LOOKAHEAD.

define

```
tstsum A,B,C
slr R+nxt
trn .+3
nxt, 0
    -0
    add spl
    sto .+1
    0
    tra ers
    tra R+nxt
    tra R+nxt
    tra R+nxt
    tra ers
    tra ers
    tra R+wck
    tra R+nxt
    tra R+nxt
    tra ers
    tra ers
    tra ers
dpc, tra R+new
    tra ers
    tra R+nxt
    tra R+nxt
    tra R+nxt
    tra ers
    tra ers
    tra ers
    tra C
    tra R+nxt
    tra R+zbh
    tra ers
    tra ers
    tra ers
zbh, clad g+331
    switch ppl,g+331
    trn R+nxt
    load tra B,lnu+nxa
    tra R+nxt
new, switch ppl,g+340
    bkkeep
    tra R+nxt
wck, branch R+nxt+1,A
    com
    sto R+nxt+1
    tra R+nxt
    terminate
```

| second. +15.

define

```
tstfix
slr R+13
cla
sto tst+nxt+1
com
sto g+331
```

```

adds slr g+340,tst+new+1
add (add-slr
llr (trn .+2
tra wip
cla
0
terminate

```

define

```

lineup
slr R+nxax
llr (3
nl
slr R+nxax+1
sto R+nxax+3
shr
shr
sto R+nxax+2
add (add g
llr (tra R+sec
zzz, sto ppl
adds 214-add, .+7
doad add
add spl+1
0
tra tst
sec, clad R+nxax+3
acmk 17
add (add g+40
subrut R+zzz
clad R+nxax+2
acmk 14
add R+nxax+1
add (add g+20
subrut R+zzz
load -2,R+nxax+2
clad R+nxax+3
doad add g-100
sto R+nxax+1
trn R+oog+2
add (add g+60
llr (tra R+nxax
tra R+zzz
oog, clad R+nxax+1
acmk 37
add (add g+60
subrut R+zzz
clad R+nxax+1
five shr
sto R+nxax+1
modify R+nxax+2,1
trn R+oog
clad R+nxax+1
add (add g+113
subrut R+zzz
nxa, 0
0
0
0
terminate

```

define

```
compress
add ppl+1
sixx cyl
add ppl+2
terminate
```

define

```
expand
llr (77
anl
sixx shr
terminate
```

define

```
initlk
load h-1,ppl
load -h-1000,ppl+1
subrut res
load slr tst+nxt,tst
load add h,mhp
slr ela+scb
cla
sto plt+1
sto ply
sto ply+1
sto ply+2
sto ply+3
sto ply+4
sto ply+5
sto ply+6
sto ply+7
sto ply+10
sto ply+11
sto ply+12
sto ply+13
sto ply+14
sto ply+15
sto ply+16
terminate
```

define

```
uppair
slr ppl+2
load tra tst+dpc,spl
sto ppl+1
load -3,ppl
subrut upm
subrut tsf
add ppl+1
load -6,spl+1
subrut lnu
clad ppl+2
load -2,ppl
subrut upm
add ppl+2
load -5,spl+1
load tra tst+dpc+15,spl
subrut lnu
```

terminate

define

```

wipeup
slr .+6
sto .+4
adds -add, .+6
cla
0
0
clc
0
add .-4
add (1
tra R+1
terminate

```

define

```

dnpair
slr ppl+1
sto ppl+2
load tra tst+nxt, tst+1
load 5, spl+1
subrut lnu
load 6, spl+1
clad ppl+1
subrut lnu
tadd ppl+1, slr g+114, .+5
load 3, g+114
tadd ppl+2, slr g+114, .+5
load 3, g+114
load trn tst+nxt+2, tst+1
terminate

```

define

```

lookup
llr ply
lac
adds 1, ply
adds slr ply, R+sco
adds add-slr, .+3
cla
0 | add ply info
sto ppl
mask 370000
slr ppl+1
lsl
five cyl
add mhp
sto R+scb
branch ppl, R+rev
clc
scb, 0 | add new moves
trn R+emv
slr
add ppl+1
adds 400000, ppl+4
lac
expand | lo 6 in lr=his hi 6 in acc=mine
ren, uppair
llr ppl+4

```

```

sco, 0 | ply info is restored
tra lsm
rev, adds 407777,ppl+4
expand
slr ppl
mask 77
add ppl
tra R+ren | main flow is reentered
emv, switch R+sco, .+3
cal
0 | ply info set =+0
modify mhp,-40
modify ply,-2
trn R+ndt
zya, clac R+sco
dosd add-slr-1
trn R+oth
acmk 7777
expand
bki, dnpair
tra R
ndt, trif -1,nwn
tra R+zya
oth, expand
slr ppl
mask 77
add ppl
tra R+bki
terminate

```

```

define
tomnbk
switch ela+sco,R+3
llr ppl+4
0
modify mhp,40
adds -add, .+3
clc
0
tra ela
terminate

```

```

define
lookwin
load add ply+1,R+4
clc
sto pft+off
add ply+1
trn .+3
amz
lkf, trn lkc
expand
slr ppl+1
acmk 77
adds slr g+114, .+3
load 3,g+114
tadd ppl+1,slr g+114, .+5
load 3,g+114
modify R+4,1
tra R+2

```


terminate

define

```

decision
branch R+dff,bla
add ply+1
trn R+1+dff
expand
slr ppl+1
mask 77
slr ppl+2
llr ppl+1
tra R+dc2

```

dff,

```

-0
expand
slr ppl+2
mask 77
slr ppl+1

```

dc2,

```

lac
subrut wrm
clad ppl+1
load -3,ppl
subrut upm
cla
write flex S
write flex ugg
write flex est
write flex yo
write flex u m
write flex ove
write flex
add ppl+2
subrut bnp
load -2,ppl
subrut upm
cla
write flex

```

```

modify R+3,1
tra lkc
terminate

```

define

```

winfix
cal
switch el+sco,+.3
llr ppl+4
0
tra lkx
terminate

```

define

```

chkwin
switch el+sco,+.6
clad ppl+4
mask 377777
0
add el+sco

```

```

doad 1.
com
trn lkw
load add g+340,R+pkcr
godo upl+12,lkc,cla
branch g+331,R+pz
branch g+332,..+3
tra tmb+4
tadd ela+scb,-add-1,..+5
clc
0
tra lsm
pz, modify mhp,40
    adds -add,R+pkq
    sto .+3
    cla
pkcr, add g+340
    0
    trn ela
    load 2,ppl
    subrut fnd
    compress
pkq, 0
    modify R+pkcr,1
    modify R+pkq,1
    tra R+pkcr-2
    terminate

```

```

define
    lookcl
    load g+214,ppl
    load -g-457,ppl+1
    llr (tra bck
    tra res
    terminate

```

```

define
    equality A,B
    clad A
    lpd
    add (-0
    trn B
    terminate

```

```

define
    listcheck
    llr (-add g+340
    branch g+331,R+nbk
    slr R+fde+1
    load 1,ppl
    slr R+swb-1
    subrut fnd
    switch ppl+1,ppl+3
    modify mhp,40
    adds -add,R+st1
fde, branch g+340,R+nnw
    load 2,ppl
    subrut fnd
    modify R+fde+1,1
    llr ppl+3

```

```

com
add plt
trn R+plr
slr R+fqe+1
modify mhp,40
adds -add,R+st3
fqe, branch g+340,R+nkn
load 2,ppl
subrut fnd
compress
st3, 0
bkkeep
modify R+fqe+1,1
tra R+fqe
nkn, switch R+st3,R+st4
clad ela+scb
add R+swt-1
perform
st4, 0
trn R+swt
modify R+st4,1
bymodi R+st4-1,R+swt-1
tra R+st4-2
1
swt, clad .-1
com
sto .-4
trn R+nkn+2
branch g+331,ela
clad ppl+4
mask 7777
add R+st4
sto .+4
adds 1, .+5
lac
0
clc
0
tra R+bke-4
plr, slr R+la+1
load slr 11,R+11t-1
lac
adds 1,R+11t+1
load 11r 11-1,R+1m
clc
sto 11
sto 11+1
sto plt+1
le, branch g+340,R+le
load 2,ppl
subrut fnd
switch ppl+1,11
11t, switch ppl+2,11+1
modify R+11t-1,2
modify R+11t+1,2
modify R+la+1,1
tra R+la
le, clad R+11t-1
sto R+12
com

```

```

equality ppl+2,R+eqa
equality ppl+1,R+eqb
lpd
sixx cyl
add ppl+2
st1, 0
bkkeep
tra R+fde
eqb, lac
switch ppl+2,ppl+1
sto ppl+2
eqa, cla
compress
adds 370000,ppl+4
switch R+fde+1,R+fge+1
switch R+st1,R+st3
tra R+fge
nnw, switch R+st1,R+st2
clad elat+scb
add R+swb-1
perform
st2, 0
trn R+swb
expand
slr ppl+2
llr ppl+3
sto ppl+1
lpd
trif 0,R+eqc
equality ppl+2,R+eqd
modify R+st2,1
bymodi R+st2-1,R+swb-1
tra R+st2-2
1
swb, clad .-1
com
sto .-4
trn R+nnw+2
cla
sto ppl+4
add mhp
perform
bke, trn R+bko
modify ppl+4,10000
modify R+bke-1,1
tra R+bke-2
bko, tadd elat+sco,1,..+
llr ppl+4
0
tra elc
eqc, lac
switch ppl+2,ppl+1
sto ppl+2
eqd, cla
compress
adds 370000,ppl+4
switch R+swb-1,R+swt-1
switch R+st2,R+st4
clad R+st2-1
tra R+st4-4
nbk, add ply

```

```

11,   adds slr-11r+2,R+1q-1
      switch mhp, .+3
      cla
      0
      trn R+1q
      expand
12,   0
      ala
      add R+12
      adds 1,R+12
      lcc
      trn R+12
      modify R+11+3,1
      tra R+11+2
lzz,  lac
      adds 1,R+1m
      adds add-11r+1,R+1m+2
1m,   llr 11-1
      branch 11+1,R+1q+4
      lpd
      trif 0,R+1eq
      modify R+1m+2,1
      tra R+1m+1
      0
1q,   switch R+12,R+1q+3
      ala
      0
      llr R+1m
      lac
      add R+1q-1
      trn R+1zz
      modify ply,-1
      com
      add plt
      com
      trn R+1df
      tadd R+1m,add-11r+2,R+1t1
      add (-1
1t2,  perform
      trn R+1df
      ala
1t1,  0
      trn R+13z
      lpd
      trif 0,R+1qe
      modify R+1t1,1
      cla
      tra R+1t1
13z,  clac R+1t2+2
      add (2
      tra R+1t2-2
leq,  clac R+1m
      slr ppl+4
      llr (1
      lpd
      perform
      lal
      five cyl
      add ppl+4
      sto ppl+4
      tadd ela+sco,1, .+5

```

```
llr ppl+4
0
tra lkw
lqe, clad R+1t2+2
add (llr-add
tra R+leg+2
ldf, modify ela+sco,1
clad ply
tra ela+zya-1
terminate
```

```
define
yesorno A,B
wait
lac
add (4000
split .+2,A
add (127777
com
trn R
zero B
tra R
terminate
```

```
define
testch A,B,C
lac
add (A
com
trn .+7
add (-0
split .+2, .+5
clad (C
tra B
terminate
```

```
define
listen
cla
sto ppl
wait
testch 7777,R+chu,0
testch 253777,R+chu,1
testch 303777,R+chu,2
testch 343777,R+chu,3
testch 323777,R+chu,4
testch 263777,R+chu,5
testch 223777,R+chu,6
testch 243777,R+chu,7
che, cla
write flex
tra R
chu, add ppl
trn R+sce
cyl
cyl
cyl
adds trn,ppl
tra R+2
sce, cll
```

```

      sto ppl
      yesorno R+che,R+wat
wat,  cal
      add ppl
      terminate

```

```

define
  octpnt
  slr R+ax
  sto R+ax+1
  shr
  shr
  shr
  doad add R+ax+2
  pne
  add R+ax+1
  cmk 7
  doad add R+ax+2
  pne
  add R+ax+1
ax,  0
     0
     char r0
     char r1
     char r2
     char r3
     char r4
     char r5
     char r6
     char r7
     terminate

```

```

define
  maximum A
  clad A+2
  com
  add A+3
  trn .+5
  switch A+3,A+2
  switch A+1,A
  terminate

```

```

define
  genmove
  slr R+awa
  cla
spc,  add g+114
     cla
     add .-2
     adds 1,.-3
     trif add g+214,..+4
     clc
     tra R+awa
     lac
     trn R+1
     clad R+spc
     trif add g+115,..+3
awa,  0
     com
     tra .-2
     terminate

```

define

```

tstst1
slr R+ncd
adds tra .+21,..+4
clad spl+7
0
tra ers | -12, 040
tra R+ncd | -11, 031
tra R+ncd | -10, 022
tra R+ncd | -9, 013
tra ers | -8, 004
tra ers
tra ers | -6, 130
tra R+ncd | -5, 121
tra R+ncd | -4, 112
tra ers | -3, 103
tra ers
tra ers
tra R+cp2 | 0, 220
tra R+ncd | 1, 211
tra R+cm2 | 2, 202
tra ers
tra ers
tra ers
tra R+cp1 | 6, 310
tra R+cm1 | 7, 301
tra ers
tra ers
tra ers
tra R+cpm | 12, 400
cp1, add R+ncd+1
tra R+ncd-1
cp2, add R+ncd+2
tra R+ncd-1
cm1, add R+ncd+3
tra R+ncd-1
cm2, add R+ncd+4
tra R+ncd-1
cpm, add R+ncd+5
sto spl+7
ncd, 0
10 | 310
1 | 220
6 | 301
40 | 202
2 | 400
terminate

```

define

```

reverse
branch g+114,R+s1
modify R+1,1
trif add g+214,R
load add g+114,R+1
tra lkc
s1, llr (1
lpd
ala

```


add R+1
adds slr-add, .+2
0
tra R+3
terminate

start beg

3-program, some definitions, learner, and helper.

define

```
clnew
clc
sto pft+dff
sto plt
load add ply+1,pft+3
load g+114,ppl
load -g-457,ppl+1
subrut res
load slr g+114,+.3
load 3,g+114
bkkeep
trif slr g+214,.-5
cla
write flex
```

```
write flex F
write flex irs
write flex t m
write flex ove
write flex by
write flex
wait
cyl
cyl
trn R+yer
cla
write flex ach
write flex ine
write flex
```

```
yer, tra bck
cla
write flex lay
write flex er
write flex
```

```
zif, godo ts1-1,sr1+rsp,tra lkc
clad bnp+ax+1
llr (25
lpd
sto spl+4
anl
lpd
shr
lpd
zero sr1+ept+2
llr (25
lpd
zero sr1+ept+2
tra lkc
```

terminate

define

```
limfud A
tac
cyr
trn R+u2
clad plt+1
com
trn R+u1
modify plt,1
add plt+2
trn lkc
u1,  cla
sto plt
tra A
u2,  clad plt
zero R+3
tra R+u1
terminate
```

define

```
strat1
switch tst,R+ept-1
load add g+114,gen+spc
load tra ts1,tst
load 0,spl+1
slr spl+6
load 6,wgt+2
load 40,wgt+3
tac
com
trn R+men
load 0,R+fmz-1
load add g+214,R+fml
cla
fml,  add g+214
trif 1,R+fmy
trif 1,R+fmz
tra R+fmy
0
fmz,  bkkeep
fmy,  modify R+fml,1
trif add g+327,R+fml-1
clad fmz-1
trif 4,+.+3
clad (4
cyl
sto wgt+2
cyl
cyl
sto wgt+3
men,  subrut gen
trn R+ept
sto spl+5
lro
slr spl+7
subrut lnu
maximum spl+4
```

```
tra R+men
0
ept, switch .-1,tst
      clad spl+4
      subrut wrm
      clad spl+4
      load -3,ppl
      subrut upm
rsp, tra qg
      write flex Y
      write flex our
      write flex mo
      write flex ve
      write flex is
      listen
      subrut bnp
      load -2,ppl
      subrut upm
lat, tra flx
      write flex
```

```
tra lkc
terminate
```

```
beg=14000
ers=err
g=120
ppl=g+400
ll=ppl+10
spl=ppl+50
plt=10076
h=10122
```

```
10100| -10
mph, add h
ply, 0
beg| wait
      tra f
bnp| octpnt
tst, tstsum lmw,tmb,pwn
tsf, tstfix
lnu, lineup
bla, initlk
lms, listcheck
ela, lookup
pft, decision
nwn, limfud abc
wip, wipeup
tmb, tomnbk
lkw, lookwin
lkc, lookcl
pwn, chkwin
lmw, winfix
gen, genmove
sr1, strat1
ts1, tstst1
rvg, reverse
cln, clnnew
```

mhp=mph
lsm=lms
wgt=ts1+ncd+1

```

abc,  cla
      switch hpl,plt+2
      load tra m1,abc
      load trn m2,lkw+lkf
      tra rvg
m2,   clc
      sto pft+dff
      load opr,m3
m1,   godo pft,rvg,cla
      slr abc
      switch mpl,plt+2
      load trn lkc,lkw+lkf
m3,   tra sr1
      load tra sr1,m3
      load add ply+1,m5+1
      load tra m5,gen
      tra sr1
m5,   clad ply+1
      acmk 7777
      zero m6
      expand
      slr m4
      godo gen,sr1+men+3,tra m5
      modify m5+1,1
      clad m4
      tra sr1+men+3
m4,   0
mpl,  -10
hpl,  -10
m6,   load slr gen+awa,gen
      tra sr1+ept
f,    cla
      write flex

```

```

      write flex Y
      write flex our
      write flex nu
      write flex mbe
      write flex r i
      write flex s
f1,   listen
      zero npn
f2,   sto ppp
      doad add fls
      sto spl
      cla
      write flex
      write flex R
      write flex ati
      write flex ng
      add spl
f3,   subrut bnp
      adds 10,wgt

```

```

shr
shr
sto wgt+4
shr
sto wgt+1
trif 5, .+3
clad (-6
sto mpl
adds 3, hpl
load cla, cln+zif
trif -4, cln
load tra lkc, cln+zif
tra cln
nbn, cla
write flex

```

```

write flex R
write flex at1
write flex ng
listen
sto spl+4
modify fls, 1
godo f1, f, cla
clad fls
subrut bnp
adds fls, .+4
clad spl+4
0
cla
write flex

```

```

clad fls
tra f2
ppp, 0
fls, 0
fls+100
flm, tadd ppp, fls, .+11
doad add
shr
0
tra flf
0
flx, bkkeep
cla
tra sri+lat+1
fwm, clad flx-1
add (-12
com
trn flf
sto flx-1
tadd ppp, fls, .+11
doad add
add flx-1
0
flf, sto flx-1
cla
write flex
write flex N
write flex ew
write flex rat

```

```

write flex ing
add (char r
pna
add flx-1
subrut bnp
cla
sto flx-1
tra beg
qq, tac
cyl
trn .+3
cla
tra sri+rsp+1
load tra qq1,upl+16
load tra vv2,wrn
load tra vv7,abc
tra lkc
qq1, clad (char rb
pna
add g+331
trn qqc
cla
write flex L
qqc, load slr ppl,upl+16
load slr wro,wrn
load cla,pft
slr abc
clc
sto pft+dff
add (char r

pna
tra sri+rsp+1
vv2, lac
trif tra vcd+21,vv4
tra vv5
vv7, load tra vvb,wrn
load tra .+3,abc
tra rvg
load tra qqc,pft
tra rvg
vv4, clad (char rw
pna
tra qqc
vv5, cla
write flex L
clc
sto pft+dff
tra vv7
vvb, clad (char rw
pna
tra vv4-3

```

constants

start add+beg

VERY DEFENSIVE LOOKAHEAD=seperate tape.

```
define
    make A,B
    load add A,R+mk1+1
    load slr B,R+mk3
mk1,  clad A
    acmk 7777
    zero R+mk2
    llr (77
    anl
    sixx shr
mk3,  slr B
    ala
    add .-2
    doad 1
    modify R+mk3,2
    modify R+mk1+1,1
    tra R+mk1
mk2,  ala
    add R+mk3
    sto .+1
    0
    terminate

    c=12000
f3|   llr (tra c
d|    load tra c1,f-1
    zero f3+2
    load tra sr1+ept,f-1
    tra f3+2
cs,   0
    c1=cs+40
c1|   tac
    cyl
    cyl
    trn .+7
    load 40,wgt
    load 2,wgt+1
    load 6,wgt+4
    switch spl+4,c1-1
    switch hpl,plt+2
    make ply+1,cs
c7,   clad c1-1
    load -3,ppl
    subrut upm
    load trn c2-2,lkw+lkf
    load tra nul+3,vcd+3
nul,  godo abc,rvg,cla
    load trn lkc,lkw+lkf
    load cla,vcd+3
c5,   clad c1-1
    llr (3
    doad slr g+114
    switch c1-1,spl+4
    godo rvg+s1-1,rvg,tra lkc
    switch mpl,plt+2
    tra sr1+ept
```



```

c3, 0
    c2=c3+40
c2-2  clc
    sto pft+off
    make ply+1,c3
    load add cs,uk+1
    load slr cs,uke
    load add c3,uk2
uk,   branch cs,uk1
    ala
uk2,  add c3
    trn uk3
    lpd
    trif 0,uke
    modify uk2,1
    cla
    tra uk2
uke,  slr cs
    bkkeep
uk3,  load add c3,uk2
    modify uk+1,1
    tra uk
uk1,  ala
    add uke
    sto .+1
    0
    branch cs,nul+3
    godo c3-3,c5,llr mpl
    subrut c10
    load add cs,c6+2
    godo sri+ept,sr1,llr sri+ept-1
    load slr gen+awa,gen
    tra c8
c6,  slr .+10
    clad cs
    ala
    add c6+2
    adds 1,c6+2
    lac
    0
c8,  switch spl+4,c1-1
    tra c7
c10, slr c11
    load tra c6,gen
    godo vcd,bck,cla
c11, 0

```

constants

start add+beg