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APL NEWS

SIAPI, is planning to sponsor a thTee-day APl,

Rochester, Nex, York, beginning NIay)0, f979. will appear in STAPI, Quote-Quad.

Conference in
f'urther details

LP. Sharp Associates are sponsoring a three-day A Pl, Confer-

ence in foronto on Septenber 18-20 of this year. Sessions will include r

Direction of API DevelopmentE Direction of Comnunication Systens Devel opnents Applications in the Research Industries, in Banking and
Finance, and in the Actuarial and Insurance Industry Applications for Graphics

API Standards for Docunentation and Programming Financial Planning Logistic Systens i.n Multi-national Manufacturing Industries

Quantitatiye Analysis and Statistical lechniques
There will also be a session on APL in Exposition organized
by Professor Robert Spence of Inperial College, as well as a

t',',o-part Ad.vanced APL course held in the evenings and consist- ing of three hours each on the topics APL Svster0 Design, and

Data Base Desisn in APL. Further infornation on the confer-ence is available fron Ms. R. Wild, I.P. Sharp Associates, .^- -

145 King Street West, Toronto, Canada. \j__ our nost rec6nt publication (STARMAP, by P, C, Berry and J. R. Thorstensen) contains functions which produce coordin-ates for a plot of the heavens at specified tines and])lacesl

We have learned from one of the authors that these functions,

together with appropriate])lotting functions, are now avail- able on the LP. Sharp APL service. We would be pleased to

announce their availability on other APL systens.

MORE ON

iiRADE t[a6n g. '4(c94eo*n
The grade function produces a permutation vector, a

vector composed of one use of each of the elements r1y. Each permutation vector is a representation of a permutation matrix, a square binary matrix with just one mark in each

row and column. The function:
v<-531624
t/

531624

[+A+(1p y) o. =I/ 001000
000010
010000
000001
100000
000100

transforms a permutation vector into a matrix.
We can test that a vector is in fact a pernutation
vector by exarnining the truth value of the expression ^/(rpv)=vLAvl.
A permutation matrix can be reduced to a permutation
vector U the expression,
9 Z+MTPV A
t 1l Z++lr\eA v

MTPV A

531624

I A permutation vector can be displayed as the same ^ttattern rotated O 9 0, 18 0, 27 0 degrees by successive appl ications of I looked at from the front and back by reversing the permutation vector and rotating again.

1Z+MA

t1l z<(rpr)".=A 9

(6 16{"}1 r)'(6 161Y& 9 V),(6 76+rM 9V v),6 16}Y,t1 {fV r

001000 010000 001000 000100 000010 000100 000001 010000 010000 000001 100000 000001

0 o o o o 1 10 o o o 0 0 0 0'010 10 o o o 0

100000 000010 010000 001000 000100 001000 000100 000010
S/mnetry may reduce the number of different displays to lr or
2. The eight possib'le vectors generating the same pattern can be generated by GBrvl

v Z+GEN P

t1l z-P,AP
t 21 z+(t+,pP>pz,s-z
t 3l z+(iz) ,(4,-4+2,pp) ttyz

V

GEN V
531624
352614
468375
647385

.

Ihe use of grade in sorting is only a smal I part of the usefulness of permutation vecIors. ni,v reJ"aini of a

set of characters and symbols from one representati;n to another is the appl ication of a permutation vector to the original representation. Note that th is means any and al I

characters can be given any new representation desired,

Recod ing is effected by

DAVL 2561ASC I I \vI

hhy th is is so can be readily visual ized by noting that a permutation matrix, viewed as a nomogram or transformation matrix permits any input on one axis to designate ary output on the other axis.

42613s 41625i -
3;:;ilr

123456

4-+-----+---o
s -o I
6-------O

similarly, permutation veitors can be used to

rearrange a set of objects into any new arrangement, and have been used in sorting bank checks in many fewer passes into sequence by branch bank, by customer account number, by check number, using dif or its equivalent I/tAI/l*-rpt/ to renumber the checks from 1 to py. lhose numbers are then converted to a number base match ing the sortinc mach ine for r

maximum efficiency in sorting the checks. V

Note that the indexed form of rrdouble up-gradetr may
execute much faster than the second grade function on long

vectors.

1-+-+-o | |

2-+-++r--t-O
3 -.r-o I

Another use for A is a fast way of detecting

dupl icates in a set of. results, lt is known that some of the sums of two integers cubed are the same. To find such instances, the sums of pairs are sorted and adjacent

elements vh ich are eq ual are selected.:

(R=1OF) /F+st lsl

A frequent use of variable insertion is restoring of
blanks between words in compressed text, where if N++\rlLv the word length vector,_ the expression:

(?x,(pN)p'')td(rp?1),/tl
restores th e bl anks.

I

UITIMATELY lamen g, l6aa{dan \,ERlODlCAttY "i;r;;'/ A;i6;

SETF.REPRODUCING EXPRESSIONS

iu,*ffi mpu*wina,gmxpy"tg.
is an exlressioD Y satietyiog

A seLf-reproducine expre€sion (sBE)

t(V =,v) ^(-vEt AEc. .. zLllg. , .zLt)
Such a.n expression is necegsarify a vector of cheracters and, as ,eported tn [1,2], one SBx of ninieat 1engtb (ZZ) 1, ,ro"r"rpt t,22pt677pt t t Readels of [2] r,'e!e cbaltenged to find a SRE of odd lengtb. One such e).pre6sion, of Lengtb only 23, is

23p2q72pt | , lzspzQ12p t r r
Itr fact there erdsts a SRE of a!!y lengtt
by tle resu-lts (SfiA I) and (SRB2 t), rbere

- defined. ia sectio[lr of tbis llotel \-
t D+S.RE' 3 s

35o 72q23p ' r

' 3 5 p 1 2 0 2 3 p 3 p 3 5 p 1 2 0 2 3 p " r

35o 7202 30 '!r 35p 12023p 3p3 sp L2Q2 30 t r t

ffi. !y defioi.tioa, a psRn of pe"iod ? Ls an etq)ression vbich reprod.uces itself afber p applicationE of the execute functlon, but not earlier, aad reaaers of [2] were cballeDgeal to find a PSRE of perlod 2.

It r'ill be seen that tbe expresrlone d 6!d B belov ale PSRE, of qul.te differeDt tJ.pes, of period 2 and 3 respectively.

L > 22. Exairyles are plovided
the fuictiods SRE arA SRE2

I

^/a=8. !n r- !U + -4

1S26P13P I r'2+1026P13P t I I 2+ 7626p73p I I r 2*102 6p 13p I I

'

1026P13P t lt 2*1026013P I I I
1

^/B=n

+ ![
4110(4Bp 47p21P I I I
4 + 10(4 8p 4 7p 21p I I I
4+10(48p 47p 21p I | |
4+10(4 8p 47p 21p I I I
7

a! evea nore strlkiag iBet4oce

the re6ult (PSRE P), $here tbe

exceeatlg 999991

r0r-!D+B+PSRE2

,10411+(48p4?p21p I I I
, 104+ 1Q (4 8p 4 7P 21P I ' I
, 104 + 10(4 8 p 4 7p 21p I I I ,104+1Q(48p47p21p t I I

3

,L0'o
. 1+, o I
,10r o I
, 1o'c

Tbe vecto? I 16 the result (PSi?82 P) (see sectjon \) where tP=s'

of tbe pbenonenon of periodicity i5 plovided by

perloa P can be anlr potitive loteger not

t!+tE
(12048p24pt | |
(1204ep24p I I i
(12048p2aPrir

^

/ (PSRE
(120q 8p 24p I I I
(12048p 2t+p ' ' '
(12048p 24p I I I
7

134

l1r(1204ep 24p ' I I),1134 l1+(12048p24p I I I),r13q
I 1r(12048p24p' I I),v134

+ !n + -!n + t(132prtr),
l1+(12048p 24p I I I),t13a
l1n(120r| I o 24p I t t),!13q
| 1+(12048p24p I I I),1134

+ PSRE
, v13r+
,Y134
,1134

134) =D
,v134
,v134
,v134

| 1+o
1"1+1

I ttz

r PS,PE 134 |

1+133
1+0

tn result 9

after yieldilg a

(T frDctio! UPSBE is

rtailt, of lengtb t' of non-re?eatedl erpressions'

perj.od P. For e*asPle r ne bave:

l0.rge !U*rf*t[:' + 2 UPSRT 3

contl4ues witb a PSRE of

(12048p24p ' ' I
(1201+8p24prrl
(12048p24prrr
(120+epz+p 'l '
(12048p 24p I I I
(1204 8p 24p I I I

,vLlO 311+(12Q48p24p I' I ,rl /.0 3l1r(120480:t+p t t t ,?L/o 3l1+(120480 24P I I I ,r[/o 311+(12048p24pr I I ,vLlo 3 | 1+(12048p 24p I rl

,rl/o 3l7+- 2
,tLlo 3l1i-1
,vL/o 3l1+o
,rl /o 3l 1r1
,vll0 3l1+2
,rL,/o 3l1r0

,t[/o 3l 1t(12048P2trP I I I)

an.exptession {bich

but tbere are 6bo"tet erple6sions possesEitrg the 8€!e Property '

h"mg,,mtiS€ sm, sRE2, PsnE, psRs2 a.Ed ./psnE.
,'-': ap-90" t r r r I r,toQ(tr-15)p rppQ',vc-3 lao 23 t2+(d>-24ia(a<re) h#;: i3l ;;: 3ilSllli : i i li l;ill!9ii :tr;:, ii 3,

2:o12+(o>24)^(.'<se)

Pt.Rf2 r (42p r 4+10(4Bo47p210 | r r '),10,),10 " r r, ' roi ro !
aPsnar (3048p' I1r(1204ap 24p r r r '), vt /o r,ro),r-qr(&r<9)

rbe characterr afue! : providle p"otectioD agailst oiEuse of the fulctions SRE, SRE2 ar\d WSW. IAe resdt (sFB tr) contains no spaces if L > 33, rbereaE the reBult (S@2 ,) reveals j.t6 operatlo! nole clearly:

2 34p (,9-Rr 34),(SRE2 34)
34p77622pt t | 34p 1102 2pp 34p 77Q22p t t t
34p rtq22e t t t 34p 77022p | | |

:-.- l{91:19p99!_i+C- 9lpt9991949. Plainty (PS8E 0), subJecr on].jr to the 'wvvvwvw\/V\/\/t/\/t^/V\ liloitation inpoEed by tbe size of tbe syste6, a1lows any mrsber of appLl.cations of tbe execute filnctioll n"itbout ever proalucing a repetition. Another [on-repeating explession is

(6034p17p I I I),v1+(603 4p 17p " r),11+or

exa,npfea nay be found.

Fird the sborbe€t ultinately periodicalLy self-reproaluclng er.pre6sion.
Flnd tbe sbortest notr-repeating extrression (NRE).
Fina the sbortest NRE rhtch tloes not use tle fo"nat function.

but-.very nucb sbolter

v
6. Tbree ploblens .

?\/WVWVV!4./VVW\ru!

(A)
(B)
(c)

t1l
l2l

REFMBNCXS .

t?! quote-Quad, VoI.It, No.2 (.ja,:rlary, 19?3)
Ibis l,lers]ette!, Vo1.2, No6.L,2,3 (19?7)

I
t