Computational Experience

The Domino Method of General Integer Nonlinear Program Applied to Problem 2 of Lawler and Bell

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The computer program below tries to solve Problem 2 in Lawler and Bell [8]. Line through line 1111 of the following computer program partly describe the problem.

The following computer program was originally modeled after the nuclear-chain-re picture on page 336 of the World Book Dictionary [1] and after the domino metho solving nonlinear systems of equations [20]. Line 501 through line 711 are illustrat intent behind line 501 through line 513 is to produce domino effect; X(8) through X slack variables. Looking at line 501, one sees that it is not hard to knock down X(8) one.

```
0 REM DEFDBL A-Z
2 DEFINT I,J,K,X
```

```
3 DIM
B(519),N(519),A(2002),H(519),L(519),U(519),X(2002),D(511),P(511),PS(33),A
12 FOR JJJJ=-32000 TO 32000
14 RANDOMIZE JJJJ
16 M=-1D+37
20 FOR J44=1 TO 7
21 A(J44)=FIX(RND*8)
22 NEXT J44
128 FOR I=1 TO 100
129 FOR KKQQ=1 TO 7
130 X(KKQQ)=A(KKQQ)
131 NEXT KKQQ
133 FOR IPP=1 TO FIX(RND*7)
181 J=1+FIX(RND*7)
182 REM GOTO 190
183 REM   R=(1-RND*2)*A(J)
184 REM   X(J)=A(J)+(FIX(RND*2))*.05-(FIX(RND*2))*.05
187 REM X(J)=A(J)+  (RND^(RND*10))*R
188 REM GOTO  222
189 REM   X(J)=A(J)+PA
190  X(J)=A(J)+FIX(RND*2 )-FIX(RND*2)
191 REM    X(J)=A(J)+FIX(RND*3)-FIX(RND*3)
396 NEXT IPP
443 FOR J44=1 TO 7
446 IF X(J44)<0 THEN 1670
449 NEXT J44
501 X(8)=   +7  -X(1)
502 X(9)=   +7  -X(2)
503 X(10)=   +7  -X(3)
504 X(11)=   +15 -X(4)
505 X(12)=   +15 -X(5)
506 X(13)=   +7  –  X(6)
507 X(14)=   -6  +   X(1) + X(2)   +X(3)
508 X(15)=   +7  – 3* X(1) -2* X(3)  –      X(5)
509 X(16)=   -7  +    X(1)  *X(6)+   X(2) +3* X(5)
510 X(17)=   -8  +   X(4)   +    X(5)   +    6*X(6)
```

```
511 X(18)=  +20  -3* X(1)*X(3) -6*   X(4) – 4* X(5)
512 X(19)=   15  -4* X(1)     – 2* X(3) –   X(6) * X(7)
513 X(20)=   -25 +4* X(2)* X(7) + 3* X(4)*X(5)
554 FOR J44=8 TO 20
555 IF X(J44)<0 THEN PS(J44)=ABS(X(J44)) ELSE PS(J44)=0
556 NEXT J44
703 POBA2= – X(1)*X(7) -3*X(2)*X(6) –  X(3)*X(5)-7*X(4)
711 POBA= POBA2 -999999999#*(
PS(8)+PS(9)+PS(10)+PS(11)+PS(12)+PS(13)+PS(14)+PS(15)+PS(16)+   PS
17)+PS(18  )+PS(19  )+PS(20 )    )
759 POB1=POBA
863 P1NEWMAY=POB1
866 P=P1NEWMAY
1111 IF P<=M THEN 1670
1452 M=P
1453 PPOBA2=POBA2
1454 FOR KLX=1 TO 20
1455 A(KLX)=      (          X(KLX)          )
1456 NEXT KLX
1557 GOTO 128
1670 NEXT I
1899 IF M<-17 THEN 2222
2001 PRINT A(1),A(2),A(3),A(4),A(5)
2002 PRINT A(6),A(7),A(8),A(9),A(10)
2003 PRINT A(11),A(12),A(13),A(14),A(15)
2004 PRINT A(16),A(17),A(18),A(19),A(20)
2011 PRINT M,JJJJ,PPOBA2
2222 NEXT JJJJ
```

This BASIC computer program was run with Microsoft's GW BASIC 3.11 interpreter.
complete output through JJJJ=-31990 is shown below. What follows is a hand cop
the computer-monitor screen; immediately below there is no rounding by hand.

```
0   4   2   0   2
1   3   7   3   5
15   13   6   0   1
```

```
3   0   12   8   23
-16   -32000   -16

1   4   1   0   2
1   2   6   3   6
15   13   6   0   0
4   0   9   7   7
-16   -31993   -16

0   4   2   0   2
1   7   7   3   5
15   13   6   0   1
3   0   12   4   87
-16   -31192   -16

0   5   1   0   2
1   3   7   2   6
15   13   6   0   3
4   0   12  10   35
-17   -31991   -17

0   4   2   0   2
1   4   7   3   5
15   13   6   0   1
3   0   12   7   39
-16   -31990   -16
```

On a personal computer with an Intel 2.66 chip and the IBM basica/D interpreter, v
GW BASIC 3.11, the throughput time from JJJJ=-32000 through JJJJ=-31990 was
seconds.

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