

Challenge June 2023

Miss Manners is back

A solution with OPL by Alex Fleischer afleischer@fr.ibm.com

OPL (Optimization Programming Language) is an abstract modeling language that helps model easily optimization problems that can be solved both with IBM CPLEX linear programming and IBM CPLEX constraint programming CPOptimizer (CPO)

The same OPL model works for the 4 data sets:

.mod

```
using CP;

tuple guest
{
    string name;
    string gender;
    int hobby1;
    int hobby2;
    int hobby3;
    int hobby4;
    int hobby5;
}

{string} genders={"m","f","m "," m "," f ","f "};

{guest} guests with gender in genders=...;

int nbGuests=card(guests);
range seats=1..nbGuests;

int isMale[i in seats]=(item(guests,i-1).gender=="m")
|| (item(guests,i-1).gender=="m ") || (item(guests,i-1).gender==" m ");

int nbHobbies=max(g in guests) max1(g.hobby1,g.hobby2,g.hobby3,g.hobby4,g.hobby5);

int hobbyPerGuest[g in guests][h in 1..nbHobbies]=
(g.hobby1==h) || (g.hobby2==h) || (g.hobby3==h) || (g.hobby4==h)
|| (g.hobby5==h);

int hobby[i in seats][h in 1..nbHobbies]=hobbyPerGuest[item(guests,i-1)][h];

// decision variable who seats at a given seat
dvar int whoSeatsThere[seats] in seats;

subject to
{
    allDifferent(whoSeatsThere);

    // boy girl
```

```

forall(i in seats) (i mod 2==0) == isMale[whoSeatsThere[i]];

// hobby

forall(i in 1..nbGuests-1)
  or(h in 1..nbHobbies) hobby[whoSeatsThere[i],h]==hobby[whoSeatsThere[i+1],h];
  or(h in 1..nbHobbies)
hobby[whoSeatsThere[1],h]==hobby[whoSeatsThere[nbGuests],h];
}

// display result

execute
{
  for(var i in seats)
    writeln(Op1.item(guests,whoSeatsThere[i]-1));
}

```

And then to link this to the Excel file we use 4 .dat files.

```

SheetConnection s("MissMannersData.xls");
guests from SheetRead(s,"'Data-16'!B4:H19");
and
SheetConnection s("MissMannersData.xls");
guests from SheetRead(s,"'Data-32'!B4:H35");
and
SheetConnection s("MissMannersData.xls");
guests from SheetRead(s,"'Data-64'!B4:H67");
and
SheetConnection s("MissMannersData.xls");
guests from SheetRead(s,"'Data-128'!B4:H131");
which give

```

```

// solution
<"2" "f" 2 1 3 0 0>
<"1" "m" 2 1 3 0 0>
<"12" "f" 3 1 2 0 0>
<"3" "m" 3 2 0 0 0>
<"7" "f" 1 2 3 0 0>
<"10" "m" 3 2 1 0 0>
<"11" "f" 1 3 2 0 0>
<"9" "m" 2 3 1 0 0>
<"15" "f" 2 3 1 0 0>
<"5" "m" 2 1 3 0 0>
<"13" "f" 2 3 0 0 0>
<"4" "m" 3 2 1 0 0>

```

```
<"14" "f" 1 2 0 0 0>
<"6" "m" 2 3 1 0 0>
<"16" "f" 2 3 0 0 0>
<"8" "m" 3 1 0 0 0>
```

And

```
// solution
<"j" "f" 2 1 3 0 0>
<"d" "m" 1 3 2 0 0>
<"sue" "f" 3 2 0 0 0>
<"o" "m" 2 3 0 0 0>
<"hope" "f" 2 1 3 0 0>
<"s" "m" 3 1 0 0 0>
<"r" "f" 1 3 0 0 0>
<"h" "m" 2 3 0 0 0>
<"i" "f" 3 2 0 0 0>
<"chuck" "m" 1 3 0 0 0>
<"n" "f" 1 2 0 0 0>
<"john" "m" 1 2 0 0 0>
<"m" "f" 2 1 3 0 0>
<"scott" "m" 2 3 0 0 0>
<"carol" "f" 2 1 3 0 0>
<"dan" "m" 2 3 0 0 0>
<"jane" "f" 2 1 0 0 0>
<"l" "m" 1 3 0 0 0>
<"pam" "f" 1 3 0 0 0>
<"doug" "m" 3 1 2 0 0>
<"kate" "f" 3 1 0 0 0>
<"tim" "m" 3 1 0 0 0>
<"jill" "f" 1 2 0 0 0>
<"k" "m" 1 2 0 0 0>
<"g" "f" 3 1 0 0 0>
<"dave" "m" 1 3 2 0 0>
<"ann" "f" 2 1 3 0 0>
<"alex" "m" 1 3 0 0 0>
<"f" "f" 2 1 0 0 0>
<"q" "m" 1 3 0 0 0>
<"p" "f" 2 1 3 0 0>
<"e" "m" 3 1 2 0 0>
```

And

```
// solution
<"51" "f" 2 1 3 0 0>
<"42" "m" 3 1 0 0 0>
<"24" "f" 3 1 2 0 0>
<"6" "m" 2 3 1 0 0>
<"35" "f" 2 3 0 0 0>
<"44" "m" 3 1 2 0 0>
<"62" "f" 2 3 0 0 0>
<"22" "m" 2 3 0 0 0>
<"34" "f" 2 1 3 0 0>
<"18" "m" 1 3 2 0 0>
<"7" "f" 1 2 3 0 0>
<"4" "m" 3 2 1 0 0>
<"25" "f" 3 1 2 0 0>
<"9" "m" 2 3 1 0 0>
<"19" "f" 3 1 0 0 0>
```

```
<"45" " m " 1 2 0 0 0>
<"58" " f " 3 1 2 0 0>
<"43" " m " 1 3 2 0 0>
<"53" " f " 2 1 0 0 0>
<"52" " m " 1 2 3 0 0>
<"57" " f " 3 2 1 0 0>
<"3" " m " 3 2 0 0 0>
<"63" " f " 3 1 2 0 0>
<"26" " m " 2 1 3 0 0>
<"48" " f " 3 2 0 0 0>
<"33" " m " 2 3 1 0 0>
<"60" " f " 3 1 0 0 0>
<"11" " m " 1 3 2 0 0>
<"12" " f " 3 1 2 0 0>
<"32" " m " 1 2 0 0 0>
<"20" " f " 1 3 2 0 0>
<"28" " m " 1 2 0 0 0>
<"29" " f " 2 3 1 0 0>
<"49" " m " 3 2 0 0 0>
<"16" " f " 2 3 0 0 0>
<"31" " m " 1 2 3 0 0>
<"46" " f " 1 2 3 0 0>
<"47" " m " 1 2 0 0 0>
<"17" " f " 3 2 0 0 0>
<"37" " m " 2 1 0 0 0>
<"59" " f " 1 2 3 0 0>
<"8" " m " 3 1 0 0 0>
<"23" " f " 1 2 0 0 0>
<"10" " m " 3 2 1 0 0>
<"54" " f " 1 2 3 0 0>
<"41" " m " 2 1 3 0 0>
<"61" " f " 3 2 1 0 0>
<"36" " m " 2 1 0 0 0>
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<"50" " m " 2 3 0 0 0>
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<"1" " m " 2 1 3 0 0>
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<"15" " m " 2 3 1 0 0>
<"27" " f " 2 3 1 0 0>
<"39" " m " 3 1 2 0 0>
<"64" " f " 3 2 0 0 0>
<"21" " m " 2 3 0 0 0>
<"56" " f " 2 1 3 0 0>
<"13" " m " 2 3 0 0 0>
<"2" " f " 2 1 3 0 0>
<"5" " m " 2 1 3 0 0>
<"40" " f " 1 2 3 0 0>
<"14" " m " 1 2 0 0 0>
```

And

/ solution

```
<"32" "f" 2 1 5 0 0>
<"46" "m" 4 1 5 0 0>
<"37" "f" 4 2 1 0 0>
<"26" "m" 1 2 0 0 0>
<"108" "f" 4 5 1 2 3>
<"104" "m" 5 3 4 1 2>
```

<"48" "f" 3 1 0 0 0>
<"20" "m" 2 3 0 0 0>
<"6" "f" 1 4 2 5 3>
<"43" "m" 3 4 5 0 0>
<"74" "f" 1 4 2 5 3>
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<"83" "f" 1 3 4 0 0>
<"47" "m" 2 5 4 0 0>
<"2" "f" 3 2 1 4 5>
<"114" "m" 3 2 0 0 0>
<"70" "f" 3 5 1 4 2>
<"55" "m" 2 4 0 0 0>
<"44" "f" 2 4 3 1 0>
<"10" "m" 2 3 4 5 1>
<"121" "f" 4 2 3 5 0>
<"27" "m" 3 5 2 0 0>
<"79" "f" 1 3 4 2 5>
<"16" "m" 2 5 4 0 0>
<"73" "f" 4 1 3 0 0>
<"45" "m" 2 4 0 0 0>
<"28" "f" 4 1 3 2 5>
<"58" "m" 5 3 2 1 4>
<"18" "f" 2 4 5 1 0>
<"49" "m" 1 5 4 3 2>
<"118" "f" 2 4 3 0 0>
<"110" "m" 5 4 1 2 0>
<"57" "f" 2 1 4 0 0>
<"22" "m" 1 2 4 0 0>
<"99" "f" 2 5 0 0 0>
<"81" "m" 4 1 0 0 0>
<"106" "f" 4 5 1 0 0>
<"4" "m" 3 2 1 4 0>
<"33" "f" 5 4 0 0 0>
<"25" "m" 4 5 0 0 0>
<"60" "f" 4 2 3 5 0>
<"34" "m" 4 5 2 0 0>
<"89" "f" 5 2 4 1 0>
<"56" "m" 2 3 0 0 0>
<"109" "f" 1 2 0 0 0>
<"119" "m" 5 3 0 0 0>
<"3" "f" 5 4 2 0 0>
<"50" "m" 2 4 3 0 0>
<"54" "f" 1 3 0 0 0>
<"86" "m" 3 4 0 0 0>
<"38" "f" 3 1 2 4 0>
<"31" "m" 3 1 4 0 0>
<"128" "f" 2 4 1 3 0>
<"87" "m" 5 4 2 3 0>
<"92" "f" 3 1 2 5 0>
<"39" "m" 5 2 0 0 0>
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<"12" "f" 3 5 2 0 0>
<"8" "m" 3 5 0 0 0>
<"75" "f" 4 2 0 0 0>
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<"7" "f" 1 2 3 5 0>

<"82" "m" 3 4 1 2 5>
<"124" "f" 2 3 4 0 0>
<"84" "m" 3 4 0 0 0>
<"113" "f" 1 3 5 2 0>
<"40" "m" 2 3 0 0 0>
<"117" "f" 4 5 2 0 0>
<"19" "m" 5 2 0 0 0>
<"91" "f" 2 3 5 1 4>
<"71" "m" 3 1 4 0 0>
<"13" "f" 5 1 0 0 0>
<"72" "m" 4 3 1 0 0>
<"62" "f" 3 2 5 4 1>
<"61" "m" 1 2 4 3 0>
<"93" "f" 3 1 2 0 0>
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<"67" "f" 1 4 0 0 0>
<"14" "m" 3 5 1 4 0>
<"35" "f" 3 1 4 5 2>
<"42" "m" 5 4 0 0 0>
<"23" "f" 4 5 2 0 0>
<"88" "m" 2 5 3 1 4>
<"97" "f" 4 2 5 0 0>
<"80" "m" 5 1 2 4 0>
<"102" "f" 2 1 5 3 4>
<"116" "m" 3 4 5 1 0>
<"85" "f" 4 1 0 0 0>
<"17" "m" 4 3 0 0 0>
<"59" "f" 2 3 5 0 0>
<"30" "m" 2 1 0 0 0>
<"52" "f" 5 3 1 4 0>
<"11" "m" 2 4 5 1 0>
<"112" "f" 4 3 5 2 1>
<"98" "m" 5 4 0 0 0>
<"24" "f" 4 3 2 1 5>
<"1" "m" 2 3 1 4 5>
<"41" "f" 5 3 0 0 0>
<"120" "m" 5 1 3 2 4>
<"95" "f" 3 4 0 0 0>
<"51" "m" 1 2 5 4 0>
<"76" "f" 5 4 3 2 1>
<"9" "m" 3 5 2 4 0>
<"94" "f" 2 5 0 0 0>
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<"127" "f" 5 1 0 0 0>
<"15" "m" 5 2 1 3 4>
<"125" "f" 3 5 2 4 0>
<"5" "m" 2 5 3 0 0>
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<"123" "m" 2 3 1 5 0>
<"111" "f" 3 2 0 0 0>
<"122" "m" 1 2 5 0 0>
<"53" "f" 5 1 4 2 3>
<"36" "m" 1 4 2 3 0>
<"126" "f" 2 3 1 4 0>
<"103" "m" 2 1 4 3 5>
<"101" "f" 2 1 5 3 4>
<"90" "m" 2 4 5 0 0>
<"29" "f" 3 5 0 0 0>
<"78" "m" 5 1 0 0 0>

```
<"64" "f" 2 4 1 5 3>  
<"115" "m" 2 1 5 4 0>  
<"66" "f" 5 3 4 0 0>  
<"100" "m" 2 3 5 4 0>
```