Solving big MIPs using AMPL and CPLEX

This is a minimization problem. In the 'Cuts/Best Node' column, CPLEX will display a *lower bound* of the problem, and in the 'Best Integer' column the best integer solution that has been found so far, i.e. an upper bound. The AMPL directive says that these values should be displayed after every 1000 nodes enumerated.

```
ampl:  model tsp.mod;  data br17.dat;  option cplex_options  'mipdisplay=2'
'mipinterval=1000';
ampl: solve;
ILOG CPLEX 9.000, licensed to "university-chapel hill, nc", options: e m b q
CPLEX 9.0.0: mipdisplay=2
mipinterval=1000
Clique table members: 34
MIP emphasis: balance optimality and feasibility
Root relaxation solution time =    0.01 sec.
```

	Nodes					Cuts/		
	Node	Left	Objective	IInf	Best Integer	Best Node	ItCnt	Gap
	0	0	2.2500	31		2.2500	17	
			18.0000	31		Cuts: 6	24	
*	30+	30		0	202.0000	18.0000	93	91.09%
*	110+	99		0	158.0000	19.8750	377	87.42%
*	200+	179		0	150.0000	19.8750	779	86.75%
*	265	208		0	91.0000	19.8750	967	78.16%
*	527	433		0	88.0000	20.5000	1918	76.70%
*	570	371		0	54.0000	20.5000	2156	62.04%
*	649	404		0	47.0000	20.5000	2370	56.38%
*	708	451		0	46.0000	20.5000	2546	55.43%
*	965	656		0	43.0000	20.7500	3412	51.74%
*	991	667		0	42.0000	20.7500	3513	50.60%
	1000	673	28.0000	16	42.0000	22.8750	3548	45.54%
*	1018	663		0	40.0000	22.8750	3607	42.81%
	2000	1327	30.0000	14	40.0000	28.0000	7430	30.00%
*	2898	1896		0	39.0000	28.0000	10665	28.21%
	3000	1965	31.1875	15	39.0000	28.0000	10987	28.21%
	4000	2649	30.6250	19	39.0000	28.0000	14509	28.21%
	5000	3311	cutoff		39.0000	28.0000	17978	28.21%
	6000	3924	29.6406	20	39.0000	28.0000	21782	28.21%
	7000	4558	infeasible		39.0000	28.0000	25584	28.21%
	8000	5169	34.0000	17	39.0000	28.0000	29729	28.21%
	9000	5830	30.8125	12	39.0000	28.0000	33507	28.21%

```
  10000  6546       33.0000     6       39.0000       28.0000    37086   28.21%
Elapsed time =  17.92 sec. (tree size =  1.69 MB)
  11000  7235       32.3125    18       39.0000       28.0000    40508   28.21%
  12000  7874       31.3750     8       39.0000       28.0000    44328   28.21%
  13000  8569       31.3750    17       39.0000       28.0000    47869   28.21%
  14000  9192       32.1250    16       39.0000       28.0000    51221   28.21%
```

If we want to specify that at most 20000 nodes should be enumerated in the BB tree:

```
ampl:  model tsp.mod;  data br17.dat;  option cplex_options  'mipdisplay=2'
'mipinterval=1000' 'nodelim=20000';
ampl: solve;
ILOG CPLEX 9.000, licensed to "university-chapel hill, nc", options: e m b q
CPLEX 9.0.0: mipdisplay=2
mipinterval=1000
nodelim=20000
Clique table members: 34
MIP emphasis: balance optimality and feasibility
Root relaxation solution time =    0.01 sec.

        Nodes                                         Cuts/
   Node  Left     Objective  IInf  Best Integer     Best Node    ItCnt     Gap

      0     0        2.2500    31                    2.2500       17
                    18.0000    31                  Cuts:  6       24
*    30+   30                    0      202.0000       18.0000       93   91.09%
*   110+   99                    0      158.0000       19.8750      377   87.42%
*   200+  179                    0      150.0000       19.8750      779   86.75%
*   265   208                    0       91.0000       19.8750      967   78.16%
*   527   433                    0       88.0000       20.5000     1918   76.70%
*   570   371                    0       54.0000       20.5000     2156   62.04%
*   649   404                    0       47.0000       20.5000     2370   56.38%
*   708   451                    0       46.0000       20.5000     2546   55.43%
*   965   656                    0       43.0000       20.7500     3412   51.74%
*   991   667                    0       42.0000       20.7500     3513   50.60%
   1000   673       28.0000    16       42.0000       22.8750     3548   45.54%
*  1018   663                    0       40.0000       22.8750     3607   42.81%
   2000  1327       30.0000    14       40.0000       28.0000     7430   30.00%
```

```
*  2898  1896                  0       39.0000       28.0000    10665   28.21%
   3000  1965       31.1875    15       39.0000       28.0000    10987   28.21%
   4000  2649       30.6250    19       39.0000       28.0000    14509   28.21%
   5000  3311        cutoff              39.0000       28.0000    17978   28.21%
   6000  3924       29.6406    20       39.0000       28.0000    21782   28.21%
   7000  4558    infeasible             39.0000       28.0000    25584   28.21%
   8000  5169       34.0000    17       39.0000       28.0000    29729   28.21%
   9000  5830       30.8125    12       39.0000       28.0000    33507   28.21%
  10000  6546       33.0000     6       39.0000       28.0000    37086   28.21%
Elapsed time =  17.18 sec. (tree size =  1.69 MB)
  11000  7235       32.3125    18       39.0000       28.0000    40508   28.21%
  12000  7874       31.3750     8       39.0000       28.0000    44328   28.21%
  13000  8569       31.3750    17       39.0000       28.0000    47869   28.21%
  14000  9192       32.1250    16       39.0000       28.0000    51221   28.21%
  15000  9807       32.8750    17       39.0000       28.0000    54770   28.21%
  16000 10421       29.8750    13       39.0000       28.0000    59000   28.21%
  17000 11141       31.0000    15       39.0000       28.0000    62669   28.21%
  18000 11793       32.7812    14       39.0000       28.0000    66213   28.21%
  19000 12419       28.0000    20       39.0000       28.0000    69933   28.21%

Flow cuts applied:  2
CPLEX 9.0.0: node limit with integer solution; objective 39
73483 MIP simplex iterations
20000 branch-and-bound nodes
1 integer variables rounded (maxerr = 5.55112e-16).
Assigning integrality = 0 might help.
Currently integrality = 1e-05.
```