Mathematical Programming: Modelling and Applications

Sonia Cafieri

LIX, École Polytechnique

cafieri@lix.polytechnique.fr

October 2009

Densest Subgraph problem: AMPL model

```
param n >= 1, integer;
set V := 1..n;
set E within {V,V};

# arc colours
param kmax default 10;   # max number of colours
param k <= kmax, >= 0, integer, default 1;
param mu{E} >=0, integer, <= kmax;

# variables
var x{V} binary;
var y{(u,v) in E} >= 0, <= min(max(0, mu[u,v]-k+1), max(0,k-mu[u,v]+1));

# model
maximize densesubgraph : sum{(u,v) in E} y[u,v] - sum{v in V} x[v];

# linearization constraints
subject to lin1 {(u,v) in E} : y[u,v] <= x[u];
subject to lin2 {(u,v) in E} : y[u,v] <= x[v];
subject to lin3 {(u,v) in E} : y[u,v] >= x[u] + x[v] - 1;
```

Densest Subgraph problem: AMPL data

```
param n := 15;  # number of vertices
param k := 2;  # color

param : E :  mu :=
1 15  1
2 15  1
2 3  1
2 4  1
3 5  1
4 5  1
5 6  1
5 11  2
5 12  2
5 13  2
5 14  2
6 9  1
7 8  1
7 11  2
7 12  2
7 13  2
7 14  2
7 15  1
8 10  1
8 14  2
11 12  2
11 13  2
12 13  2
;
```

Densest Subgraph problem: AMPL run

```
model densest_subgraph.mod;
data densest_subgraph.dat;

option solver cplex;
solve;

display x;
```