Even more pizza model formulation

Intro

Usage of integer optimization framework to model and solve the problem. Problem description can be found
https://github.com/mmarouen/hascode/tree/master/even_more_pizza

Definitions

p=1…P pizza indice
t=1…T team indice
i=1….I ingredient indice
Recipe(p,i)={0, 1} Whether pizza p contains ingredient i
Teams_vector[t], t=1…T team size vector

Decision variables

$x_{t,p} = 0 \dots N$: Count of pizzas "p" delivered to team "t"

$y_t = \{0, 1\}$: Whether team "t" gets served or not

Derived useful variables

$ind_{t,p} = 0\ if\ x_{t,p} == 0,\ 1\ if\ x_{t,p} > 0$:Whether pizza "p" gets served to team "t" or not

$ingredients_t = \sum_p y_{t,p} \sum_i R(p,i)\ with\ i\ unique$

This variable can be reformulated as: $ingredients_t = \sum_i Indicator[\sum_p y_{t,p} * R(p,i)]$

Objective function

$maximize(\sum_t ingredients_t^2)$

Constraint

C1: If the order is delivered to any team "t", exactly one pizza should be available per person. Otherwise zero pizzas are delivered.

$\forall t,\ \sum_p x_{t,p} = y_t * teams_t$

C2: Each pizza can be delivered to at most one team.

$$\forall p,\ \sum_{t} ind_{t,p} \leq 1$$