

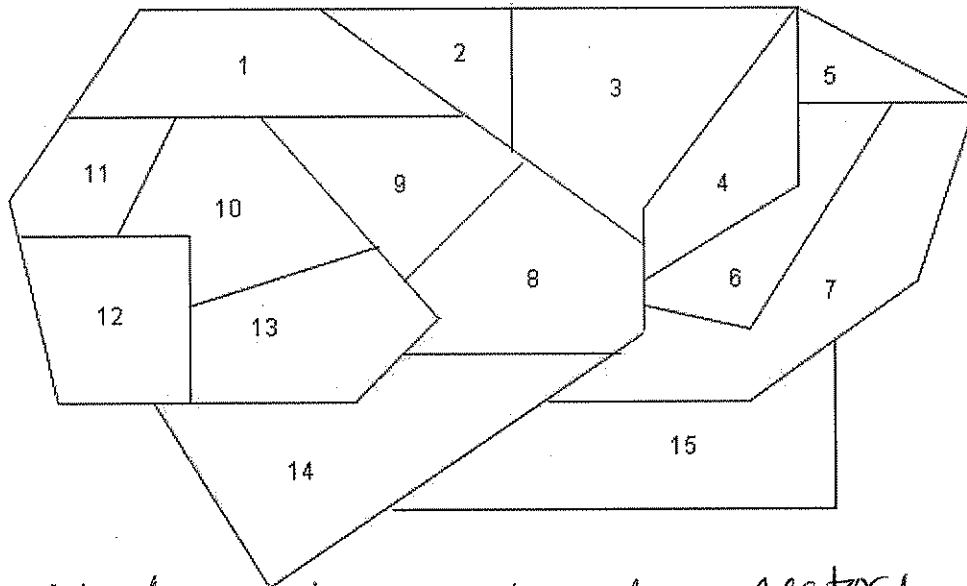
Deterministic Math Models (550.251)

Quiz 5

Name Solutions

The police department has divided the city into 15 patrol sectors. Each sector must be covered by at least one patrol. (A sector is covered if a patrol is stationed in that sector or in an adjacent sector.)

Formulate a binary model that will determine the minimum number of patrols required.



Let $x_j = \begin{cases} 1 & \text{if a patrol is placed in sector } j \\ 0 & \text{o.w.} \end{cases}$

min $\sum_{j=1}^{15} x_j$ (min # patrols)

s.t. $x_1 + x_2 + x_{11} + x_{10} + x_9 \geq 1$ (cover sector 1)

$x_1 + x_2 + x_3 + x_9 \geq 1$ (cover sector 2)

$x_2 + x_3 + x_4 + x_9 + x_8 \geq 1$ (cover sector 3)

⋮

$x_7 + x_{14} + x_{15} \geq 1$ (cover sector 15)

in general the covering constraint is (for sector i)

$x_i + \sum_{j \in N(i)} x_j \geq 1$ where $N(i) = \{ \text{sectors } j \text{ adjacent to sector } i \}$

x_j binary for all j