Computational Integer Programming
Exercise 04

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The Miller Tucker Zemlin (MTZ) Formulation

$$
\begin{array}{llcll}
\min & c^T x & & & \\
\text{(i)} & x(\delta^-(i)) & = & 1 & \forall i \in V \\
\text{(ii)} & x(\delta^+(i)) & = & 1 & \forall i \in V \\
\text{(iii)} & u_i + 1 & \leq & u_j + |V|(1 - x_{ij}) & \forall j \in V, j \neq 1 \\
\text{(iv)} & u_1 & = & 1 & \\
\text{(v)} & x_{ij} & \in & \{0,1\} & \forall ij \in A \\
\text{(vi)} & u_i & \in & \mathrm{IN} & \forall i \in V
\end{array}
$$

The Van Vyve Wolsey (VVW) Formulation

min	$c^T x$			
(i)	$x(\delta^-(i))$	$=$	1	$\forall i \in V$
(ii)	$x(\delta^+(i))$	$=$	1	$\forall i \in V$
(iii)	$u_i + 1$	$\leq$	$u_j + \vert V \vert (1 - x_{ij})$	$\forall j \in V, j \neq 1$
(iv)	u_1	$=$	1	
(v)	x_{ij}	$\in$	$\{0,1\}$	$\forall ij \in A$
(vi)	u_i	$\in$	$\mathbb{N}$	$\forall i \in V$
(vii)	$w^v(\delta^-(i))$	$=$	$w^v(\delta^+(i))$	$\forall v \in V, v \neq 1, i \in N_v, i \neq v$
(viii)	$w^v(\delta^-(v))$	$=$	$w^v(\delta^+(v)) + 1$	$\forall v \in V, v \neq 1$
(ix)	w_{ij}^v	$\leq$	x_{ij}	$\forall v \in V, v \neq 1, ij \in A_v$
(x)	w_{ij}^v	$\in$	$\{0,1\}$	$\forall v \in V, v \neq 1, ij \in A_v$