(c) Consider an instance of IP defined by the following data: $\mathbf{f} = (4, 8, 11, 9, 5)$, and

$$(c_{ij}) = \begin{pmatrix} 6 & 2 & 1 & 3 & 5 \\ 4 & 10 & 2 & 6 & 1 \\ 3 & 2 & 4 & 1 & 3 \\ 2 & 0 & 4 & 1 & 4 \\ 1 & 8 & 6 & 2 & 5 \\ 3 & 1 & 4 & 8 & 1 \end{pmatrix}$$

Using the Lagrangian multipliers $\bar{\mathbf{u}} = (3, 4, 2, 2, 5, 1)$ solve the Lagrangian subproblem $\mathrm{IP}(\bar{\mathbf{u}})$ derived in (a) and report its optimal solution $(\mathbf{x}(\bar{\mathbf{u}}), \mathbf{y}(\bar{\mathbf{u}}))$, and the corresponding dual bound.

(d) Compute the subgradient at $\bar{\mathbf{u}}$ that would be used by the subgradient algorithm. Can you conclude that $(\mathbf{x}(\bar{\mathbf{u}}), \mathbf{y}(\bar{\mathbf{u}}))$ is optimal for IP?