$$\widehat{V(T)}_J = \frac{\sum_{j=1}^{r} (T_j^* - J(T))^2}{r(r-1)} \le \frac{\sum_{j=1}^{n} (T_j^* - T)^2}{n(n-1)}$$ starting

$$\Rightarrow \frac{n-1}{n} \sum_{j=1}^{n} (T_{(-j)} - \bar{T}_{(\cdot)})^2 \le \frac{\sum_{j=1}^{n} (T_j^* - T)^2}{n(n-1)}$$ from part (a)

can also try alternate forms of $\widehat{V(T)}_J$:

$J(T) = T + (r-1)(T - \bar{T}_{(\cdot)})$ or $J(T) = \frac{1}{r}\sum_{j=1}^{n} T_j^* = \bar{T}^*$

or

$J(T) = rT - (r-1)\bar{T}_{(\cdot)}$ (part (a))

Result: no difference, $-J(T) \cdots = -rT + r\bar{T}_{(\cdot)} - \bar{T}_{(\cdot)}$

$$\left(= \frac{\sum_{j=1}^{r} \{T_j^* - rT + r\bar{T}_{(\cdot)} - \bar{T}_{(\cdot)}\}^2}{r(r-1)} \right)$$

$$T_j^* = rT - (r-1)T_{(-j)}$$

$$\frac{\sum_{j=1}^{r} (rT - (r-1)T_{(-j)} - J(T))^2}{r(r-1)} \le \frac{\sum_{j=1}^{n} (nT - (n-1)T_{(-j)} - T)^2}{n(n-1)}$$

$$\Rightarrow \sum_{j=1}^{n} (nT - (n-1)T_{(-j)} - J(T))^2 \le \sum_{j=1}^{n} (nT - (n-1)T_{(-j)} - T)^2$$

$$\rightarrow \sum_{j=1}^{n} (T_j^* - 2T_j^* J(T) + J(T)^2) \le \sum_{j=1}^{n} (T_j^* - 2T_j^* T + T^2)$$

$$\rightarrow \sum_{j=1}^{n} T_j^* - 2J(T)\sum_{j=1}^{n} T_j^* + nJ(T)^2 \le \sum_{j=1}^{n} T_j^* - 2T\sum_{j=1}^{n} T_j^* + nT^2$$

$$\rightarrow -2J(T)\sum_{j=1}^{n} T_j^* + nJ(T)^2 \le -2T\sum_{j=1}^{n} T_j^* + nT^2$$

$$\rightarrow -2\bar{T}^* \sum_{j=1}^{n} T_j^* + n\bar{T}^{*2} \le -2T\sum_{j=1}^{n} T_j^* + nT^2$$

$$\rightarrow -2\bar{T}^* \sum_{j=1}^{n} (nT - (n-1)T_{(-j)}) + n\bar{T}^{*2} \le -2T\sum_{j=1}^{n} (nT - (n-1)T_{(-j)}) + nT^2$$

$$\rightarrow -2\bar{T}^* \left[n^2 T - (n-1)\sum_{j=1}^{n} T_{(-j)}\right] + n\bar{T}^{*2} \le -2T\left[n^2 T - (n-1)\sum_{j=1}^{n} T_{(-j)}\right] + nT^2$$