Unbounded solutions of a system of difference equations with delays

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This investigation is a joint work with Radoslav Chupáč (University of Žilina, Slovak Republic) and Miroslava Růžičková (University of Žilina, Slovak Republic).

We consider a homogeneous system of difference equations with deviating arguments in the form

$$\Delta y(n) = \sum_{k=1}^{q} \beta^k(n)[y(n-p_k) - y(n-r_k)]$$

where $n \geq n_0$, $n_0 \in Z$, p_k, r_k are integers, $r_k > p_k \geq 0$ for each $k \in \{1, \ldots, q\}$, q is a positive integer, $y(n) = (y_1(n), \ldots, y_s(n))^T$, $y\colon \{n_0 - r, n_0 - r + 1, \ldots\} \to R^s$ is an unknown discrete vector function, $s \geq 1$ is an integer, $r = \max\{r_1, \ldots, r_q\}$, $\Delta y(n) = y(n+1) - y(n)$, and $\beta^k(n) = (\beta^k_{ij}(n))$ are $s \times s$ real matrices such that $\beta^k_{ij}\colon \{n_0, n_0 + 1, \ldots\} \to [0, \infty)$, $i, j = 1, \ldots, s$, and $\sum_{k=1}^{q} \sum_{j=1}^{s} \beta^k_{ij}(n) > 0$ for each admissible i and all $n \geq n_0$. There is discussed the behavior of solutions of this system for $n \to \infty$. The existence of solutions in an exponential form is proved and estimates of solutions are given. Sufficient conditions for the existence of unbounded solutions are determined. The scalar case is discussed as well.