The usual way to represent a 2-dimensional array in a computer's memory is in row major order, stringing the rows together. For example, the $3 \times 4$ array
\[
\begin{bmatrix}
5; 2; 7; 3 \\
8; 4; 2; 0 \\
9; 2; 7; 7 \\
\end{bmatrix}
\]
is represented as $5; 2; 7; 3; 8; 4; 2; 0; 9; 2; 7; 7$.

(a) Given naturals $n$ and $m$, find a data transformer that transforms an $n \times m$ array $A$ to its row major representation $B$.

\[ \forall i: 0..n \cdot \forall j: 0..m \cdot A_{ij} = B_{im+j} \]

(b) Using your transformer, transform $x := Ayz$ where $x$, $y$, and $z$ are user's variables.

\[ \forall A \cdot (\forall i: 0..n \cdot \forall j: 0..m \cdot A_{ij} = B_{im+j}) \]
\[ \Rightarrow \exists A' \cdot (\forall i: 0..n \cdot \forall j: 0..m \cdot A'_{ij} = B'_{im+j}) \land (x := Ayz) \]

Expand assignment

\[ \forall A' \cdot (\forall i: 0..n \cdot \forall j: 0..m \cdot A'_{ij} = B'_{im+j}) \land x' = Ayz \land y' = y \land z' = z \land A' = A \]

One-point

\[ \forall A' \cdot (\forall i: 0..n \cdot \forall j: 0..m \cdot A'_{ij} = B'_{im+j}) \land x' = Ayz \land y' = y \land z' = z \]

Use antecedent as context

\[ \forall A' \cdot (\forall i: 0..n \cdot \forall j: 0..m \cdot A'_{ij} = B'_{im+j}) \land x' = Ayz \land y' = y \land z' = z \]

The consequent no longer uses $A$ so $\forall A'$ and the antecedent can be dropped

\[ (\forall i: 0..n \cdot \forall j: 0..m \cdot B'_{im+j} = B'_{im+j}) \land x' = B_{ym+z} \land y' = y \land z' = z \]

Contract the first conjunct

\[ B' = B \land x' = B_{ym+z} \land y' = y \land z' = z \]

\[ x := B_{ym+z} \]