Suppose $m_j + 1 \le \alpha \le m_{(j+1)}$.

$$\Rightarrow \quad a_{m_j+1} = a_\alpha = a_{m_{(j+1)}}.$$

$$\Rightarrow \cdots a_{m_1} > \cdots a_{m_2} > \cdots a_{m_3} > \cdots > a_{m_{(j+1)}} = a_\alpha > \cdots > a_{m_\ell} \neq 0$$

$$\underset{\overset{\parallel}{m_1}}{a^*_{a_{m_1}}} \cdots < \underset{\overset{\parallel}{m_2}}{a^*_{a_{m_2}}} \cdots < \underset{\overset{\parallel}{m_3}}{a^*_{a_{m_3}}} \cdots < \underset{\overset{\parallel}{m_{(j+1)}}}{a^*_{a_{m_{(j+1)}}}} = a^*_{a_\alpha} \cdots < \underset{\overset{\parallel}{a'_{a_{m_{(j+2)}}}}}{a^*_{a_{m_{(j+2)}}}} \cdots < a^*_{a_{m_\ell}} \le \cdots \le a^*_1$$

$$a^*_{a_{m_{(j+1)}}+1} < a^*_{a_{m_{(j+1)}}} = a^*_{a_\alpha} = \underset{\overset{\parallel}{a'_{a_\alpha-1}}}{a^*_{a_\alpha-1}} = \underset{\overset{\parallel}{a'_{a_\alpha-2}}}{a^*_{a_\alpha-2}} = \cdots = \underset{\overset{\parallel}{a'_{(a_{m_{j+2}}-1)}}}{a^*_{a_{m_{(j+2)}}-1}}$$

$\Rightarrow$

$$a^*_{a'_{a_\alpha-1}} = a^*_{a'_{a_\alpha-2}} = \cdots = a^*_{a'_{(a_{m_{j+2}}-1)}} \ge a_\alpha - 1$$

$$\Rightarrow \quad a^*_{a'_{a_\alpha-1}} = a_\alpha - 1. = a^*_{a^*_{a_{m(j+1)}}} = a^*_{m_{(j+1)}}$$

And, $$a^*_{a_{m_{(j+1)}}+1} = a'_{a_{m_{(j+1)}}} = \cdots = \underset{\overset{\parallel}{a_{m_j}}}{a^*_{a_{m_j}}} = a'_{a_{m_j}-1}$$

$$\Rightarrow \quad a^*_{a'_{a_{m_j}-1}} \ge a_{m_j} - 1 \quad \text{and} \quad a^*_{a'_{a_{m_{(j+1)}}}} \ge a_{m_{(j+1)}} \cdots$$

$$\Rightarrow \quad a^*_{a'_{a_{m_j}-1}} = a_{m_j} - 1.$$

Thus

$$\cdots \underset{\overset{\uparrow}{m_j\text{-th}}}{a_{m_j}-1} > \cdots\cdots \underset{\overset{\uparrow}{m_{(j+1)}\text{-th}}}{a_\alpha - 1} > \cdots \underset{\overset{\uparrow}{m_{(j+2)}\text{-th}}}{a_{m_{(j+2)}}} > \cdots > \cdots \underset{\overset{\uparrow}{m_\ell\text{-th}}}{a_{m_\ell}}$$