10. $a_j \text{ o } a_k = a_m$ where a_m is the greater of a_j and a_k
since a_j and a_k are elements of S and $a_m = a_j$ or a_k then the operation is closed
the smallest element of S is an identity element, for suppose it is a_1 then for any k, $a_1 \text{ o } a_k = a_k$
but no element other than the identity has an inverse since $a_j \text{ o } a_k \neq a_1$ for any $j, k(\neq 1)$
$\left(a_j o a_k\right) \text{ o } a_l =$ (larger of a_j, a_k) o $a_l =$ largest of a_j, a_k, a_l
$a_j \text{ o } \left(a_k \text{ o } a_l\right) = a_j$ o (larger of a_k, a_l) = largest of a_j, a_k, a_l so associative.

$a_j * a_k = a_n$ where $n = |j-k|+1$
if a_j and a_k are elemnts of S then $0 \leq |j-k| \leq N-1$ so $1 \leq |j-k|+1 \leq N$ so $a_n \in S$ closed
a_1 is an identity element since $a_1 * a_j = a_n \Rightarrow n = |j-1|+1 = j$
$a_j * a_k = a_1$ iff $|j-k|+1 = 1$ so every element is self inverse
Let $\left(a_j * a_k\right) * a_l = a_n$ and $a_j * \left(a_k * a_l\right) = a_m$
If $j = 2, k = 3, l = 4$ then $n = 3$ and $m = 1$ so not associative.
