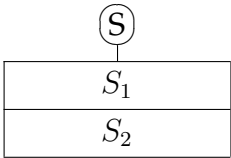
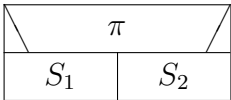
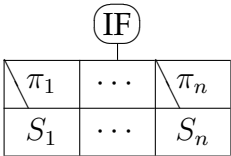


# Structogram of program constructs

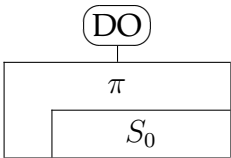
Sequence



Selection/branches



Loop



# Algorithmic patterns over intervals

## Summation

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, s:\mathcal{H})$$

$$Pre = (m = m' \wedge n = n')$$

$$Post = (Pre \wedge s = \sum_{i=m}^n f(i))$$

$s := 0$	
$i = m..n$	
	$s := s + f(i)$

## Counting

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, c:\mathbb{N})$$

$$Pre = (m = m' \wedge n = n')$$

$$Post = (Pre \wedge c = \sum_{i=m}^n 1)$$

$c := 0$	
$i = m..n$	
$cond(i)$	
$c := c + 1$	<i>SKIP</i>

## Maximum search

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, max:\mathcal{H}, ind:\mathbb{Z})$$

$$Pre = (m = m' \wedge n = n' \wedge m \leq n)$$

$$Post = (Pre \wedge (max, ind) = \mathbf{MAX}_{i=m}^n f(i))$$

$max, ind := f(m), m$	
$i = m + 1..n$	
$max < f(i)$	
$max, ind := f(i), i$	<i>SKIP</i>

## Conditional maximum search

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, l:\mathbb{Z}, max:\mathcal{H}, ind:\mathbb{Z})$$

$$Pre = (m = m' \wedge n = n')$$

$$Post = (Pre \wedge (l, max, ind) = \mathbf{MAX}_{\substack{i=m \\ cond(i)}}^n f(i))$$

$l := false$			
$i = m..n$			
$\neg cond(i)$	$l \wedge cond(i)$		$\neg l \wedge cond(i)$
$SKIP$	$max < f(i)$		$l, max, ind := true, f(i), i$
	$max, ind := f(i), i$	$SKIP$	

## Selection

$$A = (m:\mathbb{Z}, i:\mathbb{Z})$$

$$Pre = (m = m' \wedge \exists k \geq m: cond(k))$$

$$Post = (Pre \wedge i = \mathbf{SELECT}_{j \geq m} cond(j))$$

$i := m$
$\neg cond(i)$
$i := i + 1$

## Linear search

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, l:\mathbb{L}, ind:\mathbb{Z})$$

$$Pre = (m = m' \wedge n = n')$$

$$Post = (Pre \wedge (l, ind) = \mathbf{SEARCH}_{i=m}^n cond(i))$$

$l, i := false, m$
$\neg l \wedge i \leq n$
$l, ind := cond(i), i$
$i := i + 1$

## Optimistic linear search

$$A = (m:\mathbb{Z}, n:\mathbb{Z}, l:\mathbb{L})$$

$$Pre = (m = m' \wedge n = n')$$

$$Post = (Pre \wedge l = \forall_{i=m}^n \mathbf{SEARCH} cond(i))$$

$l, i := true, m$	
	$l \wedge i \leq n$
	$l := cond(i)$
	$i := i + 1$